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School choice: Money, race, and congressional voting on vouchers*

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Abstract: This paper discovers that a campaign contribution to a member of the U.S. House of Representatives by the American Federation of Teachers or the National Education Association (the two major teachers' unions) in the 2000 election cycle reduces the probability that a Representative will vote for a school choice amendment to the "No Child Left Behind Act of 2001." It also discovers that a Representative whose district has a large African American population or who is Republican is more likely to vote for vouchers.

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The charitable foundations of scholarships, exhibitions, bursaries, &c. necessarily attach a certain number of students to certain colleges, independent altogether of the merit of those particular colleges. Were the students upon such charitable foundations left free to chuse what college they liked best, such liberty might perhaps contribute to excite some emulation among different colleges. A regulation, on the contrary, which prohibited even the independent members of every particular college from leaving it, and going to any other without leave first asked and obtained of that which they meant to abandon would tend very much to extinguish that emulation. (Smith, Book V, Ch.1, 1789/1976: 285-286)

The public can facilitate this acquisition [of the most essential education] by establishing in every parish or district a little school, ... the master being partly, but not wholly paid by the public; because, if he was wholly, or even principally paid by it, he would soon learn to neglect his business. (Smith, Book V, Ch.1, 1789/1976: 306)

1. Introduction

Americans are concerned about public education system and student achievement.

Recently, there has been little to no improvement in standardized test scores and on such tests as the SAT, scores have actually fallen (Hoxby, 2001). According to the

Department of Education, there are currently 5000 chronically failing schools, meaning that these schools have under performed for at least three consecutive years (Armeiy,

2001). On the other hand, both on a federal and local level, spending on education has increased greatly. This environment—increasing spending and falling scores, combined

with significant differences in public school quality across school districts (Nechyba, 2000)—in other words, declining efficiency and effectiveness of the public schools, has

led to a greater emphasis both on accountability in the public school systems and choices outside the public school systems. In this context, school vouchers became a significant

part of the education policy debate. Moreover, the importance of vouchers has been escalated by the June 2002 decision of the US Supreme Court, ruling that a school

voucher program in Cleveland does not infringe upon the constitutional separation of church and state.

Yet, in 2000, pro-voucher proposals were defeated by wide margins. For example, in November 2000, voters rejected voucher proposals by more than a 2-1 margin in California and Michigan (the most recent two of seven). And, in 2001, the U.S. House of Representatives voted 155-to-273 (almost 2-to-1) to defeat a school-choice amendment (to the “No Child Left Behind Act of 2001) that would have authorized limited vouchers to disadvantaged students.. Surprisingly, however, vouchers are quite popular with Americans. 60% of Americans in 1999, 47% in 2000 and 52% in 2001 favored the voucher proposal discussed below and illustrated in Figure 1.

Clearly, there is a disconnect between the public’s attitudes towards school choice and the results of the voting both in the referendums and in the U.S. House of Representatives. Moe (2002: 10) provides plausible explanations for the referendum results: He writes “ ... unless the issue is familiar to voters and fairly simple for them to evaluate, a strong opponent can almost always defeat it, often by big margins.” He continues by writing “ ... a well-heeled opponent can unleash a media campaign—filled with extreme claims, half-truths, and even outright lies—that generates doubt and uncertainty among many voters and causes them to fall back on the status quo (even if they don’t like it much). The maxim among voters in these situations is ‘when in doubt, vote no’.”

To better understand the second disconnect, we analyze voting behavior in Congress on this school choice initiative. We examine the factors that might influence congressional voting, in particular campaign contributions by teachers’ unions, party affiliation of the Representative, and the income level, density, and racial composition of the Representative’s congressional district. We show that the probability that a

Representative will vote for a school choice amendment to the “No Child Left Behind Act of 2001” depends negatively on the size of the campaign contributions to a member of the U.S. House of Representatives by the American Federation of Teachers and the National Education Association (the two major teachers’ unions) in the 2000 election cycle. We also discover that a Representative whose district has a large African American population or who is Republican is more likely to vote for vouchers.

2. What the research says about school choice

According to Friedman (1962: 85-86) there are two rationales for government intervention in education: the existence of substantial “neighborhood effects;” and “paternalistic concern for children and other irresponsible individuals”. Yet, he claims that neither of these rationales justifies nationalizing schooling. Four decades ago, therefore, Friedman became the first person (other than Adam Smith, who advocated vouchers for educational foundations) to propose a voucher system. He advocated school vouchers—“universal, available to all parents, and large enough to cover the cost of high-quality education,” as an enabling device for denationalizing schooling, to provide a variety of learning opportunities and effective competition (Friedman, 1995). Since then, a number of studies have explored the public-school efficiency from *increased competition hypothesis* (see Levin, 1992; Hoxby, 1994; and Hoxby, 2000).

