

TOUGH LUCK FOR THE MAN IN THE MIDDLE: TESTING THE ENDS-AGAINST-THE-MIDDLE HYPOTHESIS

April 26, 2016

Luke B. Buffington, *Gail Werner-Robertson Fellow*
Faculty Mentor: **Dr. Diana Thomas**

EXECUTIVE SUMMARY

Primary and secondary education in the United States is a prime example of what economists call a dual provisioning system. That is, public and private alternatives are offered simultaneously in the market. This makes studying how people select and choose to fund schools complicated, as both traditional market analysis and voter-choice models are inadequate. However, a stream of literature in public choice economics seeks to address this issue, and one of its major insights is the possibility of double-peaked preference.

To illustrate what this means, consider an example. A family that sends its children to private school may prefer to allocate no tax money to public education. However, given the choice between allocating five hundred dollars and allocating one thousand dollars, it may choose one thousand dollars because at some point in that range, it will choose to opt back into the public system rather than pay private tuition and taxes for the public option.

One of the potential implications of this insight is the ends-against-the-middle hypothesis, which states that in a dual provisioning system such as this one, the lowest-income voters, who prefer to spend their money on things other than education, will band together with the highest-income voters, who are most likely to want to use the private option, resulting in voters allocating fewer tax dollars to the private option than the middle-income voters would prefer.

To provide insight into the validity of the ends-against-the-middle hypothesis, this paper tests whether greater income inequality is connected to lower local tax revenue for public schools. I run a regression model, using data from over ten thousand school districts across all fifty states, testing the relationship between the Gini coefficient of income inequality and local provisioning for public schools. I determine that income inequality has a statistically and economically significant impact on local tax revenues for public schools, which support the ends-against-the-middle hypothesis. This finding provides insight into how public school funding is determined at the local level, and should be taken into consideration when assessing the impact of school choice and school-financing reforms.

INTRODUCTION

Primary and secondary education funding is a consistently controversial political topic. For decades, people have been arguing over various methods and means for funding schools. Some advocate a purely public system where education at a government school is compulsory, and others prefer a voucher system, tax-credit scholarships, or other methods that would allow for greater or even complete privatization of schools while still maintaining fair education for people of all incomes. However, the system that currently exists in the United States is nowhere close to either of these extremes. Though systems vary substantially from state to state, currently all states have an educational model known as dual provisioning.

Dual provisioning refers to a situation where a good is offered both by the public sector and the private sector simultaneously. In the case of the United States, public schools are funded by a combination of local, state, and federal taxes, while private schools are usually funded through tuition fees and private donations and serve as a substitute for publicly provided education. This poses problems for comprehensive economic studies of public policy regarding education, as traditional, pure-market analysis does not easily apply to the study of public goods, but the political-decision models often employed as an alternative seem ill equipped to handle the interplay between public and private decisions inherent in a dual provisioning system. This is where public choice theory has come into play and provided a framework to understand how decisions about educational funding are made. The model of education funding that prevails in the public choice literature is a model of double-peaked preferences, which the literature suggests pits a coalition of rich and poor against the middle class when it comes to appropriating tax dollars for education. This “ends against the middle” hypothesis, as it is called, suggests that school districts with greater income inequality will receive less local funding than those that are more equal. This paper seeks to empirically evaluate the ends-against-the-middle hypothesis in the current US educational environment by testing the related hypothesis that districts with higher levels of inequality will see lower local funding for public education than districts with lower inequality.

DUAL PROVISIONING AND DOUBLE-PEAKED PREFERENCES

In public choice there has been substantial literature surrounding the provisioning of public goods since the beginning of the field in the 1950s. However, with very few exceptions, the early literature assumed a public good was offered exclusively by the government, with no private substitute. In the mid-1970s, scholars noted that this assumption about exclusivity was often not true, with healthcare and education being notable contexts where private and public versions of a good are often available alongside one another—a system known as dual provisioning. Yoram Barzel and Robert Deacon (1975, 1–14) identify two primary types of dual provisioning that remain the standard throughout the literature: one in which the private good can supplement or exist alongside the public good, such as in healthcare, and one where the public and private goods are mutually exclusive substitutes and cannot be consumed jointly, which is the case in education.

