Political Influence, Economic Interests and Endogenous Tax Structure in a Computable Equilibrium Framework: with Application to the United States, 1973 and 1983[1]

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Abstract

We consider the properties of a computable equilibrium model of a competitive political economy in which the economic interests of groups of voters and their effective influence on equilibrium policy outcomes can be explicitely distinguished and computed. The model incorporates an amended version of the GEMTAP tax model, calibrated to data for the United States for 1973 and 1983. Emphasis is placed on how the aggregation of GEMTAP households into homogeneous groups affects the numerical representation of interests and influence for representative members of each group.

Keywords: Political competition, probabilistic voting, political influence, tax policy, public goods, GEMTAP, computable equilibrium

JEL Classification: D7, H20, H41, C68

1 Introduction

A full understanding of public affairs requires the ability to distinguish between the economic interests of voters - that is, the policies that different groups of voters would like the government to adopt - and the political influence that they actually exert in the democratic process.[1] Often the distinction between these two elements is ignored, on the assumption that knowledge of what a majority of voters demand serves as an adequate basis for explaining what the government chooses to do. However, at the same time as voters' interests change, their political influence may evolve in a manner that is either more or less conducive to their interests being realized. The reason simply is that interests and influence do not depend on the same set of factors. Economic interests depend on individual preferences, endowments, and the general equilibrium consequences of public policy. The distinct set of factors that shape political influence include the sensitivity of voting behaviour to changes in individual welfare, the costs of collective action, the nature of political institutions, and the extent of political competition (see, for example, Downs 1957).

In this paper we investigate the properties of a computable model of a competitive political economy in which the economic interests and effective political influence of different groups of voters can be explicitly distinguished and computed. One may note that it is tempting to try and guess how the political influence of a group of voters has changed by observing the change in the relative economic status of a representative member. But such a procedure can be misleading, and is so in the model we explore. The problem is that whatever may be observed in an equilibrium, the situation for any group of voters could always have been worse (or better) had its political influence not increased (or declined). A structural model of economic and political competition is required in order to sort out the many possibilities.

The political structure of the model is based on the probabilistic voting framework developed by Hinich, Ledyard and Ordeshook (1973), Hinich (1977), Coughlin

[1] Wittman (1995, 176) has also emphasized this point.

and Nitzan (1981), Enelow and Hinich (1984, 1989), Coughlin (1992) and others, as initially implemented in the applied equilibrium context by Rutherford and Winer (1990, 1995) and Winer and Rutherford (1993). In this framework, competition forces two opposing parties to choose tax rates and the level of public expenditures to maximize their expected electoral support defined over exogenously specified groups. Since individual voting behaviour is probabilistic from the perspective of the parties, a (pure-strategy) Nash equilibrium policy platform may, and in fact, does exist even though party platforms are multi-dimensional. Policy outcomes reflect a balancing of opposing interests, and the model may be thought of as an example of an approach to political economy often referred to as pluralism, one that has a long tradition going back at least to Bentley (1908).[2]

Effective political influence in this framework is measured by the calibrated values of weights in a political support function - a particular weighted sum of the utilities of representative members of the various interest groups - the constrained optimization of which, it turns out, can be used to replicate the Nash equilibrium, a result originally due to Coughlin and Nitzan (1981). The weights may be interpreted as the sensitivity of voting behaviour to changes in economic welfare of the representative member of each interest group. The economic interests of a group are represented by the set of policies most desired by its representative member when that person is not required to compromise with other members of the electorate, a set referred to as an 'ideal point' in the spatial voting literature.

The economic structure of the model is provided by the well-known GEMTAP tax model of the United States economy (Ballard, Fullerton, Shoven and Whalley 1985). This model was originally designed for exploration of the economic consequences of alternative tax blueprints. It is amended here to include private demands for a pure public good and foreign capital flows, as discussed below.[3]

[2]Other complementary interpretations of the equilibrium are possible. For example, it may be regarded as the outcome of Nash bargaining between interest groups, as in van Winden (1983).

[3]The 1973 data set to which the model is calibrated is the original set from Ballard et al (1985). The 1983 data set was constructed by Karl Scholz (1987) with the assistance of Charles Ballard.

In the full model of political equilibrium, the nature of economic interests and political influence depends on which households are aggregated to form interest groups within which behaviour is assumed to be homogeneous, as well as on how individual preferences are specified. We consider the implications for the calculation of voter ideal points and political influence weights of four different aggregations, based on household income ranges, shares of population, shares of capital income, and capital-labour ratios. For given preferences, each method of aggregation leads to a different relationship between the interests of the representative member of each group and the general equilibrium structure of the economy. In turn, since equilibrium policy outcomes reflect a balancing of interests, each method of aggregating individuals leads to a unique set of calibrated influence weights.

To explore the importance of the distinction between interests and influence for fiscal history, we consider counterfactuals designed to shed light on the reasons for changes in U.S. tax policy over the decade after 1973, when taxes on capital services and higher personal incomes fell and those on labour services rose substantially. The counterfactuals decompose observed changes in tax policy into a part that is attributable to changes in the economic interests of voters as a result of changes in the private economy, and a part that is due to changes in the relative influence of the different groups over the decade studied.[4] Both components turn out to be important, with the exact nature of the decomposition depending on how interest groups are defined.

The probabilistic voting framework of the model is presented in section two. Other details, including the method used to calibrate the effective influence of each group of voters, are presented in section three. Next we consider the relationship between the specification of individual preferences, the method of aggregating households into groups, and the values that must be assigned to influence weights so that the model

[4]The work by Rutherford and Winer cited earlier attempts similar decompositions of fiscal history, but does not consider the effects of alternative definitions of interest groups for the calculation of influence weights nor for the outcome of the counterfactuals. This work is described in Hettich and Winer (1999, chapter 7).

replicates observed U.S. tax policy outcomes in 1973 and 1983. The consequences of alternative methods of aggregating individuals into groups for the explanation of U.S. tax history is presented in section five. Conclusions are summarized in a final section.

2 Implementing a Probabilistic Voting Model in an Applied Equilibrium Setting

2.1 Two-party competition with probabilistic voting and interest groups

Let an electorate of N individuals be divided into H mutually exclusive and exhaustive groups (or "interest groups") of homogeneous voters, each of which has n_h members. The representative member of any group has an indirect utility function u_h and votes for the party whose fiscal platform would, if implemented, allow him or her to attain the greatest after-fisc level of welfare.

While voters know what the parties propose to do if elected, political parties are assumed to be uncertain of how each individual will behave at the polls. The parties, however, have access to the same information about the probability distribution f_h describing the voting behavior of the representative member of group h. Let f_h depend only on the difference in utilities that would result from the adoption of the proposals of the incumbent (i) and the opposition (o), and be continuous and twice differentiable. Then the probability p_{hi} that h, and other members of this voter's group, vote for the incumbent is given by the continuous function[5]

$$p_{hi} = f_h[u_h(s_i) - u_h(s_o)], \tag{1}$$

where $u_h(s_j)$ represents the utility that representative voter h expects to enjoy when the platform of party j is implemented.

Each party is forced, by competition, to propose policies that continually maximize its total expected vote in the next election, subject to the general equilibrium structure

[5]For ease of exposition, only the incumbent's problem is presented since that of the opposition is analogous.

of the economy and the government budget restraint it faces if elected.[6][7] The common set of feasible policies from which the parties choose is non-empty, compact and convex. For the incumbent, the expected vote is $EV_i = \sum_h n_h p_{hi}$, while for the opposition, it is $EV_o = H - EV_i$.

Writing the general economic structure that constrains each party's choices as $E(s) = 0$ for the moment, and using the probability function f_h, the vote-maximization problem for the incumbent can be stated as

$$\max_{s_i} \sum_{h=1}^{H} n_h f_h[u_h(s_i) - u_h(s_o)] \text{ s.t. } E(s_i) = 0, \tag{2}$$

where s_o is considered fixed.

The corresponding first-order conditions for the optimal choice of instruments $s_i = (s_{1i}, s_{2i}, ..., s_{Ki})$ are

$$\sum_{h=1}^{H} \left[n_h \frac{\partial f_h}{\partial u_h(s_i)} \frac{\partial u_h(s_i)}{\partial s_{ki}} \right] / \frac{\partial E}{\partial s_{ki}} = \lambda \; ; \; k = 1, 2, ..., K, \tag{3}$$

where $u(s_i)$ refers to the arguments of representative voter h's utility function under the incumbent's policy and the given policy of the opposition, and λ represents the Lagrange multiplier associated with the constraint. The summation sign in (3) allows for the possibility that each instrument s_{ki} directly affects more than one group of voters. Condition (3) indicates that a politically optimal strategy is one that equalizes the marginal vote productivity of each fiscal instrument. Moreover, since f_h and $E(s)$ are common knowledge, it characterizes the optimal platforms of both the opposition and the incumbent.[8]

[6]We use expected vote maximization for convenience. In the absence of abstentions, expected vote maximization is equivalent to expected plurality maximization since for the incumbent, $EV_i - EV_o = EV_i - (N - EV_i) = 2EV_i - N$, where N is the total number of voters. Expected plurality maximization may be equivalent to maximization of the probability of winning, in the sense that the equilibrium choice of electoral strategies is the same, if the electoral game is symmetric (Aranson, Hinich and Ordeshook 1974) or if the number of voters is large (Hinich 1977, Ledyard 1984).

[7]It is implicitly assumed that information about the economy is common to the parties. Although this information is never perfect, we do not allow for such uncertainty here.

[8]This follows from the facts that $EV_o = H - EV_i$ and f_h depends only on the utility difference.

