Earmarking, Party Politics and Gubernatorial Veto: Theory and Evidence from US States *

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Abstract

This paper provides a theory of earmarking based on the relative power of state legislature and the governor. These two entities interact in a game with party specific preferences and uncertainty about the future. The politically powerful use earmarking as a way to resolve uncertainty and constrain the future government. The model predicts that earmarked policies will be implemented when the government is controlled by one party or when legislative power is so concentrated in one party's control that it may unilaterally overturn a governor's veto. These predictions are empirically tested using spatial econometric techniques on a panel of US state data. I find that the legislative ability to overturn gubernatorial veto causes an increase in a states percentage of revenues earmarked by 4% and a unified government causes an increase by 8.9%. Together theses estimates suggests that 21% of the decrease in the average percentage of state revenues earmarked over the years 1954 to 1997 can be explained by the model.

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1 Introduction

Earmarking is a term that has two distinct meanings in the economics and political science literatures. It is used by the popular media and by some political scientists in reference to pork-barrel spending, spending targeted to benefit some interest group or jurisdiction. This is different from the definition of earmarking in the public finance literature that this paper addresses. The entry for *earmarking* on the popular online encyclopedia Wikipedia reflects the divergent definitions. "In public finance, an earmark is a requirement that all or a portion of a certain source of revenue, such as a particular tax, be devoted to a specific public expenditure... Earmarking bypasses the normal procedure by which tax revenue is pooled in a general fund and then allocated among various government spending programs as opposed to a specific program." Revenues that are earmarked are directed away from the general fund and are not subject to the review process inherent in general fund appropriations. In the public finance view earmarking has dynamic implications. The accounts to which earmarked revenues are dedicated outlive the current fiscal year. Without a change in policy the earmarked money will continue to be dedicated to its purpose into the future. Thus, earmarking determines the allocation of funds over relatively long time horizons.

The type of earmarking addressed in this research is a prevalent practice among US state governments. In 1954 the average state earmarked 51% of its revenue to specific uses. The percentage earmarked dropped to 27.5% in 1979 and has remained relatively flat in the years following. These averages along with state by state percentage earmarked can be seen in table 1.

The dominant use of earmarked funds by states is for transportation: the building of highways and bridges, their maintenance, and public transit. It is not surprising, then, that the largest category of tax that is earmarked is the fuel tax and highway user fees. Details of the uses of earmarked funds are summarized in table 2 and a table detailing the taxes that are earmarked most often is summarized in table 3.

There are several reasons often cited in support of earmarking and against it.

Those who support earmarking make the case that it can enforce a cost-benefit principle when those who pay the earmarked tax and the benefactors of that tax are one and the same. An earmarked tax on a product or service that is highly complementary in consumption to the government service provided may be viewed as a user-charge of sorts[1]. This alleviates some of the typical efficiency problems, such as freeriding, associated with the provision of public goods. However, user charges can only be employed when the users of a particular service can be identified and charged. The most prominent tax which meets this criterion are gasoline taxes, that are often earmarked for road maintenance and construction. It is very difficult to make such a case for any other tax-expenditure bundle.

Another commonly cited reason in support of earmarking is that earmarking stabilizes government finances serving as a means to control debt. This is the case if revenues are earmarked to pay off state debt. Earmarking can also serve as a tool to gain public support for new taxes, as voters are assured that revenues generated will not be diverted to some other expenditure seen as less worthy by the electorate. However if constituents believe that an earmark will cause general funds to be diverted away from the project in question, this justification looses its appeal.

There are also arguments that suggest earmarking is not a beneficial practice. The most widely stated is that earmarking reduces the flexibility, freedom and oversight of public expenditures. Earmarking may limit the ability of the government to respond to changing economic conditions. This criticism drives at the heart of earmarking as earmarking does not allow either the legislature or the governor to weigh the relative merits of state programs relative to the revenue available at every budget cycle. For this reason earmarking is seen as an inefficient method of allocating funds to projects by its critics, regardless of other possible benefits it may entail. Earmarked spending is not subject to the same review processes as is the case with the general fund appropriations. This lack of oversight could lead to greater influence of interest groups and increased pork in earmarked spending.

While a significant amount of research has been devoted to the effects of earmark-

[1]For discussion of the user charge principle for earmarking, see Lee and Wagner (1991).

ing on public good provision or education, surprisingly little attention has been given to the reason why earmarking might occur in the first place. Although there is theoretical literature that tries to explain earmarking, it is small and incomplete. There is an even greater lack of empirical research into the causes of earmarking. This paper provides both a theory of earmarking and empirical support for the theory.

The seminal paper on earmarking is Buchanan (1963). Buchanan uses a median voter approach to analyze how earmarking and general fund financing may have differing implications for public spending. Buchanan (1963) and the succeeding literature of Goetz (1968), Goetz and McKnew (1972), Browning (1975), and more recently Athanassakos (1990) present analysis of the implications of earmarking but have little to say regarding the decision to earmark itself.

The more recent theoretical contributions all take a game theoretic approach. Most recently, Jackson (2007) formulates a legislative bargaining model in which all available revenue is spent via earmarking to the neglect of a general fund. Jackson (2007) explicitly models earmarking as it precedes general fund appropriations decisions. A legislator proposing an earmark has the incentive and ability to compensate other legislators enough to secure a winning coalition for his or her earmarking proposal. This earmarking proposal compensates the coalition members for the opportunities they forgo in general fund bargaining. That paper shows that when institutions allow earmarking to occur then, in the absence of any frictions, full earmarking will occur in equilibrium.

The idea that earmarking may present a possible solution to an agency problem is explored by both Dhillon and Perroni (2001) and Bös (2000). While both papers show that earmarking can act as a mechanism that mitigates an agency problem, neither model is particularly realistic in its treatment of earmarking. In particular, Dhillon and Perroni (2001) do not model the public choice process involved in public good provision and while Bös (2000) does address aspects of public choice, his model does not consider the legislative body (parliament) as strategic in itself.

Brett and Keen (2000) present a model which proposes a compelling rationale to earmark. In their model, incumbent politicians are able to restrict the behavior of their successors by earmarking funds for preferred expenditures such as environmental protection. This is done when an incumbent believes their re-election prospects are sufficiently low. Brett and Keen (2000) also show that earmarking can be used to mitigate the negative reputation effects of implementing a new tax.

A small empirical earmarking literature also exists. Novarro (2004) tests the hypothesis of (Brett and Keen 2000) using data on earmarking of revenues for environmental policies by Democratic legislative majorities in US states who proceeded to lose control of the legislature in the next election. Novarro (2004) finds no evidence of the type of strategic behavior described by Brett and Keen (2000). In fact she finds no evidence that Democrats earmark strategically at all. Novarro (2002) and Evans and Zhang (2002) look at the effect earmarking lottery profits has on education spending. There is a large literature which explores earmarking and its effect on education (see Deran (1965) and Dye and McGuire (1992)). Landry and Price (2007) look at the effect earmarking lottery profits to a public good (education) has on lottery play. There is little, if any, literature that actually explores the determinants of the decision to earmark empirically.

A separate but relevant literature on policy insulation has also recently appeared. This literature (Moe (1989), (1990), (1991); McCubbins, Noll, and Weingast (1987), (1989)) is predominately a non-formal literature that relates political (electoral) uncertainty to bureaucratic constraints and efficiency. The politically powerful implement a bureaucratic and organizational structure that protects their favored policy from those who will hold office in the future. This theory was then formalized by Figueiredo (2002) in what he terms the "insulation game" (this game is a modification of the reciprocity game introduced by Calvert (1989)). This game predicts that those who are electorally weak will be most likely to insulate their policy in the event that they are able to gain momentary control of the government. There are two major drawbacks to this theory. First, it assumes that insulated policies will proceed forever. An extension of the game that allows earlier legislation, including insulating mechanisms, to be repealed is hinted at but not rigorously analyzed. Second, the game doesn't consider a rich institutional structure. Bureaucratic structure in practice is centered on the separation of powers among branches, yet this model examines only one branch of government, controlled by one of two parties probabilistically. Figueiredo (2003) then tests these predictions empirically, finding evidence that electorally weak groups will insulate policies when they do have the power to do so.