Education is a particularly interesting example because voting for public-education expenditure is usually done separately from voting for other public goods and is done in special school districts, making it apt for analysis. Barzel and Deacon (1975) find that under a dual provisioning system such as the US primary- and secondary-education system, a voter below the median income will decide the public expenditure. They reach this conclusion by assuming some of the wealthiest citizens will opt out of the public education system for private education, leaving them wanting no public expenditure, and shifting the median voter to one below the median income. Marilyn R. Flowers (1975, 81–85) extends the Barzel and Deacon analysis by noting that those high-income voters who opt for private education, if confronted with only two choices, may prefer a higher expenditure even though their most preferred outcome is no expenditure at all (see the dashed line in figure 1 for an example). Assuming greater education expenditure increases the quality of the public system, a situation may arise in which they would rather opt back into the public system, and allocate more money for it, than pay a substantial tax for a system they do not use on top of private school tuition. In other words, voters may have different preferences at different potential levels of provisioning, which creates the possibility of double-peaked preferences; if so, the median-voter theory no longer applies and a new model of decision-making must be considered.

Figure 1 (Flowers 1975, 82)

THE ENDS-AGAINST-THE-MIDDLE HYPOTHESIS

Dennis Epple and Richard Romano (1996), in their paper “Ends against the Middle: Determining Public Service Provisioning When There Are Private Alternatives,” extend the analysis by explaining how double-peaked preferences play out in voting. They envision a situation in which the wealthiest and poorest voters vote together against the middle, creating an equilibrium expenditure lower than that predicted by the median-voter theorem. This is because the wealthy prefer private provisioning and zero (or as little as possible) public expenditure, and the lowest-income voters prefer lower public expenditure presumably because they want to substitute that tax expenditure for something they value more highly than increased educational quality. If this holds true, some of the highest-income voters would form a coalition with the lowest-income voters to decrease the provisioning for public education. Thus, it would follow, as mentioned in the introduction, that school districts with significant income inequality would put fewer tax dollars toward education than districts with a more uniform distribution of income.

METHODOLOGY AND VARIABLE SELECTION

To test the ends-against-the-middle hypothesis and the effect of income inequality on provisioning for public education, this paper will employ an OLS regression model. As noted in the literature review, the US educational system is particularly well suited as a test of the ends-against-the-middle hypothesis because a substantial proportion of the funding for the public school system is voted on in separate elections carried out in special school districts, rather than on general ballots that cover a wide area and a number of topics. This makes it possible to test the effect income inequality has on the local revenue of public schools. It is reasonable to assume that districts with greater levels of income inequality will see lower provisioning, controlling for other factors, than will districts with higher inequality since greater inequality will likely put more voters into the two end groups in the ends-against-the-middle scenario. Thus, this paper will test the hypothesis that greater income inequality results in lower local provisioning for public schools. The hope is that the answer to this question can provide some insight into the ends-against-the-middle hypothesis, though further research will be needed to rule out other reasons why inequality may affect local voting for tax funding for public schools. For this test the independent variable of interest is income inequality, as measured by the Gini coefficient. The Gini coefficient is a commonly used measure that represents the extent to which income distribution deviates from perfect equality. A Gini coefficient of

zero corresponds to perfect equality, while a coefficient of one corresponds to perfect inequality.

While there are many potential ways to represent public provisioning for education in a model, the nature of school district voting makes local tax revenue received by a school district particularly attractive. While federal- and state-level funding also go to education, it is the local funds that are subject to local votes and thus most greatly affected by the coalition described in Epple and Romono (1996). For this analysis, I divide the total local revenue collected by a district by the number of households in the district to determine the average local tax revenue per household, which figure I prefer because it is easier to interpret in light of the huge variation in district populations. It is also reasonable to assume a strong correlation between the level of income in a district and the average local tax revenues that district will collect since most schools are funded by property taxes, which are higher in places with wealthier individuals who own more property. Thus, I use mean income as a control variable to account for this effect. Due to the large variations in particular ways in which schools are funded state to state, including various methods of taxation and equalization programs, I also employ state fixed effects to mitigate the effects these variations have on the model.

DATA SET AND SUMMARY STATISTICS

I use a compilation of data from the US Census Bureau and the National Center of Education Statistics, which includes every unified school district in the United States for which revenue and Gini data are available. In all, the data set includes 10,735 districts across two years, 2010 and 2011 (see table 1 for summary statistics). This analysis will consist of two OLS regressions, one for each year of data.