A Nash equilibrium (s_i^*, s_o^*), defined by the first-order conditions for optimal policy choices, exists if, after substitution of the general equilibrium structure $E(s)$, the expected-vote function for each party is strictly concave in its own policy instruments for each given policy of the opposition, which we assume to be the case (see, for example, Owen 1995 p. 80 or Enelow and Hinich 1984, 107).[9] In this equilibrium, both parties adopt the same platform, i.e. $s_i^* = s_o^*$.[10]

2.2 A Representation Theorem

The following theorem suggests a method of computing the Nash equilibrium in the political game outlined above, as well as a method of distinguishing between interests and influence. It is based on Coughlin and Nitzan (1981), who first identified the connection between specific optimization problems and Nash equilibria in probabilistic voting models:

Representation Theorem *Assume that each party's expected vote function is strictly concave so that a Nash equilibrium* (s^*, s^*) *exists. Define* $\theta_h,\ h = 1, 2, ..., H$, *as the values of the terms* $n_h(\partial f_h/\partial u_h)$ *at this Nash equilibrium. If* $s^{**} = s_1^{**}, s_2^{**}, ..., s_K^{**}$ *is a solution to the problem of maximizing the political support function* $S = \sum_h \theta_h u_h(s)$

[9] It is important to note that Usher (1994) and Kirchgässner (2000) have pointed out that when policies of the parties become highly polarized, the concavity of the expected vote functions may not hold. The problem is that at some extreme policy positions, the probability that a voter will support one of the parties may fall to zero. In other words, probabilistic voting may not fully resolve the cycling problem without a restriction on the domain of the issue space. In the present paper, we assume that if such a restriction is required, it is satisfied. Whether in fact such restrictions are required is an empirical issue that is not resolved at this time. We leave the study of such domain restrictions in the present context for the future.

[10] Convergence of party platforms occurs in equilibrium whatever the form of u_h or f_h, provided that the objective functions of the parties are strictly concave and that voting depends only on the difference in utilities under opposing policies (Enelow and Hinich 1989) . We should also note that the convergence presumes perfect political competition. The implications of barriers to entry into the political marketplace is a separate and important topic in its own right, one that we must leave for another time.

subject to the equilibrium structure of the economy $E(s) = 0$*, that is, if* s^{**} *solves*

$$\max_{s_1, s_2, \ldots, s_K} S = \sum_{h=1}^{H} \theta_h u_h(s_1, s_2, ..., s_K) \;\; s.t. \;\; E(s_1, s_2, ..., s_K) = 0, \tag{4}$$

then $s^{**} = s^*$*.*

Proof: (See the Appendix.)

Unless the platform of a party solves the problem in (4), or equivalently the first-order conditions in (3), it is possible for the other party to propose a platform that improves its chances of electoral success.[11] Political competition insures that in equilibrium, no such support improving policies remain to be adopted.

The weights $\theta_h = n_h \partial f_h / \partial u_h$ in the support function serve as an interesting measure of the effective influence of each interest group, while the normalized weights $\theta_h / n_h = \partial f_h / \partial u_h$ serve as a measure of the effective political influence of the representative member of each group. When the latter becomes politically more sensitive to a change in her utility, that is when θ_h / n_h increases, the economic welfare of the members of group h are given greater weight in the support function, and thus in the Nash equilibrium. The interests of a group are also reflected more heavily in the equilibrium if, given the sensitivities of voting behavior to changes in welfare, the relative size of the group increases.

Regarding now government policies as the outcome of a Nash game for an exogenously specified method of aggregating households into groups, influence weights θ_h can be calibrated, in a manner to be described below, so that solving the problem in (4) using the calibrated weights will reproduce those same equilibrium fiscal policies, private prices and quantities.

Since the support function S in (4) is a weighted average of individual utilities, the Representation Theorem reveals additional important features besides that of providing a method of computing an equilibrium. First, it shows that the electoral

[11] See Coughlin (1992, chapter 5) for a discussion of sufficient conditions for optimization of a political support function to replicate a Nash equilibrium in the electoral game.

equilibrium involves a delicate balancing of heterogeneous economic interests. In this sense, the equilibrium is consistent with a pluralistic view of democratic institutions.[12] Second, equilibrium policy outcomes lie in the Pareto-set of policies for the representative members of the various interest groups, a result that proves useful in graphical investigations of the model.[13]

3 An Outline of the Computable Model of a Competitive Political Economy

Using the Representation Theorem to implement a computable version of the model outlined above involves choosing policy parameters (the equilibrium policy platform) to optimize political support $S = \sum_h \theta_h u_h$, defined over representative members of the various interest groups and subject to the general equilibrium structure of the private economy. Since S is linear in the utilities of voters, the existence of a solution to this nonlinear optimization problem depends on the concavity of the individual utility functions in the objective function.[14] Although there is no guarantee that this problem has a solution, policy platforms that maximize S in the neighborhood of the actual (or "benchmark") fiscal systems for 1973 and 1983 can be found. The private economy is represented using an amended version of the GEMTAP model by Ballard et. al. (1985)

We begin with a presentation of the structure of the model and then discuss the features that did not appear in the original GEMTAP model, i.e. the nature of

[12]An alternative approach is to begin with this view about the nature of public policy outcomes, the details of the underlying electoral game left unspecified. van Winden (1983), for instance, uses such an approach. He regards it as a representation of the outcome of a Nash bargaining process among the various interest groups. Both his and the present approaches lead to similar empirical frameworks.

[13]Note that this second feature stems solely from the perfectly competitive, representative democracy we have described; it is not the result of maximizing a social welfare function, in which the weights on individual utilities would be chosen according to some exogenously specified distributive goal or social philosophy. For explorations of situations in which the Pareto-efficiency property of the equilibrium does not hold, see Hettich and Winer (1999, chapter 6).

[14]More precisely, the existence of a solution for an optimal policy platform depends on the concavity of the indirect utility functions after substitution of the general equilibrium structure of the private economy.

fiscal policy instruments, the introduction of a public good, the endogenization of the capital stock and the exogenous determination of some parameters. We then turn to the cardinalization of utility functions that is required to operationalize the support function, the calibration of the influence weights and the definition of interest groups.

3.1 Amendments to the GEMTAP model

The competitive political-economic equilibrium can be summarized by the problem of maximizing $S = \sum_{h=1}^{H} \theta_h u_h$ by choice of fiscal policy parameters, subject to market clearances in goods, labour and capital; a balanced foreign exchange; zero excess profit; individual utility maximization; and a balanced government budget.[15]

In Figure 1, a flow chart provides a way of thinking about our experiments with the model as a whole. The importance of differences in the way in which households are aggregated in the original GEMTAP model and the aggregation of households into politically relevant interest groups for purposes of optimization of the political support function is emphasized.

3.1.1 The nature of the fiscal structure

The implementation of the structure outlined above first requires that the nature of the fiscal system be specified. We use a simplified version of the fiscal system in order to reduce the complexity of the computational problem posed by optimizing the support function subject to the GEMTAP structure. This fiscal structure consists of three endogenous policy instruments: a capital/income tax τ_K, a tax on labour τ_L and one pure public good G. Negative tax rates, or subsidies, are permitted. Since one instrument is determined residually by the government budget restraint, this level of aggregation enables us to optimize the support function S explicitly with respect to two instruments only, and to study the nature of equilibrium policy platforms using

[15] An algebraic description of our model is provided in Rutherford and Winer (1995) and is available upon request. See also Hettich and Winer (1999, chapter 7). For further details of the GEMTAP structure, see Ballard et al (1985) and Shoven and Whalley (1992).

