

I. Introduction: Self Interest and Voting for Public Services and Taxes

- A. In democracies, both public service levels and taxes are chosen by elected representatives and the bureaucracy.
- B. From the public choice perspective, elected representatives and bureaucrats are assumed to be **self-interested** in the same sense that consumers and firms are in the private sector.
 - i. If politicians and bureaucrats are rational and self interested, one should expect them to choose the fiscal policies that maximize their own net advantages (utility) given the constraints that they face.
 - ii. That is to say, if one wishes to understand the pattern of tax and expenditure policies, one has to take account of the interests and incentives faced by government agents.
 - iii. Of course, politicians cannot simply choose any combination of expenditures and taxes that they wish, because they have to be elected to office in order to have the power to make fiscal decisions.
 - iv. Elections and electoral politics, thus, have important effects on fiscal policies within democracies.
 - v. (As we will see, electoral politics implies that one can not simply assume that tax and expenditure policies are made by some net-benefit maximizing all knowing "government," as sometimes seems to be suggested in ordinary text books.)
- C. Although a wide variety of decision making rules can be used within democratic governments, we will focus our attention on implication of majority rule. (For a richer treatment, you should take a course in public choice.)
 - i. Examples of other voting rules that are used include:
 - ii. Unanimity (100% approval is required to pass new laws. Anyone can veto a new law.)
 - iii. Super Majority (More than 50% approval is required to pass new laws. This is required for constitutional amendments and impeachment under the US constitution.)
 - iv. Plurality Rule (The policy/rule/candidate with the most votes is adopted.)
 - v. Committee rule (A relatively small elite makes decisions, possibly by majority rule within the committee.)
 - vi. One person rule (Commander in Chief, Executive Mandates)

vii. (For an important first analytical examination of which voting rules work best for a given circumstance : *The Calculus of Consent*, by James M. Buchanan and Gordon Tullock.)

- D. An elected government is not free to pick any policy that it wants for several reasons.
 - i. First, most elected officials wish to win the next election. To do that they will have to pick policies that please a majority of the voters relative to policies proposed by their rivals for office.
 - ii. Second, there are constitutional constraints on the types of policies that can be put in place.
 - a. The "takings clause" makes government pay for goods and services taken from individual citizens.
 - b. The "equal protection" laws imply that a law should not treat different groups differently. That is to say, laws have to be based on general principles: all firms with characteristic F are subject to environmental regulation R.
 - iii. Initially, we will focus all our attention on the electoral constraint because electoral competition plays a very important role in determining policy at the margin.

II. Majority Rule and the Median Voter

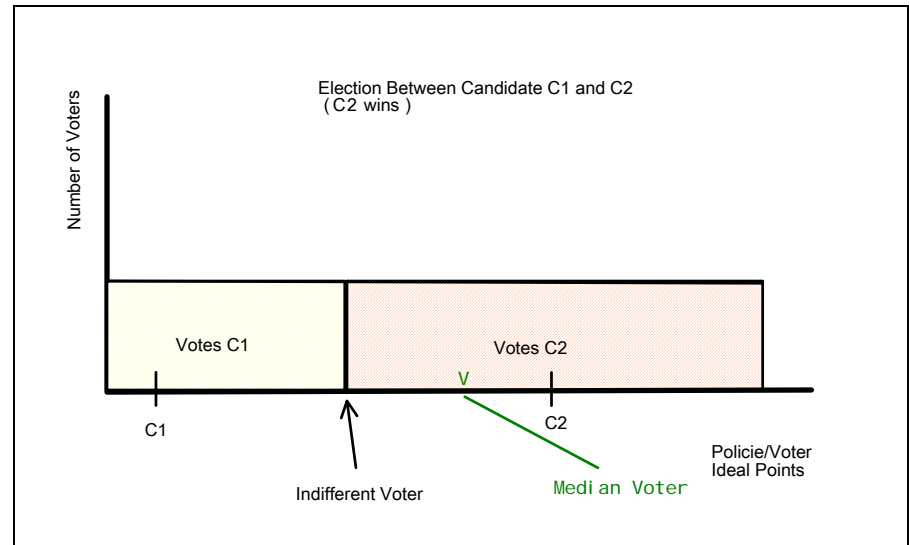
- A. The most widely used model of majoritarian politics is the median voter model. In a variety of electoral settings, self interested behavior implies that the "median voter" will get his way.
- B. For example, suppose that three individuals: Al, Bob and Cathy are to make a decision about where to eat lunch based on majority rule.
 - i. Al prefers a restaurant where lunch can be had for \$5.00, Bob wants one where lunch costs around \$10.00 and Cathy, a gourmet, prefers one costing around \$20.00.
 - ii. For convenience assume that, given any two options, each will prefer the restaurants whose price for lunch that is closest to their preferred one.
 - iii. (This "spatial voting" can be shown to be the result when their marginal benefit and marginal cost curves are straight lines.)
 - iv. Consider some votes on various alternative spending levels:

Options	Votes Cast	Outcome
a. \$10 vs. 20\$	A: 10 B: 10 C: 20	10 MP 20
b. \$5 vs. \$20	A: 5 B: 5 C: 20	5 MP 20
c. \$5 vs. \$16	A: 5 B: 5 C: 16	5 MP 16
d. \$10 vs. \$5	A: 5 B: 10 C: 10	10 MP 5
e. \$12 vs. 10	A: 10 B:10 C: 12	10 MP 12

- C. Note that Bob always votes in favor of the outcome that wins the election. (The B column and the Outcome column are EXACTLY the same.)
- D. Note also that exactly the same number of individuals prefer a more expensive dinner as prefer a less expensive dinner than Bob. (This is the definition of a median ideal point or "preference.")
- So, Bob is the median voter. (He is the voter with the median ideal point.)
 - Note that the median voter's ideal point can beat every other possible alternative in pairwise voting.
- E. The **Weak Form** of the *median voter theorem* says that the median voter always casts his vote for the policy that is adopted.
- F. The **Strong Form** of the *median voter theorem* say the median voter always gets his most preferred policy. [In the example above Bob's preferred expenditure level, \$10, will defeat any other policy.]

