A Classroom Exercise: Voting by Ballots and Feet

Roger Hewett, Charles A. Holt, Georgia Kosmopoulou, Christine Kymn, Cheryl X. Long, Shabnam Mousavi, Sudipta Sarangi*

Corresponding author: Holt

* Roger Hewett, Department of Economics and Finance, Drake University, Des Moines, Iowa, 50311, U.S.A. Phone: 515-271-3834. Email: *roger.hewett@drake.edu*

Charles A. Holt, Department of Economics, University of Virginia, P.O.Box 4182, Charlottesville, VA 22904-4182. Phone: 434-924-7894. Email: *cah2k@virginia.edu*

Georgia Kosmopoulou, Department of Economics, University of Oklahoma, Norman OK 73019-2013, U.S.A. Phone: 405-325-2861. Email: *georgiak@ou.edu*

Christine Kymn, Law School, George Mason University, Arlington, VA 22201 U.S.A. Phone: 703-993-8000. Email: *ckymnC@gmu.edu*

Cheryl X. Long, Department of Economics, Colgate University, Hamilton, NY 13346 U.S.A. Phone: 315-228-7024. Email: *Cxlong@mail.colgate.edu*

Shabnam Mousavi, Department of Economics, Virginia Tech, Blacksburg, VA 24061 U.S.A. Phone: 540-552-9550. Email: *smousavi@vt.edu*

Sudipta Sarangi, Department of Economics, Louisiana State University, Baton Rouge, LA 70803-6308, U.S.A.. *Email:* *sarangi@lsu.edu*

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Abstract: This classroom experiment illustrates the efficiency-enhancing property of a Tiebout system in which local public goods decisions are determined by a political process. Students are given playing cards that induce diverse preferences for expenditures on alternative public goods, and are initially assigned to specific communities. Then those in each community vote on the type and level of public goods provision, which determine the tax cost. After the provision and tax results are announced, students are free to move to a location where the prior results are more consistent with their preferences. This process continues for several rounds, with a new vote taken at each location after moves have been made. The exercise demonstrates that the combination of voting with feet and ballots tends to increase the total net benefit for all communities. The voting on provision levels is structured to facilitate a discussion of the median voter theorem.

1. Introduction

When there is freedom in choosing where to live among competing jurisdictions, individuals will "shop" for locations that most closely match their demands for local public goods, resulting in an efficiency-enhancing outcome. Tiebout (1956) first made this argument to challenge the Musgrave-Samuelson analysis, in which the market falls short of providing the efficient amounts of public goods. This inefficiency is caused by a free rider problem. In the ideal world envisioned by Tiebout, however, individuals sort themselves into groups with similar preferences by freely moving to their desired communities, and thus reveal their true preferences for public goods in the process. The Tiebout hypothesis has spurred a fruitful research agenda in public finance and urban economics, and the efficiency-enhancing property of the Tiebout solution has been corroborated and supported by both theoretical and empirical work.

With the level of public good provision and taxes preset by the jurisdictions in the Tiebout model, individuals essentially "vote" by moving to the jurisdiction that most closely approximates their demands for local services. Explicit voting mechanisms, which play a crucial role in the public economics literature, are absent in the original Tiebout model. Some extensions of the Tiebout model, however, have integrated voting. Konishi (1996), for instance, obtains efficient equilibrium outcomes in a local public good economy where individuals have free mobility and each jurisdiction is allowed to adopt certain collective choice rules to determine the provision of public goods and taxation. In other words, efficient outcomes can be achieved when individuals vote both by feet and by ballots.

The efficiency-enhancing property of this enhanced version of the Tiebout model is illustrated in the classroom experiment presented here. We find that individual students obtain the level of public good provision and taxation that most resembles their preferences by moving to a community with other like-minded residents and by voting to pass a budget the community as a whole prefers. Further, the exercise shows that the moves made by individual students almost always improve their welfare levels, and that the total net benefit from all the communities increases when residents can move to different jurisdictions and vote to determine the levels of public good provision and taxation. These outcomes provide an intuitive introduction to topics on the provision of local public goods and the Tiebout hypothesis. Instead of fixing the voting rule as in Konishi (1996), we allow the residents of each jurisdiction to collectively choose a decision rule. Although residents are free to choose any voting mechanism, the preferences of the median voter typically determine the level of public goods provision.[1] The outcome obtained from the median voter preferences coincides with the result from the simple majority rule, and thus can lead to a useful class discussion of voting rules and the median voter theorem. The observed outcomes can also stimulate discussions of local public goods, efficiency, fiscal federalism, migration trends, and related concepts in public choice and public finance. The experiment is designed to be used in introductory or intermediate microeconomics classes, or in public choice, law and economics, and urban economics classes.