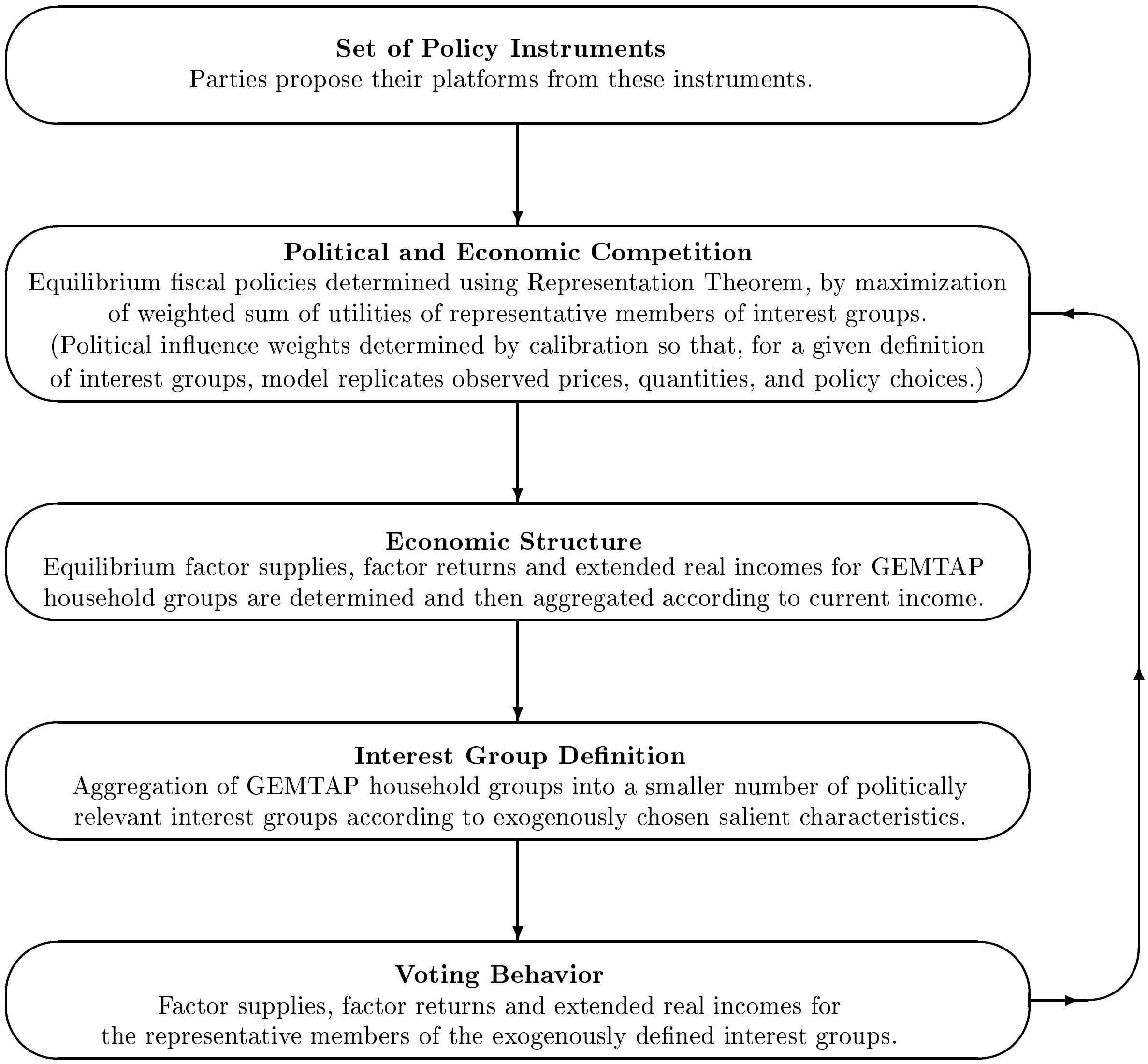

Figure 1: A simplified flow chart emphasizing how the computable model is used to explore the importance of the definition of interest groups

Tax on:	*1973*	*1983*
Labor supply (τ_L)	**.092**	**.125**
Capital supply	.492	.468
Personal income	.085	.057
Capital and income (τ_K)	**.170**	**.140**
Labour and income	.088	.087
Government size relative to private consumption	.370	.337

Table 1: Average Tax Rates and the Size of Government in the Benchmark Data Sets, 1973 and 1983

two-dimensional graphs. Note that the reduction in the dimensionality of the policy space is not sufficient to rule out vote cycles under deterministic voting.

In defining the aggregated tax on capital and personal income in simulations, we fix at the actual values (i) the ratios of capital taxes across sectors, (ii) the ratio of capital to personal income taxes, and (iii) the marginal personal income tax schedule. The tax on labour in a simulation is similar to that in the original GEMTAP model.[16]

Although the fiscal structure is simple, it still captures interesting stylized facts concerning the evolution of average tax rates over the 1973 to 1983 period in the United States. Table 1 shows that in the benchmark data sets, τ_L increases by about one third from 0.092 in 1973 to 0.125 in 1983.[17] Over the same period, τ_K decreases by about one sixth from 0.170 to 0.140. The table also shows what would occur if we had aggregated labour and personal income taxes instead of capital and personal income taxes: the increase in the taxation of labour supply and the reduction in personal income taxes over the decade are then hidden from view.

[16]The tax on labor includes social security taxes, unemployment insurance taxes and workman's compensation, all of which are treated as ad valorem taxes on the use of labor services by industry. The tax on capital and income includes state and local corporate taxes modelled as a tax on the use of capital services by industry, as well as state and local personal income taxes.

[17]Table 1, as well as a similar version of Figure 2 below, are also used in chapter 7 of Hettich and Winer (1999).

3.1.2 The introduction of a public good

The original GEMTAP structure does not include public services as an argument in individual utility functions (See Ballard et al, 1985, p. 44). It seems unlikely, however, that taxes would be observed in a democratic society unless most voters received something of value in return. In the present model, voters receive a pure public good.

The public good is introduced in a manner that leads to an extended measure of real after-tax personal income which includes the private valuation of public services. This extended real income is used in valuing the welfare of voters. The approach is based on the following reasoning (Rutherford and Winer 1995): assume that a representative household solves a problem of the following form, where subscript h is omitted,

$$\max_{d,g} U(d, g) \tag{5}$$

$$\text{s.t.} \sum_i p_i d_i = \sum_i p_i w_i - T, \tag{6}$$

$$g = G, \tag{7}$$

where T and d denote, respectively, total taxes payed by this household and private consumption demand[18]; g represents *notional* demand for the public good by the household, the supply of which is fixed at G; and w is the household's endowment. The problem in (5) explicitly assumes that the individual chooses the levels of both private goods and public services, even though the level of G is fixed and is the same for everyone. By imposing the constraint $g = G$, we insure that the solution to this problem is consistent with the fact that everyone consumes the pure public good at level G.

The introduction of the extra constraint is useful in defining an *extended* measure of real income that is net of taxes, but includes the private valuation of public goods.

[18]Leisure is omitted from (5) in this stylised model for ease of exposition. It is, however, included in the full model.

This definition of real income can be used as a cardinal measure of welfare. With the constraint $g = G$, the solution to the utility maximization problem (5) will include a Lagrange multiplier, μ, for the public good constraint in addition to the usual Lagrange multiplier, λ, for the private income constraint. We may interpret μ as the agent's marginal utility of the public good and $\nu = \mu/\lambda$ as the willingness to pay for an additional unit of the public good.

If ν is given at a level consistent with the actual level of public provision, we can then reformulate the individual household's problem in (5) in the following manner:

$$\max_{d,g} U(d, g) \tag{8}$$

$$\text{s.t.} \sum_i p_i d_i + \nu g = \sum_i p_i w_i - T + \nu G. \tag{9}$$

This transformation leads to a description of the standard consumer problem for an extended set of prices (p, ν), demands (d, g) and endowments (w, G). The demand g is what we have previously referred to as the notional demand for the public good. The right-hand side of the constraint in (9) is the representative individual's extended real income, which includes the private valuation of public services and is net of taxes. We shall denote this measure of income by R_h/n_h, where R_h is the extended income of the group.

In a simulation, equation (7) of the model determines the value of ν_h in (9) so that the notional demand g is equal to the level of public goods actually supplied G. Along with tax payments and the size of G, this is used to measure extended real income in the simulation. In the calibration of the model to an actual data set, marginal valuations of public services must be imposed in order to completely specify individual preferences. Since little is known about individual marginal valuations of public services, we assume that they are uniform across individuals, and that their sum is equal to the marginal cost of public goods production.[19] Following Piggot and

[19]The equality of the sum of the marginal valuations and the marginal cost of public goods production is the well-known Samuelson condition for Pareto-efficiency in the presence of public goods, when the excess burden of taxation and the complementarity of public and private goods are ignored.

Whalley (1987), expenditure shares in utility functions are then calibrated so that given the valuations of the public good and private goods prices, each household's demands are equal to the private-public bundle of goods that they in fact are observed to consume in the actual data sets. We also follow Piggot and Whalley (1987) by assuming a constant elasticity of substitution between public and private goods equal to one half.[20]

3.1.3 Some other amendments to the GEMTAP structure

The capital stock is endogenized through international capital flows only. International capital flows depend on the real after-tax price of capital services in the United States relative to the real exchange rate, and on the constant elasticity with respect to the relative net of tax price of capital, σ_K. This is an amendment to the original GEMTAP structure based on Goulder, Shoven and Whalley (1983) that provides an important margin for the response of the capital stock to taxation. We set $\sigma_K = 0.5$. The government budget is balanced so that there is no government debt.

3.2 Cardinalizing utility to operationalize the support function

In order for the political support function to be optimized, it is necessary to cardinalize utility so that the weighted sum of utilities can be measured. We therefore redefine utility u_h as

$$u_h(R_h/n_h) = \begin{cases} \frac{(R_h/n_h)^{1-\sigma_R}}{1-\sigma_R} & \text{if } \sigma_R \neq 1 \\ \ln(R_h/n_h) & \text{if } \sigma_R = 1 \end{cases} \tag{10}$$

where R_h/n_h is the average extended net income for group h and σ_R is the coefficient of relative risk aversion, assumed equal across households. Note that a larger σ_R implies that a low-income voter is more responsive to a given change of income relative to a better-off voter.

[20] This implies an uncompensated elasticity of demand with respect to the private "price" of public services of -0.5 if public good expenditure shares are small, a figure roughly consistent with some empirical estimates (Shoven and Whalley 1992, p. 96).

3.3 Determination of the influence weights by calibration

We now show how the influence weights θ_h can be calibrated so that optimization of the support function yields the values of policy instruments, private goods prices and quantities actually observed. Assuming, for ease of exposition, that $\sigma_R = 0$, the required weights for each group can be deduced by solving for the Lagrange multipliers of the following problem:

$$\max_{R_h} \sum_h R_h \tag{11}$$
$$\text{s.t. } E(R_1, R_2, ..., R_H, \tau_L, \tau_K, G) = 0,$$
$$R_h \geq \overline{R}_h,$$

where $E(\cdot)$ represents the general equilibrium structure of the private economy. To see why, write the Lagrangian as

$$L = \sum_h R_h - \lambda E + \sum_h \alpha_h (R_h - \overline{R}_h). \tag{12}$$

The first-order conditions are

$$1 - \lambda \partial E / \partial R_h + \alpha_h = 0,\ h = 1, ..., H. \tag{13}$$

Consider now the problem of choosing the R_h so as to maximize political support $\sum_h \theta_h R_h / n_h$ where, to recall, θ_h is the influence weight for the group, equal to the per-capita weight times the number of people in the group. Let θ_h^* denote a calibrated political weight from the support function such that optimization of the support function using such weights replicates the equilibrium. Its first-order conditions would be

$$\theta_h^* / n_h - \lambda \partial E / \partial R_h = 0,\ h = 1, ..., H. \tag{14}$$

Comparison of the above two sets of first-order conditions indicates that the calibrated per capita weight for each h is equal to $1 + \alpha_h$.[21]

[21] The correspondence of the political weights and Lagrange multipliers in a maximization problem has also been discussed in van Velthoven (1989).

