Lecture 4:

Political Agency and Public Finance

- The model is based on joint work with Michael Smart from the University of Toronto.

- Politicians are a mixture of good and bad

- Re-election is the core incentive available.

- Type, some policies and aspects of the environment is not observable.

Overview

- Tension between selection and incentives is key when you have moral hazard and adverse selection.

- Constitutional and institutional changes have:
  - Direct effects
  - Political equilibrium effects

- Crude constitutional fixes are not easy to defend on welfare grounds even in simple models.

The Model

- There are two time periods; in each, the politician in office makes decisions about government spending.

- Between periods, there is an election in which voters choose between the incumbent and a challenger.

- In each period, the politician privately observes the unit cost θ of providing a public good: $\in \{L, H\}, H > L$, and Pr$(\theta = H) = q$.

- The incumbent chooses public good G and rent diversion s.

- Total spending is $x = \theta G + s$: $x \in [0, X]$

- Voters preferences: $W(G, x) = G - C(x)$, where C is a strictly convex.

- Politicians are "good" or "bad": $i \in \{b, g\}$.

  – A good politician chooses G in each period to maximize the discounted sum of voter welfare. He chooses

  $$G_\theta^* = \arg\max G - C(\theta G) \tag{1}$$

  Let $x_\theta = \theta G_\theta^*$ and maximal voter welfare is W_θ^*.

  – $x_L^* > x_H^*$ since $C(\cdot)$ is strictly convex.

- Assume that $X > x_L^*$.

- Let

$$EW^g(\mu) = qW^g(H, \mu) + (1 - q)\, W^g(L, \mu).$$

be expected welfare from a good politician.

- – Bad politicians have lexicographic preferences over rents and voter welfare. That is, they choose policies to maximize the expected discounted value of rents diverted during their terms of office, and they choose G to maximize voter welfare among all choices that yield maximal expected rents.

Timing:

- The types $i \in \{g, b\}$ of first-period incumbent and challenger are independent draws from an identical distribution with $\Pr(i = g) = \pi$.

- The incumbent then observes θ and chooses G and s .

- Voters observes G and x prior to the election at the end of the first period.

- In the second period, the politician then in office again chooses G and s given a fresh draw of θ.

- Let $\sigma(G, x)$ be the probability that voters re-elect the incumbent when observed performance is (G, x).

- Then the expected payoff to the bad politician of diverting rents (s_1, s_2) in the two periods is $s_1 + \beta\sigma(G, \theta G + s_1)s_2$, where $\beta < 1$ is the discount factor.

- We look for a Perfect Bayesian Equilibrium (slightly refined).

Equilibrium

- Bad incumbents can restrain rent seeking to get re-elected.
- Let $\lambda = \Pr(x = x_H^* | \theta = L, i = b)$ be the probability of restraint.
- When the cost shock is $\theta = L$, b can produce G_H^* units of the public good and spend x_H^*, diverting $\hat{s} \equiv (H - L)G_H^*$ to private rent consumption.

Proposition 0.1 *Assume that* $\hat{s}(\mu) \leq S$. *Then:*

1. *A pooling equilibrium, with* $\lambda = \sigma = 1$, *exists if and only if* $q \geq \frac{1}{2}$ & $\hat{s} \geq (1-\beta)S$

2. *A hybrid equilibrium, with* $\lambda = q/(1-q)$ *and* $\sigma = (S-\hat{s})/(\beta S)$, *exists if and only if* $q < \frac{1}{2}$ & $\hat{s} \geq (1-\beta)S$

3. *A separating equilibrium, with* $\lambda = 0$ *and* $\sigma = 1$, *exists if and only if* $\hat{s} \leq (1-\beta)S$

- The key observation is that

$$\Pr(g|x_H) = \frac{\pi}{\pi + (1-\pi)\frac{(1-q)}{q}\lambda}$$

where $\frac{(1-q)}{q}\lambda$ is the likelihood ratio associated with x_H : the ratio of the probability that x_H was generated by a bad incumbent/ same thing for a good incumbent.

- Note that the equilibrium strategies are independent of π.

- In a separating equilibrium – discipline is poor.
  - However, all bad incumbents are identified as such.
- In a hybrid/pooling equilibrium – some bad politicians survive as they mimic good ones
  - This improves discipline, but worsens selection.
- It is clear from this that the value of information in the agency relationship is ambiguous – full information could be better or worse than perfect information.