2. Experimental Setup

In this section, we describe the experimental design and provide the general procedures. The Instruction Sheet in the Appendix provides the precise details for using this experiment in a class of about 15-30 students, although we have adapted the setup for somewhat larger classes.

Preferences

The basic idea is to let students sort themselves into different communities based on their preferences over (local) public goods. Each community is allowed to provide only one of several alternative public goods. Playing cards are used to induce diverse preferences over possible types of public goods. The four different suits of cards correspond to four different types of public goods. For example, you might think of the four suits (Diamonds, Clubs, Hearts, and Spades) as corresponding to alternative types sports facilities or museums, e.g. Diamonds for baseball.

The numbers on the cards are used to determine the preferences over public goods. In particular, the sum of the numbers of cards for each suit determines the intensity of preference for that suit. A person with a hand with a three of Hearts (3H), a ten of Hearts (10H), and a four of Clubs (4C) would strongly prefer a community that provides the public good associated with Hearts. For this person, the monetary value for the public good provided in a Hearts community can be 13 (= 3 + 10), although the actual benefit could be less than 13 for this person if a lower level is selected by the community. For example, suppose the Hearts community chooses 9H as its preferred level. The person in the example, with Hearts cards that sum to 13, would only receive a benefit of 9 units. Since the selected good is public in nature, a second person with Hearts cards that sum to 9 would also receive a benefit of 9 in this community. Thus, the benefit to any individual of being in a particular community that selects public good of type *i* is computed as:

Benefit = min {*provision level of type i, sum of cards of type i*}.

Note that if the community decides on 9H, then any person with Hearts cards that sum to an amount below 9 would only receive that lower amount. Thus the card sum for each type of public good represents a person's preferred level for that good, since excess provision only results in higher taxes. Benefits are measured in dollar amounts (willingness to pay) so that they can be compared directly with costs. The tax cost of the public good for each member of the community is determined by dividing the total provision cost by the number of residents:

$$\textbf{Cost} = \frac{k \times level\ chosen}{number\ of\ members\ in\ the\ community},$$

where *k* is a constant cost parameter that is greater than 1. The payoff for each person is the difference between the benefit and the tax cost paid. The instructor can discuss the different aspects of the local public good being provided in the experiment. The benefit level captures the *non-rival* part, which is identical for all members of a given community. Members from one community cannot enjoy a public good provided by another community; hence the benefits of the good are local. *Economies of scale* in the provision of the public good are modeled through the tax, where a larger community reduces the contribution of every member. Note that *non-excludability* is manifested through the "local" nature of the public good.

Procedure

Playing cards, a few manila envelopes, and copies of the instruction sheet in the appendix will suffice for advance preparation for carrying out this experiment in a 50 minute class period. Begin by marking the locations of the predetermined communities in the classroom with the manila envelopes that display the name of the community. Choose community names you think will appeal to your students, or let the residents select their own names. To generate interesting behavior, the initial number of communities should be greater than the number of public goods and we recommend using a cost parameter of k = 2. We typically use 5 communities, located at the four corners of the room, with the remaining community in the middle. Assign the students to a community based on where they are seated. You might also recruit a couple of volunteers from the class to assist with the experiment in large classes.

After locations have been assigned, designate one person in each location to serve as mayor, whose job is to coordinate the community's decision-making process by chairing meetings, voting on all issues, and serving as a tie-breaker. The mayor will also report the community's decision to the instructor. Then pass out the instruction sheets and deal 3 cards to each student (only the numbered cards). For larger classes it will be necessary to use several decks of cards. The instructions should be read aloud, and then students should be given the opportunity to calculate earnings for one or more specific examples, as indicated at the end of the instructions. This will ensure that all students understand how payoffs are computed. Finally, ask students to write down what cards they have on the Record Sheet, which will allow you to analyze their moves to other communities later.

