The median voter model in public choice theory

RANDALL G. HOLCOMBE

Department of Economics, The Florida State University, Tallahassee, FL 32306

1. Introduction

When public choice first began emerging as a distinct subdiscipline, the median voter model, built on the foundations of Black (1958), Downs (1957) and Bowen (1943), was considered one of the most solidly established models in public choice.[1] But while at the beginning of the 1970s the median voter model was accepted almost without question in public choice, by the end of that decade it had been assaulted on so many fronts that it was virtually abandoned. As Mueller (1987: 245), remarked, after noting that the median voter model is descriptive under certain conditions, "subsequent research has shown that these conditions are so unlikely to hold in practice that Black's important theorem stands, from the perspective of today, as a kind of special case illustrating the fragility inherent in majority rule committee outcomes."[2]

The purpose of this paper is to review the role of the median voter model in public choice theory, paying special attential to the subsequent research that Mueller has noted. If by the median voter model one means that the public sector produces what the median voter wants, then doubt about the model's veracity is warranted. But if the model instead is interpreted to mean that under general circumstances the demand for public sector output is a democracy is the median voter's demand, then writing off the median voter model as a special case seems unwarranted.

The thesis of this paper is that the median voter model in the public sector has served in much the same role as the model of pure competition in the private sector. In general, microeconomic theory models the economy by starting with the competitive model and then imposing elements of monopoly on it in various ways. Similarly, public sector demand can be understood using the median voter model as a foundation and then imposing various complications – such as multi-peaked preferences and agenda control – on the fundamental model. If this notion is accepted, it provides a foundation for a theory of political structure that parallels the theory of market structure, with the median voter model fulfilling a role analogous to perfect competition in the market. Just because the median voter model is not descriptive of every political market does not mean that it cannot provide a solid foundation for the analysis of public sector demand. And when the evidence is examined, there appears to be

good reason to accept the median voter model as descriptive in a wide range of majority rule decisions.

2. The rise of the median voter model

Following Downs's and Black's work in the late 1950s the median voter model enjoyed a decade of increasing acceptance along with the growing area of public choice. In the early 1970s articles were published in journals such as the *American Economic Review* and the *Journal of Political Economy* which accepted public sector output as representing the median voter's demands without any more evidence than simply citing the existence of the model.[3] Even at this point some potential problems – most notably the cyclical majority problem popularized by Arrow (1951) – were well-recognized. Acceptance of the model nonetheless could partly be attributed to Black's demonstration that cycles could arise only when preferences were not single peaked, and not always even then. While potential problems were recognized, the problems were judged to be insignificant enough that the median voter model result could be assumed without demonstration in public choice models.[4]

Another reason for the model's acceptance is that the median voter model refers not to one actual model, but to a group of models that all arrive at a common result. That the median voter's preference will emerge as the group preference generated by majority rule was demonstrated by Black (1958) for committee type majority rule decisions, by Bowen (1943) in a referendum setting, and by Downs (1957) under representative democracy. With majority rule producing the same outcome under many different specific institutional implementations of majority rule suggests the robustness of the median voter result.

3. The decline of the median voter model

Perhaps the first assault on the median voter model was Niskanen's (1971) portrayal of budget maximizing bureaucracy. Niskanen (1971: 139) explicitly uses the median voter model as the foundation of the demand side of his model. But the conclusions from Niskanen's model were so at odds with the generally perceived conclusions of the median voter model that this model was considered a critique of the median voter model.

The median voter model is clearly only a model of demand aggregation in the public sector, but since at the time there were no generally accepted models of public sector supply, the median voter model was taken to imply that public sector output was that output most preferred by the median voter. Niskanen's innovation was building a supply side of the market and mating it

to the median voter model of demand in order to develop a complete supply and demand model of the public sector. But in so doing, Niskanen's conclusions were at odds with the conclusion generally accepted as being implied in the median voter model that the public sector produced what the median voter wanted.

The next step in the decline of the median voter model was to build Niskanen's budget maximization hypothesis directly into the voting models themselves. An excellent example is the agenda control model examined extensively by Romer and Rosenthal (1978, 1979a, 1979b, 1982). The agenda control model uses a referendum process much like Bowen (1943) described, but illustrates that a budget maximizing agenda setter can manipulate the alternatives in such a manner as to produce an outcome larger than would be most preferred by the median voter.