- Equilibrium welfare

$$EW(\lambda,\sigma,\mu) = (1+\beta)W^0(\mu)+(1-\pi)(1-q)\lambda\Delta(\mu)+\beta(\pi_2-\pi)\Sigma(\mu) \quad (2)$$

where:

$$\Delta(\mu) = W^g(H,\mu) - W^b(\mu) \quad (3)$$

$$\Sigma(\mu) = EW^g(\mu) - W^b(\mu) \quad (4)$$

and

$$\pi_2 - \pi = \pi(1-\pi)[q\sigma + (1-q)(1-\sigma\lambda)] \quad (5)$$

- $\Delta(\mu)$ – discipline effect

- $\Sigma(\mu)$ – selection effect

- Differentiating (2) with respect to λ yields:

$$\frac{\partial EW(\lambda, \sigma, \mu)}{\partial \lambda} = (1 - q)(1 - \pi)\left[\Delta(\mu) - \beta\pi\sigma\Sigma(\mu)\right]. \qquad (6)$$

- The sign of this depends on the magnitude of the discipline effect ($\Delta(\mu)$) and the selection effect ($\Sigma(\mu)$).

- A higher λ (more discipline) is good for voters if $\Delta(\mu) > \beta\pi\Sigma(\mu)$.

Agency Costs in Government

- Benevolent government: $(1+\beta)\, EW^g(\mu) > 0$.

- Welfare in the political equilibrium is:

$$(1+\beta)\, EW^g(\mu) - \left[EW^g(\mu) - W^b(\mu)\right](1-\pi)\,(1+\beta\,(1-\pi))\,. \quad (7)$$

- The criterion $(1+\beta)\, EW^g(\mu) > 0$ is too optimistic.

Pure Moral Hazard: A Comment

- Voters can "commit" to re-electing any incumbent who takes rents below $(1-\beta)\,S$.

- Period one rents are always below S.

Proposition 0.2 *Under pure moral hazard, every politician chooses a level of public spending equal to* $G_\theta^* - \frac{(1-\beta)S}{\theta}$ *and takes rents of* $s = (1-\beta)\,S$. *All politicians are re-elected for sure.*

- Voter welfare under pure moral hazard is

$$EW^g(\mu) - \psi(1-\beta)X + \beta W^b(\mu)$$

where $\psi = q/H + (1-q)/L$,

- Under moral hazard and adverse selection, it is

  $$(1+\beta)W^b(\mu) + \pi(1+\beta(2-\pi))\left[EW^g(\mu) - W^b(\mu)\right].$$

  in the case of a separating equilibrium.

- For small enough π, welfare is higher under pure moral hazard.

- As π tends to one, welfare is unambiguously higher when there is both moral hazard and adverse selection.

Model delivers:

- Term limit effect

- A positive association between taxes and being removed from office.

Restraining Government

- Key issue in the public choice literature is need to restraint government

- Effect of restraints have two components:
  - Direct effect – lower taxes or whatever.
  - Indirect effects – changes the political equilibrium.

- Forms of Restraint which can be considered:
  - Increasing the costs of raising taxes:
    * citizens' initiatives.
    * tax competition.
    * restriction of the use of tax instruments.

- – Direct restrictions
  - * Attempts to lower S.
  - * Restrictions on x.

- – Informational improvements:
  - * improving transparency.
  - * yardstick competition.

A Direct Restraint on the Size of Government

- A constitutional restriction on the size of government which lowers X, the maximum tax level that the government can levy.

- Direct advantage of reducing the rent that a bad politician can extract.

- A *tax limitation that leaves the behavior of the good politicians unaltered and does not change the political equilibrium is welfare improving for the voters*.

- However, to understand its impact fully, we also need to understand how it affects the political equilibrium.

- This depends on the balance of discipline and selection effects.

- Lowering X increases the incentive of incumbents to pool, and so to make the political equilibrium less informative.

- A tax limitation will be attractive when selection is less important than discipline: $\beta\pi\Sigma(\mu) < \Delta(\mu)$.

- True when π is small.

Thus, we have:

Proposition 0.3 *(Besley and Smart (2003)) Suppose that a limit is imposed on the size of government (as measured by X). Then there exists a $\hat{\pi}$ such that voter welfare increases if $\pi < \hat{\pi}$.*

An Indirect Restraint: Transparency

- Three notions of transparency:
  - Information about the past records of incumbents which reveals information about their underlying type, permitting voters to "pre-screen" candidates and leading to an increase in π.
  - Information about the fiscal outcomes: better observations of s or, in a more general setting, better information about taxing and spending.
  - Information about the cost of public spending (θ)
- The only unambiguous case is transparency which raises π

- Suppose that, after the incumbent has chosen s_1 and before the period one election is held, the voter may learn about the true cost of public services θ.