Now announce that communities are free to choose their type and level of public good by majority vote. To avoid any undesirable strategic behavior, you should wait until all communities have finished making decisions before posting results. The first period will generally last longer. You might wish to walk around the class and help with a few suggestions. It is a good idea to limit the duration of the first round to 6-7 minutes; otherwise endless arguments between the citizens of a community could slow down the experiment. When all communities have finished making decisions, ask the mayors of each community to report the community's choice and level of public good as well as the tax rate for the community. This information is posted on the board or projected for all to see. Then announce the beginning of Round 2, at which time participants are free to move to a different community if they wish. It helps eliminate confusion if you force everyone to make their moves before the public goods discussions for the next round begin. Continue this sequence (vote, announce results, move) for a number of rounds depending on the time constraint. Usually five rounds will be sufficient for students to sort themselves into their own preferred communities or at least generate enough interesting behavior to have a stimulating class discussion.

This classroom experiment is a particularly good choice if you get a chance to take a class outdoors, since the people in each town can meet and sit in a circle. In one such outdoor class, students were given a one-page handout where they could record the cards of people in their town in the final round. As a homework assignment, they were asked to read this paper, calculate the median voter prediction, draw the value structure that is analogous to that in Figure 1, and discuss the extent to which the outcome corresponded to the surplus-maximizing level of the public good.[3] This reading and homework added an important academic balance to the relaxed atmosphere of moving the class and the discussion outside on a nice day. The only procedural issue that arose was when all members of a very large town moved in unison to a smaller neighbor town, knowing that they could dominate the voting, and with a larger number of citizens, reduce the per capita tax cost. When the people in the smaller town tried to move, the larger group followed them. This raiding was avoided in a subsequent class by introducing a rule that people cannot move more than once each round, although a cost of moving could have the same effect.

3. Discussion

The authors have run this experiment in a variety of classes (15-44) at various universities, with undergraduates and law students. We begin with a summary of the results for one class, which will clarify how the instructor can organize and structure the *ex post* discussion.[4] The 15 students were initially divided into 5 communities of 3 students each, with the communities named after popular locations from the world of media and entertainment, as shown by the column headings in Table 1. The rows show the numbers of residents, public good decisions, and resulting per capita taxes for each round. The constant marginal cost of increasing the level of each public good was set at 2.

In the first round, there were two Clubs communities with slightly different levels of provision. Then an influx of residents from South Park with lower preferred Clubs levels into Metropolis caused the level to drop in Metropolis, with a large drop in taxes. The type of public good remained the same in the other communities, but the levels changed in some cases as a result of migration.

In Tiebout's voting-with-the-feet model, individuals reveal their preferences for various public good bundles by silently voting with their feet. The moving and sorting process happened fairly quickly during this experiment. The *total* net benefit, which is obtained by summing up the individual net benefits for all members of the communities, increased steadily in each subsequent round. It went up from 14 in Round 1 to 51 in Round 2, and then to 65 and finally to 77 in Round 4. One way to highlight the Tiebout sorting process and the consequent improvement in welfare is to ask students the following question: "Compared to your initial community, are you at least as happy after moving?" In the second round, all but two students said they were happier than before, while two students were just as happy as initially. By round

4, no person could have gained by a unilateral move to a different community, under the assumption that the move would not alter the decision made by that community.[5]

In this experiment, the level of public good chosen was the level of the median voter in 17 out of the 19 decisions made. (In the case of an even number of members in the community, they chose one of the two middle numbers.) Based on this observation, the instructor can introduce the concepts of the median voter theorem, and discuss the decisiveness of the median voter under majority voting. For instance, consider Metropolis in Round 1, where the total numbers of Club cards for the three residents were 0, 15, and 18, and the group decision was a level of 15. You could ask them why they chose 15. In Rounds 3 and 4, after the influx of Club-lovers from South Park, the Metropolis Club cards became 9, 13, 13, 15 and 18, and they chose 13, which is again the median. To stimulate discussion you might introduce an alternative, e.g. what would happen if a player proposed 15? The students should recognize a majority would defeat 15. After a series of questions and examples such as above, your students should begin to recognize the median voter as decisive. Deviations from the median voter prediction may also be discussed; such deviations are typically in the direction of the average of individual's preference points.

