

The Influence of the Elderly on School Spending
in a Median Voter Framework*

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Abstract

How do the elderly influence school spending if they are a minority of the population? We estimate the determinants of school spending in a median voter model, comparing four assumptions about how the elderly influence the identity of the median voter. Under the first, elderly spending preferences are no different than others with their income. Under the second, the elderly who have moved from another state prefer \$0 spending on schools, while long-term elderly residents and recent movers from within the state care about the kids in school and have the same preferences as others with their incomes. In the third assumption, the elderly from a different county within the state or another state prefer \$0 spending, while long-term elderly residents care about the kids in school and have the same preferences as others with their incomes. Under the fourth assumption, all elderly prefer \$0 spending on schools. We also take into account differences in voter turnout between the elderly and other adults.

We take advantage of county data on elderly migration to see which assumption best explains per pupil spending in 1990 and 2000 in 3100 counties. The real income of the median voter and the tax price faced by that voter are calculated under each assumption. The evidence also shows that elderly preferences are best characterized by assuming all elderly prefer no money to be spent on schools. Estimates of the effect of having more elderly households on median voter income and the tax price faced by that voter, together with estimates of the effects of median voter income and the tax price on school spending, indicate that the tax price effect dominates the income effect, resulting in higher spending. Our other findings are consistent with other findings in the school spending literature.

I. Introduction

Families with children benefit from higher spending on public primary and secondary schools for their children. Since the elderly do not enjoy these direct benefits, they may be less willing to support better schools.¹ This is a matter of growing concern as the baby boom cohorts are poised to enter the elderly ranks. The literature on the effect of the elderly on school spending has tested whether school spending falls as the elderly share in the population rises, holding income and other variables constant. This literature, which is reviewed in the next section, is inconclusive on this question.

The empirical analysis of the determinants of government spending generally is couched in a median voter framework, which provides a basis for using median income instead of some other income construct (e.g., mean income) to capture income effects and also provides a basis for using a measure of the median voter's tax price.² Almost all jurisdictions include some elderly, but they make up a minority of the population. How do the elderly influence school spending if they are a minority of the population? In a median voter framework, the elderly affect spending only if they alter the identity of the median voter. Suppose that everyone has the same probability of voting.³ Suppose also that within a community the preferred spending of the non-elderly is a monotonic function of the household's income. If there were no elderly in the jurisdiction, the median voter

¹External benefits associated with the effects of better schools today on these school cohorts' reduced future participation in crime and increased Social Security contributions [see Poterba (1998) and Kemnitz (2000)] appear to be very small; few elderly will live long enough to enjoy the external benefits of paying to improve education now.

²The development of the median voter theorem is credited to Hotelling (1929), Bowen (1943), Downs (1957) and Black (1958). Some of the empirical literature based on the median voter model is summarized in Mueller (2003). See also the literature referenced in Section II.

³The large empirical literature that uses median income to explain government spending is based on the assumption that all have the same probability of voting.

would be the household with median income in the jurisdiction. If all the elderly prefer there to be no spending on schools, then the distribution of preferred school spending levels has a mass point at \$0 that reflects elderly preferences. The median of this distribution of preferred spending is the level of spending that is preferred by a household that we call the median voter household. The income of this median voter household is lower than the median household income among the non-elderly. Median voter household income also is smaller than median income in the community if some elderly make more than the community's median household income.

Under various assumptions about elderly preferences, we calculate median voter household income and the tax price facing that household and use these two variables along with others to explain school spending. This use of a median voter household income and modified tax price contrasts with prior research, which has used median household income in the community and the percent elderly, even though 1) the community's median household income clearly is not the median voter household's income and 2) the effect of the elderly share is not explicitly taken into account in a median voter model. Furthermore, none of the generational conflict literature uses a tax price variable specified by the median voter framework.

Our various assumptions about elderly preferences are motivated by Fletcher (2004), who hypothesized that the elderly who have lived in a community for a long period of time may be more likely to support higher school spending than those who recently moved to the area. This is because the long-term elderly may be more likely to have grandchildren in the district's schools and may care about other children in the school system. Similarly, the elderly who moved from another county in the state may have more ties to their new community than elderly who moved from another state.

Our analysis compares the explanatory powers of four assumptions about elderly preferences on school spending in a median voter model. Under the first, elderly spending preferences are no different than others with their income; this amounts to using the community's median income for all citizens. Under the second assumption, the elderly who moved from another state prefer \$0 spending on schools, while long-term elderly residents and recent movers from within the state care about the kids in school and have the same preferences as non-elderly with their incomes. In the third assumption, the elderly from a different county within the state or another state prefer \$0 spending, while long-term elderly residents care about the kids in school and have the same preferences as non-elderly with their incomes. Under the fourth assumption, all elderly prefer \$0 spending on schools.

It is well known that the elderly are more likely to vote than other adults. If so, the impact of the elderly on the identity of the median voter should reflect their higher voter turnout rate. We use voting participation rates of the elderly relative to the rest of the voting-age population to address how this affects the position of the median voter.

We take advantage of county data on recent elderly migration in 3100 counties to test which assumption best explains per pupil spending in 1990 and 2000. In this two year panel with county fixed effects, we find that elderly preferences are best characterized by assuming all the elderly prefer no money to be spent on schools. Also, as expected, we get a better fit taking into account the higher voter turnout among the elderly. We infer the impact of the elderly on school spending from the coefficients on median voter income and the ratio of median to mean income.