III. Electoral Competition and The Median Voter

- A. The previous illustration shows that the median voter determines the electoral outcome in direct elections. We now show that the median voter is also very important in representative democracy.
- B. To make our analysis of elections more straight forward, we will assume that Voters all vote for the candidate (or policy) that is "closest" to them in the policy dimension.
- C. This assumption allows competition between candidates for government office can be analyzed with a diagram that shows the distribution of voter ideal points.
- The distribution of voter ideal points can be used to form diagram with policy alternatives along the bottom (X) axis and with number of voters with a specific ideal point along the vertical axis.
 - The area under the resulting curve gives you a number of voters.



- The assumption of spatial voting allows us to determine how all these voters will vote when there are two candidates or two policy options being voted on
 - (That is to say, every voter will vote in favor of the candidate whose position is closed to their own.)
 - (Note that voters who are exactly half way between the two "alternatives" will be indifferent between them.)
 - Voters to the left of the indifferent voters will vote for the policy on the left, and those to the right of the indifferent voter will vote for the policy on the right.)
- D. The illustration above assumes that candidates 1 and 2 have taken positions and that voters vote for the candidate closest to their ideal point.
- The distribution of voter ideal points is assumed to be a "uniform" distribution.
 - As it turns out Candidate C1 loses this election.
 - How could he or she have done better? Clearly he or she should have chosen a policy position further to the right.
- E. It turns out that the candidate who is closest to the median voter's ideal point will always win the election, because that candidate will always receive AT LEAST HALF OF THE VOTES.

- F.** Thus, if candidates are free to adjust their policy position to attract votes, they will each try to be closer to the Median Voter's ideal point than the other candidate.
- G.** In **equilibrium**, this kind of competition for votes implies that both candidates will take essentially the same position, namely that of the median voter.
- i. At this equilibrium, the candidates take the same position, so they receive approximately the same number of voters.
 - ii. At the (Downsian) equilibrium, the median voter gets exactly what he or she wants.
 - iii. *That is to say the **strong form** of the median voter theorem holds!*

IV. The Median Voter and Public Policy

- A.** One important insight that follows from the median voter model is that the size and types of government programs that exist in democracies reflect **both** the benefit and cost sides of programs **from the point of view of the median voter**.
- B.** The median voter is approximately the VOTER with MEDIAN characteristics.
- i. That is to say he or she is a voter of median age with median income, median education, median family size, median political ideas and so forth...
 - ii. Note that the median voter will not ordinarily be the same as the median member of the community because not all persons are equally likely to vote!
 - a. In the US it turns out that the median voter is a bit older, richer, and better educated than the median member of the group of persons eligible to vote.
 - b. Poor, young, and less educated person vote less frequently than older, richer, and more educated persons.
- C.** Consequently, policies tend to be moderate, e. g. drawn from the middle part of the political spectrum.
- i. (The middle can be regarded as "moderate" essentially by definition.)
 - ii. Most people will be at least partially displeased with the policies chosen insofar as they have different ideal point, even in a perfectly functioning democracy, as long as peoples tastes, circumstances, or expectations differ.
 - iii. (Note that it is possible that most people are dissatisfied with government policy yet still prefer the use of majoritarian decision rules to any other. Explain why.)

- D.** To the extent that the Median Voter gets what he or she wants, anything that changes the median voter's preferred policy will affect government policy.
- i. Consequently, an implication of the median voter model of electoral politics is that any change in the constraints of the median voter, the information of the median voter, the tastes of the median voter or in the identity of the median voter will have systematic effects on the size and composition of government programs.
 - ii. Another implication is that, increases dispersion of the distribution of voter preferences (increased radicalism) tends to have little, if any, effect on public policies unless it affects the median of the distribution of voter ideal points. This implies that median voter policies will be more stable than average voter policies.
 - iii. For example, to the extent that government services are normal goods, Government services will tend to increase as the median voter becomes wealthier, as their tax-cost relative to private services decreases, and as their perceived value increases.

V. Illustration: the Mathematics of a Median Voter Model

- A.** The strong form of the median voter theorem implies that government policies in well-functioning democracies can be modeled as the solution to a single person's political optimization problem.
- B.** Such optimization problems are often very straightforward to characterize and perform comparative statics on.
- i. Consequently, the median voter model is widely used to analyze the level and growth of government service levels.
 - ii. That model plays a significant role in both the theoretical and empirical public finance literature dealing with taxes and expenditure levels.
- C.** Consider electoral selection of a public services that is funded with a non-distorting "head tax."
- i. Each voter in his capacity as a policy "maker" looks very much like the standard consumer in a grocery store, except that in addition to private budget constraints, he has a "public" budget constraint to deal with.
 - ii. Suppose that voter's have the same utility function defined over private consumption (C) and some public service (G). But suppose that each voter has a different amount of money, W_i , to allocate between C and G.