Even though the median voter outcomes achieved in this classroom experiment tended to raise the total net benefit with each round of moves, it is an interesting side issue to consider whether the median voter result would always generate the highest possible net benefit to all community members. Given the payoff structure used, with a marginal cost of 2 for each addtional unit of a public good, it can be shown that the optimal outcome for a specific community is always between the levels most desired by the residents with the second and the third highest values for the chosen suit. To understand this result, consider the Samuelsonian

Demand for Clubs (the vertical sum of individual demands) for the Metropolis Community in Round 4. Recall that the card totals were 9, 13, 13, 15, and 18 for the five residents. Each person gets a benefit of 1 for each additional unit provided, up to 9 units, so the Samuelsonian demand would be 5 for all quantities up to 9, as shown by the solid line in Figure 1 below. Only 4 residents benefit from further increases, and the Samuelsonian demand would have a height of 4 for levels from 9 to 13. The other steps in the demand curve, which shows the marginal social value, are determined similarly. Because the total social cost of providing public good of level *q* is *2q*, the marginal social cost is 2, independent of the level of public good provision, as shown by the dashed line in Figure 1. The marginal social value is given by the solid curve, decreasing in the level of public good provision. The optimal level for the community, therefore, is given by the intersection of marginal social cost and marginal social value. This intersection is on the interval between 13 and 15 in this case, but in general with a cost of 2, the intersection would occur on the range between the second and the third lowest values in the community.

In general, the median voter will not have the second of third lowest value in the group, unless the group size is three, four, or five. Since there were no more than five members in a community at any point in time in the experiment, the median voter outcome obtained for each location happens to be the best outcome for the community. It is worth emphasizing in class, however, that the median voter outcome does not always coincide with the community optimum. If there were 9 members in a community, for example, the highest net benefit for all members in this community would not be achieved at the preferred level for the median voter, i.e. the person with the fifth highest value.

In the Tiebout model, efficiency failures of the median voter outcome might be solved by a sorting process that creates new communities with diverse alternative levels of the public good, but in our setup this sorting process is constrained by the advantages of sharing the cost among more people in a larger community. As a result, the history of location decisions can cause net benefits to fall below maximum attainable levels. With tedious calculation, it can be shown that the maximum overall social benefit in a sustainable equilibrium would have been 82 in the experiment being discussed. The observed outcome in the final round attained 93.9% of that benefit and 11 of the 15 members of the community were in their optimal locations.[6]

5. Further Reading

Brouhle et al. (2004) provide an alternative classroom exercise that illustrates the Tiebout sorting process. Students are assigned one of two levels of demand for a single local public good. There are three alternative levels expenditures on the public good, $0, $50, and $100. Low-demand individuals prefer $0, and high demanders prefer $100. The actual level of expenditure is determined after the vote by taking a weighted average, calculated as $0 times the fraction of votes for the $0 level, plus $50 times the fraction of votes for the $50 level, plus $100 times the fraction of votes for $100 level. The class eventually sorts itself into two communities with $0 and $100 provision levels. The setup is simple, which is especially useful for larger classes, but it is limited to a single public good and a somewhat artificial voting mechanism that does not facilitate discussions of the median voter theorem. In the remainder of this section we provide a brief bibliography for the Tiebout model and of related work in the median voter framework.

There is a wealth of literature surrounding the Tiebout hypothesis. One portion addresses whether the conditions specified in Tiebout (1956) yield a theoretically efficient outcome. Papers such as Richter (1978) and Wooders (1980) support that view while others, such as Bewley

(1981) are more critical. Richter (1978) demonstrates a theoretical proof of Tiebout optimality with interesting numerical examples. In his paper, economy wide tax rates are identical, land values rise or fall as households enter or leave a jurisdiction, assuring that public good benefits don't lead to single large community as households with different demands for different public goods maximize their utilities.[10] Bewley (1981) presents a theoretical proof of a rigorous version of the Tiebout model implies that Tiebout does not provide an adequate basis for a general theory of local public goods. Stiglitz and Atkinson (1980) is an excellent source of review for the early theoretical work. For some recent work on the Tiebout hypothesis see Conley and Wooders (2001) and Nechyba (1997). In Nechyba's (1997) model voters own private goods and are mobile and financing of public goods is both local as well as national. Majority rule voting determines the expenditure on public goods. The existence of general equilibrium is proved with minimal restrictive assumptions on preferences and technologies. Conley and Wooders (2001) consider a Tiebout economy with differential crowding and public projects in which agents are distinguished by their tastes and genetic endowments. They establish conditions under which the core is equivalent to the set of anonymous competitive outcomes. A dynamic version of the Tiebout model has been recently analyzed by Glomm and Lagunoff (1999).