Communities with more elderly have more households who prefer \$0 spending on schools, which creates a new median voter household that is located farther down the community's income

distribution. The new median voter is not as affluent, which reduces school spending. Working against this income effect is a price effect, in which the median voter benefits more from being subsidized through property taxes by those in the community who are more affluent. This price effect dominates the income effect, so that communities with more elderly actually spend more on schooling. This median voter analysis provides an explanation for the apparently puzzling finding in some papers that spending increases as the elderly share rises.

The next section provides a brief review of the literature on the impact of the elderly on school spending. Some theoretical structure is provided in Section III. Section IV describes the sample and develops the hypotheses to be tested and the variables that will be used to test them. The empirical results are reported in Section V.

II. Literature on the Effect of the Elderly on School Spending

The evidence is mixed on whether spending falls as the percent who are elderly rises. In Miller's (1996) study, the percent who are elderly had a significantly negative impact on educational spending per adult in a panel of Texas counties but was insignificant in a panel of 48 states. Using a state panel, Poterba (1997) found that per-child education spending falls as the state's fraction who are elderly rises if the percent living in urban areas is not included in the regression. Ladd and Murray (2001) conducted an analysis similar to Poterba's but at the county level with county and time fixed effects and found that the proportion who are elderly does not significantly affect per child education spending. With a panel of school district data, Harris, Evans and Schwab (2001)

found that the elderly share had a significant but small negative effect on revenues per pupil.⁴ Other research suggests that the impact of the elderly depends on whether the elderly are long-term residents or can capitalize the benefits of having good schools into housing prices.

Similar to Fletcher (2004), Berkman and Plutzer (2004, p. 1181) hypothesize that “those who have lived in their communities for some time may ... have developed loyalty to the community and its schools,” making them more supportive of larger school budgets. Using school district data, they find that school spending in 1994-95 was higher in counties with a larger share of the population who were long-term elderly residents. On the other hand, school spending was lower in counties with a larger share who were elderly migrants in regressions with no state fixed effects; the elderly migrant variable was not significant in a regression that allowed for state fixed effects. As noted earlier, Fletcher (2004) also expected long-term elderly to have a different effect on school spending than recent elderly migrants. With county data for 1990 and using 2SLS and 3SLS procedures that take account of the endogeneity of elderly migration, she found that school spending was higher in counties with more long-term elderly and was lower in counties with a larger share who were elderly and had moved from another state.

Hilber and Mayber (2004) hypothesized that there would be greater capitalization of school quality into home prices if there was little land available for development. The opportunity to capitalize the value of better schools into home prices was expected to make the elderly more supportive of larger school budgets. Consistent with this reasoning, the authors found using a district-level cross section that the percent who were elderly had a negative impact on spending in

⁴In a related study, Button (1992) found that the share of voters 55 or older had a negative impact on the success of school bond proposals in Florida.

locations where there was much land that had not been developed (i.e., little potential for capitalization) and had a positive impact on spending in communities with little available land (i.e., great potential for capitalization).

The effect of the elderly thus appears to be sensitive to the chosen sample or level of aggregation, the inclusion of certain variables, the potential for capital gains, and the time the elderly have spent in their current location. Furthermore in the intergenerational conflict literature the coefficient on the percent 65 or older variable often has been interpreted as reflecting elderly preferences on school spending relative to those of parents of other younger adults for school spending. The finding of some studies that the percent elderly has a positive impact on school spending thus seems to imply that the elderly want to spend more than other voters on schools, which is very difficult to rationalize. The median voter framework developed later in the paper will provide an explanation for this apparent anomaly.

III. Theoretical Background

Here we provide the theoretical underpinnings for some aspects of our empirical specification. Following Lovell (1975), assume that school taxes are proportional to income. This is consistent with schools being financed by property taxes that are proportional to house values and the income elasticity for housing being 1. A household with income M_i and facing a tax rate of t pays $t \cdot M_i$ in taxes, leaving C_i units of private goods (the numeraire) to be consumed.

$$M_i = C_i + t \cdot M_i \tag{1}$$

Each of N households receives G in government services (e.g., school quality), which are produced at a cost of P_G each. The government budget constraint requires that total taxes equal total spending, or

$$t \cdot (\sum M_i) = P_G \cdot G \cdot N \quad (2)$$

Solving (2) for t ,

$$\begin{aligned} t &= (P_G \cdot G \cdot N) / (\sum M_i) \\ &= (P_G \cdot G) / M_{\text{mean}} \end{aligned} \quad (3)$$

where M_{mean} is mean household income. Substituting equation (3) into equation (1) yields

$$M_i = C_i + P_G \cdot (M_i / M_{\text{mean}}) \cdot G \quad (4)$$

Thus, for the household with income M_i , the price of government services equals $P_G \cdot (M_i / M_{\text{mean}})$. An increase in the cost of producing each unit of G [P_G], due perhaps to teachers unionizing, raises the household's cost of acquiring one more G . Having a better school is more expensive for a relatively rich household in the community [$(M_i / M_{\text{mean}}) > 1$] than for a relatively poor household in the community [$(M_i / M_{\text{mean}}) < 1$] because this entails a larger increase in property taxes for the richer household. This effect reflects the redistribution from richer households to poorer households within the jurisdiction.

Kenny (1978) showed that the preferred level of school spending increased as household income rose *within the jurisdiction* if the income effect associated with the household being better off (i.e., M_i rises) dominated the substitution effect associated with the richer household facing a higher price of having a better school [i.e., (M_i / M_{mean}) rises]. He showed that this condition is equivalent to 1) the income elasticity for school quality G being greater than the elasticity of substitution between school quality G and private consumption C , or equivalently 2) the income

elasticity for school quality being greater than the uncompensated price elasticity for school quality. Lovell (1978), using this framework, found that the income elasticity for school spending was much higher than the price elasticity. This evidence suggests that a community's richer households prefer better schools than are preferred by its poorer households.