In addition to the hypothesized competition effect, there is the *sector effect argument*—that the private sector is more productive than public sector in generating student achievement. Therefore, there is a hypothesized potential increase in student achievement from the movement of students from an unproductive public sector to a

more productive private sector (see, e.g., Coleman, Hoffer, and Kilgore, 1982; Evans and Schwab, 1995; and Neal, 1997).

Finally, there is a third channel through which school vouchers may affect student achievement, namely the *peer effect*. Pure peer effects are the spillovers within the classroom from one student to another, (Ladd, 2002: 13). But, this third effect won't affect the average quality of education unless it is asymmetric, and the evidence of asymmetry is limited and inconclusive (Ladd, 2002: 14).

The first two arguments support school choice. Howell and Peterson (2002) find evidence that black children in Dayton OH, New York City, and Washington DC do benefit from access to private schools (for details see Neal, 2002). Hoxby (2002: 50) explores choice programs in three areas: vouchers in Milwaukee, charters in Arizona and charters in Michigan. She concludes, "in each case, the regular public schools boosted their productivity when exposed to competition ... by raising achievement." Dawson (2001) concludes that in 1998, Florida's voucher program resulted in considerable improvement of failing schools. Rouse's study of the Milwaukee parental choice program suggests that the program "has a mean effect of raising math test scores 2-3 percentage points," but no effect on the performance on standard reading tests (Rouse (1997: 19). However, the evidence is not strong, as it consists of a limited number of school choice experiments in the U.S., e.g., a few pilot programs in Florida, Vermont, Milwaukee, Cleveland, Dayton, OH, New York City, and Washington, DC. And Ladd (2002: 21) in her survey of the evidence finds that "widespread use of school vouchers is not likely to generate substantial gains in the productivity of the U.S. K-12 education system."

Moreover, researchers are still in the process of analyzing the effects of these programs. For instance, Krueger and Zhu (2002) reexamine the New York City school choice program, i.e., the May 1997 series of lotteries for private school scholarships for low-income public school students. They find that the treatment effects are sensitive to the definition of race, and they urge caution in concluding that the vouchers raised achievement for African American students in New York City.

These pilot school choice programs are random experiments, which makes the evaluation very difficult due to lack of proper benchmarking. Therefore, it is possible to examine the same program and not to be able to derive conclusive results. As the recent extensive surveys by Ladd (2002) and Neal (2002) demonstrate, it is possible to interpret the same results differently.

In addition to theoretical and empirical work, Nechyba (2000) utilizes a computable general equilibrium simulation model to examine the potential impact of private school vouchers both on distribution of educational opportunities and on equity. He shows that untargeted vouchers and targeted voucher schemes aimed at poor public-school districts are likely to cause richer families to move into poorer districts, raising house prices in poorer districts and lowering them in richer districts. Consequently, mobility improves the likely equity consequences of these voucher programs.

3. Where the public stands on school choice

The issue of school choice is increasingly popular in polling. A large number of polls have been conducted on the issue. For instance, according to Michigan State University's State of the State Survey in 1998, 65 percent of African-Americans and 66

percent of household earners with annual incomes under \$20,000 were in favor of a voucher plan to have “ ‘the state pay all or part of the tuition’ to a private/parochial school.” The Joint Center for Political and Economic Studies (Bositis, 2000) found in 1999 that support for choice among African Americans with children is at 71% including 76% of African Americans aged 26-35. These data suggest that, among certain groups, especially African Americans, there is strong sentiment for school choice.

To see the change in the perception of the public within time, we use the responses from the last nine *Annual Phi Delta Kappa/Gallup Poll of the Public’s Attitude Towards the Public Schools*. Although there are changes from one year to another, the public has not made its mind up on the school choice issue. There was a clear positive trend in favoring school vouchers from 1996 to 1999, a sharp decline in 2000, and a positive trend from 2000 to 2002. Yet, we have calculated that the average proportion in favor is statistically insignificantly different from 50%. As Figure 1 shows, both support and opposition hover around the 50 percent line.