As Winer and Rutherford (1995) have made clear in an alternative, equivalent calibration procedure, in order to calibrate the political influence weights uniquely, the number of interest groups must be equal to the number of fiscal instruments.[22]

Since our stylized model of the fiscal system consists of three instruments (two tax rates and one public good), households in the GEMTAP model must be aggregated into three interest groups, within which politically relevant behavior is as homogeneous as possible.

3.4 Alternative definitions of interest groups using the GEMTAP data sets

In the GEMTAP data sets, households are aggregated into a number of groups according to current income as specified in the U.S. Treasury Department's Merged Tax Files (Ballard et al 1985, p. 28).[23] Behavior within each group is assumed to be homogeneous. Factor endowments for these groups of households are recorded in the data sets, and these endowments, along with factor supplies, determine how factor returns by industry (there are 19 industrial sectors in the GEMTAP model) are imputed to the various household groups. As shown in Table 2, the GEMTAP data set includes twelve household groups for 1973 and fourteen for 1983. The table also reports each group's share of population, average factor income, capital-labour income ratio and receipt of government transfers as a per cent of factor income.[24]

The issue we face is how to aggregate the GEMTAP households into three larger and politically relevant groups within which political behavior is relatively homoge-

[22]This alternative procedure involves solvng the first conditions for policy instruments, considered as a set of equations in the unknown influence weights.

[23]We have removed one very small group, group H1, from the 1983 data set because it exhibits a negative average factor income, probably due to capital losses, or some farmers' low yields, for the current year.

[24]Note that the average factor income in Table 2 does not always correspond with a group's household income range. There can be two reasons for this: (i) factor income does not include government transfers; (ii) adjustments were performed over factor incomes in order to make them consistent with factor payments. (These two reasons do not seem satisfactory, however, to justify the differences between average factor incomes and household income ranges for groups H12 and H13 in 1983.)

1973

group (income range)	*share of population (%)*	*average factor income*	*K/L ratio*	*transfers (% of factor income)*
H1(0-3000)	15.9	1062	0.547	85.9
H2(3-4000)	7.7	2482	0.337	65.7
H3(4-5000)	7.0	3586	0.227	44.8
H4(5-6000)	6.9	4708	0.203	31.9
H5(6-7000)	5.7	5830	0.178	25.2
H6(7-8000)	5.3	7208	0.149	16.6
H7(8-10000)	9.6	8804	0.123	12.7
H8(10-12000)	8.5	11121	0.123	9.4
H9(12-15000)	11.0	14017	0.106	6.3
H10(15-20000)	11.5	18016	0.111	5.2
H11(20-25000)	5.2	22639	0.139	5.1
H12($>$ 25000)	5.7	38303	0.424	4.5

1983

group (income range)	*share of population (%)*	*average factor income*	*K/L ratio*	*transfers (% of factor income)*
H2(0-3000)	1.0	933	0.136	64.9
H3(3-6000)	3.1	1692	0.285	157.4
H4(6-10000)	7.0	3715	0.227	90.0
H5(10-15000)	11.0	7385	0.182	41.3
H6(15-20000)	11.5	10696	0.170	27.0
H7(20-25000)	10.6	13806	0.159	20.0
H8(25-30000)	9.5	17218	0.149	14.1
H9(30-40000)	15.3	20120	0.144	11.0
H10(40-50000)	11.0	24429	0.141	8.1
H11(50-75000)	13.6	27231	0.176	6.7
H12(75-100000)	3.7	33928	0.279	5.2
H13(100-200000)	2.2	54013	0.437	2.9
H14($>$ 200000)	0.5	206846	1.129	0.7

Table 2: GEMTAP Data for Household Groups

neous. Since there is little guidance in the literature on how this task should be accomplished in the computable context, we investigate a number of alternatives. No doubt, much work on the definition of interest groups in the computable political economy setting remains to be done.

Each of the four different methods of aggregating households into interest groups we use involves a subjective judgement about the relative size of the interest groups in 1973, about changes in the nature of the groups over time, and about the basic characteristics of households that are to be used in defining the groups. The four methods we employ emphasize respectively the following characteristics of the population: household income ranges; household incomes and population shares; household incomes and shares of income from capital (the method used in Rutherford and Winer 1995); and capital-labour income ratios. The first three methods combine groups with adjacent household income levels according to different criteria, while the fourth relies solely on the ratio of capital to labour income.

An argument can be made that each of these four methods of aggregating people into groups combines voters with similar interests and political behaviours. The proportion of factor income from ownership of capital has often been used as a basis upon which to define interest groups, on the argument that the ownership of capital is highly correlated with economic interests and, consequently, with political behavior. The position of an individual in the income distribution is often thought to be decisive in determining voting behavior with respect to distributive matters (as in Coughlin, Mueller and Murrell 1990), while capital/labour ratios have often been relied upon in the political economy of trade literature because of the importance of this ratio within the general equilibrium structure of the economy (see, for example, Mayer 1984 and Yang 1995).

The exact definition of, and results from applying, the four methods of aggregation are recorded in Table 3, and highlighted by shaded entries. The first method shown in the table relies on *household income ranges* alone and is given in the panels labelled INCOME RANGE. Taking into account the discrete nature of the household subgroupings in the original GEMTAP data, in 1973 group L, the lower income group, is assumed to consist of all households with incomes between 0 and $6000 in current dollars; that is, we aggregate groups H1 to H4 into one group in 1973 within which behaviour is assumed to be homogeneous. Similarly, group M, the middle income group of households, includes all households within the $6000 to $25000 range, while group U, the upper or higher income group of voters, includes all households with current incomes over $25,000. This yields a set of three groups, a richer group that is quite small (5.7% of the population), a very large middle income group (56.8%), and a sizable lower income group that includes blue collar workers as well as poorer individuals (37.5%). In assessing the nature of these groups, it may be helpful to note that in 1973 the official poverty threshold for a family of four was $4540 in current dollars and that 11.1% of the total population was considered to be poor (Department of Commerce, 1990). The corresponding figures for 1983, after prices had approximately doubled, are $10,178 and 15.2%.

Since prices approximately doubled between 1973 and 1983, groups for 1983 are defined by using income ranges approximately twice those used in 1973, as indicated in the shaded column of the panel labelled INCOME RANGE in Table 3. The imprecise correspondence of group L's income range in 1983 with that in 1973 stems from the discrete nature of subgroupings in the original GEMTAP data sets. As can be seen in Table 2, it is not possible to include only households with incomes below $12000 in the lower income group in 1983, and it is our judgement that the large group with incomes between $10000 and $15000 (11% of the population in 1983) is best included in the lower income interest group for that year.

Using household income ranges alone to aggregate subgroups leads to interest groups with other characteristics that differ substantially across the two years for which we have data. For instance, group U defined by income alone makes up 5.7 percent of the population in 1973, and 20.1 percent of the population in 1983. More-

1973						1983					
	INCOME RANGE	POPULATION SHARE (%)	AVERAGE FACTOR INCOME	K/L RATIO	CAPITAL SHARE (%)		INCOME RANGE	POPULATION SHARE (%)	AVERAGE FACTOR INCOME	K/L RATIO	CAPITAL SHARE (%)
INCOME RANGE						INCOME RANGE					
L(H1 - H4)	**0 - 6000**	**37.5**	**2494**	**0.288**	**12.7**	L(H2 - H5)	**0 - 15000**	**22.0**	**5138**	**0.196**	**5.8**
M(H5 - H11)	**6 - 25000**	**56.8**	**12834**	**0.122**	**48.1**	M(H6 - H10)	**15 - 50000**	**57.9**	**17431**	**0.149**	**40.8**
U(H12)	**> 25000**	**5.7**	**38303**	**0.424**	**39.2**	U(H11 - H14)	**> 50000**	**20.1**	**35688**	**0.315**	**53.5**
SHARE OF POPULATION						SHARE OF POPULATION					
L(H1 - H4)	**0 - 6000**	**37.5**	**2494**	**0.288**	**12.7**	L(H2 - H6)	**0 - 20000**	**33.5**	**7048**	**0.182**	**11.3**
M(H5 - H11)	**6 - 25000**	**56.8**	**12834**	**0.122**	**48.1**	M(H7 - H11)	**20 - 75000**	**60.0**	**20952**	**0.155**	**52.5**
U(H12)	**> 25000**	**5.7**	**38303**	**0.424**	**39.2**	U(H12 - H14)	**> 75000**	**6.4**	**53650**	**0.508**	**36.2**
SHARE OF CAPITAL INCOME						SHARE OF CAPITAL INCOME					
L(H1 - H4)	**0 - 6000**	**37.5**	**2494**	**0.288**	**12.7**	L(H2 - H7)	**0 - 25000**	**44.1**	**8672**	**0.173**	**17.6**
M(H5 - H11)	**6 - 25000**	**56.8**	**12834**	**0.122**	**48.1**	M(H8 - H11)	**25 - 75000**	**49.4**	**22486**	**0.154**	**46.2**
U(H12)	**> 25000**	**5.7**	**38303**	**0.424**	**39.2**	U(H12 - H14)	**> 75000**	**6.4**	**53650**	**0.508**	**36.2**
CAPITAL-LABOR RATIO						CAPITAL/LABOR RATIO					
L(H6 - H11)	**7 - 25000**	**51.1**	**13610**	**0.120**	**45.1**	L(H2,H7 - H11)	**-**	**61.0**	**20632**	**0.155**	**52.5**
M(H3 - H5)	**3 - 15000**	**19.6**	**4631**	**0.200**	**9.2**	M(H5 ,H6)	**10 - 20000**	**22.5**	**9080**	**0.175**	**9.5**
U(H1,H2,H12)	**-**	**29.3**	**8633**	**0.425**	**45.7**	U(H3,H4,H12 - H14)	**-**	**16.5**	**22799**	**0.481**	**38.0**

TABLE 3: ALTERNATIVE DEFINITIONS OF INTEREST GROUPS

over, the group L received 12.7 percent of total capital payments in 1973 while in 1983, at 5.8 percent, its capital income share was reduced to less than half that amount. Clearly, use of other criteria such as population share or share of capital income, will alter the definition of interest groups substantially.