- iii. To simplify a bit, assume that the government faces a balanced budget constraint, and that all expenditures are paid for with a head tax, T. Assume that there are N tax payers in the polity of interest.
- iv. A typical voter's ideal policy level can be characterized as his or her utility maximizing combination of public services and private consumption.
 - a. $U = u(C, G)$ (objective function)
 - b. $W_i = C + T$ (personal budget constraint)
 - c. $g(G) = NT$ (public sector budget constraint)
- v. Note that T can be written as $T = g(G)/N$ and substituted into the private budget constraint to make a single unified budget constraint:
 - a. $W_i = C + g(G)/N$
 - b. This in turn can be solved for C and substituted into the utility function to create an objective function with one control variable (G) that fully incorporates the effects of the personal and public budget constraints:
 - c. $U = u(W_i - g(G)/N, G)$
- vi. Differentiating with respect to G yields a first order condition that characterizes the median voter's preferred government service level:
 - a. $-U_C(g_G/N) + U_G = 0 = H$ or equivalently as $U_C(g_G/N) = U_G$
 - b. The right hand side of the latter is the **subjective marginal benefit** (marginal utility) of the government service, the left-hand term is the subjective marginal opportunity cost of government services in terms of lost private consumption.
 - c. Note that the **subjective marginal cost** of the service is determined by both preferences (marginal utility of the private good C) and objective production or financial considerations, g_G/N . The latter can be called the median voter's marginal cost share, or "price" for the government service.
- vii. An implication of the first order condition together with the implicit function theorem is that each voter's demand for public services can be written as:
 - a. $G_i^* = \gamma(W_i, N)$ that is to say, as a function of his own wealth (holding of the taxable base) and the population of tax payers in the polity of interest.
 - b. The implicit function differentiation rule allows one to characterize comparative statics of how changes in wealth, W_i , and number of tax payers, N, affect a voter's demand for government services.

- c. Specifically $G^*_W = H_W/-H_G$ and $G^*_N = H_N/-H_G$ where H is the first order condition above.
- d. Recall that solving for these derivatives requires using the partial derivative version of the composite function rule and paying close attention to the location of all the variables in the various functions included in "H," the first order condition. We find that:

$$G^*_W = [-U_{CC}(g_G/N) + U_{GW}] /$$

$$-[U_{CC}(g_G/N)^2 - U_C(g_{GG}/N) - 2U_{CW}(g_G/N) + U_{GG}] > 0$$

and

$$G^*_N = [-U_{CC}(g_G/N)(g(G)/N^2) + U_C(g_G/N^2) + U_{GW}(g(G)/N^2)] /$$

$$-[U_{CC}(g_G/N)^2 - U_C(g_{GG}/N) - 2U_{CW}(g_G/N) + U_{GG}] > 0$$

- e. That is to say, with head-tax finance, each voter's demand for a pure public service rises with their personal wealth and with population.
- viii. Note also that since demand is strictly increasing in W, it turns out that the median voter is the voter with median income.
 - a. It is this voter, whose demand for public services lies exactly in the middle of the distribution.
 - b. The voter with median income has a preferred service level G^{**} such that the same number of voters prefer service levels greater than G^{**} as those who prefer service levels lower than G^{**} .
- ix. The comparative statics of a voter with median income can, in this case, be used to characterize the course of government spending through time, as other variables change (here, exogenous shocks to W or N, changes in tastes, etc.).
- D.** Other, somewhat richer, models can be built to analyze the effects of:
 - i. different tax instruments: proportional and progressive tax instruments
 - ii. optimal redistribution motivated by narrow self interest and/or altruism
 - iii. the effects of varying degrees of publicness on demand for services: club goods
 - iv. An very influential application of the median voter model occurred in Meltzer and Richard (1981), which provide a Spartan but sophisticated analysis of how the median voter model can be used to represent the equilibrium size of government in a pure transfer model of government policies.

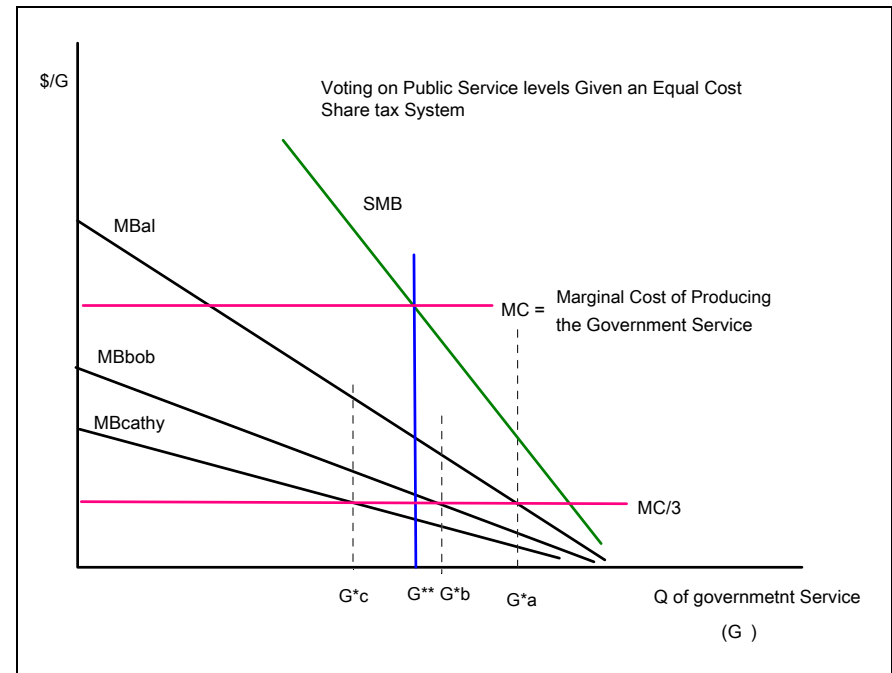
E. It bears noting that **not every median voter model has unambiguous predictions** about the effects of changes in the parameters of the median voter's choice problem on the median voter's demand for a given public policy, but useful insights may be obtained about the relationships between those parameters of public policy formation are often obtained even in those cases.

