

I. The last lecture noted a variety of implications of the simple median voter model in terms of government policies (some of which we will explore in more detail today).

A. For example, the median voter theorems predict that:

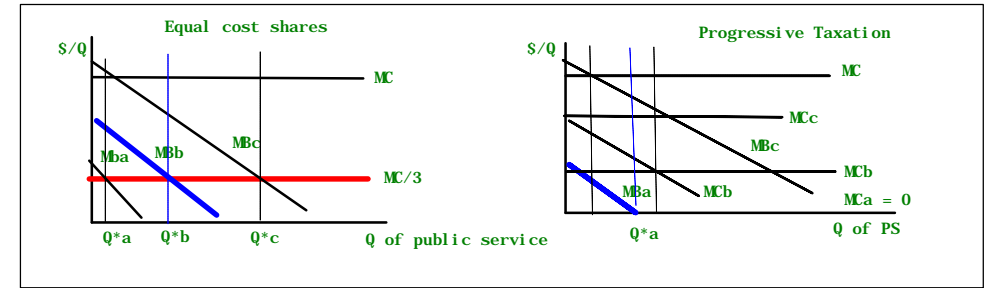
- i. Policies will tend to be moderate, e. g. drawn from the middle part of the political spectrum.
 - ▶ (The middle can be regarded as "moderate" essentially by definition.)
- ii. Most people will be at least partially displeased with the policies chosen insofar as they have different ideal points, even in a perfectly functioning democracy, as long as peoples tastes, circumstances, or expectations differ.
 - ▶ (However, although most people may be dissatisfied with government policy they may still prefer the use of majoritarian decision rules to any other procedures that they are aware of.)
- iii. At the Nash equilibrium in many two party or two coalitions election contests, government policies will maximize the median voter's expected utility, given her constraints, expectations, and goals.
 - a. An implication of this is that **any change in circumstance that changes the constraints of the median voter, or the identity of the median voter, will have systematic effects on the size and composition of government programs.**
 - b. Moreover, increases in the dispersion of the distribution of voter preferences (increased radicalism) tends to have little, if any, effect on public policies unless it also affects the median of the distribution of voter ideal points.
 - ▶ *This implies that median voter policies will be more stable than average voter policies.*
 - ▶ **[Student puzzle: explain why?]**

B. Today we will use the strong form of the median voter model to analyze some public policy issues and also begin to explore weaknesses of the model.

- i. The median voter model is widely used to analyze the level and growth of government service levels.
- ii. It also plays a significant role in both the theoretical and empirical public finance literature dealing with taxes and expenditure levels.
- iii. And, it can be used as test of the "competitiveness" of existing democracies.
- iv. However, from a theoretical perspective, it has a number of serious weaknesses.

II. The strong form of the median voter theorem, implies that particular policies can be modeled as the solution to one person's political optimization problem.

A. Such optimization problems are often very straightforward to characterize and perform comparative statics on.



B. Median voter models of public policies can be developed both geometrically and mathematically.

- i. Consider first a geometric representation of three voters, who are trying to decide the level of a public service, given particular tax institutions.
 - ▶ A pure public good or service is one that is equally available to all because of its technical "shareability" properties (Samuelson 1954).
 - ▶ A pseudo public good or service is one that equally available to all because of the manner in which it is provided (Buchanan and Congleton 1998).
- ii. For the problem at hand, both the nature of the service and the tax system have significant effects on voter demands.
 - ▶ For example in the figures above, the tax code determines how the cost of public services will be divided among the voters, which affects the level of services demanded by each of the three voters modeled, Al, Bob, and Cathy.
 - ▶ The "publicness" of the service implies that everyone will have the same amount of the service whether they have a high demand for it or not.
- iii. The geometry of rational choice implies that the median voter's preferred service level depends upon his or her tax price.
 - ▶ A voter's demand for the service partly depends on the cost of the service, and partly on the way that cost is divided up among tax payers.
 - ▶ And, it partly depends on his or her own marginal benefits from the service.
- iv. Note that insofar as demand (marginal benefits) for government services reflect income differences, and the service is a normal good, then it is even possible that a progressive taxation will cause high income "high demand" tax payers to vote in favor of smaller service levels than "low demand" voters, because of their relatively higher price for those services.
- v. Note also that a suitably designed progressive tax system can reduce the dispersion among voter ideal service levels.
 - ▶ Indeed, a tax system can be designed, at least in principle, so that everyone prefers the same public service level (Lindahl 1919).
- vi. The above model can be modified to represent voter preferences for regulations of various kinds by replacing a "tax price" with a "regulatory price."