Table 1: Summary statistics

Variable	Mean	Std. Dev.	Minimum	Maximum
Gini (2010)	0.4143907	0.0471167	0.023	0.671
Gini (2011)	0.4164974	0.0469598	0.0314	0.6907
Mean income (2010)	2,518.709	2,997.937	0	124,326.1
Mean income (2011)	2,577.242	3,233.759	0	137,768.3
Per-household local tax revenue (2010)	62,339.78	23,301.92	14,765	362,743

Per-household local tax revenue (2010)	63,980.60	23,186.88	3,456	342,445
--	-----------	-----------	-------	---------

The results of the model (see table 1) reveal that income inequality does have an economically significant effect on public provisioning for primary and secondary education. In 2010 this amounted a decrease of \$154.30 for every 0.1-point change in the Gini coefficient. Considering the Gini coefficient has a range of 0.648 with a standard deviation of 0.047, a school even just one standard deviation below the mean in terms of equality receives \$72 less in local funds per student than a school at the mean, and the most unequal school district receives \$999 less per student than the most equal district. This effect, while not statistically significant at the 10 percent level, has a *p*-value of 0.133, meaning it is significant at the 15 percent level. Taken in isolation this would not provide very strong evidence, but the effect in 2011 was larger, and significant at the 5 percent level with a *p*-value of 0.019. Specifically, in 2011, the results show a \$303.20 decrease in local revenue for every 0.1-point change in the Gini coefficient. With a range of 0.659 and a standard deviation of 0.047, this amounts to \$1,999 less funding for the most unequal district than the most equal district, and \$143 less funding for a school one standard deviation below the mean in terms of equality than for a school at the median.

Table 2: OLS regression (dependent variable: districts' per-household local tax revenue)

Variable	Coefficient	Standard error
Gini (2010) ¹	-154.1033	102.5311
Mean income (2010) ²	0.0501797***	0.0019661
Gini (2011) ¹	-383.2803**	163.0719
Mean income (2011) ²	0.049868***	0.001599

***1% statistical significance **5% statistical significance *1% statistical significance

1. Coefficients represent dollars of tax revenue per 0.1-point Gini index change.

2. Coefficients represent dollars of tax revenue per dollar of mean income.

CONCLUSION

My analysis of public provisioning for education in the US public school system provides minimal support for the “ends against the middle” theory advanced by Epple and Romano (1996). Income inequality had a statistically and economically significant impact on local provisioning for public schools in 2011 and an economically significant impact in 2010. Greater income inequality is associated with decreased per-household tax

revenues provisioned for public schools. This result provides support for the theory that in a mutually exclusive dual provisioning system, double-peaked preferences prevail and an “ends against the middle” story ends in decreased provisioning for the public good.

DISCUSSION

While this paper offers support for the ends-against-the-middle hypothesis, it leaves open a number of questions. For example, further research is needed to show that the hypothesis is indeed the definitive explanation for local tax provisioning for public schools is negatively related to income inequality. An extended version of this analysis could include a number of additional control variables as well as more years of data as it becomes available. An especially useful extension would be to control for availability of a private substitute in reasonable proximity to a district, though this presents a number of data-collection challenges.

The other major question is, given that the ends-against-the-middle hypothesis finds support, what implications that has for policy topics including school funding, school choice, and local taxation. Epple and Romano themselves speculate on this question and develop a quantitative, but not empirically motivated, analysis of how their hypothesis may affect voucher programs. They conclude, “Our results suggest that public school expenditure per student is relatively insensitive to the introduction of vouchers, but that public school attendance is relatively sensitive to their introduction” (Epple and Romano 1996, 322). More empirical analysis of the consistency and magnitude of the ends-against-the-middle effect and applying it to vouchers and other policy initiatives could provide additional understanding of how these programs will affect stakeholders including students and community members.

REFERENCES

- Barzel, Yoram, and Robert Deacon. 1975. "Voting Behavior, Efficiency, and Equity." *Public Choice* 21 (Spring): 1–14.
- Epple, Dennis, and Richard Romano. 1996. "Ends against the Middle: Determining Public Sector Provision When There Are Private Alternatives." *Journal of Public Economics* 62, no. 3 (November): 297–325.
- Flowers, Marilyn. 1975. "Double-Peaked Preference Rankings for Public School Expenditures: Extension of the Barzel-Deacon Analysis." *Public Choice* 23 (Fall): 81–85.
- National Center for Education Statistics. "School District Local Revenue by Source, 2010–11." Generated by Luke B. Buffington using ELSI expressTables.
- United States Census Bureau. "American Community Survey, 2008–2013 5-Year Estimates, Table B19083." Generated by Luke B. Buffington using American FactFinder.
- United States Census Bureau. American Community Survey, 2008–2013 5-Year Estimates, Table DP03. Generated by Luke B. Buffington using American FactFinder.