4. How Congress voted on school choice and the house debate

In the 107th Congress, the House of Representatives considered an amendment to H.R.1, the “Leave No Child Behind Act of 2001,” that sought to implement school choice in the form of vouchers. The amendment considered is the following:

H.AMDT.57 to H.R.1 Amendment sought to authorize private school choice for students who have attended low performing schools for at least 3 years; allow private school choice as a local use of funds under title IV of the Innovative Education Grants for Disadvantaged Students; and allow private school choice for students in unsafe schools or who have been victims of crime on school premises.

Source: www.thomas.loc.gov, “Bill Summary & Status for the 107th Congress, item 15 of 28.”

The amendment was defeated as the House voted on May 24, 2001 to reject it 155-273.¹

The quotes below give a flavor of the arguments from the congressional debate on the amendment. They are drawn from the *Congressional Record*, May 23, 2001. Although not directly, the Representatives eloquently made the major points of the proponents and the opponents of the school choice. The quotes highlight the fundamentals of voucher politics: as they illustrate, the proponent Representatives raise issues such as (i) fairness and accordingly providing opportunities for low income minorities; (ii) generating competition to reform stagnant education bureaucracies with powerful lobbies; and (iii) giving choice to parents to increase public school accountability. Similarly, the opponent Representatives emphasize (i) the fear that vouchers will drain off resources from public schools; and (ii) the possibility of school fraud by fly-by-night institutions. Interestingly, however, none of the opponents mentions potential decline in student achievement.

This issue is about **fairness**. It is about equity. It is about providing a safety valve for disadvantaged students. ... This is about an **education bureaucracy that is resistant to change** and mired in habit. This is about **powerful lobbies** that refuse to accept any change in the status quo. (Mr. BOEHNER, Ohio).

This debate, Mr. Chairman, between the status quo and **the needs of largely minority students** is not new. Decades ago, the defenders of the status quo stood in the schoolhouse door and said to some, you may not come in. Now, the defenders of the status quo stand in the schoolhouse door and say to the grandchildren of many of those same Americans, you may not come out. (Mr. PENCE, Indiana).

This is **empowering parents** and will force schools to be **accountable** not to a bureaucrat in Washington, not to a bureaucrat in the Department of Education, and not to a bureaucratic test that is mandated out of Washington. (Mr. HOEKSTRA, Michigan).

Why is it that the D.C. public schools are not good enough for the children of Al Gore and Bill Clinton, but somehow they are good enough for the **low-income African**

¹ In an interesting commentary on the amendment that we consider, Garrett (2002: 2) writes “Of the 273 Members who voted against the amendment, 69 had sent or were sending at least one child to private school. Had these Members voted for the amendment instead, it would have passed by a vote of 224-204.”

American kids trapped in these failing schools? It defies common sense and logic. (Mr. KELLER, Florida).

School choice is the heart of this education reform, and it is successful as Milwaukee's school choice program has proven. Yet opponents of school choice are kowtowing to **teacher unions** and thus sacrificing the future of our children on the altar of politics. (Mr. LEWIS, Kentucky).

Public schools are a **monopoly** and they face little to no consequences for failure. If I brought a bill to this floor proposing we put restaurants and supermarkets in the control of the government, nobody would support it, because everybody knows quality would go down. (Mr. WELDON, Florida).

This amendment is an **invitation to school fraud**, not school choice. It will create a marketplace of **fly-by-night institutions** posing as legitimate schools simply to sop up this new Federal voucher that will be out there. It will degrade the well-earned reputation of legitimate private schools sponsored by religious and other organizations around the country. (Mr. ANDREWS, New Jersey).

Two hundred or 300 years ago in this country, we had a practice, a medical practice called bleeding. And the way it worked was when someone got sick, we would put leeches on the body and let blood be taken out. If they did not get better, we added more leeches and more leeches and took out more and more blood. Not surprisingly, not many patients got better. ... Mr. Chairman, instead of bleeding the public school patient dry [with vouchers] and condemning it to never getting better, we should do with education as we did in medicine and **devote our resources** to new technologies, new intervention models and preventive programs... After all, we want our patient to live. (Ms. RIVERS, California).

5. Logit analysis of voting on the school choice amendment

We use logit analysis to explore congressional voting on this amendment. More specifically, this paper's objective is to determine the effects of campaign contributions from the American Federation of Teachers and National Education Association political action committees (PACs), party affiliation, congressional district density and racial makeup on how Representatives in the House voted on the amendment.

Our analysis uses the votes of representatives on this amendment to H.R. 1 as the dependent variable (VOTE), where votes were counted as 0 for aye and 1 for nay, with a nay vote as registering a preference against school choice.