- θ is revealed with probability ξ; otherwise, no signal is received by the voter.

  - The payoff when a bad politician pools with a good one is $\hat{s}(\mu) + (1-\xi)\beta X$ while, if he chooses to reveal his type, it is X.

  - Pooling is now worthwhile if and only if $\hat{s}(\mu) > (1-(1-\xi)\beta)X$, a more stringent condition than in the absence of an informative signal (see Proposition 3).

  - Moreover, pooling is less likely to be optimal the closer is ξ to one.

- Better information therefore tends to reduce discipline and increase first-term rent seeking.

- It improves selection, as bad incumbents are less likely to survive re-election.

- Assume $q > 1/2$, the only comparison is between pooling ($\lambda = 1$) and separation ($\lambda = 0$).

- Evaluating welfare from ((2)) gives the difference between separating and pooling equilibrium welfare as

$$(1 - \pi)(1 - q)(\beta\pi\Sigma(\mu) - \Delta(\mu))$$

Proposition 0.4 *(Besley and Smart (2003)) Suppose* $q > 1/2$ *and that the voter receives an informative signal about the cost of providing public goods. The signal improves voter welfare only if the selection effect of elections dominates the discipline effect, i.e.* $\beta\pi\mathbf{\Sigma}(\mu) \geq \mathbf{\Delta}(\mu)$.

Tax Competition

- What happens if μ goes up?
- An increase in μ which leaves the political equilibrium unchanged is always welfare decreasing.
- But an increase in μ may sometimes be welfare improving because of its effects on the political equilibrium.
- Observe:
  - Increasing μ will make the political equilibrium more informative

- This will worsen discipline, but improve selection.
- A welfare improvement is possible if π is close enough to one.
  - Any bad incumbent will likely be replaced by a good one.
  - From an ex ante point of view, the likelihood of ill-discipline is low.

Proposition 0.5 *There exists a* $\pi^* \in (0,1)$ *such that intensification of tax competition (as represented by an increase in* μ*) unambiguously reduces voter welfare for all* $\pi < \pi^*$*. For* $\pi \geq \pi^*$*, an increase in tax competition which moves the equilibrium from hybrid or pooling to separating may increase voter welfare if it induces a shift from a hybrid or pooling equilibrium towards a separating equilibrium.*

Public Debt

- A lot of the discussions in public choice and elsewhere have attached particular significance to the role of public debt and the agency problems which surround public debt.

- We begin by outlining a simple extension of our two period model to incorporate government debt.

- Suppose that, after observing θ_1, the incumbent may issue debt D in period 1, incurring a gross liability payable in period 2 for the government of $R(D)$, where $R(D) \geq D$, and R is a strictly concave function.

- Assume that $\beta R'(0) = 1$ so that (as we shall see) the role of debt for a good government is merely to smooth taxation shocks between periods.

- With the presence of debt, the government's budget constraints in the two periods become

$$x_1 = \theta_1 G_1 + s_1 - D$$

and

$$x_2 = \theta_2 G_2 + s_2 + R(D).$$

- The optimal fiscal policy may again be solved by backward induction. In period two:

$$G^*_{\theta 2} = \arg\max \{G - \mu C(\theta_2 G + R(D))\}$$

- This implies that:

$$1 = \theta_2 \mu C' \left(\theta_2 G^*_{\theta 2} + R\left(D \right) \right).$$

- Thus period two taxes will be equal to x^*_θ with spending equal to $x^*_\theta / \theta - R\left(D \right) / \theta$.

- The period one level of public spending will solve:

$$G^*_{\theta 1} = \arg\max \left\{ G - \mu C \left(\theta_1 G - D \right) \right\}.$$

- The period one taxation is set equal to x^*_θ with spending being $G^*_\theta = x^*_\theta / \theta + D / \theta$.

- Optimal debt:

$$\frac{1}{\theta_1} = \beta\psi R'\left(D\left(\theta_1\right)\right).$$

- Since $\beta R'\left(0\right) = 1$, the model predicts that the government will run a budget surplus when costs are high ($D_H^* < 0$) and a budget deficit when costs are low ($D_L^* > 0$) .

The Politics of Debt.