Suppose that preferences over school spending can be characterized in one of two ways. Some share of the community α_e (e.g. all the elderly) prefer \$0 spending on the public schools irrespective of their income. For the remainder of the community $(1 - \alpha_e)$, preferred spending G^* rises with household income (M_i). The cumulative distribution of preferred school spending levels for the "non-elderly" segment can be represented as a function of income $[F(M_i)]$. The median voter household is the household with income M_N for which

$$\alpha_e + (1 - \alpha_e) \cdot F(M_N) = 0.50$$

That is, if 20 percent prefer \$0 spending, the median voter household is found by going up the distribution of "non-elderly" income until another 30 percent of the total households are added to the low spending group. This occurs where $F(M_N) = 0.375$, or where 3/8 of the non-elderly have an income below M_N . This illustrates how the income of the median voter household ($M_{\text{median voter}}$) is calculated under the various assumptions about elderly preferences on school spending.

IV. Sample, Hypotheses and Variables

Sample

Ladd and Murray (2001) argued that a county- or district-level analysis is more appropriate than state-level analysis because less aggregate data capture important features of education finance that would be missed at the state level. In the median voter framework, since school spending

decisions are made at the local level, the income of the median voter household ($M_{\text{median voter}}$) and its tax price ($M_{\text{median voter}} / M_{\text{mean}}$) are best measured at the county or school district level. Since the elderly migration rates are available from the Bureau of the Census at the county level and not the school district level, the empirical analysis in this paper utilizes county data. The county data also avoid bias due to Tiebout-sorting into districts within a county.

Data from the 1990 Census of Population and Housing were available for 3141 counties or county equivalents. These data were merged with public school district enrollment and finance data taken from the 1992 Census of Governments. Ninety eight of the 15,868 school districts in the Census of Governments could not be matched with a county FIPS code. The school district data were aggregated to the county level [total rev/total enrollment for the county]. There were school districts in 3126 of the 3141 counties, but student enrollments were zero in three of these counties, which were dropped from the sample. Thus, the sample for 1990 consists of 3123 counties and county equivalents.

All of the 15,383 school districts in the 2002 Census of Governments could be matched with a county FIPS code. Data from the 2000 Census of Population and Housing were available for 3141 counties or county equivalents.⁵ Based on the 2002 Census of Governments, 3123 of these counties had school districts. Two of these counties were dropped from the sample due to zero student enrollments. Twenty four counties and 31 independent cities (county equivalents) in Virginia were dropped because the migration data for the cities were merged with the data for the surrounding or

⁵ There were a few differences between the 3141 counties in 1990 and the 3141 counties in 2000. Two county equivalents in 1990 did not exist in the 2000 Census: Yellowstone National Park, listed as a county equivalent in 1990, is legally part of Gallatin County, MT and Park County, MT. In 1995, South Boston City, VA was absorbed into Halifax County, VA. Two new county equivalents were also created between 1990 and 2000: Yakutat Borough, AK and Broomfield County, CO.

adjacent counties. One county was dropped because a change in the county boundaries was reflected in the Census of Population and Housing but not the Census of Governments. Thus, the sample for 2000 consists of 3065 counties and county equivalents.

The full pooled sample consists of 3123 counties in 1990 and 3065 counties in 2000, for a total of 6188 observations.

Variables and Hypotheses

The dependent variable is the county per pupil state and local revenues for public primary and secondary schools, inflated to 2000 dollars using the implicit government purchases deflator. Summary statistics for all the variables are reported in Table 1. This variable ranged from \$2,486 to \$28,451 in 1990 and from \$3,836 to \$50,114 in 2000. To eliminate outliers due to data errors, a reduced sample was created by trimming in each year the 1 per cent of the observations with the largest per pupil school revenues and the 1 per cent of the observations with the smallest per pupil school revenues, resulting in 6064 observations. In this reduced sample, the range in school revenue per pupil was \$3,000 to \$12,478 in 1990 and \$4,586 to \$15,222 in 2000. Thus, the reduced sample has a range that is 0.365 (0.230) the range in the full sample in 1990 (2000).

An increase in income is expected to lead, through an income effect, to higher school revenues. MED HHD INCOME equals the income of the median voter household ($M_{\text{median voter}}$) inflated to 2000 dollars using the CPI-U. This is calculated for each of the four scenarios described above by clumping the appropriate group of elderly at \$0 and then moving up the income distribution of the remaining households until the median voter household is found. Interpolation between the midpoints of adjacent income categories is used to find the household income of this

median voter household. It can be seen in Table 1 that the calculated income of the median voter household falls as more elderly are assumed to prefer \$0 spending on education.

The ratio of the median household's income to mean household income in the county (MED INCOME / MEAN INCOME) corresponds to the term $M_{\text{median voter}} / M_{\text{mean}}$. Due to the skewness in the income distribution, median income is less than mean income in each county. The ratio of the median voter's income to mean income falls in Table 1 as more elderly are assumed to prefer \$0 school spending. A fall in the ratio of the median voter household's income to mean household income is associated with the median voter facing a lower price to increase school quality and should lead to more spending. There is some support for this prediction in the literature (e.g., Lovell 1978, Gemmell et al. 2002).

An increase in the number of students per household makes it more expensive to increase spending on each student by \$1, which is expected to result in lower spending per student. This effect is captured by the fraction of the population who are aged 5 to 17 (FRACTION 5-17). This hypothesis has been supported in Poterba (1997), Ladd and Murray (2001), Harris, Evans, and Schwab (2001), and a number of other papers.