In order to obtain groupings of households based on observed population shares or shares of capital income that are similar for the two years for which we have data, in all cases we retain, for 1973, the same groupings of households that are used to define groups based on household income ranges alone. Then, using in turn population shares and shares of capital income as an additional characteristic, we aggregate GEMTAP subgroups with adjacent income ranges in 1983 to create interest groups that match those in 1973 as closely as possible with respect to this additional characteristic, given the discrete nature of the subgroupings in the GEMTAP data sets. This procedure yields three sets of groups in 1983 that differ considerably with respect to the key characteristics of groups.

The results of using the share of population as an additional characteristic are shown in the second panel of Table 3 labelled SHARE OF POPULATION. This method of defining interest groups results in a lower income group that makes up 37.5 per cent of the population in 1973 (as in the method based only on income ranges) and 33.5 percent of the population in 1983. The upper income group U includes 5.7 percent of the population in 1973 and 6.4 percent in 1983. The resulting middle income group in 1973 includes 56.8 and 60.0 percent of the population in 1973 and 1983 respectively.

Using the share of capital income in addition to household income range as a basis for aggregation (see the panel called SHARE OF CAPITAL INCOME) suggests matching the L group for 1973 which received 12.7 percent of the economy's capital income, with groups H2 to H7 in 1983 which together received 17.6 percent of capital income in 1983. And so on for the M and U groups. Again the correspondence across the two benchmark data sets is approximate due to the discrete nature of the original

GEMTAP subgroupings of households.

The fourth method of defining interest groups differs substantially from the previous three since it is not based on aggregating subgroups with adjacent household income ranges. Rather, it rests solely on aggregation according to ratios of capital to labour income. In view of the importance of capital-labour ratios in the present general equilibrium setting, this seems like an equally sensible way to define interest groups. Again we define groups so that, with respect to the characteristic of primary concern, interest groups are as similar as possible across the two benchmark data sets.

In order to define groups with similar capital/labour ratios across the two years, it is necessary to combine subgroupings of households with non-adjacent income ranges in both years; other groupings of GEMTAP households result in more substantial differences in ratios of factor incomes across the two benchmark data sets. As can be seen in the last panel of Table 3, to define three groups with similar capital/labour ratios in the two years we combined the two lowest income subgroups in 1973, H1 and H2, with the highest income group, H12, to create a group (U) in 1973 with a relatively high capital/labour ratio of 0.425. (We conjecture that the high capital/labour ratios observed in some of the lower income groups are due to the presence of pensioners.) The corresponding group for 1983 is made up of two low income groups, H3 and H4, and the three highest income groups, H12 to H14, and has a similar ratio of 0.481. And so forth for the middle and lower capital-labour interest groups.

4 Influence and Interests in the United States

4.1 Ideal points and Pareto sets

Before presenting calibration results, we first take a look at the ideal points and Pareto sets for each method of defining interest groups. An ideal point represents a voter's preferred policy platform when he does not have to compromise with other members of the electorate. The ideal point for a group is thus computed by attributing a strictly positive value to its influence weight in the support function S, while a zero weight is assigned to the other groups. It provides a useful record of the economic interests of a group. As for the Pareto set, it is constructed from the set of tax rates bounded by the contract curves between pairs of ideal points for the three representative voters.

Figure 2 presents, for 1973, the Pareto set, ideal points, benchmark tax rates and other information based on the use of household income alone as a basis for aggregation. Figure 3 presents similar information when capital/labour ratios alone are used in 1973 as a basis for aggregation.

In Figure 2, points B73 and B83 locate the actual, or benchmark tax rates in 1973 and 1983 respectively. Between the two periods, the capital-income tax falls by about 18 percent while the labour tax rate increases by about 36 percent. Points L, M and U respectively denote the ideal points for the lower, middle and upper income groups respectively. The figure shows that the lowest income group L prefers subsidisation of labour at a rate of -47 percent, while a capital-income tax rate of 144 percent. The Middle income group prefers a labour tax rate of -11 percent and a capital-income tax rate of 32 percent, while the higher income voters prefer a labour tax rate of 38 percent and subsidization of capital and high incomes at the rate of -0.5 percent. Since the benchmark tax system for 1973 lies inside of the banana-shaped Pareto-set, calibration of the influence weights may be successful in that year, provided that the support function has sufficient concavity. The dotted line running through the benchmark B73 represents the government's constant revenue curve. We can see that in 1973, groups U and M would prefer a smaller level of public services.

The dashed line labelled "Path of (local) ideal points for L" illustrates the evolution of the calculation of the ideal point for the lower income group as a search over an increasingly large neighbourhood of the benchmark is conducted. The paths of local ideal points for the middle and upper income groups have also been drawn on Figure 2, although they have not been labelled for clarity. The nonlinearity of these lines indicates that the choice between a local and a global definition of equilibrium - the size of area around the benchmark within which the search for an optimum of

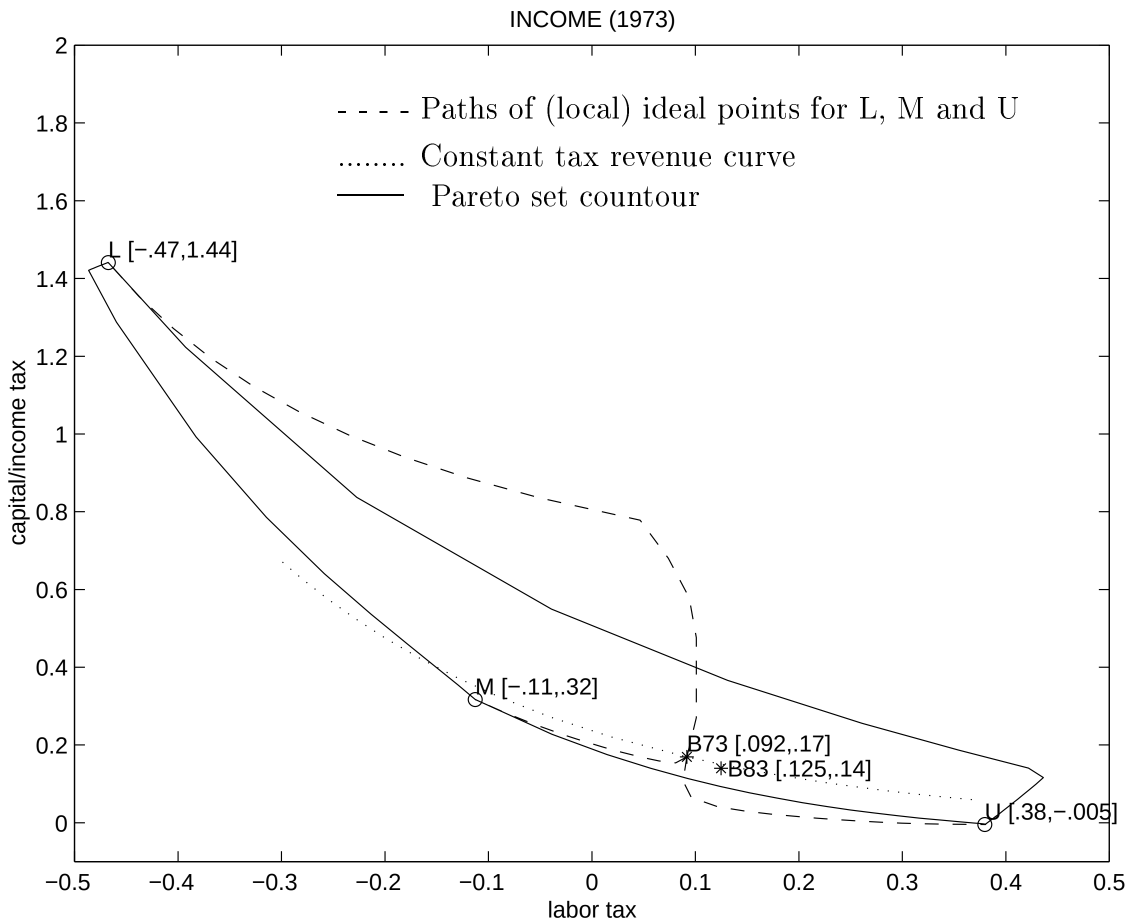

Figure 2: Ideal Points and Pareto Set with Interest Groups Defined by Household Income Ranges, 1973