- Let $\bar{D}$ be the highest level of debt that can be incurred in period one.
- A bad politician who decides to go-for-broke in period one will now take rent equal to $X + \bar{D}$.
- At the same time, the amount of rent that he can extract by mimicking a good incumbent with cost shock H is lower.
- A politician will exercise restraint is:

$$(H - L)\frac{\left[x_H^* + D_H^*\right]}{H} + \beta\left[X - R\left(D_H^*\right)\right] \geq X + \bar{D}. \qquad (8)$$

Thus we have:

Proposition 0.6 *Suppose that the government can raise resources though both debt and taxation. Then, public debt reduces incumbent discipline. More specifically, a pooling equilibrium with* $\lambda = \sigma = 1$ *exists if (8) holds. The equilibrium is separating otherwise.*

- The fact that debt leads to ill discipline motivates the observation that the citizens would wish to impose a restriction on the deficit that can be raised.

- If the political equilibrium is pooling, then a relatively weak restriction on debt $\bar{D} > D_L^*$, which does not change the political equilibrium, must improve voter welfare.

- It leaves equilibrium behavior for good incumbents and bad incumbents in state L unchanged.

- However, it reduces the long-run harm that bad incumbents can do in state H.

Proposition 0.7 *A cap on the size of the deficit of $\bar{D}$ which does not change the political equilibrium raises voter welfare.*

Yardstick Competition

- To extend the model to include yardstick comparisons, suppose now that here are two identical jurisdictions, labeled "domestic" and "foreign";

- We focus on symmetric equilibria of the game among incumbents and voters in the two jurisdictions, assume that the joint probability distribution function of cost shocks $\Pr(\theta, \theta')$ is symmetric, with

$$\begin{aligned} \Pr(H, H) &= \Pr(L, L) = \frac{\rho}{2} \\ \Pr(H, L) &= \Pr(L, H) = \frac{1-\rho}{2} \end{aligned} \tag{9}$$

- Moreover, we work with the case where $\rho > 1/2$, so that cost shocks in the two jurisdictions are positively correlated.

- Assume also that $\hat{s} > (1 - \beta)X$, so that a separating equilibrium cannot exist.

- Since the marginal p.d.f. has $q = \Pr(\theta = H) = 1/2$, it follows from Proposition 3 that the unique equilibrium of the game without yardstick competition is one with pooling. We now show that, depending on the value of π, both hybrid and pooling equilibria are possible with yardstick competition.

- Voters may base their decision to re-elect the incumbent or not on *relative* performance in the two jurisdictions.

- Let the probability of re-election in the domestic jurisdiction be $\sigma(x, x')$ when observed spending levels in the domestic and foreign jurisdictions are x and x' respectively.

- The voter's strategy involves yardstick competition when re-election occurs with positive probability if spending is high in both jurisdictions, but the probability of re-election is zero if domestic spending is high and foreign spending is low.

  - $\sigma(x_H, x_H) = \sigma$ for some $\sigma > 0$

  - $\sigma(x_H, x_L) = 0$.

- Let λ denote the probability type (b, L) chooses $s_1 = \hat{s}$.

- Assume that strategies are symmetric ($\lambda = \lambda'$),

- Then

$$\begin{aligned} \Pr(x_H, x_H|g) &= \pi\frac{\rho}{2} + (1-\pi)\lambda\frac{1-\rho}{2} \\ \Pr(x_H, x_H|b) &= \pi\lambda\frac{1-\rho}{2} + (1-\pi)\lambda^2\frac{\rho}{2} \end{aligned} \tag{10}$$

- Then:

$$\Pr(g|x_H, x_H) = \frac{\pi}{\pi + (1-\pi)\,\ell(\lambda, \rho, \pi)} \tag{11}$$

(12)

$$\ell(\lambda, \rho, \pi) = \frac{\Pr(x_H, x_H|b)}{\Pr(x_H, x_H|g)}$$

where $\ell(\lambda, \rho, \pi)$ is the likelihood ratio that (x_H, x_H) was generated by a bad rather than good incumbent.

- A necessary and sufficient condition for an equilibrium with yardstick competition to exist is that $\Pr(g|x_H, x_L) < \pi$, so that the voter prefers to remove the incumbent from office when domestic spending is high and foreign spending is low.

Proposition 0.8 *(Besley and Smart (2003)) Suppose that* $\hat{s}(\mu) > (1 - \beta)X$*. Then voters use yardstick competition in equilibrium. A pooling equilibrium exists if and only if* $\pi \geq 1/2$*, and a hybrid equilibrium exists if and only if* $\pi < 1/2$*.*

- Key observation:

- The likelihood ratio $\ell(\lambda, \rho, \pi)$ is decreasing in π, as it depends on the voter's assessment of the quality of the incumbent in the *other* jurisdiction.