Per pupil revenues from the federal government (FEDERAL REVENUE) has an ambiguous impact on state and local school revenues. The largest federal program for primary and secondary education, Title I, is a block grant. This has an income effect that should lead to higher total revenues for schooling but less state and local funds as some of these are diverted to fund increases in non-educational programs. Gordon (2004) studied the effect of discrete census-induced changes in Title I funding and concluded that greater funds from this program led to no change in state revenues but led to smaller local revenues. But other federal programs, such as the free/reduced

lunch and technology funds programs, require some local matching. Matching provisions could lead to greater state and local spending. Ladd and Murray (2001) reported that aggregate federal aid had a significantly positive impact on state and local revenues in the urban sample of counties but was unrelated to spending in the complete sample. Harris, Evans, and Schwab (2001) found that aggregate federal revenues had a positive effect on school district local revenues.

An increase in the fraction of a county's population living in an urban area (FRACTION URBAN) makes it easier to take advantage of economies of scale in schooling, which leads to lower expenditure (see Kenny 1982). On the other hand, teacher salaries are higher in urban areas due to the higher cost of living (see Kenny and Denslow 1980), making the net effect ambiguous.

Fischel (2001) argued that the ability to capitalize good schools into home values makes homeowners more willing than renters to support higher spending on schools. But Denzau and Grier (1984) rationalized the negative coefficient often found on the fraction of housing units that are owner occupied with "renter illusion," in which renters favor higher taxes because they do not expect the higher taxes to result in higher rents. The fraction of housing units that are owner occupied is commonly used in spending studies and is another variable that does not fit into a median voter framework. To overcome this problem, we use a HOME OWNER DUMMY, which equals 1 if a majority of housing units are owner occupied and 0 if a majority are rentals. A value of 1 suggests that the median voter is a homeowner. Only 50 of the 3123 counties in the full sample for 1990 did not have a majority living in owner occupied housing; in 2000 there were only 21 "renter" counties.

State governments engage in redistribution from a state's richer school districts to a state's poorer school districts, which results in *relatively* affluent districts spending less and *relatively* poor

districts spending more. A number of state supreme courts have ruled that the state's educational finance system was unconstitutional because of the disparity in school resources or spending across districts. This court-mandated redistribution is expected to be more substantial than the redistribution by the state that took place without a court ruling. There is some support in the literature for this prediction. Harris, Evans, and Schwab (2001) interacted dummies capturing a school district's position in the state income distribution with a dummy indicating whether the state supreme court had overturned the state's school finance system. Overturning the educational finance structure resulted in a shift in total revenues from richer districts to poorer districts. Card and Payne (2002) similarly showed that rulings that the school financing system was unconstitutional caused the slopes describing the effect of district income on state revenues and on total spending to be flatter.

The county's position on the state's income distribution is measured here by the ratio of mean income in the county to mean income in the state (RELATIVE STATE INC). SUPREME CT RULING equals 1 for 1990 in the 7 states in which the state supreme court had overturned the state's educational finance system prior to 1987 (New Jersey 1973, California 1976, Connecticut 1977, Washington 1978, West Virginia 1979, Wyoming 1980, and Arkansas 1983); another 6 states (Kentucky 1989, Montana 1989, Texas 1989, Massachusetts 1993, Tennessee 1993, and Arizona 1994) were added for 2000 based on a similar criterion.⁶ This treatment allows some time for the court ruling to affect the distribution of spending within the state. The interaction between these two variables (SUPREME CT RULING \times RELATIVE STATE INC) provides a test for the hypothesis described above.

⁶This classification is based on Figlio, Husted, and Kenny (2001).

County fixed effects control for variation in local amenities, the timing of school board elections, state education policies, and so on. A year dummy allows for spending to change over the decade in response to factors that have not been taken into account by other variables.

V. Empirical Results

Results for county fixed effects regressions under the four scenarios describing elderly preferences are reported in Tables 2 and 3 for the restricted sample and in Tables 4 and 5 for the full sample. In Tables 2 and 4 the elderly and non-elderly receive equal weights; in Tables 3 and 5 the elderly receive more weight to reflect their higher voter turnout rate.⁷ The regressions are highly significant. With fixed effects, the ordinary R^2 is maximized and is reported as the R-sq within. This equals 0.72 in the restricted sample regressions and 0.59 in the full sample regressions. The hypothesis that the set of county fixed effects adds nothing to the regressions is soundly rejected. The standard deviation in estimated county fixed effects equals 1542-1564 in the restricted regressions and 2031-2053 in the full regressions.

The results of various specification tests comparing the 7 regressions estimated for the reduced sample are summarized in Table 6.⁸ Akaike's AIC criterion, Amemiya's PC R-squared criterion, Hocking's Sp criterion, the Davidson-McKinnon J test and the Prediction Sum of Squares (PRESS) criterion are described in Maddala (1992), and the Cox test and Schwartz's SBC criterion are described in Greene (2003). The best fit is obtained assuming all the elderly prefer to spend \$0 on education and weighting the elderly more to reflect their greater participation in elections.

⁷The voter turnout rates pertain to the 2000 presidential election and were obtained from the U.S. Bureau of the Census (2002).

⁸The first regression is same in Tables 2 and 3. These specification test results are nearly identical to unreported test results based on the full sample regressions in Tables 4 and 5.

Although this is not a significantly better fit than the same assumption with equal weights under the prediction sum of squares test, using voting weights instead of equal weights for this assumption produces a better fit in four other tests (Amemiya PC R-squared criterion, Hocking's Sp criterion, Akaike's ACI criterion, and Schwartz's SBC criterion). All five of these tests conclude that assuming all elderly prefer \$0 spending under either weighting scheme results in a significantly better fit than is obtained under any of the other three assumptions about elderly preferences. Similarly J tests find that assuming all elderly prefer low school spending levels and weighting by voter turnout provides a significantly better fit than any of the three assumptions about elderly preferences.