In this paper I develop a game theoretic model of earmarking. An elected legislature chooses a policy bill to send to the governor who can either sign the bill or veto it. The legislature may overturn the veto if the requirements to do so are met. The model predicts that legislatures controlled by a party with unilateral power to overturn gubernatorial veto and unified (one party) governments will tend to implement earmarked policies more than governments with less concentrated party control. This prediction is tested empirically using a panel of data on US state earmarking behavior. The econometric findings show that the legislative ability of a party to overturn gubernatorial veto causes an increase in a state's percentage of revenues earmarked by 4 percentage points and a unified government leads to an increase of 8.9 percentage points. This suggests that 21% of the decrease in percentage of state revenues earmarked from 1954 to 1997 can be explained by the reduction in concentrated political control.

The paper is organized as follows. Section 2 presents the theoretical model. Section 3 outlines the econometric strategy and data with the results presented in section 4. Section 5 concludes.

2 Theory

There is little theory that explains why earmarking as a means of financing public services occurs. Classically, earmarking refers to the dedication of specific revenues to specific expenditures on an ongoing basis, tying a tax to an expenditure. The theory here abstracts from this general definition and focuses on the expenditure aspect of earmarking along with a simple dynamic component. In this model, an earmarked policy simply constrains a future government to provide the same public good bundle as the previous government while the absence of earmarks grants the next government the freedom to make its own policy choice. Earmarking allows the current government to overcome the uncertainty it faces about future government decisions. A brief overview of the game theoretic model is provided in the following paragraphs.[2]

Governments in each of two periods consist of two branches: legislative and executive. The government in time period one has expectations about what the future government will be, reflecting electoral uncertainty. In each time period the government plays a game that determines if policy A, B, or C is enacted. The branches of government may be controlled by one of two parties: party A or party B. Each party is named for their respective favorite policy while policy C serves as a default or compromise policy.

The game begins with the legislature deciding to send the governor either an earmarked bill or a bill with no earmarks. An earmarked bill specifies that the policy will be the same in both period 1 and 2 while a non-earmarked bill leaves the period 2 policy decision for the future government to decide. After either a non-earmarked bill or earmarked bill is sent to the governor, the governor either signs the bill with the bill then becoming law, or he vetoes it. Then, after the governor vetoes a bill, the legislature may have the ability to overturn that veto (with the knowledge of this ability for the current period, but without certainty for period two). A vetoed bill becomes law if the veto is overturned by the legislature. If the governor vetoes an earmarked bill and the legislature cannot overturn it, then the legislature will submit another bill; this bill may **not** be an earmarked bill.[3] However, if the governor vetoes a non earmarked bill and the legislature does not overturn that veto then the default policy C is enacted.

Period 2 begins with a new government chosen from a known distribution. This draw determines the party (A or B) of the governor, the party that controls the legislature, and whether or not the legislature has the ability to overturn a gubernatorial

[2]It may help the reader to observe the game trees in figures 1 and 2 while reading the model overview.
[3]This feature is necessary to maintain proposal power of the legislature.

veto.[4] If the period 1 bill enacted was earmarked, the new government does nothing, whereas the period 1 policy is enacted again in period 2. If the period one bill enacted was not earmarked then the new legislature submits a bill to the new governor specifying the policy for period 2. The governor again has an opportunity to veto the bill with a following decision by the legislature to overturn the veto. If the legislature fails to overturn the veto then policy C, the default policy, is enacted in period 2.

2.1 Formal Model

The government has revenue that it can use in each time period to execute one policy from from three feasible options; A, B or C. It is assumed that it is not feasible for more than one policy to be implemented, either because of scarcity of revenue or the fundamental nature of the policies being considered. Throughout the model I refer to a generic policy at time t by X_t.

There are two types of agents in the economy, those who prefer policy A and those who prefer B. Agents in the economy belong to one of two political parties and they group themselves according to policy preferences. Agents who prefer policy A belong to party A and agents who prefer policy B belong to party B. Party preferences over policies in period t are represented by utility functions as given in equations 1 and 2 where $1 > \gamma > 0$.

$$u_{At}(X_t) = \begin{cases} 1 & if\ X_t = A \\ \gamma & if\ X_t = C \\ 0 & if\ X_t = B \end{cases} \tag{1}$$

$$u_{Bt}(X_t) = \begin{cases} 1 & if\ X_t = B \\ \gamma & if\ X_t = C \\ 0 & if\ X_t = A \end{cases} \tag{2}$$

The government in each of the two time periods is composed of a governor and a legislature. The government in time period 1 is given at the beginning of the game and in time period 2 the government is drawn from a known distribution. A government

[4] This effectively captures the idea that a legislature has the ability to overturn a veto when it is controlled by a party that has supermajority control.

is defined by three pieces of relevant information: the party of the governor (G = A or B), the controlling party of the legislature (L = A or B), and the power of the legislature to overturn gubernatorial veto or not (VO = Y or N). This structure of the game incorporates the idea of electoral uncertainty as stated by Moe (1989), (1990) and McCubbins, Noll, and Weingast (1987), and as implemented similarly by Figueiredo (2002). Choices by either the governor or the legislature are determined solely by the preferences of the party controlling that branch of government.[5]

After the policy decision has been made in time each period the parties receive stage utility, $u_{it}(X_t)$. Given a probability function, $f(X_2)$, over policies chosen in period 2 and the discount rate $\delta \in (0, 1]$, the expected utility for party $i \in \{A, B\}$ in stage 1 can be written as in equation 3.

$$EU_i(X_1 \mid f(X_2)) = u_{i1}(X_1) + \sum_{X_2 \in \{A,B,C\}} \delta u_{i2}(X_2) f(X_2) \tag{3}$$

I now begin to describe the sequencing of decisions in the game. The game begins in period 1 with the legislature choosing to pursue an earmarked (E) policy or not (NE). If the legislature chooses to pursue an earmarked policy, they next decide on which earmarked policy to send to the governor. The legislature can either send a bill that earmarks either policy A or policy B. Then the governor can either sign (S) the bill into law, in which case the earmarked policy is carried out and utilities are received, or veto (V) the bill. After a veto by the governor, the legislature can then either overturn the veto (VO) if it has the power (supermajority control) required or choose to not overturn the veto (NO) and subsequently send the governor a non-earmarked bill. If the legislature overturns the veto then the earmarked bill becomes law, the earmarked policy is carried out and stage utilities are received. If the legislature does not overturn the governor's veto then the game proceeds as it would have if the legislature initially chose not to pursue an earmarked bill in the first place. In both of those cases, the legislature now chooses a non-earmarked bill to send to the governor which specifies a policy for the current year only, again either

[5]This is consistent with a majority rule decision making process in a legislature made up of three legislators, each belonging to one of two parties.

A or B. Then the governor can either sign the bill into law, in which case the policy is decided for $t = 1$ and the game moves on to the second time period, or the bill is vetoed. In the event of a veto, the legislature can either overturn the veto (if it has the power to do so) with the bill becoming law or they don't overturn in which case the policy C (the default/compromise policy) is enacted for period 1 and utilities are received accordingly. A game tree showing the sequencing of period one decisions is presented in figure 1. The game then progresses to time period two.

Period 2 begins with the government being selected by nature from a distribution which is common knowledge. It chooses the controlling party of both the legislature and the governor in addition to whether or not the legislature has the power (supermajority control) required to overturn a gubernatorial veto. The combinations of possible governments and the probability associated with each are given in table 4. If an earmarked bill became law in period 1 then there are no decisions to be made in period 2, policy is implemented as planned and utilities awarded. If period 1 involved no earmarking then decision making follows the same process as in the no earmarking case from period 1. The legislature sends a bill to the governor, either A or B. The governor can then either sign the bill, in which case the bill becomes law, is executed and agents receive utilities, or he can veto the bill. Again, when the governor vetoes a bill the legislature can overturn the veto (if it has the power) or if the legislature does not overturn the veto then the policy C is implemented and utilities received. A game tree representing the sequence of decisions in period 2 in the absence of an earmarked policy is given in figure 2.

The analysis of the game in search of subgame perfect Nash equilibrium (SPNE) is straightforward. The interesting implications of the game are the political conditions in which an earmarked policy will be implemented in the first stage with SPNE strategies. These conditions are given in theorem 1 as summarized in tables 2.4 and 2.5.