Proposition 0.9 *(Besley and Smart (2003)) There exist parameters* $0 < \tilde{\pi}_a < \tilde{\pi}_b < 1/2$ *such that voter welfare is lower when yardstick comparisons are available than when they are not if* $\pi < \tilde{\pi}_a$*, and the converse is true if* $\pi > \tilde{\pi}_b$*.*

- Yardstick competition is welfare decreasing when politicians' reputations are poor because rents are increased with little advantage from the improved information generated as most politicians who are kicked out are replaced by an incumbent of the same type.

Testing the Model (Besley-Case)

- Let $\Omega^i(\Delta\tau_{it}, \Delta\tau_{-it}) =$ gain from re-electing the incumbent

- Let

$$\Pr\left\{\Omega^i(\Delta\tau_{it}, \Delta\tau_{-it}) > -\varepsilon_{it}\right\} = R^i(\Delta\tau_{it}, \Delta\tau_{-it})$$

be the probability that the incumbent is re-elected (using a Probit specification)

- Let

$$V_t^i(\theta_{it}) = \max_{\tau_{it}}\left\{\lambda_i(\tau_{it} - \theta_{it}) + R^i(\Delta\tau_{it}, \Delta\tau_{-it})\,\delta E\left\{V_{t+1}^i(\theta_{it+1})\right\}\right\}$$

- which yields:

$$\lambda_i = -\frac{\gamma_1}{\sigma_\varepsilon}\left(\frac{\beta x_{it} + \gamma_1 \Delta\tau_{it} + \gamma_2 \Delta\tau_{-it}}{\sigma_\varepsilon}\right) * \delta E\left\{V^i_{t+1}\left(\theta_{it+1}\right)\right\}$$

- which is re-arranged to:

$$\Delta\tau_{it} = \beta^* x_{it} + \phi\Delta\tau_{-it} + \nu_{it}.$$

- where $\phi = \frac{\gamma_2}{\gamma_1}$ and $\beta^* = \frac{\beta}{\gamma_1}$.

- So there are two equations:

  - probablility of defeat

– tax setting equation

TABLE 1—REELECTION HISTORIES OF U.S. GOVERNORS 1960–1988
INCUMBENT OUTCOMES

Year	Number of elections	Defeated		Did not run		Could not run; reached limit	Reelected	
		Election	Primary	Retired	Ran for Congress		Reelected	Percentage
1960	28	6	0	2	5	8	7	25
1961	2	0	0	0	0	2	0	0
1962	33	9	2	0	3	6	13	39
1963	2	0	0	0	0	2	0	0
1964	26	3	0	3	2	7	11	42
1965	2	0	0	0	0	1	1	50
1966	33	6	2	1	2	9	13	39
1967	2	0	0	0	0	2	0	0
1968	22	3	0	2	3	4	10	45
1969	2	0	0	0	0	2	0	0
1970	33	6	0	8	1	5	13	39
1971	2	0	0	0	0	2	0	0
1972	19	2	2	3	1	4	7	37
1973	2	0	1	0	0	1	0	0
1974	33	2	1	6	1	7	16	48
1975	3	0	0	0	0	1	2	67
1976	14	2	1	3	1	2	5	36
1977	2	0	0	0	0	1	1	50
1978	34	4	2	3	2	11	12	35
1979	3	0	0	0	0	3	0	0
1980	13	3	2	0	0	1	7	54
1981	2	0	0	0	0	2	0	0
1982	34	5	1	6	1	4	17	50
1983	3	1	0	0	0	2	0	0
1984	13	2	0	3	1	3	4	31
1985	2	0	0	0	0	1	1	50
1986	34	2	0	4	2	11	15	44
1987	3	0	0	1	0	2	0	0
1988	12	1	0	2	0	1	8	67

model to give a workable empirical specification. Section IV presents the results, and Section V discusses some extensions and alternative models. Section VI contains some concluding remarks.

I. Preliminary Data Analysis

Our data are centered on the reelection bids of governors in the continental United States from 1960 through 1988. Table 1 shows the reelection histories of governors during this period. We will assume below that eligible governors who did not run for reelection and who did not run instead for another office chose to step down because they assumed they would lose or were pressured to do so by dissatisfied party officials. The empirical analysis controls for age of governors who chose not to run for office again.[5]

Table 1 suggests that a nontrivial proportion of governors eligible for reelection either chose not to run or were defeated at the polls.[6] During this 30-year period, there

[5]Repeating our analysis excluding the "retired" group just results in an increase in the standard errors.