There is much less agreement in the specification tests about how to rank the remaining three elderly assumptions: both groups have the same preferences, cross-state migrants dislike education, or all migrants dislike education. The Amemiya and PRESS tests cannot distinguish among these alternatives. A J test finds a significantly better fit assuming all elderly migrants prefer low spending and using voting weights than assuming that the elderly have the same preferences as other voters. This is consistent with the Hocking Sp, Akaike ACI, and Schwartz's SBC criteria, which rank the all elderly migrants with voting weights specification in the top two of the five elderly preference/weighting mixes, and which rank same preferences in the bottom two of the elderly preference/weighting mixes.

Accordingly, our description of the empirical results will focus on the fourth restricted sample regression in Table 3, which is based on all elderly preferring \$0 and uses weights based on voter turnout rates. Note that we get virtually the same results using the complete sample in the fourth regression in Table 5.

Income has the anticipated positive impact on school revenues. A one standard deviation rise in median household income is estimated to raise spending per pupil by \$598.

Communities in which the median voter is less able to take advantage of redistribution within the jurisdiction spend less on schools. A one standard deviation rise in MED INCOME / MEAN INCOME leads to a \$302 fall in school revenues.

It also is costlier to increase school quality if school age children represent a larger share of the population. The coefficient on FRACTION 5-17 has the predicted negative sign and is quite significant statistically. A one standard deviation rise in the fraction who are of school age leads to a small \$179 fall in school revenue per pupil.

Unlike some other studies, we find that state and local spending increases when the federal government provides more revenue for primary and secondary schools. A typical rise in FEDERAL results in a small \$188 rise in state and local revenues.

With two tailed tests, neither FRACTION URBAN nor HOME OWNER DUMMY are statistically significant.

The coefficients on SUPREME COURT RULING and its interaction with RELATIVE STATE INC are highly significant statistically. The coefficient on RELATIVE STATE INC has the predicted negative sign and, with a one-tailed test, is significant at the 5 percent level. A one standard deviation rise in the county's position on the state income distribution, as measured by RELATIVE STATE INC, is associated with a \$137 fall in school spending with no court ruling and a \$352 fall after the state supreme court had ruled the state's educational finance system to be unconstitutional. Thus, there is more leveling of spending across districts within a state after one of these court rulings. The coefficients further imply that after a school financing system was ruled

unconstitutional revenues fell all in the state's counties and fell particularly in the state's richer counties. A court mandate to equalize spending led to a \$1346 fall in revenues evaluated at the mean value for RELATIVE STATE INC and led to a \$1561 fall in revenues evaluated at one standard deviation above the mean of RELATIVE STATE INC.

Finally note that real spending was \$1,401 higher in 2000 than in 1990, holding our other variables constant.

Estimating the effect of elderly on spending

The various specification tests suggest that all the elderly prefer very low spending on education. But this provides no direct evidence on how the elderly affect spending. In the median voter model used in this paper, the elderly affect spending through a change in the identity of the median voter household. To investigate this linkage, we first need to estimate the impact of the fraction who are elderly on the income of the median voter household and on the ratio of median to mean income for this household. The county and year fixed effects regressions that do this are reported in Table 7.

The dependent variable in the first regression is the estimated median voter income under the assumption that all elderly prefer \$0 spending on education and weighted by voter turnout, which was used in the All Elderly regression in Table 3. The independent variables include the county's median income (used in the Same Preferences regressions), the fraction who are elderly, and a year dummy variable. This regression fits the data very well. The adjusted median voter income rises as the unadjusted median income rises. The coefficient on the county's median income is highly significant and is very close to 1. But the variable of interest in this regression is FRACTION

ELDERLY. As the elderly become more numerous, the mass point at \$0 gets larger, resulting in a lower adjusted median voter income. The coefficient on FRACTION ELDERLY is negative and highly significant. A one standard deviation (0.043) rise in this variable is estimated to lower the income of the median voter household by \$2,326 ($= -54096 \times 0.043$), a 6.6% fall. A \$2,326 fall in median voter income is estimated in the fourth regression in Table 3 to cause spending per pupil to fall by \$133 [$= 0.057 \times (-2326)$].

The second regression in Table 7 replaces the median household income variables in the first regression with ratio of median to mean income variables. The dependent variable is the estimated ratio of median voter income to mean income under the assumption that all elderly prefer \$0 spending on education and weighting by voter turnout, which was used in the All Elderly regression in Table 3. The income ratio variable is the county's ratio of median income to mean income, which was used in the Same Preferences regression. This regression also has a very good fit. The variable that controls for the county's ratio of median to mean income has the expected strong positive relationship with the adjusted median to mean income ratio. More importantly, we find that as the fraction who are elderly rises (creating a larger mass point at \$0 preferred spending), the median voter household's income falls relative to the mean county income. A one standard deviation (0.043) rise in FRACTION ELDERLY is estimated to reduce the ratio of median to mean income by 0.102, representing a 12.8% fall. This in turn leads to a \$247 rise in school spending according to the fourth regression in Table 3.

Communities with one standard deviation more elderly have more voters who prefer very low spending on education. As a result, the median voter is farther down the community's income distribution. Median voter income is 6.6 percent lower, resulting in \$133 less school spending in

an income effect. But the median voter's lower income also reduces the voter's price of raising school quality, represented by the ratio of median income to mean income, by 12.8 percent. The greater subsidy of the median voter's school spending is estimated to raise spending by \$247. On net the substitution effect dominates the income effect, resulting in a \$114 rise in spending per student. Based on the MED HHD INCOME and MED INCOME/MEAN INCOME coefficients in the fourth regression in Table 3, an F-test rejects the hypothesis that the net effect is zero.