Control of the agenda provides a powerful tool for manipulating political outcomes,[5] but within a referendum setting such as that employed by Romer and Rosenthal, the possibility of agenda control begs more questions than it answers. In the Romer and Rosenthal model the referendum acts only as a constraint on the agenda setter, and since most public sector spending decisions are made without approval via referendum, if their model is descriptive of actual referenda, it leaves open the more important question of what constrains the size of the budget in the more typical case when a referendum is not held.[6]

The most devastating blow to the median voter model was dealt by McKelvey (1976), who used a model with assumptions similar to Black's, where individuals have single peaked preferences and motions can be considered sequentially by majority rule.[7] The main difference between McKelvey's model and Black's is that McKelvey expands the model so that political issues are multidimensional rather than single dimensional. But with this change McKelvey illustrated that an agenda setter could start at any point in the issue space and by strategically selecting issues end up at any other point in the issue space, so that there is no unique and stable majority rule outcome. Reactions to McKelvey's model varied,[8] but the point here is that the median voter model, accepted almost without question in the early 1970s, was considered to be just a special case not very relevant to the real world only a decade later.

4. Theoretical issues

One explanation of the rapid decline of prominence of the median voter model in public choice theory is that it has suffered from excess in the application of theoretical results to the real world. At the height of its prominence its modest claim that under some circumstances the median voter's preference will emerge as the collective preference in a majority rule election system often was taken

to imply that the public sector produces what the median voter wants. There are two reasons why this exaggerated claim might not be true.

First, the median voter model says nothing about the supply side of the public sector. Niskanen's contribution in this regard was noted earlier. But adding a supply side to the model does not refute the model of demand aggregation, and Niskanen explicitly employed the median voter construction. Along these lines, note the significant difference between McKelvey's (1976) model and Romer and Rosenthal's (1978). While both are about agenda control, Romer and Rosenthal use the median voter construction and add a budget maximizing agenda setter to show how supply side considerations can affect the referendum variant of the median voter model. But their model is a median voter model nonetheless, using the same demand side but adding a supply side which was not included in the original formulation of the model. McKelvey, on the other hand, also writes about agenda control, but shows conditions where the median voter framework is inappropriate. Thus, McKelvey rejects the basic median voter framework, whereas Romer and Rosenthal accept it and build their model onto it.

The lack of a supply side in the model is not sufficient reason to reject the median voter model itself. The model could be faulted for being incomplete, or more precisely, the model's proponents could be faulted for taking a purely demand side model and using it as a description of the entire market for public sector output, but previous exaggerated claims for the model should not discredit the model entirely.

The second reason why the exaggerated claims of the median voter model might not be true is that the model itself may not be descriptive of the majority rule decision making process, which is the critique of the model within McKelvey's framework. The claim is not that the model is not correct, but rather that there are plausible conditions under which majority rule will not produce a determinate equilibrium. Considering Arrow's (1951) book, this finding has been a part of the public choice literature since the beginning of public choice.

Putting these two critiques in perspective, they amount to determining when the conditions exist that will produce a median voter equilibrium and when those conditions do not exist. This has not changed. What has changed is that public choice theorists in general now believe that the median voter model is less generally applicable than they formerly believed.

A similar sequence of events occurred after the rigorous proof of the uniqueness and stability of a competitive equilibrium in the market. With a fragile mathematical proof as a target, economists set about proving that the conditions of a competitive equilibrium could never be met, the spirit of which is fully captured in Bator's classic article, 'The Anatomy of Market Failure' (1958). A similar taxonomy on the anatomy of government failure has yet to be written, but the literature to form its foundation is already in place. The median

voter model provides a benchmark in that it describes a unique and stable majority rule equilibrium so that theorists – much as they did with the competitive equilibrium – can demonstrate how easy it is to develop plausible conditions under which the model's conclusions will not hold. But, that having been done, it is worthwhile to step back and examine the model and its exceptions to see when the model's conclusions might ever be expected to hold true.

5. The applicability of the model

The median voter model, as a model of public sector demand, should not be expected to show a full public sector equilibrium. The median voter model is simply a model of demand aggregation, so that in the same way that individual demand curves are summed in a private market to find the market demand, the median voter model depicts the market demand when aggregated by majority rule to be the demand of the median voter. The question, then, is when conditions would exist such that the median voter model accurately describes the demand aggregation process.

The model's developers and its critics agree that it is descriptive when the alternatives to be considered can be ranked on a single dimensioned continuum such that individual preferences for the alternatives are single peaked. This statement requires some elaboration. First, it is not necessarily true that multiple peaked preferences will lead to indeterminacy. In one dimension, multiple peaked preferences are a necessary but not sufficient condition for there to be no median voter outcome. Second, saying the model is descriptive does not necessarily imply that the median voter will get what he or she wants. For example, agenda control in the Romer and Rosenthal model operates by identifying the median voter and then manipulating the alternatives that the median voter faces. Third, the alternatives do not have to be related in any manner other than being able to be placed on the continuum such that there are not multiple peaked preferences. For example, one candidate might run solely on a platform related to an arms control treaty, while another runs on a platform devoted to balancing the government budget, and a third runs on an antiabortion platform. These are three separate issues that produce a three-dimensional issue space, but if the candidates can be ranked in one dimension such that preferences for the candidates are single peaked, then the median voter model applies.