[6]In many states, governors face a term limit. That is, by law they may be ineligible to succeed themselves in office. Elections in which the term limit binds are not included in our voting analysis. However, term limits will be used in tax-setting analysis as a natural means of separating those governors who should care about neighbors' taxes (i.e., those eligible to run for reelection) from those who should not (lame-duck governors). For further analysis of gubernatorial term limits and policy-making, see Besley and Case (1993).

TABLE 2—CORRELATION BETWEEN CHANGES IN TAX LIABILITY AND THE UNSEATING OF INCUMBENTS, 1979–1988 (TAXSIM DATA)

A. *Correlation in Neighboring States' Tax Liability Changes* $(t-[t-2])$

	Income groups			
	$25,000	$40,000	$60,000	$100,000
Pearson product-moment correlations:	0.18	0.24	0.29	0.30

B. *Correlation Between Changes in Effective Income-Tax Liability and Governor Defeat at the Polls*

	General-election defeat			Primary + general-election defeat			Defeated or retired[a]		
	Income groups			Income groups			Income groups		
Tax change $(t-[t-2])$	$25,000	$40,000	$100,000	$25,000	$40,000	$100,000	$25,000	$40,000	$100,000
Own	0.25	0.17	0.07	0.21	0.14	0.07	0.22	0.17	0.18
Neighbors'	−0.12	−0.09	−0.11	−0.10	−0.09	−0.11	−0.07	−0.05	−0.08
Number of observations:	66	66	66	69	69	69	85	85	85

[a]"Retired" governors are those eligible for reelection who chose not to run and did not run for Congress.

ing states.[9] Table 2 reveals that there is a significant amount of correlation between neighbors' tax changes and a given state's tax changes, with the Pearson correlation coefficient ranging from 0.18 for the $25,000 income group to 0.30 for the $100,000 income group. For all groups, this correlation is significant. This could, of course, be explained by a number of factors. Below, we will control for year effects and for the possibility that neighbors face common shocks.

Correlations between increases in effective income-tax liabilities and incumbent defeat are also present in the raw data. As the second part of Table 2 reveals, changes in a state's income-tax liability are positively and significantly correlated with unseating an incumbent governor, with a correlation coefficient of roughly 0.20. At the same time, changes in neighbors' tax liabilities are *negatively* correlated with defeat of an incumbent in a given state, with a correlation coefficient of roughly −0.10. Thus while neighbors' tax changes are positively correlated with a given state's tax change, they are negatively correlated with the defeat of that state's incumbent.

II. A Theoretical Example

Our empirical specification, developed below, allows for an *informational externality* between neighboring jurisdictions, which affects both voting behavior and incentives for incumbents to increase taxes. There are three premises behind this:

Premise 1: Agency problems due to asymmetric information are a feature of political competition. Specifically, incumbents know more about the short-term evolution of some key variables than do voters.

[9]We choose a geographical definition of neighborliness for two main reasons. First, geographic neighbors are quite likely to experience similar shocks to their tax bases and, for this reason, provide information on the size of the innovation to neighboring states' voters. Second, geographic neighbors capture as nearly as possible the idea that states belong to the same media market, having good information about what is going on close by.

TABLE 3—ESTIMATION OF INCUMBENT DEFEAT BASED ON LINEAR PROBABILITY MODELS USING TAXSIM DATA ON CHANGES IN INCOME-TAX LIABILITY, 1977–1988
(DEPENDENT VARIABLE: GOVERNOR DEFEATED OR RETIRED)