VI. Some Normative Properties of Median Voter Policies

- A. Although the median voter model implies that the median voter gets what "he wants," it does not imply that public policies will be efficient in the usual Paretian sense.
- i. This can be seen mathematically by comparing the service level in the above model with that which would be Pareto efficient in a society of taxpayers with different tastes or wealth.
 - Recall that the Pareto Efficient level can be characterized with a social welfare function, or by maximizing one person's utility while holding the other's constant.
 - ii. Alternatively, one can develop a graphical illustration that demonstrates that the median voter will prefer an output (or other policy level) that is Pareto inefficient whenever the median and "average" voter have different ideal points.
 - (This is illustrated below for a simple Samuelsonian tax system.)
- B. The median voter model developed to this point has ignored information costs faced by all voters which might lead voter's to be less than perfectly informed about their tax burdens or the benefits of public programs.
- i. In the case where the median voter's expectations are unbiased, he/she will still on average get what he/she wants. (See Congleton 2007.)
 - ii. In cases where rational ignorance implies biased expectations about the consequences of policies (as for example when one remains entirely ignorant of some policy detail or implication) then the median voter may not even get what he/she truly wants.
- C. Information problems open the door to interest groups and the bureaucracy who may manipulate voters by appropriately subsidizing various kinds of information and encourage malfeasance (agency costs, bribery) on the part of elected and unelected government officials which would be unlikely to be detected by rationally ignorant voters.

- [Essentially, the whole special interest group/rent-seeking literature is predicated on informational problems of these kinds in open competitive democratic polities.]

VII. Illustration: the Geometry of the Median Demand for Government Services under a Simple Samuelsonian tax system



- A. Suppose that there are three voters, each with a somewhat different marginal benefit curve for the government service of interest (G).
- i. For purposes of illustration assume that the tax system in place is an "equal share" system.
 - a. (Recall, that this will satisfy the Samuelsonian conditions for the Pareto efficient supply of a public services if the "right" service level is produced.)
 - b. Given this tax system, these three voters will all **disagree** about the optimal level of the government services.

- ii. If a referenda is held to determine the service level, we know from our previous analysis that the median voter will determine the outcome.
 - a. (Recall that the median voter is the voter whose ideal point is exactly in the middle in the sense that there are exactly the same **number** of voters with ideal points to the left as to the right of his or her ideal point)
 - b. In this case, Bob is the median voter. (Why?)
 - iii. Thus the predicted result of democratic politics is policy Q^* .
 - iv. However, this is not the same as the Pareto efficient level of the public service!
 - a. Bob has no reason to take account of the benefits and costs imposed on other voters by his vote.
 - b. (Remember we assuming self-interested voting, so Bob maximizes his own consumer surplus rather than social net benefits.)
 - c. Q^{**} is somewhat below Q^* .
 - d. And, the supply of public services will be somewhat higher than the net-benefit maximizing level of services.
 - v. (It is also possible for Q^{**} to be greater Q^* --draw such a case.)
 - vi. What does the above result imply about fiscal policy in a direct democracy?
- B.** Note that the median voter's demand for services depends in part on his tax price for that service.
- i. There are two reasons for this.
 - ii. First, the tax system may affect WHO the median voter is, because it affects the demands of all voters.
 - iii. Most public services are normal goods, ordinarily a wealth person will demand higher services than a poor person.
 - a. That is to say, a wealthy person's MB curve for a normal good tends to be higher than that of poorer persons.
 - b. Wealthy voters are willing to pay a higher price to have one more unit of a public service than a poor person (just as they are for ordinary private goods).
 - iv. However, the tax system affects what QUANTITY of services each voter wants to purchase.
 - a. Rich voters will generally prefer more public services than poor persons under a flat tax or under a regressive tax.

- b. However, rich voters may prefer smaller public service levels than poor persons under a progressive tax.
- v. It is the quantity demanded that determines a voter's ideal point, and thus who the median voter is.
- vi. Second, even if a change in tax price does not affect the identity of the median voter, it will affect the quantity demanded by her.
 - a. For example, if one uses a flat tax to fund all services, the rank order of service demands will reflect differences in tastes and incomes of voters.
 - b. Generally an increase in the marginal tax rate faced by individuals for services (an increase in the tax rate) will reduce demands for services without affecting their "rank order" -- that is to say, without changing the median voter.