This third point is significant when considering the applicability of the median voter model to national electoral politics. In the 1984 presidential election, for example, the three plausible candidates were Mondale, Hart, and Reagan. The issues were complicated, ranging from abortion to taxation to foreign policy, making it appear as a multidimensional setting. But the voters do not have

a choice of selecting any point in an n-dimensional issue space; rather, they have the choice of only three points in the issue space, and it is plausible that most voters would have single peaked preferences ranking those three points on a single dimensioned continuum from left to right such that Mondale is the furthest left and Reagan the furthest right. This requires only that those preferring Mondale would choose Hart over Reagan and those preferring Reagan would choose Hart over Mondale. If this condition is met, then because only a subset of points is the multidimensional issue space are available, the issue space can be collapsed into one dimension and the median voter model applies.[9] It should be noted that this will always be the case when there are only two choices. Seen in this light, it appears plausible that in general electoral politics the limited number of points in the issue space over which voters have the option of choosing creates a structure whereby candidates can be ranked on a single dimensioned continuum in such a way as to have a determinate median.

This is not proof of the applicability of the median voter model. Indeed, proof is not possible that the assumptions or conclusions of a theoretical model accurately reflect the conditions of the real world. But arguments taken to discredit the median voter model as a general description of majority rule electoral outcomes do so only by showing that in theory there are many conditions that could cause the model's assumptions to be unrealistic. This does not by itself imply that the median voter model is any less relevant to majority rule voting than the model of pure competition is to markets.

6. Empirical evidence

Empirical evidence can be consistent or inconsistent with a hypothesis, but it can never provide irrefutable proof. With this in mind, it is worth noting that most of the evidence published regarding the median voter model is consistent with the model. This by itself should suggest that the model is more than just a special case that is rarely applicable to the real world.

A test of the hypothesis was presented by McEachern (1978), who divided states into three categories: those which require no referenda to approve school spending, those which require simply majority rule referenda, and those which require more than a simple majority to approve. He found no difference between the majority rule states and the non-referendum states, but did find significantly lower spending in the states which required approval of more than a simple majority. He concluded that the non-referendum states were already at a median voter equilibrium as a result of Downsian competition, so majority rule referenda would produce the same result. More than a simple majority rule makes some other voter (e.g., the 60th percentile voter if 60 percent approval is required) the decisive voter, thus differentiating those states.

Empirical tests by Holcombe (1980) and Munley (1984) attempted to identify the median voter from referendum data and compare the median voter's most preferred outcome with the actual referendum outcome. In both cases, the evidence was consistent with the median voter hypothesis. These tests are of further interest because they are done in the same theoretical framework as Romer and Rosenthal used for their agenda control models of referenda, but the evidence was consistent with the Bowen model rather than the Romer and Rosenthal model. Romer and Rosenthal (1982) present a test in which they try to differentiate their agenda setter model from the median voter model. They conclude (p. 577), "Rather than resolving the question of the simple setter model against the simple median voter model, our results indicate that both may be inappropriate ..." and suggest further investigation.

Studies by Pommerehne and Frey (1976), Pommerehne (1978), and Inman (1978) examine test the median voter model by comparing predictions using the median versus mean incomes and find the median to be the better predictor. Holcombe (1977) describes a referendum system once held in Florida that always picked the median voter outcome. In short, there have been a number of empirical tests of the model over the years, all taking very different approaches, and most have found the evidence to be consistent with the model. Mueller (1979: 106–111) cites several other empirical studies which reinforce the conclusion that, in general, empirical work on the subject is consistent with the median voter model. It is worthwhile noting, at the very least, that the preponderance of evidence in the literature is consistent with the model that some are willing to write off as irrelevant.

7. Toward a theory of political structure

Over the past decade, public choice theorists have become increasingly aware that the institutional structure in the public sector is an important determinant of the characteristics of the resulting outcome. Around 1970, the median voter model was accepted as descriptive of the characteristics of majority rule equilibrium regardless of the specific institutions, and one result of the work on public sector supply models and disequilibrium voting models has been to focus the theorist's attention more closely on the specific political institutions and their impact on the resulting outcome. The disequilibrium and public sector supply models have shown that there are a number of reasons why the median voter model might not be descriptive of reality.