Empirical research generally favors the Tiebout hypothesis in broad terms. Oates (1969) is frequently cited in support of the Tiebout hypothesis, though many other, more recent, articles such as Gramlich and Rubinfeld (1982), Hoyt and Rosenthal (1997) and Fisher and Wassmer (1998) also affirm the central tenets of Tiebout.[11] Of particular interest to students might be the fact that voter demands for education in Long Island and New York support the Tiebout prediction that sorting of communities should be more complete the greater the range of community choices (Munley 1982; Gramlich and Rubinfeld 1981). Specifically these papers find that voter demand for education decreased as the number of school jurisdictions increased. Similarly, using data from local public schools in Michigan, Rubinfeld, Shapiro, and Roberts (1987) show a bias in demand estimates in the presence of a taste for the quantity and quality of the public goods in each community (Tiebout bias). Hoyt and Rosenthal's (1997) findings support the Tiebout hypothesis that households will efficiently sort themselves across municipalities. Fisher and Wassmer's (1998) results too are consistent with the Tiebout hypothesis: variations in demand for government services directly influence the number of local governments. Oates (1998) is also a useful reference for an investigation of the empirical relationship between property taxes and the Tiebout hypothesis.

The basic Tiebout model has also been extended in a number of interesting ways. Brueckner (2000) includes corruption and tax evasion into the Tiebout model to investigate Tiebout's claim in developing countries and shows the reverse effect of these factors on the operation of the Tiebout mechanism. Mueller (1989) examines the Tiebout's model in the framework of the club theory.[12] He reports strong support from empirical studies for two testable aspects of the Tiebout model: (1) the relationship between government expenditure-tax plans and migration patterns, and (2) that these migrations lead to the formation of groups with almost same tastes for public goods. Note that our experiment also provides evidence for both of these features. When there are both public and private producers for a public good, their competition does not necessarily lead to efficient outcomes. In an interesting paper, Hoxby (1995) extends the Tiebout hypothesis to form a theory of producers of a public good like education and compares the gain and losses from equitable policies with the efficiency of the public good (cost minimization).[13] She shows that equalized consumption could leave the society, of producers and consumers, with a net negative gain.

The literature underpinning the median voter analysis begins with Hotelling (1929) before being refined by Downs (1957) and others. Hotelling (1929) provides a locational model adapted by Downs and others to construct the median voter model. Plott (1976) is an early reference that provides a long and interesting overview of the area. Empirical research, such as Gramlich and Rubinfeld (1982) and Turnbull and Chang (1998), tends to support the hypothesis that median voter's preferences determine government fiscal behavior, though some, such as Romer and Rosenthal (1979), question whether the median voter is decisive. Adapting the generalized axiom of revealed preference (GARP), Turnbull and Chang (1998) find local governments behave as if they maximized the median voter's utility. Gramlich and Rubinfeld (1982) affirm both Tiebout and Median Voter hypotheses. In their paper Romer and Rosenthal (1979) review the empirical work and show that actual expenditures do not correspond, in general, to median voter's choices. More recently, Perroni and Scharf (2001) argue that for individuals with same taste in each jurisdiction under majority voting for public goods, tax competition can improve the welfare.

References

Aronson, R.J., and E. Schwartz. 1973. Financing Public Goods and the Distribution of Population in a System of Local Governments. *National Tax Journal* 26: 137-160.

Bewley, T., 1981. Critique of Tiebout's Theory of Local Public Expenditures. *Econometrica* 49: 713-740.

Brouble, Keith, Jay Corrigan, Rachel Croson, Martin Farnham, Selban Garip, Luba Habodasova, Laurie Johnson, Martin Johnson, and David Reiley. 2004. Local Residential Sorting and Public Goods Provision: A Classroom Demonstration. *Journal of Economic Education.* In Press.

Brueckner, Jan K. 2000. Fiscal Decentralization in Developing Countries: The Effects of Local Corruption and Tax Evasion. *Annals of Economics and Finance* 1: 1-18.

Buchanan, J. M. 1950. Federalism and Fiscal Equity. *American Economic Review* 40: 583-600.

Buchanan, J. M. 1952. Federal Grants and Resource Allocation. *Journal of Political Economy* 60: 201-17.

Conley, J. and M. Wooders. 2001. Tiebout Economies with Differential Genetic Types and Endogenously Chosen Crowding Characteristics. *Journal of Economic Theory* 98: 261-94.

Downs, A. 1957. An Economic Theory of Political Action in a Democracy. *The Journal of Political Economy* 65: 135-150.