VIII. Rational Ignorance, Fiscal Illusion, and Interest Groups

- A.** An implication of the median voter theorem(s) is that the median voter gets what she/he wants. However, the median voter's ability to pick the policy that is most in her (or his) interest is limited by the information, theories, and time that she (he) has available for analyzing the alternatives.
- B.** Analyzing the relative merits of alternative public policies is just like any other activity--it is engaged in only up to the point that maximizes expected net benefits.
- i. In most cases this occurs at the point where the expected marginal benefits of more information and more analysis equals its expected marginal cost.
 - ii. An implication of this (stressed by Downs and Tullock) is that voters will **rationally remain ignorant** of much useful information.
 - iii. They will use smaller than possible samples of data and ignore types and dimensions of information that are relatively costly to acquire and/or to analyze.
 - iv. [Draw a diagram (and/or write down a few equations) that illustrates the collection of information by an expected net benefit maximizing individual.]
- C.** A bit of rational ignorance is not a problem for democracy as long as it does not induce "biased expectations" about the benefits and/or costs of public policy.
- i. For example, if the sampling of information done by voters is reasonably complete they will tend to have unbiased estimates--although not perfect ones--and the result will *on average* advance the interests of the median voter.

- ii. Indeed, as long as voter expectations are unbiased, the Condorcet jury theorem implies that the outcomes of majority rule can also "aggregate" the information in the minds of voters (by using the median of their estimates when assessing candidates or policies).
- iii. However, if the information included in the sample is not complete, voter expectations may be biased, and the results of elections will not necessarily advance even the interest of the median voter.
- iv. (See Congleton 2007 and 2001 for more on this.)

D. When voters have biased expectations about the benefits and/or cost of public programs they are said to exhibit **Fiscal Illusion**.

- i. In cases in which the median voter's expected marginal benefit from a public policy is greater than the actual benefit or her (or his) expected marginal cost is lower than the actual cost, the result will be an OVER demand for public services, relative to that which actually maximizes net benefits for the median voter.
- ii. In cases in which the median voter's expected marginal benefit from a public policy is less than the actual benefit or her (or his) expected marginal cost is higher than the actual cost, the result will be an UNDER demand for public services, relative to that which actually maximizes net benefits for the median voter.
- iii. It bears noting that both governments and interest groups may attempt to induce biased expectations by "subsidizing" (freely providing) information about the benefits of programs and/or "taxing" (withholding) information about the costs of programs.
- iv. [Draw a diagram of the policy preferences of voters with "biased" assessments of their marginal benefits or costs, (and/or write down a few equations) and contrast the results with their actual interests.]

E. Fiscal illusion causes problems within a median voter model, because if voters are unable to accurately assess their own marginal costs and benefits they may vote for the wrong candidate and favor the "wrong" policies. (See Congleton 2001, 2007.)

- i. If voters make systematic mistakes, the policies chosen through elections may not advance even median voter interests.
 - a. Too little of services with "hidden" benefits will be provided.
 - b. And, too much of services with "hidden costs" will be produced.
 - (Illustrate voter choice under fiscal illusion.)

F. Note that a good deal of what **interests groups** do is informational in nature (Congleton 1986, 1991, 2001).

- i. They sponsor research and testimony of researchers in Congress and before regulatory commissions.
- ii. They sponsor political advertising of various kinds.
- iii. To the extent that these informational strategies affect voter expectations about their costs or benefits, they **may induce fiscal illusion**.

G. Voter ignorance also allows candidates for office to trade favors for campaign resources.

- i. If voters knew everything, campaign resources would not matter.
- ii. However, voters typically know relatively little about candidate positions, and have to be informed about them in various ways.

H. Most of these methods require economic resources, so it turns out that a candidate's campaign resources also affects his probability of winning an election (along with his or her policy positions).

- i. Candidates can move away from the median voter's position along dimensions of policies in which voters are ignorant of (or disinterested in) in order to secure campaign resources.
 - a. Voters typically will not know very much about specialized issues, like the tax treatment of insurance companies, the specific details of farm subsidies, the manner in which public services are produced (by whom, how and where).
 - b. On the other hand, interest groups may care deeply about such issues and be willing to pay for policies that advance their interests--either with campaign contributions or with other sorts of support during elections.
- ii. This allows interest groups to have direct effects on policy that is disproportional to the number of votes that they cast in an election.
- iii. (It is also one reason why **campaign reform law** tends to be discussed and eventually promoted. Voters know something goes on, even if they do not know what, and they demand some method of control over these deals. Politicians respond by passing legislation.)

I. It bears noting that a good deal of campaigning and lobbying is ideological rather than economic in nature. Evidently, one cannot gather majority support simply by arguing that "you" will be better off under "my" policy than others currently being considered.

- i. There are, partly for this reason, also “non rational” and “non instrumental” theories of voting.
- ii. For example, the importance of "expressive voting" in voter behavior is not well understood at this point, but is attracting considerable attention (see for example Brennan and Hamlin 1998, 2000) or Caplan (2001, 2002).
- iii. Morality, Altruism, and Ideological dimensions of voter choices are also attracting new attention from economists and rational-choice based political science.