Due to the limits on the values that the dependent variable may take, logit analysis was used rather than linear regression. Logit analysis allows the model to obtain the probability of a nay vote as a function of the independent economic, political, and demographic variables. The analysis uses a logit function, which makes the probability of a nay vote ($VOTE=1$) a function of a vector of constants, β , times a vector of values for the independent variables, x , according to:²

$$Prob(VOTE = 1) = \frac{e^{\beta x}}{1 + e^{\beta x}}.$$

Because of their superior opportunities for organization, teachers' unions are the main contributors on the issue of school choice. Out of 20 education related PACs, more than 99.5% of the contributions were from the two national teachers' unions, the AFT and the NEA. Therefore total contributions from these two PACs were used in this paper's analysis.

The variable, TEACHER PAC, is contributions from the NEA PAC and AFT PACs for the 2000 election cycle (November 1998-October 2000), measured in thousands of dollars. It is predicted that contributions from these PACs positively affect the probability of a nay vote ($VOTE=1$). Both of these variables are available from the web page of the Center for Responsive Politics, www.opensecrets.com, which utilizes reports filed to the Federal Election Committee by the Representatives.

A political variable, PARTY, a dummy variable, which takes on the value of 1 for a Democrat and the value of 0 for other party affiliations (either Republican or Independent) is included. The ideological views of each party suggest that Democrats

² For details, see Greene (2000: 811-818).

will align with the teachers' unions (NEA and AFT) and that Republicans will align with the market solution. Consequently, it is predicted that being a Democrat (PARTY=1) will positively affect the probability of a nay vote (VOTE=1) on H.AMDT.57 to H.R. 1.

The variable, AFRAM, which represents the percentage of African Americans in a congressional district (drawn from the year 2000 census), is included. African Americans tend to be Democrats, but polling data indicates that they also tend to approve of vouchers. Thus, we would expect Representatives from African-American intensive districts to be Democrats who vote for vouchers. This suggests that the AFRAM variable will negatively affect the probability of a nay vote (VOTE=1).

The variable, DENSITY, drawn from the year 2000 census, represents the population density measured in thousands of individuals per square mile of land in a congressional district. It is included because inner city school districts are among the nation's worst. So it is expected that parents who live in these districts will be likely to support choice. And under the assumption that representatives' voting behavior is sensitive to the opinions of their constituents, it is expected that DENSITY will negatively affect the probability of a nay vote (VOTE=1).

Finally, the variable, INCOME, represents the median income measured in thousands of dollars in each congressional district. We were uncertain what sign to expect for the coefficient of this variable, especially since our analysis controls for a number of other variables.

Table 1 summarizes the information on contributions.

6. Results

The logit model maximum likelihood estimates uses PARTY, TEACHER PAC, AFRAM, DENSITY, and INCOME as independent variables. Table 2 presents the estimated coefficients and marginal effects for the logit model.³ It shows that the estimated coefficients of DENSITY and INCOME are not significant at any customary level of significance. The model predicts that a Republican receiving no campaign contributions in an “average congressional district”—i.e., a district with a population density of 2,501 persons/square mile, 12.6% African American population, and a median income of \$30,750—is likely to vote aye (VOTE=0) on H.AMDT.57. The probability of a nay vote is only 22.5%. On the other hand, a Democrat receiving no campaign contributions from an “average congressional district” votes nay (VOTE=0) on H.AMDT.57 with a probability of 90.0%. In other words, (for a representative from an “average congressional district” with no TEACHER PAC money) changing party affiliation from Republican to Democrat increases the probability of voting nay on H.AMDT.57 by 67.5 percentage points.

The variable, AFRAM is significant at a 5% level but has a weaker effect than TEACHER PAC and PARTY on voting behavior. For instance, no matter what the proportion of African Americans, a Democratic representative is unlikely to support choice. Yet, an increase of 6 percentage points from the mean value of constituencies’ African American population, (otherwise still an “average congressional district”)

³ As the referee suggested, we also ran regressions using contributions from teachers’ union PACs expressed as a percentage of a given Representative’s total “war chest” during the time period in question. The results are almost identical with the estimates in Table 2 and available in the Appendix of the Working Paper version of this study at www.econ.duke.edu/Papers/Abstracts02/abstract.02.27.html.

increases the likelihood of a nay vote by -5.5 percentage points for a Republican (from 53.2% to 47.7%), meaning the representative is more likely to support choice.

In interpreting these estimates it is important to bear in mind the two-way causality between voting and campaign contributions. We believe that it is appropriate to think of anti-voucher Representatives as being on retainer from the teachers' unions PACs, and our estimate as describing the steady state relationship between campaign contributions and anti-voucher votes.