Fisher, R. and R. Wassmer. 1998. Economic Influences on the Structure of Local Government in U.S. Metropolitan Areas. *Journal of Urban Economics* 43: 444-71.

Glomm, G. and R. Lagunoff. 1999. A Dynamic Tiebout Theory of Voluntary vs. Involuntary Provision of Public Goods. *Review of Economic Studies* 66: 659-77.

Gramlich, E.M. and D.L. Rubinfeld. 1982. Micro Estimates of Public Spending Demand Functions and Tests of the Tiebout and Median-Voter Hypotheses. *Journal of Political Economy* 90: 536-560.

Henderson, J. V. 1979. Theories of Group, Jurisdiction, and City Size. In *Current Issues in Urban Economics*, edited by Peter Mieszkowski and Mahlon Straszheim. Baltimore: Johns Hopkins University Press, pp. 235-269.

Hotelling, Harold. 1929. Stability in Competition. *The Economic Journal* 39: 41-57.

Hoyt, W., and S. Rosenthal. 1997. Household Location and Tiebout: Do Families Sort According to Preferences for Locational Amenities? *Journal of Urban Economics* 42: 159-178.

Hoxby, Caroline M. 1995. Existence of Equilibrium and Stratification in Local and Hierarchical : Is There An Equity-Efficiency Trade-Off In School Finance? Tiebout and a Theory of the Local Public Goods Producer. NBERWorking Paper No. 5265.

Konishi, Hideo. 1996.Voting with Ballots and Feet: Existence of Equilibrium in a Local Public Good Economy. *Journal of Economic Theory* 68: 480-509.

Mueller, Dennis C. 1989. *Public Choice II: A revised edition of Public choice*. Cambridge: Cambridge University Press.

Munley, V. 1982. An Alternate Test of the Tiebout Hypothesis. *Public Choice* 38: 211-217.

Nechyba, T. 1997. Existence of Equilibrium and Stratification in Local and Hierarchical Tiebout Economies with Property Taxes and Voting. *Economic Theory* 10: 277-304.

Oates, W. 1969. The Effect of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. *Journal of Political Economy* **77**: 957-971.

Oates, W. 1998. The Economics of Fiscal Federalism and Local Finance. In *Elgar Reference Collection: International Library of Critical Writings in Economics* 88, edited by W. Oates. Cheltenham, U.K. and Northampton, Mass.

Pack, H., and J. Pack. 1978. Metropolitan Fragmentation and Local Public Expenditures. *National Tax Journal* 31: 349-362.

Perroni, Carlo, and Kimberly A. Scharf. 2001. Tiebout with Politics: Capital Tax Competition and Constitutional Choices. *Review of Economic Studies* 68: 133-54.

Plott, Charles R. 1976. Axiomatic Social Choice Theory: An Overview and Interpretation (in The Workshop). *American Journal of Political Science* 20: 511-596.

Richter, Donald K. 1978. Existence and Computation of a Tiebout General Equilibrium. *Econometrica* 46: 779-805.

Romer, T. and H. Rosenthal. 1979. The Elusive Median Voter. *Journal of Public Economics* 12: 143-70.

Rubinfeld, Daniel L., and Perry Shapiro, and Judith Roberts. 1987. Tiebout Bias and the Demand for Local Public Schooling. *Review of Economics and Statistics* 69: 426-37.

Sandler, T. and J. T. Tschirhart. 1980. The Economic Theory of Clubs: An Evaluation Survey. *Journal of Economic Literature* 18: 1481-1521.

Scott, A. D. 1950. A Note on Grants in Federal Countries. *Economica* 17: 416-22.

Scott, A. D. November 1952a. Evaluation of Federal Grants. *Economica* 19: 377-94.

Scott, A. D. December 1952b. Federal Grants and Resource Allocation. *Journal of Political Economy* 60: 534-6.

Tiebout, Charles M. 1956. A Pure Theory of Local Expenditures. *Journal of Political Economy* 64: 416-424.

Turnbull, Geoffrey, K. and C. Chang. 1998. The Median Voter According to GARP. *Southern Economic Journal* 64: 1001-10.

Wooders, Myrna. 1980. The Tiebout Hypothesis: Near Optimality in Local Public Good Economies. *Econometrica* 48:1467-85.