J. Another Neglected Assumption

- i. The strong form of the median voter theorem, by neglecting information problems, also ignores possible "agency problems."
 - a. Candidates may say one thing to get elected and do something else once in office.
 - b. Moreover, elected representatives may not be able to fully control the bureaucracy.
 - c. However, candidates that are known to have cheated and one poorly at overseeing the bureaucracy will be more likely to lose the next election than those that have not since the median voter will not have gotten what he or she wants. So this is not a crazy assumption.
- ii. It also assumes that the real issue space can be mapped into a single dimension and that voters rank order candidates according to their policy positions.
 - a. There is evidence that supports this assessment, especially the very detailed analysis of voting in the US Congress by Poole and Rosenthal (1991,1996, 2001).
 - b. However, as the number of relevant dimensions of public policy increase, the probability that a median voter exists shrinks. Very strong symmetry assumptions are required for the distribution of voter preferences in multidimensional issue spaces (Plott, 1967).
- iii. Informational assumptions about candidates and voters, turnout, and electoral institutions also tend to affect the character of an electoral equilibrium.
- iv. None the less, the median voter model is widely used and widely found to be a useful first approximation of public policy formation in democracies.

IX. Majority Rule, Interest Groups, and Representative Governance

- A. The median voter model represents a pure electoral model of policy formation in democratic governments.
 - ◆ Although a very useful and powerful model, and also a quite accurate one for many purposes, the median voter model neglects the effects of interest groups and the bureaucracy on public policy.
- B. Incorporating such interest groups into the model in a systematic way is more properly the subject of Public Choice than public finance, but some brief discussion of their effects is undertaken below.
 - i. Both interest groups and the bureaucracy can influence public policy by lobbying elected officials for particular policies.
 - a. When these groups are successful, the policies that we observe will depart from those preferred by the median voter toward those preferred by these "special interest groups."
 - b. Note, however, if voters punish politicians for putting policies in place that are different from those announced during campaigns, that this will reduce the extent to which elected officials will listen to lobbyists and bureaucracy.
 - ii. **William Niskanen** suggests that **bureaucrats** have incentives to try to **maximize their budgets** for many private reasons.
 - a. Larger budgets often create new opportunities for advancement, more pleasant office environments, more staff support, and, perhaps, even opportunities for travel.
 - b. Note that even "public spirited" bureaucrats who want to advance their agency's "mission" will also lobby for larger budgets.
 - c. Thus, Niskanen argues that lobbying by bureaucrats creates systematic increases in government budgets to the extent that they are successful.
 - d. (Illustration of bureaucratic bargaining, using all or nothing offers.)
- C. The effects of other interest groups are less systematic, but in general one anticipates affects in policy areas in which benefits are substantial and concentrated so that the interest group can over come its own "free riding problem." (**Mancur Olson**, *Logic of Collective Action*)

X. Appendix: On the Mathematics of Taxation and Rent Extraction as sources of Revenue in Authoritarian Regimes (from Congleton and Lee 2009)

A. Consider the case in which national government is independent of its citizens--as in a pure authoritarian regime--and interested in maximizing long term revenue from “its” country.

B. Suppose that it can tax its people and/or sell off monopoly privileges.

- i. The latter can be done explicitly and also implicitly, by determining the general extent of monopoly power, M , through broad polices such as anti-trust enforcement.
- ii. A government's net revenues, N , in this case can be characterized as:

$$N = y(G, M, t, L, R) - c(G) + \alpha r(M) \quad (1)$$

- iii. Where y is the national production function, G is the government service level, M is the degree of monopolization encouraged, L is the exogenous labor stock, R is the exogenous natural resource base, t is the proportional sales or income tax, $c(G)$ is the cost of government services, and $\alpha r(M)$ is the revenue generated from would be monopolists. N is assumed to be strictly concave.
- iv. Differentiating with respect to government service level G , t , and M , allows us to characterize the net revenue maximizing combination of government services, tax rates *and monopoly policies*.

$$tY_t + Y = 0 \quad (2.1)$$

$$tYG - CG = 0 \quad (2.2)$$

$$tYM + \alpha rM = 0 \quad (2.3)$$

v. Subscripts denote partial derivatives of the variables subscripted.

C. The revenue maximizing government selects its policies over government services, tax rates, and monopolization policies to satisfy the three first order conditions simultaneously.

- i. Equation 2.1 implies, as in the Buchanan-Brennan model, that tax rates will be set to maximize tax receipts (with ideal government service levels and monopolization throughout the economy).
- ii. Equation 2.2 implies, as in the Olson-McGuire model, that productive government services will be provided by a revenue maximizing dictatorship up to the point where marginal tax revenues equal the marginal cost of those services.
- iii. It bears noting that Leviathan produces *fewer* government services than required to maximize national income when optimal marginal tax rates are less than one hundred percent.

- (The later reinforces the Buchanan-Brennan argument favoring progressive income taxation under Leviathan.)

iv. Equation 2.3 implies that *monopolization will be encouraged* up to the point where the marginal loss of tax receipts equal the marginal gains from rent-seeking receipts induced by those policies.