7. Illustrating the vote against the amendment to authorize and fund school choice

We illustrate the voting on H.AMDT.57 with two charts. In Figure 2, contributions are measured in thousands of dollars. This means that the curves in Figure 2 indicate the probability of a nay vote measured in percentage points as a function of campaign contributions.

The average TEACHER PAC contribution is \$4,923/Representative (averaging over all members). The figure shows that a TEACHER PAC contribution of \$2,275 to a Republican from an "average congressional district" changes a vote from aye (for school choice) to nay (against school choice). For Republicans, who we expect to be ideologically in favor of school choice, the result is surprising. A relatively modest TEACHER PAC contribution has great power over education policy.

Figure 3 shows the effect of the percentage of African American population in a congressional district on a Republican Representative's voting behavior on school choice. Regardless of the share of the African American population, a Republican Representative with no TEACHER PAC contribution is likely to vote aye (for choice). Yet, unless the

percentage of the African American population in a congressional district was at least 16.1%, a Republican Representative (with roughly half of the average size of the TEACHER PAC contribution, i.e., \$2,500) is likely to vote against vouchers. Also, a Republican Representative who received the roughly average \$5,000 TEACHER PAC contribution still is likely to vote against school choice, if the percentage of the African American population in her district was less than 53.7%.

8. Conclusions

This paper presents some evidence about school choice, the public's support for school choice and the patterns of congressional voting on school choice issues. Congress is sensitive to constituent opinion on school choice such that an increase in the proportion of African Americans in a Representative's constituency increases the probability of an affirmative vote on the issue. Recent opinion polls suggest a shift in public opinion on school choice from overwhelming opposition to some cautious support, and recent research into the subject suggests that there may be benefits from school choice. But the effect of campaign contributions on congressional voting behavior has been able to inhibit efforts for school choice reform. Consequently, congressional support for school choice (as measured by the proportion of aye votes on the school choice amendment) is more limited than the support of the public (as measured by the most recent polling data).

Friedman (1995: 2) writes:

Many attempts have been made in the years since [I first proposed a voucher system 40 years ago] to adopt educational vouchers. With minor exceptions, no one has succeeded in getting a voucher system adopted, thanks primarily to the political power of the school establishment, more recently reinforced by the National Education Association and the American Federation of Teachers, together the strongest political lobbying body in the United States.

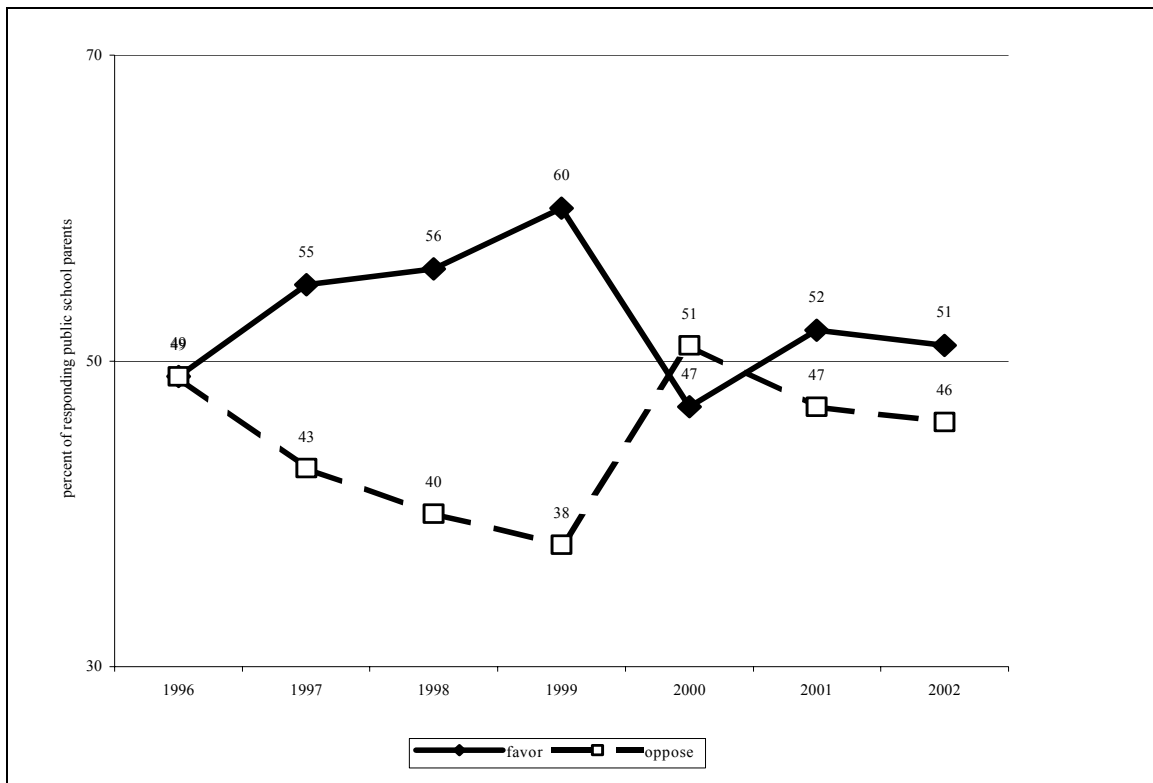
Our findings are consistent with Friedman's view.