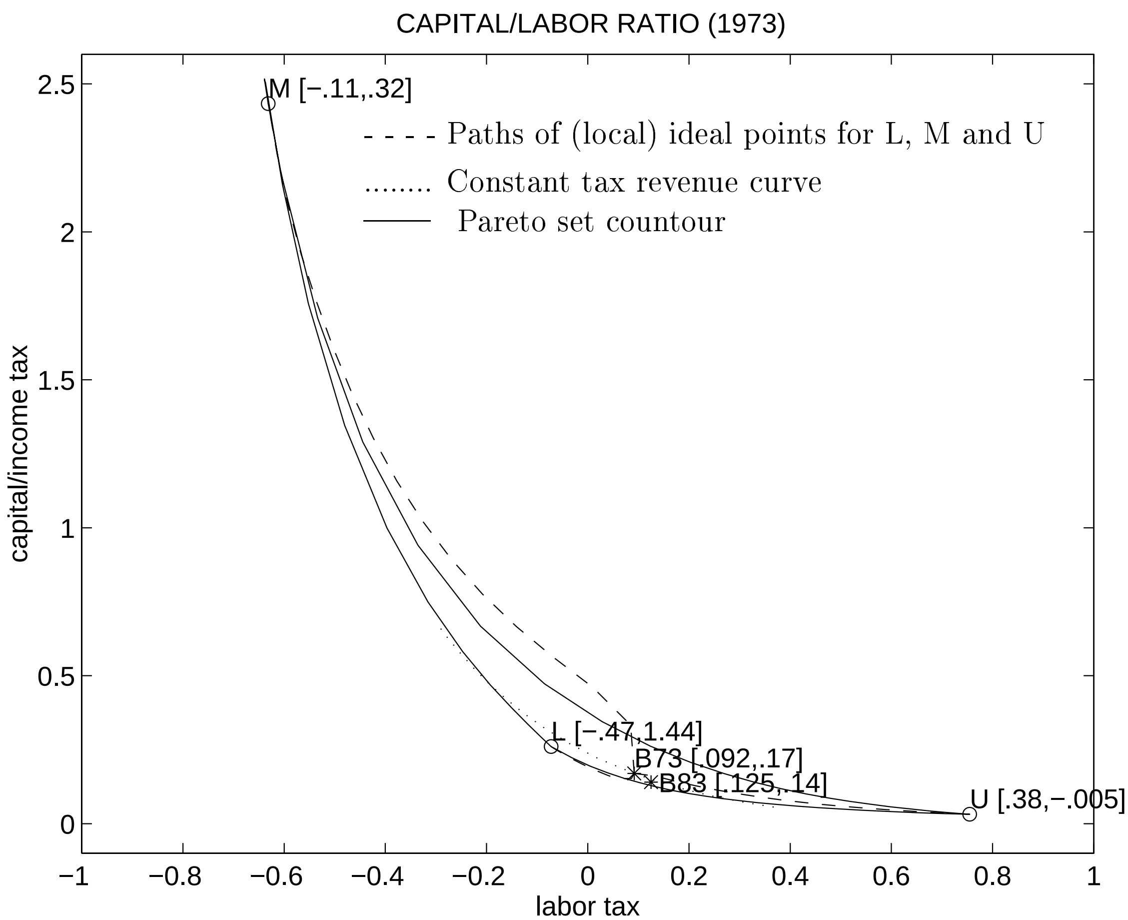

Figure 3: Ideal Points and Pareto Set with Interest Groups Defined by Ratio of Capital to Labour Income, 1973

the support function is conducted - is a matter of considerable importance for the implementation of the spatial voting model.

Figure 3 presents results analogous to those in Figure 2, but uses capital/labour ratios as the basis for the definition of interest groups. Since this method of aggregation involves combining groups that do not have adjacent household income ranges, the results are different. Here the middle group in terms of capital/labour income ratios would like the lowest tax on labour income and the highest rate of taxation of capital and high incomes, while the group with the lowest such ratio has an ideal point much closer to the benchmark in 1973. The reader is invited to compare Figures 2 and 3 further with the help of Table 3.

Figure 2 is reproduced in the upper left corner of Figure 4, which also shows ideal points and Pareto sets for other definitions of interest groups in 1983. If interest groups are formed only according to household income ranges, the relevant figures to compare are the upper left figure for 1973 with the top right one for 1983. This comparison suggests that structural changes in the economy that occurred between 1973 and 1983 have resulted in a lowering of the ideal tax on capital and personal income and a reduction in the subsidy to labour desired by group L. The same can be said for the middle income group but to a much smaller extent. The ideal point of the upper income group shows little change. Comparisons of ideal points based on using population (using the top right figure for 1973 and the bottom left one for 1983) and a comparison based on using shares of capital income (using the top left for 1973 and the bottom right figure for 1983) suggest the same conclusion.

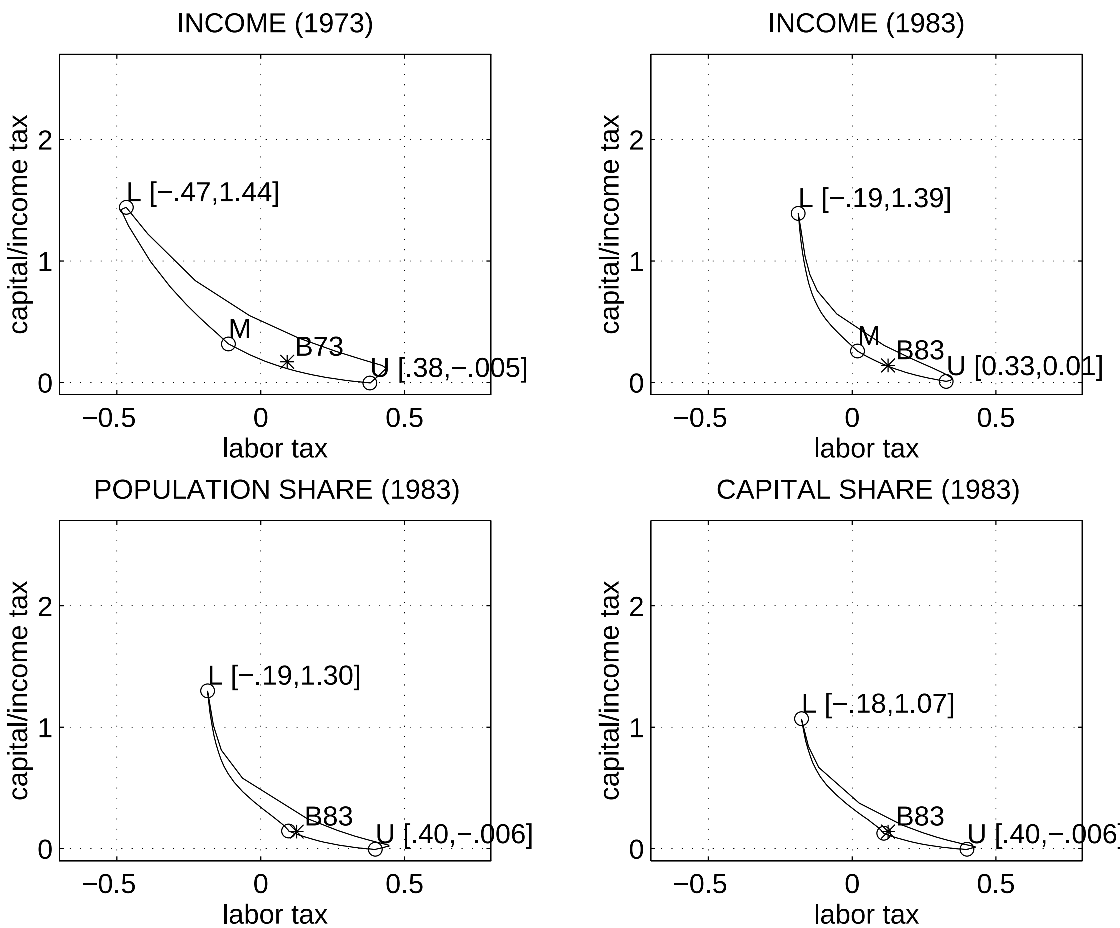

Figure 4: Ideal Points and Pareto Sets for Different Definitions of Interest Groups that Involve Aggregating Households with Similar Incomes, 1973 and 1983

Pareto sets for 1973 and 1983 when groups are defined by capital/labour ratios are shown in Figure 5. Here a comparison of ideal points across the two years reveals that the group with ideal points of both the M and L groups move down and to the right by substantial amounts relative to the differences between the two benchmark tax systems.

One possible explanation for changes in ideal points between 1983 and 1973 shown by Figures 4 and 5 is that a more open economy in 1983 increased the full cost for lower income interest groups of taxing capital. At the same time, the ideal labour subsidy for lower income groups was reduced so that the lower tax on capital and personal incomes would not reduce too severely the provision of public services.[25]

4.2 Political influence weights for 1973 and 1983

Calibrated influence weights are reported in Figure 6 for each method of defining interest groups, and for three values of the coefficient of relative risk aversion σ_R (denoted CRRA in the figure). Calibration is successful for all definitions of interest groups and values of the risk aversion parameter we investigated. In each case, the figure shows the calibrated influence weights of the representative member of each group using bar graphs, with the per-capita influence for group L normalized to one. In the figure, the prefix "INC" before a date refers to income as a method of aggregation, and the prefixes POP, K and K/L refer respectively to the methods that rely on population shares, shares of income from capital and capital-labour income ratios.

Figure 6 also reveals that for a given definition of interest groups, an increase in

[25] Calculation of Pareto sets based on an amended model that is closed to trade and capital flows suggest that the openness of the economy did increase between 1973 and 1983. For definitions of interest groups based on income ranges, population shares and capital income shares, the ideal point of the M group, the one nearest to the benchmark in 1983, moves substantially upwards and to the left when the 1983 economy is closed to trade. This indicates that when the economy is closed off, the M group finds it advantageous to have a much higher tax on capital and much greater subsidisation of labour. This movement, when the 1983 economy is closed, is of larger magnitude than the analogous change in the ideal point for the group when the 1973 economy is closed. A similar result holds for the L group defined by capital/labour income ratios. See Rutherford and Winer (1995) and Hettich and Winer (1999, ch. 7).