- ▶ A "regulatory price" is simply the extent to which prices rise (and real income falls) as a consequence of the regulation of interest.
- ▶ In some cases, regulations may use taxes, as with the proposed carbon taxes (a Pigovian tax on CO2 emissions), which also implies higher prices for many products that voters purchase.

C. **Mathematical representations** of a median voter model generally focus on the choice made by a single "typical" voter, and then use parameters of the model to "identify" the particular voter that is the median.

- ▶ In general, the comparative statics of the median voter in such models is essentially the same as that of other voters, although her preferred service level differs from that of other voters because her tastes, income, age, etc. differs somewhat from that of other voters.

D. 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:
 - a. that voter's have the same utility function defined over private consumption (C) and some public service (G).
 - b. that each voter has a different amount of money, W_i , to allocate between C and G, and that there are N tax payers in the polity of interest.
 - c. And, to simplify a bit, assume also that the government faces a balanced budget constraint, and that all expenditures are paid for with a head tax, T.
- iii. This allows the typical voter's decision to be represented as:
 - a. maximize: $U = u(C, G)$
 - b. subject to: $W_i = C + T$
 - c. and: $g(G) = NT$
- iv. 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:
 - c. $U = u(W_i - g(G)/N, G)$
 - d. (Note that the substitutions imply that the voter has in fact only a single degree of freedom. Once G is chosen, tax rates and personal consumption levels are also determined.)
- v. 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 represents the **subjective marginal benefit** (marginal utility) of the government service, the left-hand term represents 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, c_G/N .
 - ▶ The latter can also be called the median voter's marginal cost share, or price for the government service.
- vi. 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, each voter's demand for the public service is 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 the comparative statics of a typical voter's demand for public services.
 - ▶ How will changes in wealth, W_i , and number of tax payers, N, affect a voter's demand for government services?
 - c. Applying the implicit function differentiation rule implies that:
 - ▶ $G^*_W = H_W / -H_G$
 - ▶ and $G^*_N = H_N / -H_G$
 - ▶ where H is the first order condition above.
 - d. 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::

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

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

and

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

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

- e. That is to say, **with head tax finance**, each voter's demand for a pure public service rises with personal wealth and with population.
- vii. Moreover, **since demand is strictly increasing in W, this implies that the median voter is the voter with median income** (in this particular model).
 - a. This voter's demand for public services will lie in the middle of the distribution.
 - ▶ That is to say, 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^{**} .
 - b. 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.).

E. Other, somewhat richer, mathematical models can be built to analyze such problems as:

- i. The effects of different tax instruments: proportional and progressive tax instruments
- ii. The effects of varying degrees of publicness on demand for services: club goods
- iii. Optimal redistribution motivated by narrow self interest and/or altruism.
 - ▶ For example, Meltzer and Richards (1981) 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.

F. It bears noting that **not every median voter model yields 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.

- i. For example, when public services are financed with a progressive income tax, the tax price changes with income.
 - ▶ In this case, whether demand increases or decreases with income depends on whether a voter's marginal cost rises faster than willingness to pay as his or her income and/or wealth increases.
- ii. However, useful insights may be obtained about the relationships between the median voter's own choice setting and the parameters of public policy formation are obtained even in those cases.
- iii. In either case, the final test of the median voter model is empirical.
 - ▶ How well does the median voter representation of a policy formation explain real policies and real world data about such policies.
 - ▶ On this score, the median voter model does quite well.

III. On the Normative Properties of Median Voter Policies

A. Although the median voter model implies that the median voter gets what "he or she 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 three individuals 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. See lecture notes.]
- ii. This can also be seen by developing a graphical illustration that contrasts the median voter's preferred output of a public service or regulation with a Pareto efficient one.
 - ▶ Generally, the median voter's preferred policy is Pareto inefficient whenever the median and "average" voter have different ideal points.
 - ▶ (A **Pareto efficient policy** is one that cannot be changed to make at least one person better off without making at least one person worse off.)

B. **Rational Ignorance and Fiscal Illusion.** The median voter model developed to this point has ignored information problems.