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Figure 1. Answers to the question: Would you favor or oppose the proposal that would allow parents to send their school-age children to any public, private, or church related school they choose (for those parents choosing nonpublic schools, the government would pay all or part of the tuition) in your state?



Data source: Rose and Gallup (September 2002: 46) *The 34th annual Phi Delta Kappa/Gallup poll of the public's attitudes towards the public schools.*

Table 1. Summary of AFT and NEA PACs contributions and voting on H.AMDT.57 to H.R. 1

	<i>AFT PAC</i> <i>Contributions</i>		<i>NEA PAC</i> <i>Contributions</i>		Yes Votes	No Votes
	Amount	Recipients	Amount	Recipients		
All Members					155	273
Financed Members	\$961,005	189	\$1,146,075	222	6	222
Financed Democrats	\$936,105	181	\$1,081,325	197	0	202
Financed Republicans	\$24,900	8	\$64,750	25	6	20

Table 2. Logit model maximum likelihood estimates: H.AMDT.57

<i>Variable</i>	<i>Coefficient</i>	<i>t ratio</i>	<i>Marginal effect</i>	<i>t ratio</i>
Constant	-0.619	-0.962	-	-
PARTY	3.439	3.418	0.141	1.775
TEACHER PACs	0.546	3.835	0.022	2.595
AFRAM	-3.636	-2.093	-0.149	-1.640
DENSITY	-0.027	-0.300	-0.001	-0.295
MEDIAN INCOME	-0.003	-0.165	-0.0001	-0.165

Log L = -134.734

LR1* = 0.519

Frequencies of actual and predicted outcomes**

		<i>Predicted</i>		
		Vote = Yes	Vote = No	Total (actual)
<i>Actual</i>	Vote = Yes	149	6	155
	Vote = No	54	219	273
Total (predicted)		203	225	428

Notes: Marginal effects are computed at the means of the explanatory variables.

* LR1 is McFadden's likelihood ratio index, which is an analog to the R^2 in a conventional regression.

** The model predicts 86% of the votes accurately (368 out of 428 votes): In particular, the model accurately predicts 149 out of 155 of the Yes votes; and 219 out of 273 No votes.