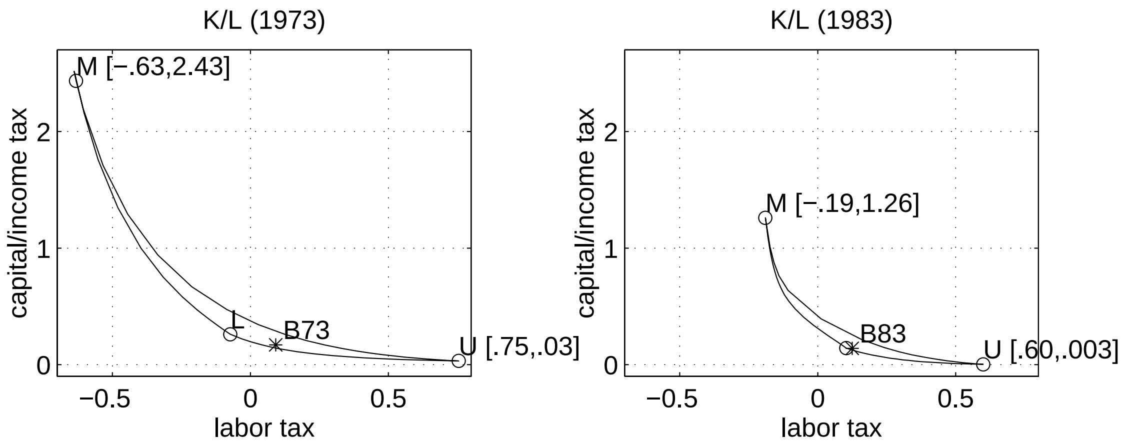

Figure 5: Ideal Points and Pareto Sets when Households are Aggregated According to Capital/Labour Income Ratios, 1973 and 1983

the coefficient of relative risk aversion leads to a reduction in the weight assigned to the lower income group. As noted earlier, this is to be expected since a higher value of σ_R results in an increase in the relative sensitivity of lower income voters to a change in extended real income or welfare. The lower weight is thus required to insure that the same benchmark tax rates, rather than ones that are more favourable to the now more politically sensitive group, result from maximization of an appropriate political support function. (In the case of the capital/labour ratio criterion for interest group formation, the interpretation of the effects of an increase in the risk aversion parameter is not straightforward, since members of the three groups are quite heterogeneous as far as within-group income levels are concerned.)

If the coefficient of relative risk aversion is equal to one and interest groups are formed according to income levels and population shares, Figure 6 indicates that the per capita political influence of the upper income group relative to the lower income group decreases from 3.78 in 1973 to 1.55 in 1983. (Equivalently, it can be said that the relative influence of group L increases over the decade.) As for the middle income group M, its influence also declined somewhat over the decade relative to the lower income group since its relative per capita weight moves from 1.14 to 0.89. On the other hand, the influence of the representative member of the middle income group

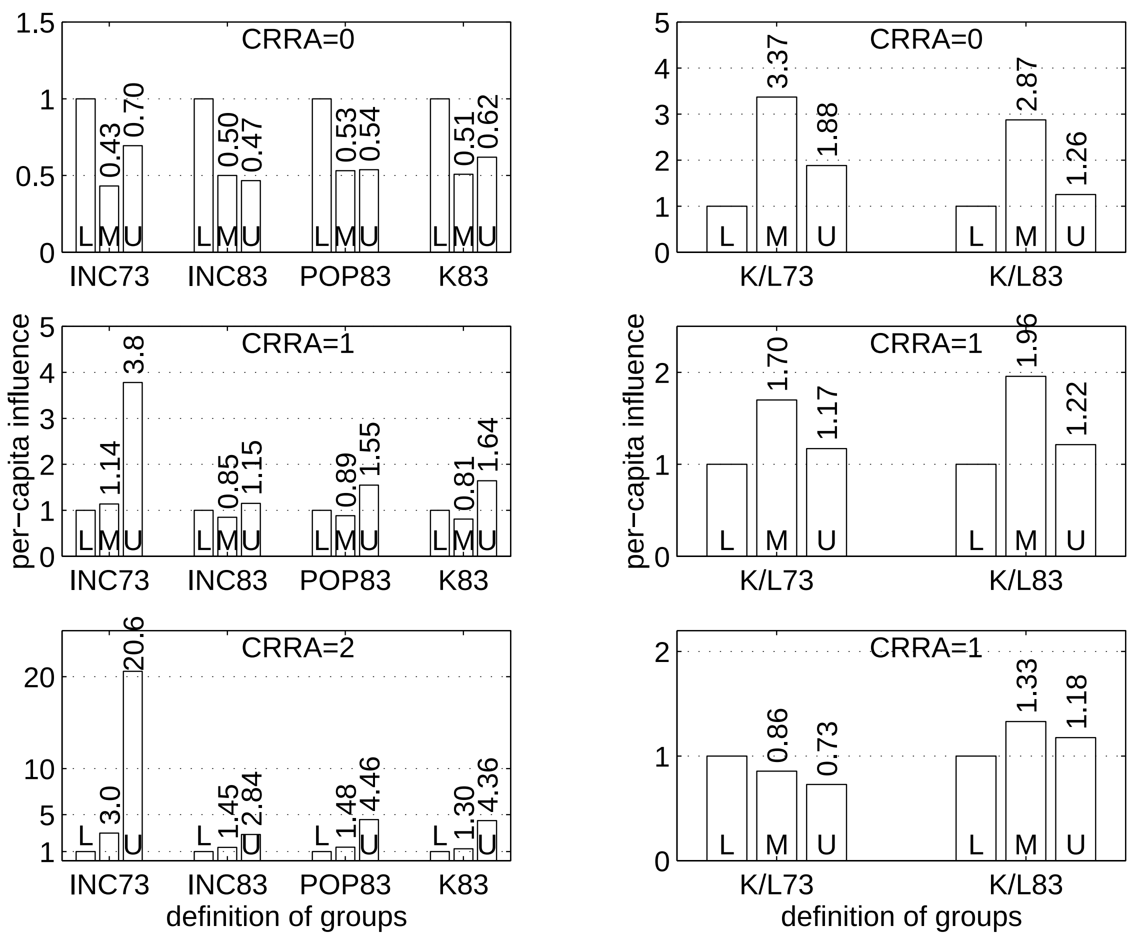

Figure 6: Calibrated Relative Per-capita Political Influence Weights

increases relative to that of the upper income group, going from a relative weight of $1.14/3.78 = 0.30$ in 1973, to $0.89/1.55 = 0.57$ in 1983.

If we consider only the left hand panels in Figure 6, an intriguing pattern of change in relative influence weights across the two years emerges: the influence of the upper income group U declines between 1973 and 1983 relative to the lowest income group. This result is robust with respect to definitions of interest groups based on income ranges, population shares and shares of capital income, as well as on differences in the choice of the coefficient of relative risk aversion. It is a surprising result if one attempts to prejudge the direction of changes in influence by looking at differences in actual equilibrium platforms in the two years, or on the basis of general knowledge of economic events over the decade in question. The fact that the (model equivalent) labour tax rate increased by about 36 percent and the capital-income tax rate fell by about 18 percent between 1973 and 1983 might be taken as an indication that there was a shift in influence in favour of higher income voters and voters with a higher share of capital income. However, such a judgement would be incorrect.

The results of calibration using interest groups defined by capital/labour ratios, shown on the right-hand panels in Figure 6, do not lead to straightforward conclusions concerning the direction of change in the relative influence of the groups. In studying the evolution of effective political influence in the present context, it obviously matters how interest groups are defined. For our preferred value of $\sigma_R = 1$, the figure indicates that the group with the median capital/labour income ratio gained in influence relative to the other groups.

5 Influence versus Interests in Fiscal History

In this section, we wish to isolate the effect of two sources of change on actual policy outcomes: (i) changes in the effective influence exerted by different groups and (ii) structural changes in the economy. We take the per capita weights derived from calibration of the economy to the 1973 data set for each definition of interest groups and apply them to the 1983 economy. The new equilibrium political platforms obtained by optimization of the implied, counterfactual political support function indicates what would have happened in 1983 had per capita relative political influence not evolved. The difference between the 1983 benchmark tax system and the counterfactual tax system thus reveals what would have happened solely as a result of political responses to the changing demands of voters that followed structural changes in the economy.

The results of the counterfactual experiments are reported in Figure 7. Points B73 and B83 again denote the observed tax systems in 1973 and 1983 respectively, while the points labelled INC, CAP, POP and K/L represent counterfactuals based on the use of income ranges, capital income shares, population shares and capital/labour ratios respectively to define interest groups.[26]

Setting aside results based on using capital/labour ratios for the moment, Figure 7 shows that if political influence as a source of change in equilibrium policy outcomes is eliminated, capital-income tax rates fall substantially farther than they actually did, and that the tax rate on labour increases substantially more than actually occurred. This pattern holds for each of the definitions of interest groups and for all values of the risk aversion parameter considered, though the exact amount of the changes depends on the precise definition of groups and the value of the CRRA coefficient employed in constructing the counterfactual. In these cases, it is necessary to appeal to changes in political influence to explain why labour tax rates didn't rise even more than was observed to occur, and why the capital-income tax rate didn't fall even further.

Counterfactuals based on using interest groups defined by capital/labour income ratios suggest a somewhat different decomposition. With a risk aversion coefficient of 2, the counterfactual labour tax rate is below that in the benchmark for 1983. Note, however, that in all cases, the counterfactual capital-income tax rate is lower than the benchmark level. With $\sigma_R = 1$, the counterfactual outcome is quite close to the 1983 benchmark reflecting the modest changes in calibrated weights between the

[26]Results in Rutherford and Winer (1995) are presented for definitions based on income only.