- ▶ For example, information costs faced by voters will generally cause voters to be less than perfectly informed about their tax burdens or the benefits of public programs.
 - ▶ That is to say they may "rationally" choose to remain ignorant of many policy details and also to economize on their "political research" by using small samples.
 - i. In cases in which the median voter's expectations are **unbiased** estimates of the consequences of public policies, he/she will still **on average** get what he/she wants.
 - ii. However, in cases in which 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 get** what he/she *truly* wants.
- C. Information problems open the door to interest groups and the bureaucracy who may manipulate voters by strategically subsidizing particular kinds of information. It also allows malfeasance (agency costs, corruption) on the part of elected and unelected government officials.
- i. Such problems would not exist if voters were completely informed about government policies and electoral competition was "perfect" in the sense that it lead to median voter policies.
 - ii. **[Student puzzle: explain why?]**
 - iii. Indeed, it can be argued that essentially the whole special interest group/rent-seeking literature is predicated on informational problems of these kinds in open democratic societies.

IV. A Theoretical Weaknesses in the Median Voter Model

- A. There is one nearly devastating weakness to the median voter model, namely "the median voter" does not always exist in even an analytical sense.
- i. Duncan Black is the modern (re) discoverer of the idea of electoral cycles in one dimensioned policy spaces.

L3: Applications, Extensions, and Weaknesses of the Median Voter Model.

- a. In some, fairly unlikely, one dimensional arrays of voter preferences, the majority rule preference ordering may be intransitive and no median voter would exist.

Illustration of Cyclic (Non-transitive) Majorities				
Preferences	Al (utility)	Bob (utility)	Cathy (utility)	referenda outcomes
Policies I	1	3	2	II > I
II	2	1	3	III > II
III	3	2	1	I > III

- c. *Single peaked* preferences are sufficient to guarantee the existence of a median voter in one dimensional issue spaces.
- ▶ Note that if you plotted policies I, II, and III along the "x-axis" and utilities in the "y-axis,"
 - ▶ Al and Cathy have "single peaked preferences" (only one high point)
 - ▶ whereas Bob's ordering has two peaks, it is V-shaped, with a peak at policy I and another at policy III.
- d. (Spatial voters of the sort we have modeled in previous lectures, always have single peaked preferences.)

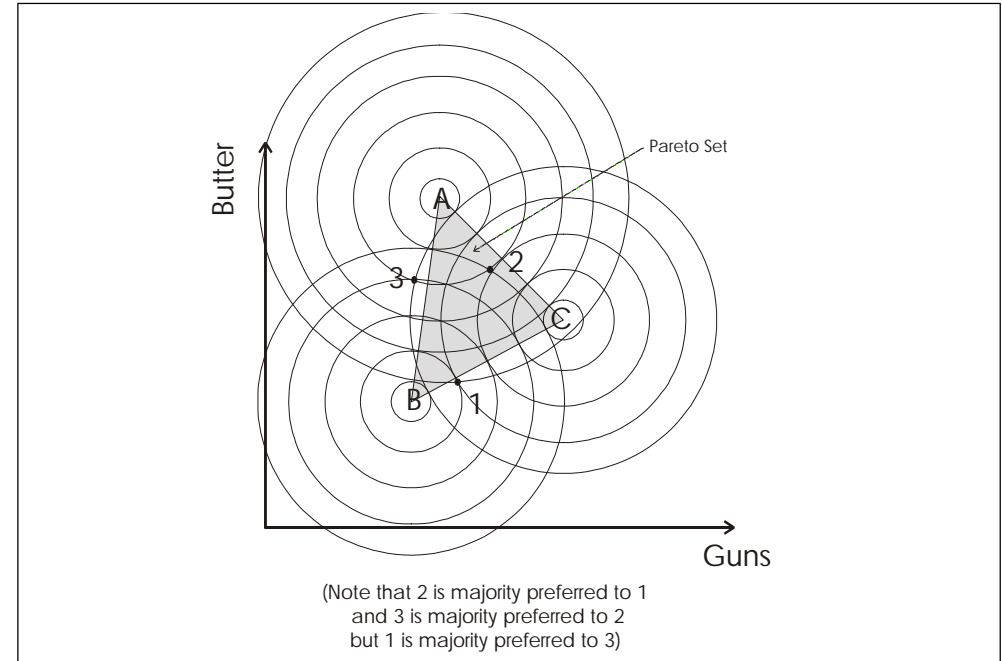
▶ [Student puzzle: explain why?]