Theorem 1. *The policy outcomes of the various governments generated by SPNE strategies are given in tables 2.4 and 2.5.*

Proof. First, the stage two game must be analyzed for the case in which a non earmarked policy was implemented in stage one. Before any decisions in stage two are made, nature chooses the government according to the probability distribution specified in table 2.4.[6] It is necessary to look at the policy that each of the possible governments will implement. For example, suppose that nature chooses a legislature controlled by party A, a governor from party B , and the legislature does not have the power to overturn a gubernatorial veto.[7] If the legislature sends the governor the policy A, then the governor will veto it and policy C will be implemented because the payoff to the governor from C exceeds that of A, $\gamma > 0$. If the policy B is sent to the governor he will sign it because $1 > \gamma$. The legislature in choosing to send either A or B to the governor is effectively choosing between policy C and B respectively. Therefore, this government will implement policy C because the payoff from C to the legislature, γ, is bigger than the payoff from B, 0. A similar analysis reveals that a government with the same legislative and gubernatorial control but with legislative veto overturn power (VO=Y) will implement the policy A. This reasoning leads to the conclusion that when a legislature has the power to overturn gubernatorial veto then the legislature can implement its most preferred policy. Likewise, if both branches of government are controlled by the same party then they will be able to implement their preferred policy. All other governments implement the compromise policy, C. Therefore, the policy implemented (X_2) by each government in period 2 (in the absence of earmarking) under Nash strategies are those given in the last column of table 4.

Given the policy outcomes in period 2 for the case that the period 1 government does not pass an earmarked policy and the probability distribution of the various possible governments in period 2, expectations over the policy that will be implemented in period 2 are formed. Specifically let ρ_A be the probability that A is implemented in period 2 so that $\rho_A = a + b + c$. Let $\rho_B = e + f + g$, be the probability B is implemented and $\rho_C = d + h$ the probability of C. Together, these form a probability

[6] For the probabilities to form a distribution it is necessary that $a+b+c+d+e+f+g+h = 1$ and $a, b, c, d, e, f, g, h \geq 0$.

[7] This case corresponds to L=A, G=B, and VO=N in table 4.

distribution over X_2, $f(i) = \rho_i$ $i \in \{A, B, C\}$. These expectations are then used in calculating expected utility as in equation 3.

The analysis of decisions in period one along the no earmarking path is analogous to that in period 2. Suppose that the government in period 1 has a legislature controlled by party A, a governor from party B, and that the legislature does not have the power to overturn a gubernatorial veto. Then, if the legislature chooses the non-earmarked path the policy outcome will be C. If the legislature does have the ability to overturn the gubernatorial veto then the non-earmarked policy outcome would be A.[8] A legislature without the power to overturn gubernatorial veto will not be able to earmark A and will not desire to earmark B; therefore the policy outcome will be the compromise policy C. But, when the legislature does have the ability to overturn the gubernatorial veto it can implement the earmarked policy A and will choose to do so because $1 + \delta > 1 + \delta(\rho_A + \gamma\rho_C)$. The analysis follows similarly for unified (one-party) governments. Thus, earmarked policies will be implemented in period one by unified governments and by governments with a legislature that can overturn the veto of the governor. This is consistent with the outcomes given in table 2.5. □

Intuitively it makes sense that the government will want to earmark policies whenever it can. This is consistent with the results from Jackson (2007), that shows in a frictionless world where policy is the result of legislative bargaining among self interested legislators, all revenue will be spent via earmarked mechanisms. The model of this paper diverges from Jackson (2007) most significantly in that differing party preferences and the separation of powers among government branches creates a friction that prevents earmarking from occurring all the time. The frictions are overcome whenever the government is unified or the legislature has the power to overturn the governor's veto, making the power separation irrelevant. These points demonstrated in table 5 form the basis of the empirical analysis presented in the rest of the paper.

These results are not too different from what would be expected in an infinitely repeated game. To analyze an infinitely repeated game with a stage game similar to

[8] This holds based on the same analysis as that of the period 2 strategies.

that in the period one game here, it is necessary to specify the duration for which an earmarked policy would last or the conditions in which an earmarked policy can be overturned and replaced. In either case, earmarked policies will be put in place by those governments that have the power to do so.[9]

3 Data and Econometric Model

The model presented in the previous section provides a concise theory of earmarking that predicts earmarking will occur more often when the legislature has the power to overturn gubernatorial veto and when the government is united under one party's control. I empirically test these implications using a panel of earmarking data by US states obtained from Fiscal Planning Services (2000). This report contains data on the percentage of state revenues earmarked for specific uses in the years 1954, 1963, 1979, 1984, 1988, 1993 and 1997. The report compiles data from a series of surveys; this data and its sources can be seen in table 1. This is the dependent variable for the econometric test of the theory.

There are two independent variables of interest that the empirics will explore, VO and $same$. The variable VO is a dummy variable that is equal to one if the state's legislature is controlled by a large enough majority to overturn a gubernatorial veto. The variable *same* is a dummy variable set to one when the governorship and the legislature are controlled by the same party. Data on the size of majority vote required to overturn gubernatorial veto and on the number of seats held by each party in state legislatures was obtained from The Book of the States. States tend to be bicameral in legislative system while the theory specifies a unicameral system. This discrepancy must be accounted for in the construction of both VO and $same$. I do this by setting the dummy, VO, equal to one if both the state house and senate are controlled by the same party and the majority in each is large enough to overturn a veto by the governor, and by setting *same* equal to one if both the state house and senate and the governorship are controlled by one party. Two states, Nebraska

[9]There is no suitable punishment strategy that can maintain cooperation in a repeated setting.

and Minnesota, provide some difficulty in constructing the variables. Nebraska has a unicameral system with no-party elections, meaning there is no data on party affiliation. Therefore, for Nebraska VO is set to zero for all time periods. Minnesota also had no-party elections until 1976, therefore VO is set to zero for Minnesota in both 1954 and 1963. It is less clear what to do with the variable *same* for these states. For the empirical results presented in this paper *same* was set equal to one for both of these states', results are robust to changing this to zero.

The theory suggests that VO should have an effect on earmarking behavior. Figure 3 graphs the average percentage of revenues earmarked (*ear*), percentage of states whose legislatures have veto override power (VO) and the percentage of states controlled by a unified government (*same*). It is evident that some relationship exists between these aggregated numbers. I explore this empirical relationship more fully to try to answer the question: Does the ability of a legislature to overturn gubernatorial veto and a unified government cause increased usage of earmarking at the state level? I estimate the effects of VO and *same* on earmarking while accounting for state level and year specific fixed effects. It is also widely known that state level policy variables tend to be subject to spatial autocorrelation; for examples and discussion see Besley and Case (1995), Case and Rosen (1993), Brueckner (2003), and Brown and Rork (2005). Therefore, the empirical specification controls for spatial autocorrelation with both a spatial lag and a spatial error term as the diagnostic lagrange multiplier tests suggested by Anselin, Bera, Florax, and Yoon (1996) dictate their use. For a detailed discussion of spatial econometrics I refer to Anselin (1988).[10]

A spatial lag term controls for the potential influence of the policy of *neighbor* states on a states own policy. This influence can come from a number of potential avenues as summarized in Revelli (2005). Yardstick competition describes mimicking policy behavior, a state may try to replicate the policy of others because it views that states policy as being successful. Fiscal competition of states can also cause the earmarking policy of one state to affect another. It is also possible that there

[10]Spatial econometric methods require the use of a balanced panel. Therefore, for years in which earmarking data is unavailable, an interpolated value is used in the regression analysis.

could be direct spillovers of policy. For example, investment in highways and bridges in one state may prompt a neighboring state to invest complementarily; if both are are funded through earmarked taxes, then one state's earmarking policy can directly affect its neighbor's. All of these possible avenues of influence are empirically implemented in the same way using a spatial lag. The spatial lag is created by premultiplying the dependent variable vector, y_t, by a weighting matrix, W_t. The time specific weighting matrix, W_t, assigns a weight of zero to state i and then averages the value of the independent variable for *neighboring* states, however that is defined. The most commonly used weighting matrix is the contiguity matrix that treats those states sharing a geographic border as neighbors and weights them equally.[11] It is also possible that states consider other states similar to them in some demographic or fiscal dimension to be neighbors.[12] It is not econometrically possible to estimate W_t; it must be exogenously enforced. Therefore the empirical analysis proceeds by using a variety of weighting matrices.

The estimation equation including the spatial lag is written in equation 4, Where ρ is the spatial lag parameter, β_0 the constant, β_1 the coefficient for VO, β_2 the coefficient for $SAME$, β a vector of parameters on the control variables in vector $\mathbf{x_{it}}$, γ_i is the fixed effect, γ_t the time effect, and ϵ_{it} is the error term.

$$y_{it} = \rho W_t \mathbf{y_t} + \beta_0 + \beta_1 VO_{it} + \beta_2 SAME_{it} + \beta \mathbf{x_{it}} + \gamma_i + \gamma_t + \epsilon_{it} \tag{4}$$

The presence of a spatial lag creates an endogeneity problem as the independent variable appears on both sides of the regression equation. Therefore the OLS estimators will be both biased and inconsistent.