- a. A net revenue-maximizing Fisc has a direct interest in the industrial organization of its domain that is not entirely benevolent.
 - The marginal increase in revenues generated by increased monopolization, αrM , varies with the institutional setting, characterized by α , and with the extent to which increased monopolization induces rent-seeking by would be monopolists, rM .
 - The marginal cost of inducing rent-seeking revenues varies with effectiveness of the tax system, tYM , and the rate at which national income is reduced by the monopoly grants conferred, YM .⁶
- b. Given optimal government service levels, G^* , and tax rates, t^* , equation 2.3 implies that the larger is the marginal increase in rent seeking revenues

⁶ We interpret t as the effective tax rate, which may differ from both the statutory tax rate and the marginal tax burden. Opportunities to avoid paying taxes vary with the ability of the Fisc to police the tax law and opportunities to legally avoid paying taxes. It also bears noting that in some tax systems, tax revenues may actually increase as monopoly profits increase. For example, sales, value added, and profits tax revenues tend to increase as prices and monopoly profits increase. In such cases, rent-seeking possibilities may be expected to affect the choice of tax system as well as the degree of monopolization. We leave consideration of Leviathan's preferred tax *system* for future analysis. The income-based tax used in our analysis has been widely used in previous Leviathan models.

received by those with policy making power and the smaller the marginal tax loss, the greater is the government's ideal extent of monopolization.

D. It bears noting that the inequality forms of equation 2.3 allow the possibility of two corner solutions.⁷

- i. First, there is a corner solution where no inefficient monopolization takes place.
- ii. National income maximizing monopoly policies are adopted when the marginal tax cost of rent seeking is larger than marginal receipts, $-tYM > \alpha rM$, for all M .
 - a. In this case, the Fisc's "encompassing interest" in the size of the tax base causes monopoly power to be allowed or promoted only insofar as it adds to national income.
 - b. Tradable copyrights, patents and exclusive land grants might be created, but other monopolies would be prevented by state action as with antitrust enforcement.
 - c. This is the only case where Leviathan will adopt the policies recommended in textbook discussions of optimal patent, trade and antitrust policies.
- iii. The other extreme policy analogous to the Ekelund-Tollison interpretation of mercantilism is adopted when the marginal receipts from induced rent seeking exceed tax losses over the entire range of interest, e.g. when $tYM < \alpha rM$ for all M .
 - a. Complete monopolization of the economy can arise when the tax losses induced by monopolization are relatively small or when tax instruments are relatively ineffective sources of revenue (possibly because of shift of activities into the underground economy as in Marcouiller and Leslie, 1995).
 - b. In cases where tax losses are insignificant, the net revenue maximizing state attempts to *maximize* the size of rent seeking expenditures whenever $\alpha > 0$. Olson (1993) and Anderson and Boettke (1997) suggest that a good deal of the industrial policies of the former Soviet Union can be understood as such a corner solution.

- iv. The intermediate cases between these corner solutions are the focus of the present analysis.
 - a. In this range, governments use a combination of tax, government services and monopolization policies to maximize net receipts.
 - b. Potential rent-seeking revenues lead government to adopt policies that induce *greater* monopolization than is consistent with maximizing national income, $YM < 0$ at M^* , but the economy is not completely monopolized.
- v. The implicit function theorem allows the relationships describing the Fisc's preferred vector of tax, government service and monopoly policies to be characterized as:

$$G^* = g(L, R, \alpha) \quad (3.1)$$

$$T^* = t(L, R, \alpha) \quad (3.2)$$

$$M^* = m(L, R, \alpha) \quad (3.3)$$

E. Proposition 1: *The greater is the possibility of obtaining additional revenues from rent-seekers, the more inclined the Fisc is to adopt policies that promote "inefficient" monopolization, e.g. to use rent-seeking games as a source of government revenue even though such policies reduce national income.*

- i. The ideal monopolization policy, as characterized by equations 3.3, is of special relevance for the purposes of this paper.
- ii. Using the implicit differentiation rule to differentiate M^* with respect to α yields:

⁷ We assume that the Fisc's objective function is strictly concave and that his constraint set is convex; consequently the Arrow Enthoven sufficiency conditions are satisfied. These imply that the corner solutions to the optimization problem with inequality constraints can be completely characterized using the Kuhn-Tucker first order conditions. The Kuhn-Tucker first order conditions imply that in cases where the conditions for an internal maximum or tangency condition are not satisfied, e.g. $-tYM \neq \alpha rM$ for $0 \leq M \leq 1$, the maximal values of the objective function lie along the constraints as discussed above.

$$\begin{array}{|ccc|}
 \hline
 tY_{GG} - C_{GG} & tY_{tG} + Y_G & 0 \\
 \hline
 tY_{tG} + Y_G & tY_{tt} + 2Y_t & 0 \\
 \hline
 tY_{MG} & tY_{tM} + Y_M & -t\alpha rM \\
 \hline
 \end{array}
 \quad
 \begin{array}{l}
 [(tY_{GG} - C_{GG})(tY_{tt} + 2Y_t) - \\
 (tY_{tG} + Y_G)^2] / (t\alpha rM)
 \end{array}$$

$$M^*_\alpha = \text{-----} = \text{-----} > 0 \quad (4)$$

$$\begin{array}{|ccc|}
 \hline
 tY_{GG} - C_{GG} & tY_{tG} + Y_G & tY_{MG} \\
 \hline
 Y_G + tY_{Gt} & tY_{tt} + 2Y_t & tY_{tM} + Y_M \\
 \hline
 tY_{GM} & tY_{tM} + Y_M & tY_{MM} + \alpha rMM \\
 \hline
 \end{array}
 \quad | H |$$

- i. The equation 4 is unambiguously greater than zero in the case where the net revenue function is strictly concave.
 - a. (The second order condition of the original optimization problem requires $|H| < 0$ and the bracketed term of the numerator to be greater than zero.)
 - b. The last term in the numerator is also negative under the assumption that greater rent's induce greater rent seeking revenues.
 - c. Consequently, the leviathan model unambiguously implies that policies oriented toward increasing monopolization expand as the government's ability to profit from induced rent seeking efforts, α , increases.