But showing that there are conditions where the median voter model might not be descriptive of reality does not imply that the model is never descriptive or that it should be regarded as a special case rarely relevant to real world collective choices. The earlier sections of the paper argued that there is both theo-

retical and empirical evidence weighing in the model's favor. The evidence does not imply that the public sector produces what the median voter wants; this claim is stronger than the model warrants, but it is the claim that is often attacked under the name of the median voter model. Rather, the evidence suggests that the median voter model is a good description about how demands are aggregated under majority rule in many circumstances.

Recall that some of the critiques of the median voter model use the median voter framework to develop alternatives. This method accepts the general validity of the model as a demand aggregation mechanism while attacking the overly strong conclusion that the public sector produces what the median voter wants. Combined with the evidence on the model, this suggests that the more appropriate role of the model is to provide a polar case of demand aggregation under majority rule in much the same way that the model of pure competition provides the polar case with regard to the market.[10]

In microeconomics, the competitive model provides the polar case upon which imperfections are added to form more realistic models. In public choice theory, the median voter model can provide a similar polar case of majority rule decision making under ideal 'competitive' conditions. But again, complications can arise. These complications do not disprove the median voter model any more than the monopoly model disproves the model of competition. Rather, they provide a method for building on to the basic model a description of how the real world can differ from the competitive ideal under certain conditions.

The median voter model has already been used like this in Niskanen's bureaucracy model and in Romer and Rosenthal's model of agenda control, to cite two examples. Theorists wanting to explore supply conditions or develop models of bureaucracy accept some notion of stable public sector demand implicitly rather than some indeterminate or forever cycling demand. Empirical work in public choice also accepts the notion, although sometimes implicitly, because in most circumstances it would make no sense to run regressions on oberved characteristics that are assumed to be unstable. If this implicit recognition were made explicitly, then the median voter model would be in more of a position to provide a foundation for the theory of public sector demand. As it stands, the model is often accepted implicitly while its relevance is explicitly questioned.

8. Conclusion

The changing perception by public choice theorists about the relevance of the median voter model is a result of excessive extrapolation of the conclusions of theoretical models to the real world. Early in the 1970s the median voter model

was often accepted as implying that the output produced in the public sector was what was most preferred by the median voter. This claim is excessive because the median voter model is only a model of demand aggregation under majority rule and has little to say about the supply side of the public sector. In the late 1970s many scholars identified several circumstances under which the model would not apply in theory, but these critiques of the model were often viewed as reasons to abandon the median voter model altogether. The model went from having excessive claims that made the model appear to be more powerful than it really is to excessive claims that made the model appear to be less powerful than it really is. These latter claims were often in response to the earlier claims rather than to the model, appropriately applied.

Pointing out that the model might not be valid under some circumstances in no way implies that the model is never valid. In fact, this paper has reviewed strong arguments, both empirical and theoretical, suggesting that the median voter model is a good approximation of demand aggregation in the public sector for many issues. One paper will not change the opinions of public choice theorists on the median voter model. But the argument given here is that there is a large amount of theoretical and empirical evidence supporting the median voter model as a good foundation for the development of the theory of public sector demand. Once the overly ambitious claims that have been made for the model are set aside, the median voter model is in a good position to provide a base for the development of a theory of political structure that is analogous to the theory of market structure in economics.

Notes

1. See Buchanan (1975) for a discussion of the emergence of public choice as a subdiscipline in the years following World War II.
2. Rowley (1984) gives a detailed analysis of the generality, realism, and predictive power of the median voter model and concludes that the model falls short on each count. His paper gives a good overview of the research that Mueller refers to.
3. See, for example, Barlow (1970), Bergstrom and Goodman (1973), and Borcherding and Deacon (1972).
4. See, for example, Tullock's (1967) argument that cycles are unlikely in a large number setting, in a model that is a special case of Plott's (1967) majority rule equilibrium. These models are discussed at greater length in Holcombe (1985: Ch. 4).
5. See Plott and Levine (1978) for an illustration in a committee setting.
6. See Holcombe (1983) Chapters 3 and 4, for further discussion.
7. See also McKelvey (1979) and Hinich (1977). The intuition behind McKelvey's mathematical demonstration can be seen in a simpler graphical framework in Holcombe (1985), Chapter 4.
8. Riker (1980) abandoned hope of finding a stable political equilibrium analogous to general equilibrium in the market, while Tullock (1982) asked how the public sector could appear so stable in the face of these formal proofs of instability.
9. This is an example of a structure induced equilibrium, to use the terminology of Shepsle and

Weingast (1981), although they consider the notion in relation to legislative choice rather than in a general election. Slutsky (1977) also illustrates the point that if the voter choice set is limited so that it does not cover all points in the policy space, a majority rule equilibrium can exist.
10. See Holcombe (1985: 71–74) for some additional discussion along these lines.

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