	Income = $40,000				Income = $100,000			
Variable	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Own tax change	0.0004				0.0001			
	(1.44)				(1.84)			
Own tax change (IV)[a]		0.0022				0.0006		
		(1.56)				(1.67)		
Own tax change (2SLS)[b]			0.0015				0.0005	
			(1.57)				(1.80)	
Neighbors' tax change	−0.0012	−0.0014	−0.0013		−0.0005	−0.0007	−0.0007	
	(1.94)	(1.80)	(1.94)		(2.85)	(2.71)	(2.82)	
Unanticipated own tax change[c]				0.0004				0.0001
				(1.35)				(1.58)
Unanticipated neighbors' tax change[d]				−0.0008				−0.0004
				(1.43)				(2.31)
Δ State income per capita ($1,000's)	−0.123	−0.005	−0.052	−0.144	−0.214	−0.286	−0.280	−0.216
	(0.79)	(0.02)	(0.29)	(0.93)	(1.42)	(1.55)	(1.56)	(1.40)
Δ Neighboring states' incomes per capita ($1,000's)	−0.089	−0.104	−0.098	−0.048	−0.003	0.137	0.124	0.008
	(0.52)	(0.47)	(0.51)	(0.28)	(0.02)	(0.61)	(0.58)	(0.05)
Δ State's unemployment rate	0.082	0.088	0.085	0.088	0.069	0.043	0.046	0.083
	(1.76)	(1.48)	(1.65)	(1.87)	(1.50)	(0.76)	(0.83)	(1.79)
Δ Neighboring states' unemployment rate	−0.067	−0.059	−0.062	−0.078	−0.045	−0.011	−0.014	−0.073
	(1.17)	(0.80)	(0.97)	(1.35)	(0.79)	(0.16)	(0.21)	(1.28)
Δ Total state debt ($1,000's)	−0.236	−6.77	−0.502	−0.249	−0.317	−0.739	−0.700	−0.317
	(0.69)	(1.24)	(1.15)	(0.73)	(0.95)	(1.45)	(1.47)	(0.93)
Δ Total neighboring state debt ($1,000's)	0.701	1.354	1.095	0.790	0.724	1.087	0.001	0.821
	(1.48)	(1.74)	(1.77)	(1.48)	(1.58)	(1.80)	(1.82)	(1.76)
Governor's age	0.024	0.022	0.023	0.023	0.025	0.022	0.023	0.023
	(3.44)	(2.48)	(2.94)	(3.25)	(3.61)	(2.76)	(2.85)	(3.56)
Number of observations:	85	85	85	85	85	85	85	85
Overidentification test:[e]			0.706				0.640	
(*P* value for *F* statistic):			(0.716)				(0.774)	

Notes: Numbers in parentheses are *t* statistics. "Retired" governors are those eligible for reelection who choose not to run and do not run for Congress. "Unanticipated" tax change is the difference between the actual tax change and that predicted by an ordinary least-squares regression that includes changes in state income per capita, unemployment, proportion elderly, and proportion young as explanatory variables.

[a] Instruments = year indicators.

[b] Instruments = year indicators and changes in the proportions of elderly and young.

[c] $\Delta\tau_i - E(\Delta\tau_i|\mathbf{x}_i, \mathbf{z}_i, \mathbf{Y})$.

[d] $\Delta\tau_{-i} - E(\Delta\tau_{-i}|\mathbf{x}_{-i}, \mathbf{z}_{-i}, \mathbf{Y})$.

[e] Test of exclusion of year effects and changes in proportions elderly and young in a residual regression. See text for details.

TABLE 4—ESTIMATION OF STATE TAX CHANGES

	Dependent variables					
	Change in income-tax liability, $40,000 joint filers 1979–1988			Change in sales, income, and corporate taxes per capita, 1962–1988		
	Governor cannot run for reelection	Governor can run for reelection		Governor cannot run for reelection	Governor can run for reelection	
Explanatory variable	OLS	OLS	2SLS[a]	OLS	OLS	2SLS
Neighbors' tax change $(t-[t-2])$	−0.006 (0.05)	0.305 (2.49)	0.746 (1.81)	0.086 (1.01)	0.216 (3.23)	0.538 (1.96)
State income per capita $(t-[t-2])$	−0.011 (0.34)	−0.068 (2.09)	−0.073 (2.16)	0.023 (3.70)	0.016 (3.84)	0.014 (2.80)
State unemployment rate $(t-[t-2])$	9.13 (1.58)	17.35 (1.71)	18.52 (1.77)	−0.665 (0.45)	−3.17 (2.07)	−2.19 (1.25)
Proportion young (aged 5–17) $(t-[t-2])$	−3,381.30 (0.74)	−3,680.97 (0.80)	−356.80 (0.92)	631.96 (2.17)	618.10 (2.63)	545.51 (2.17)
Proportion elderly (aged 65+) $(t-[t-2])$	4,315.03 (1.05)	15,791.35 (2.33)	12,813.98 (1.72)	1,287.50 (1.75)	512.57 (1.18)	697.88 (1.46)
Governor's age	−7.75 (2.12)	−0.126 (0.06)	0.027 (0.01)	0.323 (1.12)	−0.118 (0.50)	−0.096 (0.38)
Number of observations:	113	302	302	354	846	813
Overidentification test:[b]			1.26			0.20
(P value):			(0.287)			(0.820)

Notes: Numbers in parentheses are t statistics. All regressions include state and year indicator variables. OLS denotes ordinary least-squares analysis; 2SLS denotes two-stage least-squares analysis.