- ii. **In 2-dimensional cases, however, a median voter exists ONLY in cases where voter preferences over policies are very symmetrically arrayed** (see Plott, 1969).

- a. For example, median voter outcomes can occur with spatial voting if:
- ▶ voter ideal points all lie along a single straight line,
 - ▶ voter ideal points are symmetrically distributed around a single voter in the middle of the distribution of preferences, as with "5" on most typical dice.
- b. In most other plausible looking 2-D policy space diagrams, cycles occur even if voter preferences are single peaked!
- iii. Consider for example the case in which voter preferences form a triangle.
- a. In a two dimensional diagram over "guns and butter," a voter's ideal platform is a specific combination of "guns and butter" which can be represented as a single point.
- ▶ The indifference curves of spatial voters are concentric circles.
 - ▶ [Student puzzle: explain why?]
- b. Note that in the triangular case, every policy has a non-empty *win set*, even when all voters have *single peaked preferences*.
- ▶ Def: The **win set** of policy "z" is the set of policies which could beat "z" in a majority rule election or referendum.

Public Choice/USD Odense

- ▶ In a three person diagram, these are the policies that can make two of the three person better off than at "z."
- ▶ Note that voters A, B, and C are spatial voters, and that policies 1, 2 and 3 make a "cycle" that show how such preferences in 2 dimensional policy spaces may cause majority rule to be inconsistent (intransitive).



- iv. The possibility of majoritarian cycles is widely regarded as a problem, because it implies that there may be no majority decision, and/or if there is one, the result is arbitrary.
- ▶ Buchanan, however, has argued that "cycling" can, perhaps surprisingly, be a *good property* of majority rule systems insofar as it promotes equity.
 - ▶ With cycling, everyone eventually gets to be a member of the majority coalition at some point and so will not be perpetually exploited.
- B. Fortunately for those who like simple models of the world, there is a large body of **empirical evidence that suggests that public policies reflect median voter interests** and change when median voter interests and circumstances change.
- i. For example, the median voter model has a good empirical track record in Public Finance as a model of government program size across states and through time.
- ii. Although the theory may be said to rest on "unlikely" assumptions about the distribution of voter preference, **estimated median demand** functions for public service can account for a good deal of the observed variation in actual public services.

- C. There are a number of possible explanations for the empirical results that support the median voter model and the "surprising" stability of government policies.
- i. First we could be lucky regarding the distribution of voter preferences.
 - a. It is possible that voter preferences over policies are (largely) of the sort which can be mapped into a single issue space while retaining "single peakedness."
 - b. For example, the work of Poole and Daniels (*APSR*, 1985) suggests that the distribution of policy preferences tend to be fundamentally "linear" and stable.
 - ▶ Using an enormous data set of roll call voting from the American Congress, they demonstrate that **a single dimension (the left-right political spectrum) predicts more than 80% the votes cast** by representatives in the US Congress (over *all* recorded votes).
 - ▶ See also Poole and Rosenthal 1997.
 - ii. If voter preferences are fundamentally fairly similar, the observed variation in policy preferences may also reflect **different voter ideologies** used to estimate the consequences of alternative policies.
 - a. It may be the distribution of "ideal points" is more or less one dimensional because ideological models of the world tend to lie along a one-dimensional "left-right" spectrum.
 - ▶ In that case, differences in voter assessments of many policy would none the less yield ideal point that are essentially one dimensional in the sense that knowing a person's ideology would allow you to predict their positions on most policy issues.
 - ▶ Perhaps the "one-dimensional debates" of political philosophers and pundits tend to "create" voter preferences over public policies that are also essentially one dimensional
 - iii. If ideology is not very important, it is possible that voter preferences for goods and services are fairly similar, and the observed variation in preferences over policies simply reflects **differences in income, as in the model developed above.**
- D. The emergence of two party or two coalition political systems (as with Duverger's 1959 theory of parties, which we will discuss later) also tends to reduce the dimensionality of the voting space insofar as a straight line through any two party platforms tends to be generate a "one dimensional" of policy alternatives, essentially those between the main party platforms.