Figure 2. TEACHER PAC contributions and voting on H.AMDT.57

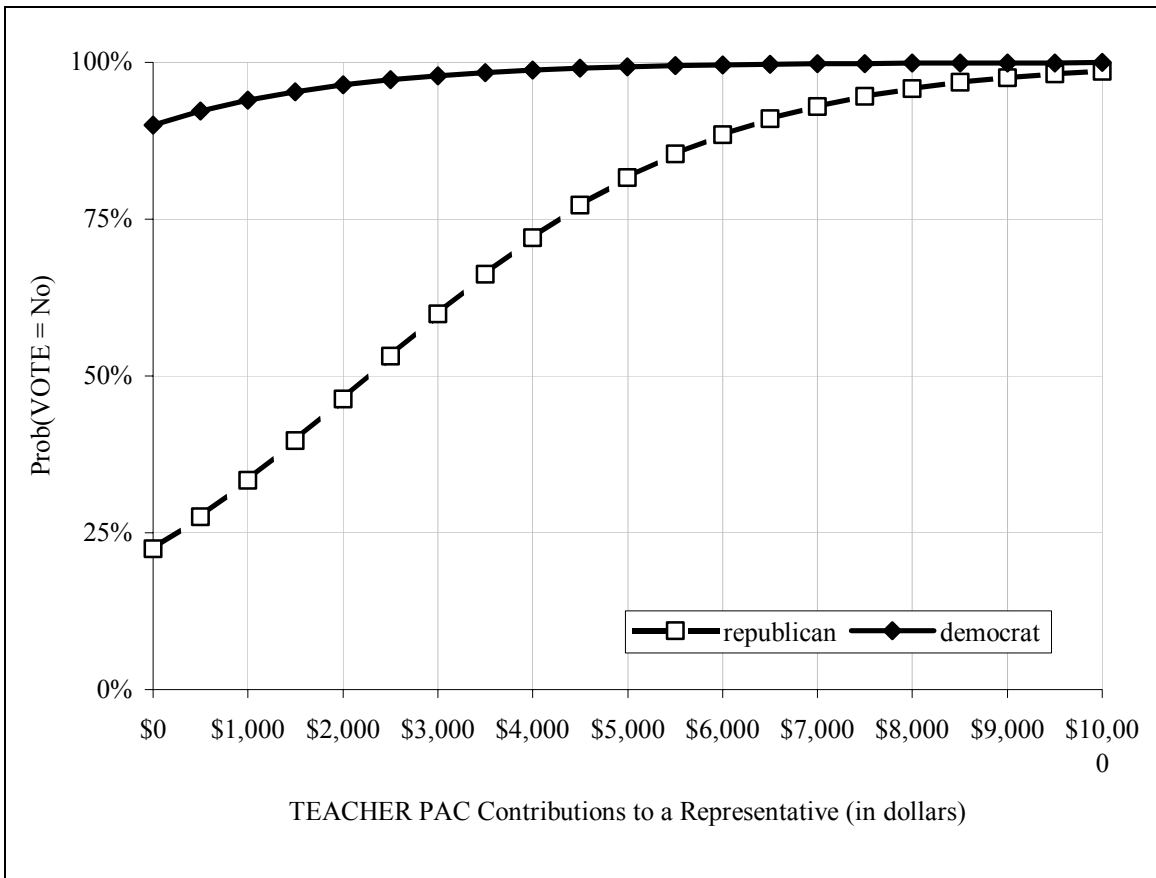
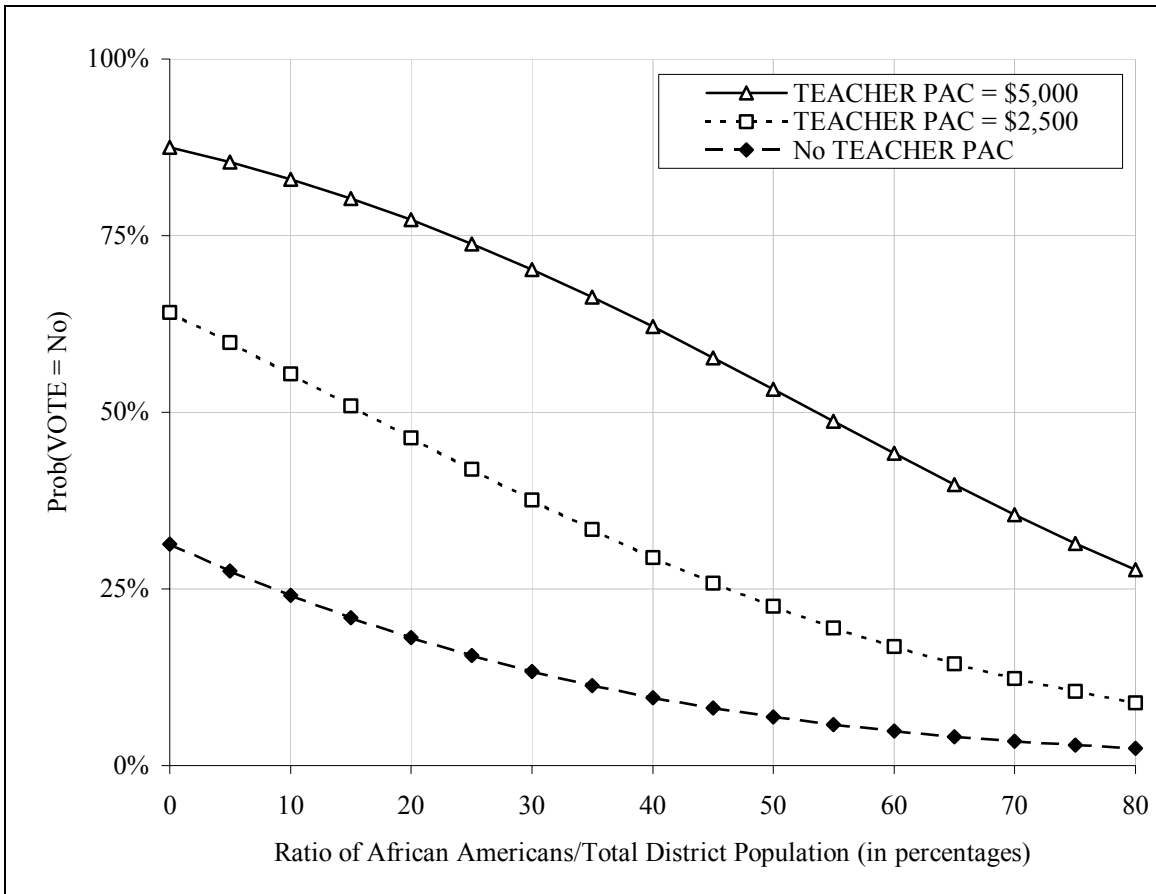