F. Proposition 2: *regulations or monopoly grants that provide protection in output markets are generally more valuable to prospective rent-seekers than are protected production processes (patents) for firms in a given industry.*

- i. A monopoly privilege that grants the exclusive right *to sell* a specific product allows a firm to profit from production within its protected sphere, without fear of price competition from close rivals.
- ii. Grants of patent protection for specific production processes similarly allow firms to realize extra-ordinary returns by ensuring their position as a low cost producer.
 - a. A patented production process yields a Ricardian rent or inframarginal profits if the patented process is more cost effective than those not protected.
 - b. However, the rent associated with a patent is smaller than the profit associated with a monopoly in the same output market(s) insofar as the profitability of any production process clearly increases if one is able to manipulate price as well as output.⁸
- iii. The most valuable patents are those which generate such dramatic cost savings over other available methods that a monopoly results in the specific output markets, as patents on specific production processes occasionally do.
 - a. Moreover, output monopolies are more readily enforced than production methods are insofar as sales of outputs usually take place in public whereas production normally takes place in private.⁹
- iv. **Consequently, a revenue maximizing Fisc will be inclined to grant monopoly protection to output markets rather than production processes, other things being equal.**

B. Proposition 3, Ramsay Monopolization: *the markets granted the most protection by the Fisc are those in which the demand for goods and services is least price sensitive. Consequently, the revenue maximizing pattern of monopolization tends to resemble a Ramsey tax.*

⁸ This can be demonstrated mathematically as follows. Profit is revenue less cost. Consider the maximal profit associated with a given degree of monopoly power, M , and production technology, T . $\Pi^* = R(Q^*, M) - C(Q^*, T)$ Totally differentiating and appealing to the envelope theorem yields: $D\Pi^* = dM (\delta R / \delta M) - dT (\delta C / \delta T) > 0$. Maximal profit rises as production technology improves (allowing lower production costs) and as monopoly power increases allowing greater revenues.

⁹ A patent for a production process that can be used to produce products for *several* markets can be more valuable than an output market in any *single* market. Thus, to the extent that the Fisc protects production processes, we would expect such *broadly applicable* processes would attract the interest of a revenue maximizing Fisc before narrower markets. Protecting production methods does have the political advantage of being less observable than output protections. Of course, as noted above, this also makes patented production methods more difficult to protect.

- i. Monopolization of the least price sensitive markets maximizes the level of rent seeking induced because it maximizes the profits generated by a given degree of protection while minimizing the tax revenues lost by reduced output.
- ii. To see this, we now disaggregate the original model of monopoly power within a market as a whole and focus on individual markets and revenues.
- iii. Suppose there are n final goods markets that can potentially be granted a degree of monopoly power.
 - a. We represent the extent of monopolization generated by government policies in a particular industry as "monopoly mark up," m_i , while retaining our assumption that government output is a pure public good and that the tax system is a broad based sales or proportional income tax.
 - b. We assume that in the absence of monopolizing regulation, the markets in question would be conventional competitive markets with constant marginal and average costs, $A_i = a_i(t, G)$.
 - c. Tax rates and government services affect the average cost of producing output in market j .
- iv. Average cost is increased by tax rates which reduce the effective real return to capital and labor, and is decreased by government services which lower transactions and transport costs.
 - a. Industry i 's output can thus be represented as, $Q^*_i = q_{ii}(P_i, t, G)$ where $P_i = A_i + m_i$.
 - b. Monopoly profits and total rent-seeking efforts in market i are $m_i Q^*_i$. Net revenue for the Fisc is now:

$$R = \sum_i (t P_i Q^*_i + \alpha m_i Q^*_i) - c(G) \quad (5)$$

- v. In the case of a sales tax, monopolization can increase nominal tax receipts by increasing the value of output in the affected markets if total revenues or industrial income increases with price. Differentiating with respect to t, G and m_i yields the first order conditions that characterizes the government's vector of taxation, services, and monopoly policies.

$$\sum_i (P_i Q^*_i + t P_i Q^*_i) = 0 \quad (6.1)$$

$$\sum_i (t P_i Q^*_i G) - CG = 0 \quad (6.2)$$

$$\sum_i [t (Q^*_i + P_i Q^*_i P_i) + \alpha (Q^*_i + m_i Q^*_i P_i)] = 0 \quad (6.3)$$

- vi. Given t^* and G^* , equation 6.3 is satisfied when m_i is such that:

$$\alpha m^*_i + t^* P_i = (t + \alpha)(Q^*_i / - Q^*_i P_i) \quad \text{for all } i \quad (7.1)$$

or

$$m^*_i / P_i = [(t + \alpha) / \alpha] [Q^*_i / - P_i Q^*_i P_i] - t^* / \alpha \quad (7.2)$$

Given ideal tax and service policies, equation 7.2 indicates that the revenue maximizing vector of monopoly mark ups (as a percentage of the original price) is proportional to the price elasticity of demand in every market. (Recall that $\eta_i = Q^*_i / - P_i Q^*_i P_i$.)