VI. Conclusion

The literature on the effect of the elderly on primary and secondary school spending has not taken advantage of the structure provided by the median voter model. As a result, the specification used in this literature offers little insight into how the elderly affect school spending. Moreover, this line of research has not provided consistent evidence on whether the elderly indeed pull school spending down.

We have used the median voter model to estimate the demand for school spending under four assumptions about elderly preferences and under two assumptions about how the elderly and non-elderly populations should be weighted in determining the median voter household income. There is strong evidence that the best fit is provided when all elderly are assumed to prefer \$0 spending on schooling and when the elderly are given more weight to reflect their higher voter turnout. Specification tests are less consistent in ranking the other three assumptions about elderly preferences. Nevertheless, assuming that the elderly and other adults have the same preferences appears to produce the worst fit. Assuming that only elderly migrants from another state dislike education seems to give a slightly worse fit than assuming that elderly migrants from another state

or county oppose higher spending.

In jurisdictions with more elderly, the median voter household is farther down the jurisdiction's income distribution. Due to lower income, this household would spend less on schools. But this household also faces a lower price to improve schools, since it is subsidized by more of the community's households. On net the lower price effect appears to dominate the income effect, resulting in a rise in school revenues. This finding, based on a median voter model, helps to explain why some studies have found that school spending is higher in communities with more elderly. It is difficult to rationalize this result in an alternative setting; why would the elderly be more favorably disposed to higher school spending than parents?

Our other results provide additional evidence on the determinants of school spending. State supreme rulings that the system of educational finance was unconstitutional reduced the variation within the state in spending and caused a very large decrease in educational spending. State governments appear to have engaged in some redistribution from the state's richer school districts to its poorer districts even without any mandate from the state supreme court. Spending is found to be higher in more affluent counties and in counties in which the median voter faces a lower price of raising school quality, as proxied by a low ratio of median income to mean income or school age children representing a small share of the county's population.

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Table 1
Data Characteristics

A. Non-Median Income Variables

	<u>Restricted Sample (n=6064)</u>				<u>Full Sample (n=6188)</u>			
	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>
SCHOOL SPENDING	6554	1831	3000	15223	6645	2283	2486	50114
FEDERAL REVENUE	.612	.525	0	10391	.627	.583	0	10391
FRACTION 5-17	.195	.026	.067	.360	.195	.026	.067	.360
FRACTION URBAN	.383	.302	0	1	.379	.302	0	1
HOME OWNER DUMMY	.990	.097	0	1	.989	.103	0	1
SUPREME CT RULING	.178	.383	0	1	.179	.384	0	1
RELATIVE STATE INC	.865	.168	.426	1.897	.865	.169	.426	1.897
SUPREME CT RULING ×RELATIVE STATE INC	.230	.392	0	1.897	.233	.394	0	1.897

Table 1 Continued

B. Median Income Variables: Elderly and Non-elderly Equally Weighted

	<u>Restricted Sample (n=6064)</u>				<u>Full Sample (n=6188)</u>			
	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>
<u>Same preferences</u>								
MED HHD INCOME	35098	9095	12601	86624	35102	9218	12601	86624
MED INCOME/ MEAN INCOME	.794	.059	.446	.978	.793	.060	.446	.979
<u>Elderly Cross-state Migrants Prefer \$0</u>								
MED HHD INCOME	34978	9087	12575	86466	34982	9210	12575	86466
MED INCOME/ MEAN INCOME	.791	.060	.446	.977	.790	.061	.446	.979
<u>All Elderly Migrants Prefer \$0</u>								
MED HHD INCOME	34794	9081	12488	86289	34799	9204	12488	86289
MED INCOME/ MEAN INCOME	.787	.061	.445	.975	.786	.061	.445	.979
<u>All Elderly Prefer \$0</u>								
MED HHD INCOME	28235	10217	6601	85118	28252	10318	6601	85118
MED INCOME/ MEAN INCOME	.628	.110	.174	.959	.627	.110	.174	.971

Table 1 Continued

C. Median Income Variables: Elderly and Non-elderly Weighted by Voter Turnout

	<u>Restricted Sample (n=6064)</u>				<u>Full Sample (n=6188)</u>			
	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>	<u>Mean</u>	<u>Std Dev</u>	<u>Min</u>	<u>Max</u>
<u>Elderly Cross-state Migrants Prefer \$0</u>								
MED HHD INCOME	34218	9006	12524	85869	34224	9127	12524	85869
MED INCOME/ MEAN INCOME	.773	.058	.434	.970	.773	.059	.434	.970
<u>All Elderly Migrants Prefer \$0</u>								
MED HHD INCOME	34001	8997	12427	85653	34008	9118	12427	85653
MED INCOME/ MEAN INCOME	.768	.059	.433	.968	.768	.060	.433	.968
<u>All Elderly Prefer \$0</u>								
MED HHD INCOME	25759	10491	6147	84212	25784	10583	6147	84212
MED INCOME/ MEAN INCOME	.568	.125	.122	.951	.568	.125	.122	.959

SCHOOL SPENDING and FEDERAL REVENUE are deflated to 2000 dollars using implicit government purchases deflator. MEAN HHD is deflated to 2000 using the CPI-U.