Figure 3. African Americans as a proportion of a Republican Representative's district and voting on H.AMDT.57



Appendix: (Not be published in *Public Choice*)

In the body of this paper, we use *nominal-aggregated* contributions from two teacher PACs. In this appendix, we test the validity of this choice. In particular, we run two additional set of regressions to check (i) whether using nominal (in dollars) instead of relative value of the teacher PACs contribution makes a different; and (ii) if different teacher PAC contributions have different impact on voting.

1. Regression results with STEACH:

We calculated the percentage, STEACH, which the contributions from teacher union PACs constitute in a given Representative’s total “war chest” during the time period in question. Then, we run the same regression that we reported its results in Table 1, by replacing TEACHER PACs with STEACH. The following is the LIMDEP output for this regression. In this regression, the Log L is slightly better, but the magnitude and the significance of the estimated coefficients and partial derivatives, and also the predictive power of the model are very similar to the ones reported in Table 1.

Multinomial Logit Model	
Maximum Likelihood Estimates	
Dependent variable	A15
Number of observations	428
Iterations completed	9
Log likelihood function	-131.9191

Variable	Coefficient	Standard Error	z=b/s.e.	P[Z _z]	Mean of X
Characteristics in numerator of Prob[Y = 1]					
Constant	-0.7368155	0.63360	-1.163	0.24487	
PARTY	2.822126	0.91085	3.098	0.00195	0.4813
MEDIANINCOME	0.2331421E-05	0.18478E-04	0.126	0.89960	0.3075E+05
DENSITY	-0.1969239E-04	0.70177E-04	-0.281	0.77901	2505.
AFRAM	-0.4561831E-01	0.19435E-01	-2.347	0.01891	12.51
STEAACH1	509.4430	130.64	3.900	0.00010	0.6197E-02

<p>Partial derivatives of probabilities with respect to the vector of characteristics. They are computed at the means of the Xs. Observations used for means are All Obs.</p>

Variable	Coefficient	Standard Error	z=b/s.e.	P[Z _z]	Mean of X
Constant	-0.2696478E-01	0.29957E-01	-0.900	0.36807	
PARTY	0.1032796	0.70101E-01	1.473	0.14067	0.4813
MEDIANINCOME	0.8532155E-07	0.68144E-06	0.125	0.90036	0.3075E+05
DENSITY	-0.7206699E-06	0.25786E-05	-0.279	0.77988	2505.
AFRAM	-0.1669465E-02	0.11460E-02	-1.457	0.14519	12.51
STEAACH1	18.64377	8.2718	2.254	0.02420	0.6197E-02

Frequencies of actual & predicted outcomes
 Predicted outcome has maximum probability.

Actual	Predicted		TOTAL
	0	1	
0	148	7	155
1	54	219	273
TOTAL	202	226	428

2. Testing the null hypothesis that the coefficients on AFT and NEA PACs are equal to each other

The model in the paper does not differentiate AFT contributions from NEA contributions. We were implicitly assuming that the impact of a dollar from NEA and AFT PACs are the same. In other words, we impose the restriction on our model that the coefficients of AFT PAC and NEA PAC are the same. This restriction corresponds to the following null hypothesis:

$$H_0: \beta_{\text{NEA PAC}} = \beta_{\text{AFT PAC}} = \beta_{\text{TEACHER PAC}}$$

We test this hypothesis by using the likelihood ratio statistic

$$LR = -2 \left[\ln \hat{L}_R - \ln \hat{L}_U \right] \approx \chi^2(1).$$

We calculate $LR = -2 [-134.734 + 133.441] = 2.586$. The critical value from the chi-squared distribution with 1 degree of freedom at a significance level of 0.05, $\chi^2(1, \alpha = 0.05) = 3.84$, so the hypothesis that the coefficients on AFT PAC and NEA PAC are equal to each other is not rejected.