In addition to a spatial lag it is possible that the error term, ϵ_{it}, is subject to spatial dependence. This spatial dependence takes the form specified in equation 5

[11] Using a contiguity matrix the weighting matrix will be the same regardless of the time period.

[12] Demographic and fiscal characteristics change over time; therefore a weighting matrix defined over these dimensions may change over time as well.

where $\epsilon_{\mathbf{t}}$ is a vector made up by all the ϵ_{it}'s.

$$\epsilon_{it} = \lambda W_t \epsilon_{\mathbf{t}} + \nu_{it} \quad (5)$$

The spatial dependence of ϵ_{it} comes about when there are potentially omitted variables that are spatially dependent. If the spatial dependence is present and a correction is not made, then the estimators will not be consistent.

The presence of both spatial lag and spatial error dependence in equations 4 and 5 results in both biased and inconsistent OLS estimates. These issues are accounted for by using well known maximum likelihood methods as presented in Anselin (1988) to estimate equations 4 and 5 under standard assumptions on ν_{it}.

Summary statistics for all variables can be found in table 6 and an explanation of the control variables and their sources are found in table 7. The majority of the control variables are dummies that describe the political environment. There are dummies to describe party affiliations of the governor and majority of the house and senate and dummies that describe when the pieces of the government are controlled by the same party. In addition to the political descriptors, there are variables for net population migration of a state, the total road miles in a state, and a dummy for the presence of a state lottery. Net migration is included as a regressor to control for the potential effects of mobility as suggested by Tiebout (1956)[13]. Road miles are used as a control because a large proportion of earmarked taxes come from fuel and highway user taxes (see table 2.3) and a large proportion of revenues are earmarked to transportation (see table 2). A larger transportation structure could then be correlated with a larger percentage of revenues being earmarked. Road miles is a proxy for the size of the transportation structure. Lastly, lottery adoption is included as a control variable because of the simple correlation between average percentage of revenues earmarked and average state lottery adoption. This simple correlation is evident from observing table 6. In 1954 and 1963 no state had a lottery. Then from 1979 to 1997, 77%

[13]The empirical models were also run using a lag on net migration to account for possible endogeneity. Using lagged net migration did not change any of the results reported in the following section in any significant way

of states in the sample started a state lottery.[14] This increase in lottery adoption coincides with the decrease in average percentage of revenues earmarked over the sample time period.

4 Results

I begin the empirical analysis completely ignoring the vector of control variables. After a baseline relationship is established I then test the robustness of the relationships to the inclusion of controls.

Table 8 presents the spatial diagnostic tests for spatial dependence suggested by Anselin, Bera, Florax, and Yoon (1996) for seven different specifications of the spatial weighting matrix neglecting control variables. W_{cont} is the standard contiguity based weighting matrix while the rest were constructed by comparing other state characteristics. Those weighting matrices isolate the five states that are most similar to a particular state and assigns them a weight accordingly.[15] I construct weighting matrices based on similarity in debt outstanding (W_{Debt}), personal income (W_{PI}), population (W_{Pop}), and number of road miles (W_{RM}). It is likely that states don't compare themselves based on total debt outstanding alone but on some weighted measure of indebtedness. Therefore, I also construct spatial weight matrices based on the debt outstanding to population ratio ($W_{Debt\ Pop}$) and debt outstanding to personal income ratio ($W_{Debt\ PI}$).

Table 8 presents five diagnostic tests for each spatial weighting matrix. LM_ρ is the standard lagrange multiplier statistic to test for spatial error due to omitted spatial lag and LM_ρ^* is the robust version of this statistic. Likewise, LM_λ is the standard lagrange multiplier statistic to test for spatial error due to spatial error autocorrelation with LM_λ^* being its robust statistic. $LM_{\rho\lambda}$ is a test of joint mis-specification. Each of these test statics is distributed as a χ^2; the joint test statistic has 2 degrees of freedom and the rest have one. Examination of the diagnostic statistics reveals that spatial

[14] Alaska and Hawaii are not included in the sample.

[15] Details on the construction of the spatial weight matrices based on demographic variables can be found in the appendix.

error of either kind is not present for W_{Debt}, W_{Pop}, or W_{PI}. This implies that OLS estimates of the empirical model, ignoring spatial lag and error components, will yield consistent and unbiased estimates; with respect to these weighting matrices there are no spatial issues with OLS estimates. However, there is evidence that spatial error may be a problem with respect to each of the other weighting matrices.

It is most apparent that spatial error due to both spatial lag and spatial error autocorrelation is present with respect to the contiguity based weighting matrix. The evidence is also strong that spatial error is present with respect to weighting matrices based on road miles and debt to personal income ratio. The evidence is weakest for the weighting matrix defined by debt to population ratio. However, the test results are inconclusive enough for $W_{Debt\ Pop}$ that it is necessary to report estimates of the spatial econometric specifications for it.

Tables 9-12 give regression results for a set of econometric specifications based on the weighting matrices W_{cont}, $W_{Debt\ Pop}$, $W_{Debt\ PI}$, and W_{RM}. Estimates of β_1 and β_2 are given for all specifications: OLS (without spatial terms), OLS with spatial lag, ML with spatial lag, ML with spatial error dependence, and ML with spatial lag and spatial error dependence. Estimates for the spatial components are presented for the specifications for which they are estimated. In addition to the parameter estimates the tables also show both the Moran-I statistic and Lagrange Multiplier statistic for spatial correlation in the residuals for each specification. These tests consider the null hypothesis of spatial dependence of the specified form.

The parameter estimates for the effect of VO are strongly statistically significant across all econometric specifications. Estimates in the absence of controls range from .0397 to .0585. The most convincing estimate for VO comes from the general spatial model using the contiguity based weight matrix presented in the last column of table 9. That regression has a point estimate for β_1 of .0403 which is statistically significant at the 5% level. This means that having both legislative branches controlled by the same party with both majorities being large enough to overturn gubernatorial veto results in an increase in the percentage of revenues earmarked by 4 percentage points.

The parameter estimates for the effect of *same*, however, are not statistically significant for any of the econometric specifications. This is possible because the model we are testing may not accurately reflect the potential for preferences to be not only party specific but also office specific. The goals of a governor and legislature may not align well even when both are controlled by members of the same party.

The Moran-I and lagrange multiplier tests for spatial autocorrelation in the residuals reject spatial autocorrelation as specified by each of the weighting matrices in the most general econometric specifications. Any spatial autocorrelation of the types allowed by these weighting matrices is controlled for in these regressions by the spatial lag and error components resulting in estimates that are both consistent and unbiased. The less general maximum likelihood and OLS estimates do, however, show evidence of uncorrected spatial autocorrelation.[16]

Table 13 presents the spatial diagnostic statistics with respect to the same weighting matrices but with the inclusion of the control variables. Most of the relationships displayed in table 8 persist except for the weight matrix based on the debt to population ratio. There is little evidence of spatial autocorrelation based on that weighting matrix. Nevertheless, for the sake of comparison the regression results are presented for the same weighting matrices as was when control variables were excluded. The regression results appear in tables 14-17.

The parameter estimates for β_1 are still strongly statistically significant and positive across all econometric specifications. The most convincing estimate for VO is again come from the general spatial model using the contiguity based weight matrix in the last column of table 14. From that regression we get a point estimate for β_1 of .0397. This estimate is very close to the estimate from the regressions that excluded the controls. This estimate means that having both legislative branches controlled by the same party with both majorities being large enough to overturn gubernatorial veto results in an increase in the percentage of revenues earmarked by 4 percentage points. This estimate explains 6.3% of the decrease in average state percentage of revenue earmarked over the years 1954-1997 as resulting from the decreased ability

[16]The OLS estimates are reported for the sake of comparison only. OLS estimates including ρ are always biased and inconsistent.

of legislative majorities to unilaterally overturn a gubernatorial veto. Estimates of β_1 from the general spatial model including controls range from .0359 to .0537.[17]

With the inclusion of controls the estimates for β_2 are strikingly different. The estimate for the general spatial model using the contiguity weighting matrix is .0886 which is statistically significant at the 10% level.[18] Without the controls this same regression yields an insignificant estimate of .0039. When the legislature and the governorship are all controlled by the same party this results in an increase in percentage of revenues earmarked of 8.9 percentage points. This estimate explains 14.7% of the decrease in average state percentage of revenues earmarked over the sample period and considered together the estimate for VO and *same* explain 21% of this decrease.