[a]First-stage regression using TAXSIM data:

Change in Neighbors' Tax Liability = Constant + 14.70 (Neighbors' Change in Unemployment Rate) [$t = 1.66$]

− 3.99 (Neighbors' Change in Unemployment Rate Lagged) [$t = 0.43$]

− 0.092 (Neighbor's Change in Income per Capita Lagged) [$t = 3.79$]

+ 5,551.04 (Neighbor's Change in Proportion Young Lagged) [$t = 2.50$]

+ state and year indicators and own state covariates (those that appear in table above)

(number of observations = 302, $R^2 = 0.4413$; observations for 1987 and 1988 restricted to states with information available on whether incumbent governor can run in next election).

First-stage regression using sales, income, and corporate tax data:

Change in Neighbors' Taxes = Constant + 0.027 (Neighbor's Change in Income per Capita Lagged) [$t = 6.97$]

+ 4.28 (Neighbors' Change in Unemployment Rate Lagged) [$t = 3.23$]

+ year and state indicators and own state covariates (those that appear in table above)

(number of observations = 813, $R^2 = 0.7889$).

[b]F test of significance of instruments in regression: $[\Delta\tau_i - \hat{b}\Delta\tau_{-i}]$ on own state covariates and state and year indicators, where $\hat{b}$ is the estimated coefficient from the two-stage least-squares regression.

TABLE 5—MAXIMUM-LIKELIHOOD ESTIMATION OF VOTING AND TAX-SETTING BEHAVIOR

Variable	Coefficient using data on changes in sales, income, and corporate tax per capita, 1962–1986
Tax change coefficients:	
Neighbors' tax change ($t-[t-2]$)	0.177 (3.92)
State income ($t-[t-2]$)	0.017 (5.68)
State unemployment rate ($t-[t-2]$)	−3.313 (2.79)
Proportion young ($t-[t-2]$)	6.563 (1.84)
Proportion elderly ($t-[t-2]$)	6.988 (4.77)
Governor's age	0.135 (0.73)
Year effects	yes
Incumbent-defeat coefficients:	
Own tax change ($t-[t-2]$)	0.015 (1.14)
Neighbor's tax change ($t-[t-2]$)	−0.033 (1.99)
State income ($t-[t-2]$)	−0.317 (1.38)
State unemployment ($t-[t-2]$)	0.044 (0.79)
Governor's age	0.023 (2.25)
Numbers of observations:	
Tax-setting	846
Election	266

Note: Numbers in parentheses are t statistics.

unemployment continue to reduce the per capita taxes collected, while increases in state income per capita add to per capita taxes collected. In addition, taxes increase with an increase in the proportion of elderly people and young people in the population.

Consonant with the theory presented above, the probability of incumbent defeat is increased by an increase in state taxes. However, this effect is offset if neighbors increase their taxes simultaneously.

We can formally test whether the sensitivity to neighbors' tax changes is of a size consistent with the yardstick-competition model, by testing whether $\varphi = -\gamma_2/\gamma_1$. The likelihood-ratio test statistic associated with constraining this relationship to hold is 4.48. Although the rejection holds in a 90-percent confidence interval, it is not a strong rejection. We find the results to be broadly consistent with the model presented in Sections II and III.[31]

V. Extensions and Alternative Models

A. *Consistency of the Results with the Tiebout Model*

It is interesting to speculate whether our results are consistent with Tiebout-style tax competition based on factor mobility. At first sight, a negative effect of own taxes on reelection is hard to justify in a Tiebout framework: individuals should move if they are dissatisfied with the tax change. This would leave only contented voters in the state and thus enhance the probability that the incumbent is reelected. Likewise, increases in taxes in a neighboring state would lead to an influx of voters into a state that disliked high taxes, thus lowering the average tolerance to taxes at home.[32] Thus increases in neighbors' taxes tend to decrease the probability that an incumbent will survive. At face value, therefore, both of the predictions of the Tiebout model would be contrary to what we find in our empirical results.

It is important to acknowledge that some stories based on factor mobility could be consistent with our results. Suppose that higher taxes lead businesses to relocate and that this reduces property values, which

[31] Note that we cannot reject the null of equality in our second set of overidentification tests: $\beta^* = (-\beta/\gamma_1)$. However, this is only because the standard errors on the coefficients in the tax-setting equation are large.

[32] However, to the extent that taxes are capitalized into property values, the incentive to move would be weakened.