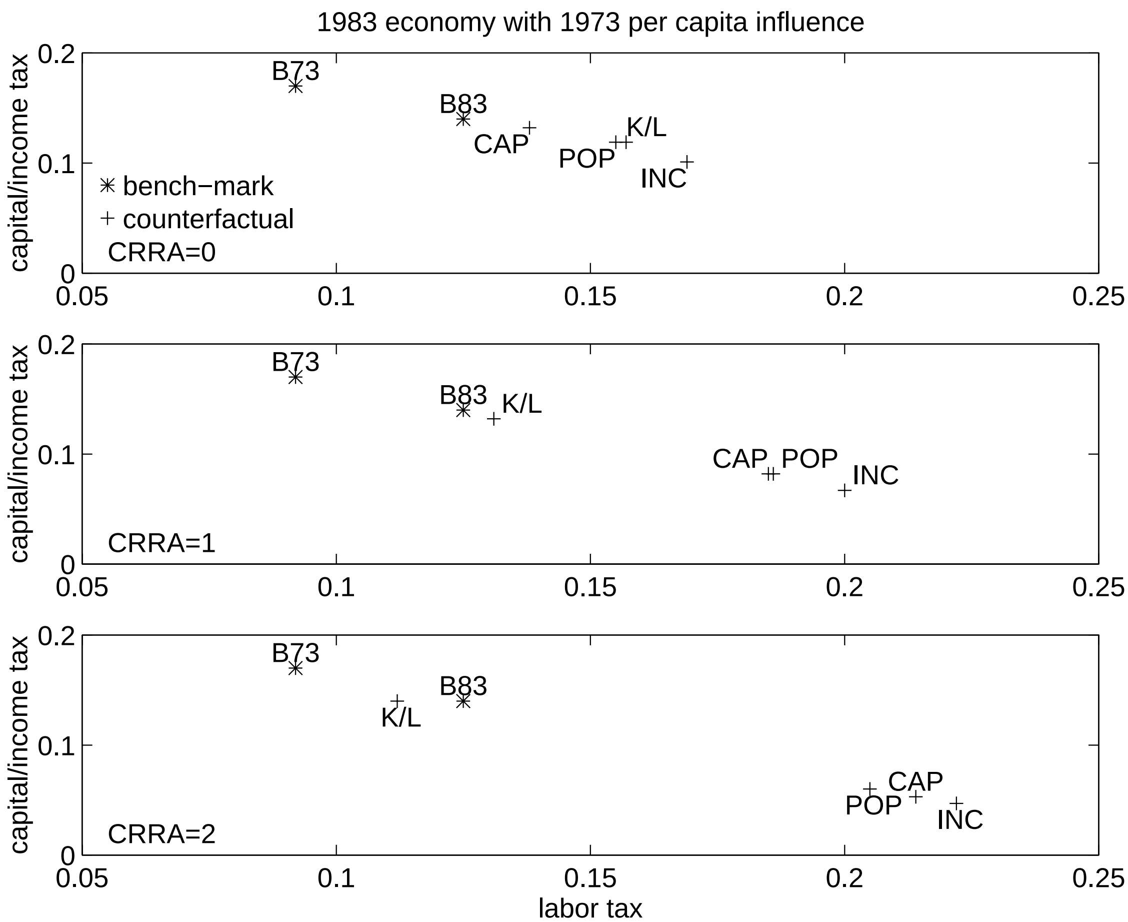

Figure 7: The 1983 Economy with 1973 Calibrated Influence Weights

Interest groups defined by	*Effects of introducing 1973 influence weights into 1983 economy (relative to actual 1983 tax rates)*	*Implication on evolution of interest groups' relative influence*
income and - income ranges - capital income shares - population shares (CRRA = 0,1 or 2)	↑ labour tax ↓ capital/income tax	decrease in relative influence of high-income groups
capital/labour income ratios and - CRRA = 0 or 1	↑ labour tax ↓ capital/income tax	decrease in relative influence of high K/L group
- CRRA = 2	↓ labour tax ↓ capital/income tax	ambiguous

Table 4: Summary of key conclusions from the counterfactual experiment

two years in that case. This particular counterfactual suggests that the evolution of the equilibrium tax system was primarily due to political responses to the changing economic interests of voters.

The key conclusions from the counterfactual experiment are summarized in table 4.

6 Conclusion

In many explorations of the political economy of taxation (including, for example, Winer and Hettich 1991), the distinction between economic interests and influence is bypassed. When institutions are stable, and if the relative political influence of different groups remains substantially unchanged, an understanding of how the demands of the electorate are evolving can provide a parsimonious explanation of changes in a tax system. But there is always the risk that changes in relative political influence have occurred and do matter. We have drawn attention to this possibility by exploring a model in which there is a well-defined difference between the policies that voters would like the government to adopt and the influence that different voters actually exert on equilibrium policy outcomes.

A key aspect of the probabilistic-voting theory on which the model is based is that policy outcomes reflect a balancing of heterogeneous and opposing interests in the electorate. This feature of the equilibrium is exploited to allow calibration of weights representing the relative influence of different groups on equilibrium policy platforms. In this respect, a substantial part of the paper is concerned with the importance of assumptions about how individuals are aggregated into interest groups. Since the equilibrium represents a balancing of the opposing interests of different groups, how these interests are defined can be expected to affect the outcome of our experiments. If interest groups are defined by aggregating households with similar incomes, the model indicates that the influence of higher income voters in the U.S declined relative to that of voters in the lower income (L) group over the decade after 1973. Providing an explanation for this pattern of political weights is an interesting task. (Since these weights are calibrated, the model does not provide one). A speculative answer is that voter registration and other related policies during the 1960's and 1970's resulted in a significant increase in the political influence of lower income groups.[27] (For some recent corroborating evidence, see Husted and Kenny 1997).

By inserting 1973 influence weights in the 1983 economy and computing a counterfactual equilibrium, we are able to explore the importance of the distinction between interests and influence for the evolution of tax policy. For interest groups defined by aggregating households from adjacent income ranges in different ways, the implied decomposition of U.S. fiscal history suggests that tax rates on labour services in the U.S would have increased even more over the decade after 1973, and those on capi-

[27] It seems unlikely to us that the Reagan administration could have had, as early as 1983, much impact on the influence weights. Hence, any evolution we are observing should mostly reflect developments in the 1970's.

tal services and personal incomes would have been substantially lower than actually occurred, had the relative influence of higher income voters not declined.

A definition of groups based on capital/labour ratios leads to a different pattern of calibrated weights and, therefore, to a different decomposition of fiscal history. In this case, with the preferred value of one for the coefficient of risk aversion, decomposition of fiscal history suggests that observed changes in the tax system should be attributed primarily to changes in economic interests that took place as a result of structural changes in the economy after 1973.

If one is not prepared to judge which method of defining interest groups is most appropriate, the results of our experiments as a whole suggest the following general conclusion: a full understanding of U.S. fiscal history over the decade after 1973 requires that changes in the effective political influence of different groups in the electorate be explicitly distinguished from changes in the policies that the various groups would like to see adopted.[28] In assessing this conclusion, it should be recalled that observations concerning changes in the welfare of voters and changes in the nature of equilibrium policy outcomes may be, and in the model we explore are, misleading indicators of changes in relative influence. The reason is that the welfare of a group may always have been worse (or better), and policy outcomes less favourable (or more desirable) had the influence of the group not improved (or deteriorated).

From a strictly methodological point of view, it is interesting that **all** of the definitions of interest groups used in the paper can be used within the **same** computable-equilibrium framework calibrated to the same set of actual tax policy outcomes, private prices and quantities. There is, it seems, an indeterminacy in the definition of interest groups, a basic element of many political-economic investigations, that cannot be resolved by the test of which definition works better in the present framework. This raises the questions of whether and how a "correct" method of aggregating individuals, and hence how a "true" attribution of political influence weights, can be

[28]This conclusion is, in our view, inherent in the work of authors such as Bentley (1908), Downs (1957) and Wittman (1995).

defined?

Finally, it may also be worthwhile to draw attention to the fact that the way in which the original GEMTAP benchmark data sets have been constructed constrains the way these data can be used in a political-economic investigation of the type we have conducted. We do not want to complain about this. Applied equilibrium modelling of the private economy, of which this data is an essential part, is a major intellectual achievement. However, researchers who want to use a computable-equilibrium framework to study tax and other public policies in a political-economic setting may wish to have incomes and other data disaggregated in a manner that is more closely related to interest group activity. For example, it may be useful to have data sets in which factor incomes are attributed to groups such as pensioners, those on social assistance, the self-employed, those in the public versus the private sector, and so on. Construction of such alternative data sets would allow computable equilibrium modelling to contribute more fully to the sort of issues and problems that arise in a study of the political economy of public policy.

APPENDIX

Proof of the Represntation Theorem

By definition, a Nash equilibrium platform in the electoral game solves the first-order conditions in (3). Thus at Nash equilibrium s^*,

$$\sum_{h=1}^{H}\left[\theta_h \frac{\partial u_h(s^*)}{\partial s_k}\right] / \frac{\partial E(s^*)}{\partial s_k} = \lambda \; ; \;\; k = 1, 2, ..., K,$$

where the θ_h defined in the theorem have been substituted into the first-order conditions. Second-order conditions for political optimization at s^* must be satisfied as well. But (i) the first-order conditions at the Nash equilibrium are identical to the first-order conditions satisfied by a solution s^{**} to the problem (4) of maximizing the support function S; (ii) Second-order conditions for an optimal choice of platforms by each party are satisfied at s^{**} since expected vote functions are assumed to be strictly concave; and (iii) the equations for the Lagrange multipliers λ in the solution for a Nash equilibrium strategy and for the problem in (4), which are not shown, are identical since the constraints on each party in the Nash game and in problem (4) are as well. Hence, $s^{**} = s^{*}$. **Q.E.D.**

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