Again, the Moran I and lagrange multiplier tests for residual spatial autocorrelation fail to reject the null hypothesis of the absence of spatial autocorrelation for the general spatial specification for all spatial weight matrices.

5 Conclusion

A large portion of state revenue is earmarked to specific uses and few studies have provided compelling arguments as to why this occurs. The theoretical studies addressing the issue are sparse and the empirical literature even more so. In this paper I have presented a game theoretic model of earmarking that shows revenue gets earmarked in an effort by a current government to overcome policy uncertainty it faces over the future government. The ability of the legislature to earmark is somewhat alleviated by gubernatorial veto; however, the veto is meaningless if the legislature can get the votes it needs to overturn it. The model predicts that the earmarking of revenue will occur more often when the legislature is controlled by a majority large enough to overturn a veto by the governor or when the government is unified under one party's control.

Few theories of earmarking have been tested empirically and the theory presented

[17]The average of the VO estimates for the general spatial model accross weighting matrices is .0447. Using this estimate, 7% of the decrease in earmarking can be explained.

[18]The results from the other weighting matrices are varied but give point estimates that range from 0.0619 to the .0886 estimate from the contiguity weighted regression.

in this paper is the first to receive positive empirical support. The empirical implications of the model are confirmed using spatial econometric techniques on a panel of data from US states. A state with a legislature that is controlled by a single party with a large enough majority to overturn gubernatorial veto will earmark 4% more of its revenue than other states, whereas a state with a unified government will earmark 8.9% more. These estimates explain 21% of the decrease in average state percentage of revenue earmarked over the years 1954-1997.

6 Appendix

6.1 Construction of W_t

This appendix details the construction of the weight matrices W_t not based on contiguity but on some characteristic represented by the vector C_t. For notational simplicity I neglect the time subscript throughout the rest of this section.

Let $A_{ij} = d(C_i, C_j)$ where d represents the usual Euclidean distance. Now identify the observations that are no more than $\theta > 0$ away from i.

$$N_i(\theta) \equiv \{j \in I \quad s.t. \quad j \neq i, \quad A_{ij} < \theta\}$$

Define $\theta(n)$ to be the theta that makes the cardinality of the set $N_i(\theta)$ equal to $n < |N|$.[19] That is $\theta(n) \equiv \{\theta \in \mathbb{R}^+ \quad s.t. \quad |N_i(\theta)| = n\}$. Then the set of the n closest neighbors to i is $N_i(\theta(n))$.

I now begin to define the elements of W. The ith row of W contains weights for all the neighbors of i. If $k \notin N_i(\theta(n))$ then k is not a neighbor of i and the kth element of row i in matrix W will be zero, $W_{ik} = 0$. Note that $i \notin N_i(\theta(n))$ so that $W_{ii} = 0$ for all i regardless of n. For those $\jmath \in N_i(\theta(n))$ the assigning of weights is more complicated.

Define γ_i as follows.

$$\gamma_i = 2 * \max_{j \in N_i(\theta(n))} A_{ij}$$

Now assign to each $\jmath \in N_i(\theta(n))$ a number γ_{ij} according to $\gamma_{ij} = (\gamma_i - A_{ij})^2$. The weight that is given to i's neighbor j (W_{ij}), which appears in the jth column of row i in matrix W, can now be written as follows.

$$W_{ij} = \frac{\gamma_{ij}}{\sum_{k \in N(\theta(n))} \gamma_{ik}}$$

.

Constructing the weight matrix W in this manner results in the n closest neighbors

[19] The notation $|A|$ refers to the cardinality of the set A.

to unit i in terms of characteristic C getting positive weight in a manner such that the closest neighbors get the greater weight. This construction also row standardizes the matrix so that the sum of the weights assigned to neighbors of any i sum to unity.

For the analysis presented in the paper I set $n = 5$. Increasing this number slightly has no effect on the analysis but as n gets large computational difficulties begin to build up. It does not seem reasonable that any state compares itself to all the other states when making policy comparisons. It is much more likely that they may look at a few that have similar characteristics. Therefore, setting $n = 5$ is reasonable.

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Figures and Tables

Table 1: Purpose of Earmarked Revenues: 1997

Purpose	Total Dedicated	Percent of Total	Rank
Transportation	$31,011.6	34.4%	1
Education	24,020.2	26.6%	2
Local Governments	23,709.6	26.3%	3
Health	3,872.3	4.3%	4
Debt Service	2,876.5	3.2%	5
Conservation	1,051.4	1.2%	6
Public Safety	899.7	1.0%	7
state Building/Public Works	734.4	.8%	8
Environmental Cleanup	537.0	.6%	9
Human Services	415.8	.4%	10
Tourism	267.2	.3%	11
Housing	145.6	.2%	12
Regulation	98.9	.1%	13
Economic Development	89.5	.1%	14
Other	486.1	.5%	-
Total	$90,215.8	100%	-

All dollars are in millions.

Table reproduced from *Dedicated State Tax Revenues: A Fifty-State Report*, Fiscal Planning Services Inc. (2000).

Table 2: Summary By Tax Type: 1997

Tax Type	Total Tax Collections	Amount Dedicated	Percent Dedicated	Percent of Total Dedicated
Fuel and Highway User Tax	34081.2	31752.4	93.2%	35.2%
Sales and Use	121804.1	26097.1	21.4%	28.9%
Income	60312	16372.4	27.1%	18.1%
Propery	3948.1	3277.5	83.0%	3.6%
Debt Service	4577.5	2477.6	54.1%	2.7%
Public Utility	4884.4	2046.8	41.9%	2.3%
Severance	3246.1	1475.2	45.4%	1.6%
Other Business	5445.8	1372.5	25.2%	1.5%
Racing and Gaming	1458.1	1291.8	88.6%	1.4%
Insurance	3246.1	866	26.7%	1.0%
Real Estate Transfer	1309.7	579	44.2%	0.6%
Environmental	525.7	525.7	100.0%	0.6%
Alcoholic Beverage	1951.5	465.1	23.8%	0.5%
Health Care Provider	325.1	324.8	99.9%	0.4%
Estate/Inheritance	710.2	258.7	36.4%	0.3%
Lodging	574.5	214.3	37.3%	0.2%
All Other Types	1541.8	818.9	53.1%	0.9%
All Types/General Fund	165876.7	0	0.0%	0.0%
Total	416098.7	90215.8	21.7%	-

All dollars are in millions.

Table reproduced from *Dedicated State Tax Revenues: A Fifty-state Report*, Fiscal Planning Services Inc. (2000).

Table 3: State Earmarking of Revenues

state	1954	1963	1979	1984	1988	1993	1997
Alabama	89	87	88	89	89	87	87
Alaska		6	1	2	9	8	5
Arizona	47	51	31	29	32	30	31
Arkansas	41	36	21	18	17	13	16
California	42	28	12	13	12	19	10
Colorado	75	51	17	25	18	20	12
Connecticut	26	23	0	1	12	10	7
Delaware	0	3	0	5	7	6	8
Florida	40	39	28	28	26	28	21
Georgia	29	22	11	9	8	6	6
Hawaii		7	5	5	6	5	11
Idaho	51	44	38	32	25	21	20
Illinois	39	43	14	18	21	32	30
Indiana	49	39	43	33	30	26	28
Iowa	51	44	19	13	21	22	13
Kansas	77	66	29	25	21	25	16
Kentucky	46	29		16		4	14
Louisiana	85	87	5	4	9	15	12
Maine	46	39	19	20	17	12	12
Maryland	47	40	34	24	20	17	18
Massachusetts	56	54	41	40		39	42
Michigan	67	57	38	39	35	39	55
Minnesota	73	74	12	13	14	16	12
Mississippi	40	37		30	26	26	30
Missouri	57	40	20	29	30	27	24
Montana	61	53	55	60	65	64	51
Nebraska	55	53	41	29	22	21	16
Nevada	55	35	34	52	49	57	65
New Hampshire	53	54	31	24	24	14	13
New Jersey	7	2	25	39	36	39	48
New Mexico	80	31	36	44	47	40	33
New York	13	10	0	6		8	11
North Carolina	38	30	20	8	14	19	15
North Dakota	73	43	29	21	22	22	24
Ohio	48	48	21	18	19	17	20
Oklahoma	62	59		43	24	21	24
Oregon	47	36	23	19	23	21	16
Pennsylvania	41	63	15	15	14	11	8
Rhode Island	6	4	0	1	5	5	8
South Carolina	69	62	56	55	44	17	18
South Dakota	59	54	33	32	27	47	25
Tennessee	72	77	60	61	66	60	60
Texas	81	66	54	20	24	21	14
Utah	71	62	52	48		55	54
Vermont	42	39	23	23	12	13	15
Virginia	39	32	27	24	25	25	23
Washington	35	30	29	26	29	30	26
West Virginia	57	39	21	21	20	19	21
Wisconsin	63	61		12	12	9	8
Wyoming	61	64	54	69		17	47
Average	51.27	43.06	27.50	26.60	25.07	24.50	24.06

Sources:

1954, 1963: *Earmarked State Taxes*, Tax Foundation.