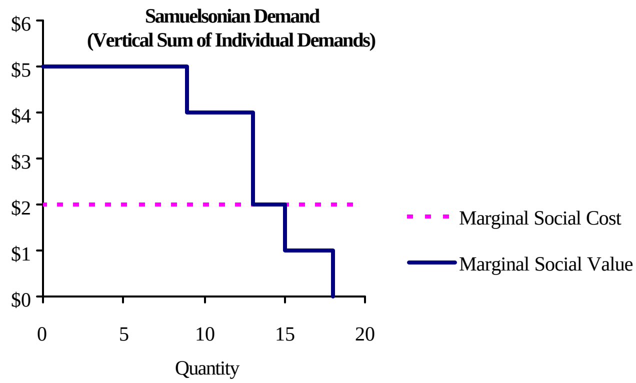
Zodrow, George (editor). 1983. *Local Provision of Public Services: the Tiebout Model after Twenty Five Years*. New York: *Academic Press*.

Table 1. Results from classroom experiment with a cost parameter with *k* = 2

(Key: C = Clubs, D = Diamonds, H = Hearts, S = Spades)

	Hoth	Metropolis	Moe's Tavern	Springfield	South Park
Round 1	3 residents	3 residents	3 residents	3 residents	3 residents
	11S, tax = 7.3	15C, tax = 10	15D, tax = 10	8H, tax = 5.3	13C, tax = 8.7
Round 2	3 residents	2 residents	3 residents	4 residents	3 residents
	13S, tax = 8.7	15C, tax = 15	15D, tax = 10	12H, tax = 6	13C, tax = 8.7
Round 3	3 residents	5 residents	3 residents	3 residents	1 resident
	13S, tax = 8.7	13C, tax = 5.2	15D, tax = 10	10H, tax = 6.7	4H, tax = 8
Round 4	3 residents	5 residents	3 residents	4 residents	0 residents
	13S, tax = 8.7	13C, tax = 5.2	15D, tax = 10	14H, tax = 7	-

Figure 1. ***Metropolis*** **community preference structure, round 4**


Samuelsonian Demand
(Vertical Sum of Individual Demands)
$6
$5
$4
$3
$2
$1
$0
0
5
10
15
20
Quantity
Marginal Social Cost
Marginal Social Value

Appendix 1. Experiment instructions

Community Structure: This is a classroom exercise in which you will be able to choose where you prefer to live. There are initially five communities with locations marked by manila envelopes. Each of you will now be assigned to one of these communities. I will now distribute several playing cards to each of you. The cards have a number and a suit (Hearts , Clubs , Diamonds , and Spades). The suit corresponds to a particular type of public good. The number reflects the intensity of your preference for that type of public good. For example, if your cards are 3 , 4 , 9 , and 2 , then your intensity is 3 for , 4 for , 11 (9+2) for . For example, you might think of these as possible types of museums, such as medical ( ), agricultural ( ), military ( ), and baseball ( ).

Community Choice: Your community must choose to provide one (and only one) of these public goods. In addition, the community must decide on the level of that good to provide. For example, a community may decide to provide a level of 6 (which means the levels of the other three goods are zero). These decisions will be made by a series of votes that follow an initial discussion of preference and negotiations. All votes will be decided on the basis of majority rule. These votes and discussions will be coordinated by a mayor, someone who I will now appoint for each community. The mayor will chair meetings, announce the community's choice of public good, and the individual tax rate (individual cost). If the mayor moves to another community, he/she should appoint another mayor before leaving. In the event of a tie, the mayor, who votes individually as well, can cast a second vote to break the tie.

Preferences: Your voting decision may be guided by the cards that you have. In general, you prefer the community adopt a high level of the public good for the suit in which you have a high card number (or sum of numbers). You will be happiest if the community chooses a level that corresponds exactly to the total number that you have for that suit. The cost of providing the public good is two times the level. All members of the community must share this cost equally, so a high provision results in higher taxes. Therefore, you would not want your community to choose a level of the public good that is higher than the number you have for that suit.

(Example 1) Suppose your cards are: 10 , 2 , 5 , 6 , and that your community has 6 people and decides on a level of 6 . The cost of this decision is 2x6 = 12, which is to be divided by the number of people (6), yielding an individual cost of 2. Your payoff is 2 (since you have a 2 of) minus the individual cost, 2, which equals 0.

(Example 2) Now suppose another community member's cards are: 7 , 10 , 3 , 4 . This member's could potentially receive a benefit of 10 for Spades, but the person's payoff is capped at 6 (the level voted upon). The net benefit is, therefore, 6 minus the individual cost, 2, which equals 4.