Table 2
 Regressions: Restricted Sample:
 6064 observations from 3100 counties
 Elderly and Non-elderly Equally Weighted
 (absolute t-statistics in parentheses)

	Same <u>Preferences</u>	<u>Elderly Preferring \$0 Spending</u>		
		Cross State <u>Migrants</u>	All <u>Migrants</u>	All <u>Elderly</u>
MED HHD INCOME	.042 (3.12)	.044 (3.23)	.044 (3.25)	.057 (4.53)
MED INCOME/ MEAN INCOME	-1585 (2.11)	-1736 (2.32)	-1724 (2.30)	-2414 (3.97)
FEDERAL REVENUE	.332 (5.26)	.333 (5.28)	.333 (5.29)	.345 (5.52)
FRACTION 5-17	-7219 (5.47)	-7196 (5.46)	-7186 (5.45)	-7104 (5.40)
FRACTION URBAN	15.1 (0.08)	13.3 (0.07)	13.0 (0.07)	-53.1 (0.28)
HOME OWNER DUMMY	-369 (1.25)	-369 (1.25)	-369 (1.25)	-397 (1.35)
RELATIVE STATE INC	-803 (1.28)	-876 (1.40)	-876 (1.40)	-984 (1.93)
SUPREME CT RULING	-244 (4.65)	-243 (4.65)	-243 (4.64)	-238 (4.53)
SUPREME CT RULING ×RELATIVE STATE INC	-1366 (2.32)	-1364 (2.31)	-1359 (2.30)	-1276 (2.16)
2000 DUMMY	1396 (21.0)	1388 (20.8)	1388 (20.8)	1380 (26.9)
CONSTANT	8251 (10.4)	8384 (10.7)	8355 (10.7)	8541 (14.7)
R-sq: within	.7155	.7156	.7156	.7165
between	.0722	.0736	.0746	.0868
overall	.2349	.2362	.2372	.2501
F-statistic: overall	742.95	743.14	743.21	746.71
F-statistic: fixed effects=0	6.04	6.04	6.04	6.19
F(error)	744.4	744.3	744.3	743.1

Table 3
 Regressions: Restricted Sample:
 6064 observations from 3100 counties
 Elderly and Non-elderly Weighted by Voter Turnout
 (absolute t-statistics in parentheses)

	Same <u>Preferences</u>	<u>Elderly Preferring \$0 Spending</u>		
		Cross State <u>Migrants</u>	All <u>Migrants</u>	All <u>Elderly</u>
MED HHD INCOME	.042 (3.12)	.044 (3.21)	.045 (3.24)	.057 (4.63)
MED INCOME/ MEAN INCOME	-1585 (2.11)	-1725 (2.30)	-1716 (2.28)	-2419 (4.29)
FEDERAL REVENUE	.332 (5.26)	.332 (5.27)	.332 (5.28)	.341 (5.47)
FRACTION 5-17	-7219 (5.47)	-7239 (5.50)	-7226 (5.48)	-7207 (5.49)
FRACTION URBAN	15.1 (0.08)	9.32 (0.05)	9.01 (0.05)	-71.9 (0.38)
HOME OWNER DUMMY	-369 (1.25)	-371 (1.26)	-371 (1.26)	-408 (1.39)
RELATIVE STATE INC	-803 (1.28)	-846 (1.37)	-846 (1.37)	-815 (1.70)
SUPREME CT RULING	-244 (4.65)	-244 (4.64)	-243 (4.64)	-237 (4.52)
SUPREME CT RULING ×RELATIVE STATE INC	-1366 (2.32)	-1364 (2.31)	-1359 (2.30)	-1282 (2.17)
2000 DUMMY	1396 (21.0)	1391 (20.3)	1391 (21.3)	1401 (30.1)
CONSTANT	8251 (10.4)	8354 (10.7)	8326 (10.8)	8442 (15.5)
R-sq: within	.7155	.7156	.7156	.7167
between	.0722	.0727	.0737	.0810
overall	.2349	.2353	.2364	.2451
F-statistic: overall	742.95	743.10	743.17	747.19
F-statistic: fixed effects=0	6.04	6.05	6.05	6.28
F(error)	744.4	744.4	744.3	742.9

Table 4
 Regressions: Full Sample:
 6188 observations from 3124 counties
 Elderly and Non-elderly Equally Weighted
 (absolute t-statistics in parentheses)

	Same <u>Preferences</u>	<u>Elderly Preferring \$0 Spending</u>		
		Cross State <u>Migrants</u>	All <u>Migrants</u>	All <u>Elderly</u>
MED HHD INCOME	.075 (4.44)	.077 (4.52)	.077 (4.54)	.090 (5.65)
MED INCOME/ MEAN INCOME	-3701 (3.87)	-3823 (4.00)	-3930 (4.10)	-4388 (5.62)
FEDERAL REVENUE	.577 (7.74)	.577 (7.75)	.577 (7.75)	.587 (7.93)
FRACTION 5-17	-10639 (6.24)	-10598 (6.22)	-10551 (6.18)	-10432 (6.14)
FRACTION URBAN	93.3 (0.38)	92.6 (0.38)	91.9 (0.37)	-20.4 (0.08)
HOME OWNER DUMMY	-366 (0.87)	-335 (0.87)	-335 (0.87)	-367 (0.95)
RELATIVE STATE INC	-2396 (3.02)	-2455 (3.10)	-2481 (3.13)	-2172 (3.32)
SUPREME CT RULING	-16.7 (0.24)	-16.6 (0.24)	-16.0 (0.23)	-5.76 (0.08)
SUPREME CT RULING ×RELATIVE STATE INC	-2307 (3.07)	-2304 (3.07)	-2293 (3.05)	-2227 (2.97)
2000 DUMMY	1154 (14.0)	1147 (13.9)	1144 (13.9)	1178 (18.3)
CONSTANT	10991 (10.9)	11083 (11.1)	11159 (11.2)	10699 (14.4)
R-sq: within	.5924	.5925	.5925	.5942
between	.0431	.0437	.0438	.0485
overall	.1404	.1411	.1415	.1489
F-statistic: overall	443.80	444.01	444.11	447.28
F-statistic: fixed effects=0	5.80	5.81	5.81	5.93
F(error)	1006.1	1005.9	1005.9	1003.8