1979: March 19, 1980 Memo, Montana Office of the Legislative Fiscal Analyst.

1984, 1988, 1993: *Earmarking State Taxes*, National Conference of State Legislatures.

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Figure 1: Game Tree (t=1)

Figure 2: Game Tree (t=2)

Table 4: Government Distribution

Leg	Gov	VO	Prob	X_2
A	A	Y	a	A
A	A	N	b	A
A	B	Y	c	A
A	B	N	d	C
B	B	Y	e	B
B	B	N	f	B
B	A	Y	g	B
B	A	N	h	C

Y indicate the legislature (L) has the power to overturn the governor's (G) veto with N indicating it does not.

Table 5: Period 1 Policy Implementation

Leg	Gov	VO	E or NE	X_1
A	A	Y	E	A
A	A	N	E	A
A	B	Y	E	A
A	B	N	NE	C
B	B	Y	E	B
B	B	N	E	B
B	A	Y	E	B
B	A	N	NE	C

Y indicates the legislature (L) has the power to overturn the governor's (G) veto with N indicating it does not. E indicates the policy was implemented by earmarking and NE means the policy was not earmarked.

Figure 3: Average Percentage of Revenues Earmarked, VO and Same

Table 6: Summary Statistics

	1954	1963	1979	1984	1988	1993	1997	All Years
Ear	0.5127	0.4458	0.2921	0.2756	0.2668	0.2525	0.2473	0.3276
	(0.2020)	(0.1959)	(0.1789)	(0.1839)	(0.1717)	(0.1707)	(0.1770)	(0.2067)
VO	0.6458	0.4583	0.4375	0.3750	0.3542	0.2708	0.2292	0.3958
	(0.4833)	(0.5035)	(0.5013)	(0.4892)	(0.4833)	(0.4491)	(0.4247)	(0.4898)
same	0.8125	0.6458	0.5417	0.5833	0.3750	0.3958	0.3750	0.5327
	(0.3944)	(0.4833)	(0.5035)	(0.4982)	(0.4892)	(0.4942)	(0.4892)	(0.4997)
nm*	39.4625	59.5938	180.4292	159.7792	126.2458	78.4788	37.1449	97.3049
	(487.242)	(506.464)	(591.140)	(633.795)	(669.169)	(506.873)	(420.814)	(548.922)
gov	0.3958	0.6667	0.6458	0.6667	0.5000	0.5833	0.3125	0.5387
	(0.4942)	(0.4764)	(0.4833)	(0.4764)	(0.5053)	(0.4982)	(0.4684)	(0.4992)
sen	0.3913	0.5870	0.7234	0.7021	0.6809	0.7234	0.4894	0.6147
	(0.4934)	(0.4978)	(0.4522)	(0.4623)	(0.4712)	(0.4522)	(0.5053)	(0.4874)
hou	0.3913	0.5870	0.7021	0.7872	0.7021	0.7234	0.5319	0.6330
	(0.4934)	(0.4978)	(0.4623)	(0.4137)	(0.4623)	(0.4522)	(0.5044)	(0.4827)
sengov	0.8542	0.7083	0.6250	0.6250	0.4583	0.5417	0.4375	0.6071
	(0.3567)	(0.4965)	(0.4892)	(0.4892)	(0.5035)	(0.5035)	(0.5013)	(0.4891)
hougov	0.9167	0.8750	0.8958	0.9167	0.5208	0.5625	0.7917	0.7827
	(0.2793)	(0.3342)	(0.3087)	(0.2793)	(0.5049)	(0.5013)	(0.4104)	(0.4130)
senhou	0.9167	0.8750	0.8958	0.9167	0.7708	0.7083	0.7917	0.8393
	(0.2793)	(0.3342)	(0.3087)	(0.2793)	(0.4247)	(0.4593)	(0.4104)	(0.3678)
samed	0.2917	0.4375	0.4375	0.5000	0.2500	0.3333	0.1250	0.3393
	(0.4593)	(0.5013)	(0.5013)	(0.5053)	(0.4376)	(0.4764)	(0.3342)	(0.4742)
lot	0.0000	0.0000	0.2917	0.3542	0.5833	0.7500	0.7708	0.3929
	(0.0000)	(0.0000)	(0.4593)	(0.4833)	(0.4982)	(0.4376)	(0.4247)	(0.4891)
rm*	70.6950	75.2043	81.3203	84.8574	80.2869	80.9512	81.7965	79.3017
	(43.711)	(44.092)	(47.567)	(56.546)	(49.979)	(50.033)	(50.396)	(48.829)

Numbers reported are averages with standard deviations given in parenthesis.

*Thousands.

Table 7: Control Variables

Variable	Explanation	Source
nm	Net migration	US Census Bureau
gov	Dummy=1 if governor is a democrat	Book of states
sen	Dummy=1 if senate democrat majority	Book of states
hou	Dummy=1 if house democrat majority	Book of states
sengov	Dummy=1 if Gov and Senate majority are same party	Book of states
hougov	Dummy=1 if Gov and House majority are same party	Book of states
senhou	Dummy=1 if Senate and House majority are same party	Book of states
same	Dummy=1 if Gov, House and Senate are same party	Book of states
samed	Dummy=1 if Gov, House and Senate are Democratic	Book of states
lot	Dummy=1 if state has a lottery	Coughlin, Garrett, and Hernandez-Murillo (2006)
rm	road miles	Highway Statistics (US Department of Transportation)

Table 8: Spatial Diagnostic Tests - No Controls

	W_{cont}	W_{Debt}	W_{Pop}	$W_{Debt\ Pop}$	$W_{Debt\ PI}$	W_{PI}	W_{RM}
LM_ρ	10.1727***	0.7145	0.0000	1.0479	0.1438	0.4558	0.0508
	(0.0014)	(.3980)	(0.9987)	(0.3060)	(0.7045)	(0.4996)	(0.8218)
LM_ρ^*	5.7750**	0.0208	0.0001	0.1668	2.0580	0.3769	2.7488*
	(0.0163)	(.8854)	(0.9933)	(0.6829)	(0.1514)	(0.5393)	(0.0973)
LM_λ	8.6080***	0.9278	0.0000	3.3025*	4.0930**	1.4752	0.8669
	(0.0033)	(0.3354)	(0.9947)	(0.0692)	(0.0431)	(0.2245)	(0.3518)
LM_λ^*	4.2103**	0.2341	0.0001	2.4214	6.0071**	1.3963	3.5649*
	(.0402)	(.6284)	(0.9916)	(0.1197)	(0.0142)	(0.2373)	(0.0590)
$LM_{\rho\lambda}$	14.3829***	0.9496	0.0001	3.4693	6.1510**	1.8521	3.6157
	(0.0008)	(0.6223)	(0.9999)	(0.1764)	(0.0462)	(0.3961)	(0.1640)

Significance levels: 1% ***, 5% **, 10% *.

Test statistic marginal probabilities are in parenthesis.