(Example 3) Now it is your turn to work an example. A person is in a community of 5 people which chooses Clubs at a level of 5, i.e. 5 , for a total cost of ____. A person with the following cards: 9 , 4 , 6 , 10 would receive a benefit of ____, pay a tax of ____ , and hence would have a net benefit of ____. (Other examples can be added as needed.)

Choosing Communities: The residents of each community will make their decision (suit and level) by voting, in a meeting conducted by the mayor. After all communities have made decisions, we will ask the mayors to announce their decisions, thus completing the first round. Then, people will be free to switch to a community with a public good decision more to their liking, with the understanding that newly configured communities will vote again at the start of the round on the type and level of the good to be provided. Using the provided table, please record your card distribution (suits and numbers), community/location in each round, the community decision, and your payoffs after each round. You may move communities to improve your well being, or you may choose to remain in a community. Communities may dissolve and re-emerge during this process.

Individual earnings sheet

Your card distribution:

	1st Card	**2nd Card**	**3rd Card**	**4th Card**
SUIT				
NUMBER				

Your earnings:

Round	**City Name**	**Community Decision**	**Your Benefits**	**Your Costs**	**Net Benefits**
1.					
2.					
3.					
4.					
5.					
TOTAL					

Definitions

Benefits: minimum of the level chosen by the community and the number of your card with the same suit

Costs: 2 times the level chosen by the community/#of members in the community

Net Benefits: Benefits **-** Costs

Endnotes:

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[1] This is consistent with empirical research as well. See for instance Gramlich and Rubinfeld (1982) and Turnbull and Chang (1998).

[2] Of course once an agent votes with their feet and moves to a given community, within the community all members pay the same level of taxes.

[3] The students were given a copy of this paper, along with the instructions that were read aloud just prior to the end of the class: "Please use the voting results for your group to construct a graph for the final period that corresponds to Figure 1 of the paper. Then write a brief (one-paragraph) account of how the voting outcome for that period lines up (or not) with the prediction of the median voter theorem, and with the level of the socially optimal level of the public good, i.e. the level that maximizes the total earnings for your group. To do this, you will need the total numbers on the cards for each person in your group (only for the suit that the group chose in that period). For example, if your group chose Hearts, then you need the total of the Heart card numbers for each person, so a person with a 2 and a 6 of Hearts would have a total of 8. You may write these numbers now on the bottom of your Decision Sheet."

[4] This was a Public Choice class at Washington and Lee University.

[5] This check on the profitability of unilateral moves does not imply that the outcome is Pareto optimal, or even that it is a Nash equilibrium (since a move might alter the voting outcome of the target community).

[6] When deciding whether to include the computation of socially optimal outcome during the experiment in class, the instructor should be aware that finding the socially optimal outcome

involves trying all possible combinations of individuals in different numbers of communities and therefore quickly becomes very cumbersome as the size of the class exceeds 15.

[7] The experiment results will be made available upon request to the authors.

[8] The students were given a copy of this paper, along with the instructions that were read aloud just prior to the end of the class: "Please use the voting results for your group to construct a graph for the final period that corresponds to Figure 1 of the paper. Then write a brief (one-paragraph) account of how the voting outcome for that period lines up (or not) with the prediction of the median voter theorem, and with the level of the socially optimal level of the public good, i.e. the level that maximizes the total earnings for your group. To do this, you will need the total numbers on the cards for each person in your group (only for the suit that the group chose in that period). For example, if your group chose Hearts, then you need the total of the Heart card numbers for each person, so a person with a 2 and a 6 of Hearts would have a total of 8. You may write these numbers now on the bottom of your Decision Sheet."

[9] This variation requires more time due to complex calculation of payoffs but can produce a larger variety of solutions with one or more goods produced in each community. We thank an anonymous referee for providing this suggestion.

[10] See Wooders (1980) for another proof of Tiebout optimality.

[11] Even papers that are critical of this approach, such as Aronson and Schwartz (1973), Pack and Pack (1978) and the contributions in Zodrow (Ed.; 1983) tend to question the significance of the economic forces imbedded in the Tiebout model while not denying their existence.

[12] For more on this strand of the literature see also Henderson (1979), and Sandler and Tschirhart (1980).

[13] See Buchanan (1950, 1952) and Scott (1950, 1952a, b).