Table 5
 Regressions: Full Sample:
 6188 observations from 3124 counties
 Elderly and Non-elderly Weighted by Voter Turnout
 (absolute t-statistics in parentheses)

	Same <u>Preferences</u>	<u>Elderly Preferring \$0 Spending</u>		
		Cross State <u>Migrants</u>	All <u>Migrants</u>	All <u>Elderly</u>
MED HHD INCOME	.075	.078	.078	.088

	(4.44)	(4.53)	(4.55)	(5.64)
MED INCOME/ MEAN INCOME	-3701 (3.87)	-3999 (4.17)	-4148 (4.32)	-4127 (5.65)
FEDERAL REVENUE	.577 (7.74)	.576 (7.73)	.575 (7.72)	.581 (7.88)
FRACTION 5-17	-10639 (6.24)	-10677 (6.28)	-10623 (6.24)	-10698 (6.32)
FRACTION URBAN	93.3 (0.38)	79.9 (0.32)	78.7 (0.32)	-39.1 (0.16)
HOME OWNER DUMMY	-366 (0.87)	-339 (0.88)	-339 (0.88)	-384 (1.00)
RELATIVE STATE INC	-2396 (3.02)	-2465 (3.14)	-2499 (3.19)	-1830 (2.96)
SUPREME CT RULING	-16.7 (0.24)	-15.2 (0.22)	-14.4 (0.21)	-6.51 (0.09)
SUPREME CT RULING ×RELATIVE STATE INC	-2307 (3.07)	-2304 (3.07)	-2291 (3.05)	-2253 (3.00)
2000 DUMMY	1154 (14.0)	1150 (14.2)	1146 (14.2)	1224 (21.0)
CONSTANT	10991 (10.9)	11207 (11.3)	11317 (11.5)	10343 (14.8)
R-sq: within	.5924	.5926	.5926	.5943
between	.0431	.0427	.0427	.0440
overall	.1404	.1401	.1405	.1435
F-statistic: overall	443.80	444.17	444.32	447.29
F-statistic: fixed effects=0	5.80	5.82	5.82	6.00
F(error)	1006.1	1005.8	1005.7	1003.7

Table 6
Specification Tests

Restricted Sample

other 5 specifications < all elderly at \$0 (ew) = all elderly at \$0 (vw)
Prediction sum of squares

other 5 specifications < all elderly at \$0 (ew) < all elderly at \$0 (vw)
Amemiya PC R-squared criterion

elderly cross-state migrants at \$0 (ew) < same preferences < all elderly migrants
at \$0 (ew)
 < elderly cross-state migrants at \$0 (vw) < all elderly migrants at \$0 (vw)
 < all elderly at \$0 (ew) < all elderly at \$0 (vw)
Hocking's Sp criterion

same preferences < elderly cross-state migrants at \$0 (vw) < elderly cross-state
migrants at \$0 (ew)
 < all elderly migrants at \$0 (vw) < all elderly migrants at \$0 (ew)

< all elderly at \$0 (ew) < all elderly at \$0 (vw)
Akaike's ACI criterion
Schwartz's SBC criterion

J test conclusive comparisons:

same preferences < all elderly at \$0 (vw)
elderly cross-state migrants at \$0 (ew) < all elderly at \$0 (vw)
elderly cross-state migrants at \$0 (vw) < all elderly at \$0 (vw)
all elderly migrants at \$0 (ew) < all elderly at \$0 (vw)
all elderly migrants at \$0 (vw) < all elderly at \$0 (vw)

same preferences < all elderly migrants at \$0 (vw)

Inconclusive Comparisons

Cox tests: reject all pairs
J tests: reject many pairs

< means worse fit than

= means not distinguishable from

ew means equal weights

vw means voter turnout weights

Table 7
 Regressions: Restricted Sample:
 6064 observations from 3100 counties
 Elderly and Non-elderly Weighted by Voter Turnout
 (absolute t-statistics in parentheses)

<u>Independent Variables</u>	<u>Dependent Variables</u>	
	<u>MED HHD INCOME</u>	<u>MED INCOME/MEAN INCOME</u>
<u>(All Elderly Prefer \$0)</u>	<u>(All Elderly Prefer \$0)</u>	
MED HHD INCOME (unadjusted)	0.997 (121)	
MED INCOME/ MEAN INCOME (unadjusted)		0.764 (47.8)
FRACTION ELDERLY	-54096 (28.2)	-2.376 (47.6)
2000 DUMMY	-2906 (29.9)	0.0073 (7.51)
CONSTANT	1642 (4.46)	0.311 (20.0)
R-sq: within	.9749	.6629
between	.9758	.8129
overall	.9755	.8048
F-statistic: overall	38294	1941
F-statistic: fixed effects=0	3.19	4.15
F(error)	1043	.0273

Note: The independent variables MED HHD INCOME (unadjusted) and MED INCOME/MEAN INCOME (unadjusted) correspond to the variables used in the Same Preferences regression in Table 3. The dependent variables MED HHD INCOME and MED INCOME/MEAN INCOME correspond to the variables used in the All Elderly regression in Table 3.