Table 9: Regression Results for W_{cont}: No Controls

	OLS	OLS	ML	ML	ML
VO	0.0479**	0.0369*	0.0429**	0.0370**	0.0403**
	(2.4515)	(1.9405)	(2.4664)	(2.1473)	(2.3184)
same	-0.0004	0.0052	0.0021	0.0056	0.0039
	(-0.0274)	(0.3661)	(0.1653)	(0.4371)	(0.2952)
ρ		0.5802***	0.2650***		0.1630
		(4.6449)	(3.8941)		(0.2302)
λ				0.2560***	0.1170
				(3.8397)	(0.1610)
Moran-I	3.3855***	-2.2214**	3.3854***	3.4856***	0.6437
	(0.0007)	(0.0263)	(0.0007)	(0.0005)	(0.5198)
LM	8.6080***	8.5324***	8.9278***	9.5661***	0.0135
	(0.0033)	(0.0035)	(0.0028)	(0.0020)	(0.9073)
Nobs	336	336	336	336	336
Nvars	56	57	57	57	58
R^2	0.7719	0.7883	0.7729	0.7823	0.7817

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 10: Regression Results for $W_{DebtPop}$: No Controls

	OLS	OLS	ML	ML	ML
VO	0.0479**	0.0486**	0.0484**	0.0531***	0.0521***
	(2.4515)	(2.4849)	(2.7191)	(3.0893)	(3.0491)
same	-0.0004	-0.0013	-0.0011	-0.0018	-0.0012
	(-0.0274)	(-0.0862)	(-0.0792)	(-0.1391)	(-0.0971)
ρ		-0.0893	-0.0680		0.0750
		(-1.0768)	(-1.0029)		(0.9627)
λ				-0.3590***	-0.3920***
				(-3.5539)	(-2.6867)
Moran-I	-1.2019	-0.3086	-1.2271	-2.3634**	0.1384
	(0.2294)	(0.7576)	(0.2198)	(0.0181)	(0.8899)
LM	3.3025*	1.0159	3.3908	8.5948***	0.2823
	(0.0692)	(0.3135)	(0.0656)	(0.0034)	(0.5952)
Nobs	336	336	336	336	336
Nvars	56	57	57	57	58
R^2	0.7719	0.7728	0.7711	0.7803	0.7824

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 11: Regression Results for W_{DebtPI}: No Controls

	OLS	OLS	ML	ML	ML
VO	0.0479**	0.0484**	0.0483***	0.0580***	0.0573***
	(2.4515)	(2.4677)	(2.7099)	(3.3454)	(3.3679)
same	-0.0004	-0.0006	-0.0006	0.0016	0.0023
	(-0.0274)	(-0.0403)	(-0.0422)	(0.1180)	(0.1765)
ρ		-0.0301	-0.0260		0.1260*
		(-0.3872)	(-0.4052)		(1.8886)
λ				-0.3920***	-0.4900***
				(-3.8764)	(-3.5052)
Moran-I	-1.4327	-1.0758	-1.4263	-2.7245***	-0.1381
	(0.1519)	(0.2820)	(0.1538)	(0.0064)	(0.8902)
LM	4.0930**	2.9812*	4.0681**	10.6578***	0.6065
	(0.0431)	(0.0842)	(0.0437)	(0.0011)	(0.4361)
Nobs	336	336	336	336	336
Nvars	56	57	57	57	58
R^2	0.7789	0.7720	0.7713	0.7820	0.7887

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 12: Regression Results for W_{RM}: No Controls

	OLS	OLS	ML	ML	ML
VO	0.0479**	0.0484**	0.0482***	0.0431**	0.0401**
	(2.4515)	(2.4617)	(2.7047)	(2.4341)	(2.2970)
same	-0.0004	0.0001	-0.0001	-0.0027	-0.0028
	(-0.0274)	(0.0060)	(-0.0052)	(-0.2077)	(-0.2149)
ρ		-0.0280	-0.0190		-0.1640
		(-0.2668)	(-0.2553)		(-1.2364)
λ				0.1180*	0.2390*
				(1.4782)	(1.8917)
Moran-I	1.5870	1.8793*	1.5482	1.9338**	0.9406
	(0.1125)	(0.0602)	(0.1216)	(0.0531)	(0.3469)
LM	0.8669	1.3932	0.7964	1.6290	0.0827
	(0.3518)	(0.2379)	(0.3722)	(0.2018)	(0.7737)
Nobs	336	336	336	336	336
Nvars	56	57	57	57	58
R^2	0.7789	0.7719	0.7722	0.7732	0.7778

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 13: Spatial Diagnostic Tests - With Controls

	W_{cont}	W_{Debt}	W_{Pop}	$W_{Debt\ Pop}$	$W_{Debt\ PI}$	W_{PI}	W_{RM}
LM_{ρ}	9.4899***	0.6148	0.0249	0.7307	0.0580	0.3649	0.0859
	(0.0021)	(.4330)	(0.8745)	(0.3927)	(0.8097)	(0.5458)	(0.7694)
LM_{ρ}^{*}	8.5000***	0.1890	0.0007	0.0807	2.0055	0.2423	3.1489*
	(0.0036)	(.6637)	(0.9786)	(0.7764)	(0.1567)	(0.6226)	(0.0760)
LM_{λ}	7.0140***	0.4298	0.0276	2.1410	3.2687*	1.0873	0.7932
	(0.0081)	(0.5121)	(0.8680)	(0.1434)	(0.0706)	(0.2971)	(0.3731)
LM_{λ}^{*}	6.0241**	0.0040	0.0034	1.4910	5.2162**	0.9647	3.8562**
	(.0141)	(.9497)	(0.9534)	(0.2221)	(0.0224)	(0.3260)	(0.0496)
$LM_{\rho\lambda}$	15.5141***	0.6188	0.0284	2.2217	5.2742*	1.3296	3.9421
	(0.0004)	(0.7339)	(0.9859)	(0.3293)	(0.0716)	(0.5144)	(0.1393)

Significance levels: 1% ***, 5% **, 10% *.

Test statistic marginal probabilities are in parenthesis.

Table 14: Regression Results for W_{cont}: With Controls

	OLS	OLS	ML	ML	ML
VO	0.0446**	0.0335*	0.0396**	0.0339*	0.0397**
	(2.2211)	(1.7100)	(2.2509)	(1.9539)	(2.2497)
same	0.0846	0.0931*	0.0885*	0.0950*	0.0886*
	(1.5136)	(1.7217)	(1.8101)	(1.9380)	(1.8019)
nm	0.0000	0.0000	0.0000	0.0000	0.0000
	(-1.4149)	(-0.9977)	(-1.3860)	(-1.0207)	(-1.3830)
gov	0.0096	0.0045	0.0073	0.0061	0.0074
	(0.3081)	(0.1512)	(0.2679)	(0.2260)	(0.2719)
sen	0.0141	0.0092	0.0119	0.0109	0.0120
	(0.5119)	(0.3471)	(0.4937)	(0.4560)	(0.4972)
hou	-0.0265	-0.0091	-0.0185	-0.0126	-0.0188
	(-0.9982)	(-0.3514)	(-0.8003)	(-0.5421)	(-0.8095)
sengov	-0.0670**	-0.0672**	-0.0671**	-0.0665**	-0.0671**
	(-1.9866)	(-2.0634)	(-2.2763)	(-2.3059)	(-2.2723)
hougov	0.0046	0.0010	0.0030	0.0001	0.0030
	(0.1986)	(0.0462)	(0.1469)	(0.0055)	(0.1472)
senhou	-0.0206	-0.0204	-0.0205	-0.0184	-0.0205
	(-0.7941)	(-0.8158)	(-0.9054)	(-0.8033)	(-0.9011)
samedem	-0.0450	-0.0462	-0.0456	-0.0505	-0.0458
	(-0.6869)	(-0.7291)	(-0.7950)	(-0.8811)	(-0.7958)
lot	0.0099	0.0018	0.0062	0.0027	0.0064
	(0.4403)	(0.0840)	(0.3164)	(0.1287)	(0.3212)
rm	-0.0002	-0.0004	-0.0003	-0.0004	-0.0003
	(-0.3917)	(-0.7972)	(-0.6471)	(-0.8182)	(-0.6373)
ρ		0.5811***	0.2650***		0.2380
		(4.4953)	(3.9168)		(0.6318)
λ				0.2610***	0.0106
				(3.9265)	(0.0250)
Moran-I	3.2370***	-2.0739**	3.3913***	3.6987***	0.8547
	(0.0012)	(0.0381)	(0.0007)	(0.0002)	(0.3927)
LM	7.0140***	8.1759***	8.1870***	10.1192***	0.0497
	(0.0081)	(0.0042)	(0.0042)	(0.0015)	(0.8236)
Nobs	336	336	336	336	336
Nvars	66	67	67	67	68
R^2	0.7789	0.7944	0.7802	0.7887	0.7890

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 15: Regression Results for $W_{DebtPop}$: With Controls

	OLS	OLS	ML	ML	ML
VO	0.0446**	0.0458**	0.0455**	0.0515***	0.0493***
	(2.2211)	(2.2748)	(2.5298)	(2.9486)	(2.7985)
same	0.0846	0.0826	0.0831*	0.0832*	0.0833*
	(1.5136)	(1.4749)	(1.6597)	(1.6964)	(1.6892)
nm	0.0000	0.0000	0.0000	0.0000	0.0000
	(-1.4149)	(-1.3815)	(-1.5541)	(-1.3407)	(-1.3910)
gov	0.0096	0.0105	0.0103	0.0101	0.0088
	(0.3081)	(0.3375)	(0.3684)	(0.3624)	(0.3163)
sen	0.0141	0.0152	0.0149	0.0176	0.0156
	(0.5119)	(0.5505)	(0.6041)	(0.7157)	(0.6343)
hou	-0.0265	-0.0257	-0.0259	-0.0179	-0.0204
	(-0.9982)	(-0.9700)	(-1.0926)	(-0.7589)	(-0.8645)
sengov	-0.0670**	-0.0656*	-0.0660**	-0.0675**	-0.0678**
	(-1.9866)	(-1.9433)	(-2.1842)	(-2.2462)	(-2.2520)
hougov	0.0046	0.0060	0.0056	0.0026	0.0022
	(0.1986)	(0.2572)	(0.2699)	(0.1268)	(0.1088)
senhou	-0.0206	-0.0230	-0.0223	-0.0272	-0.0244
	(-0.7941)	(-0.8820)	(-0.9616)	(-1.1915)	(-1.0580)
samedem	-0.0450	-0.0446	-0.0447	-0.0405	-0.0398
	(-0.6869)	(-0.6807)	(-0.7625)	(-0.6932)	(-0.6814)
lot	0.0099	0.0115	0.0111	0.0115	0.0106
	(0.4403)	(0.5095)	(0.5493)	(0.5812)	(0.5287)
rm	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
	(-0.3917)	(-0.3247)	(-0.3827)	(-0.3760)	(-0.4351)
ρ		-0.0763	-0.0559		0.0370
		(-0.8924)	(-0.8299)		(0.4405)
λ				-0.3270***	-0.2599*
				(-3.2700)	(-1.8210)
Moran-I	-0.8385	-0.1157	-0.9002	-2.1162**	0.0982
	(0.4018)	(0.9079)	(0.3680)	(0.0343)	(0.9218)
LM	2.1410	0.6718	2.3174	7.2181***	0.3207
	(0.1434)	(0.4124)	(0.1279)	(0.0072)	(0.5712)
Nobs	336	336	336	336	336
Nvars	66	67	67	67	68
R^2	0.7789	0.7796	0.7784	0.7853	0.7844

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 16: Regression Results for W_{DebtPI}: With Controls

	OLS	OLS	ML	ML	ML
VO	0.0446**	0.0451**	0.0450**	0.0545***	0.0537***
	(2.2211)	(2.2298)	(2.4958)	(3.1031)	(3.1163)
same	0.0846	0.0844	0.0844*	0.0689	0.0619
	(1.5136)	(1.5057)	(1.6844)	(1.4063)	(1.2854)
nm	0.0000	0.0000	0.0000	0.0000	0.0000
	(-1.4149)	(-1.4156)	(-1.5814)	(-1.6009)	(-1.5266)
gov	0.0096	0.0097	0.0097	0.0123	0.0096
	(0.3081)	(0.3122)	(0.3478)	(0.4433)	(0.3499)
sen	0.0141	0.0141	0.0141	0.0143	0.0121
	(0.5119)	(0.5121)	(0.5721)	(0.5833)	(0.5006)
hou	-0.0265	-0.0263	-0.0263	-0.0180	-0.0171
	(-0.9982)	(-0.9906)	(-1.1087)	(-0.7693)	(-0.7412)
sengov	-0.0670**	-0.0664*	-0.0666**	-0.0506*	-0.0476
	(-1.9866)	(-1.9640)	(-2.2029)	(-1.6988)	(-1.6267)
hougov	0.0046	0.0044	0.0044	0.0116	0.0160
	(0.1986)	(0.1869)	(0.2114)	(0.5766)	(0.8090)
senhou	-0.0206	-0.0208	-0.0208	-0.0167	-0.0130
	(-0.7941)	(-0.8023)	(-0.8943)	(-0.7409)	(-0.5867)
samedem	-0.0450	-0.0453	-0.0453	-0.0491	-0.0436
	(-0.6869)	(-0.6902)	(-0.7704)	(-0.8410)	(-0.7561)
lot	0.0099	0.0101	0.0101	0.0152	0.0149
	(0.4403)	(0.4483)	(0.4991)	(0.7724)	(0.7760)
rm	-0.0002	-0.0002	-0.0002	-0.0003	-0.0002
	(-0.3917)	(-0.4112)	(-0.4556)	(-0.6916)	(-0.4854)
ρ		-0.0192	-0.0150		0.1290*
		(-0.2420)	(-0.2352)		(1.9238)
λ				-0.3600***	-0.4810***
				(-3.5909)	(-3.4380)
Moran-I	-1.1935	-0.9520	-1.1958	-2.5353**	-0.0966
	(0.2327)	(0.3411)	(0.2318)	(0.0112)	(0.9230)
LM	3.2687*	2.6375	3.2765*	9.5695***	0.5731
	(0.0706)	(0.1044)	(0.0703)	(0.0020)	(0.4490)
Nobs	336	336	336	336	336
Nvars	66	67	67	67	68
R^2	0.7789	0.7790	0.7786	0.7872	0.7942

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.

Table 17: Regression Results for W_{RM}: With Controls

	OLS	OLS	ML	ML	ML
VO	0.0446**	0.0452*	0.0451**	0.0395**	0.0359**
	(2.2211)	(2.2391)	(2.5009)	(2.2106)	(2.0581)
same	0.0846	0.0839	0.0841*	0.0774	0.0649
	(1.5136)	(1.4970)	(1.6749)	(1.5613)	(1.3338)
nm	0.0000	0.0000	0.0000	0.0000*	0.0000**
	(-1.4149)	(-1.4290)	(-1.5901)	(-1.7209)	(-1.9927)
gov	0.0096	0.0096	0.0096	0.0007	-0.0089
	(0.3081)	(0.3065)	(0.3415)	(0.0256)	(-0.3268)
sen	0.0141	0.0142	0.0142	0.0119	0.0102
	(0.5119)	(0.5168)	(0.5756)	(0.4875)	(0.4259)
hou	-0.0265	-0.0275	-0.0272	-0.0234	-0.0243
	(-0.9982)	(-1.0288)	(-1.1420)	(-0.9812)	(-1.0266)
sengov	-0.0670**	-0.0664*	-0.0665**	-0.0677**	-0.0639**
	(-1.9866)	(-1.9634)	(-2.2019)	(-2.2616)	(-2.1790)
hougov	0.0046	0.0052	0.0050	0.0045	0.0071
	(0.1986)	(0.2229)	(0.2407)	(0.2169)	(0.3566)
senhou	-0.0206	-0.0209	-0.0208	-0.0229	-0.0272
	(-0.7941)	(-0.8053)	(-0.8951)	(-0.9964)	(-1.2099)
samedem	-0.0450	-0.0440	-0.0443	-0.0321	-0.0136
	(-0.6869)	(-0.6688)	(-0.7508)	(-0.5511)	(-0.2368)
lot	0.0099	0.0089	0.0092	0.0117	0.0098
	(0.4403)	(0.3927)	(0.4564)	(0.5704)	(0.4787)
rm	-0.0002	-0.0002	-0.0002	-0.0001	-0.0002
	(-0.3917)	(-0.4593)	(-0.4959)	(-0.2821)	(-0.5545)
ρ		-0.0390	-0.0270		-0.2080
		(-0.3504)	(-0.3570)		(-1.5234)
λ				0.1370*	0.2860**
				(1.7401)	(2.3621)
Moran-I	1.5888	1.9523*	1.5183	2.2849**	1.2428
	(0.1121)	(0.0509)	(0.1289)	(0.0223)	(0.2140)
LM	0.7932	1.4593	0.6736	2.5000	0.2996
	(0.3731)	(0.2270)	(0.4118)	(0.1138)	(0.5842)
Nobs	336	336	336	336	336
Nvars	66	67	67	67	68
R^2	0.7789	0.7790	0.7794	0.7806	0.7873

Significance levels: 1% ***, 5% **, 10% *.

Coefficient standard errors and test statistic marginal probabilities are in parenthesis.