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VOTING ON SOCIAL SECURITY: EVIDENCE FROM OECD COUNTRIES

by Friedrich Breyer and Ben Craig

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Abstract

This article tests the subset of public choice models for social security that have empirical implications. The data, collected from OECD countries for the years 1960, 1970, 1980, and 1990, provide some support for each of the theories. Higher median voter age, more income heterogeneity, greater similarity in family size, and variables that make a public pension program more profitable are all associated with a larger program. However, none of the theories explains why the shape of the age distribution and the time trend are so important. The results are robust under both fixed-effects and random-effects estimation.

1. Introduction

If a person has a formal pension, the chances are that at least part of his retirement benefits will be paid for by a form of social security. Indeed, in 1993, Bangladesh, Myanmar, Thailand, and five African countries were the only nations that did not have a mandated old-age pension program. Exceptions to the pay-as-you-go approach, such as Chile's privatized pension system, remain rare. Of the industrial democracies belonging to the Organisation for Economic Co-operation and Development (OECD), virtually all have a pay-as-you-go system. Yet there is no immediately obvious reason why this might be so. Naive models of the adoption of a public pension program assume that a country chooses the most efficient method of saving for retirement. Following Aaron (1966), a nation adopts a social security system if its rate of return, equal to the population growth rate plus the productivity growth rate, exceeds the real interest rate. However, as Browning (1975) shows, a model of public choice in a democracy can yield inefficiently high levels of social security. Following Browning's seminal paper, there has evolved a vast theoretical literature that attempts to explain 1) why these transfers from young to old exist in democracies even when contributors outnumber recipients, 2) why, if there is a majority in favor of such transfers, the amounts are not even larger, and 3) what determines the enormous differences in these programs across countries.[1]

Empirical work must show which of the many models of public choice proposed in the literature are good approximations of the political process, in the sense of predicting future levels of public pension plans. Tests of the various models are also necessary to make a normative statement of whether the democratic process overshoots the optimal level of public pensions. Yet the general difficulties that complicate the testing of public choice models of economic policy are relevant to the public pension choice as well.

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[1] For a comprehensive survey of this theoretical literature, see Breyer (1994).

Time-series data for the United States do not help to answer these questions, since individual social security laws are complicated, and it is difficult to determine their long-run effects. Although U.S. social security provisions are unusual in that they are debated and amended every two years, in fact, there have been only five major legislated changes in the size of the program since 1950. Statistical inference based on the timing and magnitude of these five observations (as in Congleton and Shughart [1990] and Turner [1984]) must necessarily remain imprecise.[2] A cross-sectional analysis of the effect of congressional-district voting patterns on U.S. social security legislation offers its own difficulties. All that is observed are voting records for the bill as finally presented. Subsumed beneath the surface are the logrolling and party loyalties that went into crafting the final form of the legislation and collecting the votes needed for passage (or defeat). For example, in 1994, HR427 was passed, which restricted benefits paid to alcoholics or drug addicts under Social Security Insurance and made the Social Security Administration an independent agency. The vote was 413-0 for passage of the bill. It is unclear how one can test theories of public choice from such data.

This paper compares the behavior of similar countries over wide time intervals. To this end, we have assembled a data set that properly tests the correspondence of a country's underlying economic and demographic structure with the public pension outcome. We have chosen countries that are similar in their democratic processes and industrial structures both to emphasize the variables that are shifting over this period and to highlight their effect on the level of pay-as-you-go pensions. Observations in the data set are for OECD countries in the years 1960, 1970, 1980, and 1990. These large time intervals allow a country the leeway to change its social security program to the desired level even if the legislative process moves slowly. Of course, it is difficult to attribute the different outcomes in data from several nations to differences in the particular set of explanatory variables we have measured. We use several econometric techniques to

[2] Congleton and Shughart's analysis uses the size of the average benefit as the dependent variable for yearly observations. To the extent that benefits change without new legislation, the timing of the legislation becomes less important.

mitigate this problem and find a similar pattern of results regardless of the approach used.

The empirical work presented in this paper is a clear improvement over previous empirical tests of public choice theories. Unlike Tabellini's (1990) cross-section of 63 countries, our sample consists of nations that are quite similar in both their level of industrial development and their strong democratic political process. (Interestingly, it is within this subsample of countries that Tabellini's results are not all robust.) Compared to Rizzo's study of the post-war Italian experience or her examination of a single cross-section of OECD members (1990, chapter 7), our panel of countries provides far more precise estimates.

In section 2, we describe four models of public choice for social security, focusing on the empirical implications of each. We use a similar structure and the same notation throughout our discussion and do not presume to describe all the theories in the vast literature on public choice of public pension systems. However elegant or persuasive excluded theories might have been, our criterion for inclusion was that a theory must have an unequivocal empirical implication. We found this to be a very small subsample.

We then describe the data set we have gathered for this paper, paying particular attention to trends in the OECD countries and comparing the general patterns in this group with the better-known pattern in the U.S. social security program. Finally, we report the results of our tests and finish with some concluding remarks.

2. Four Models of Public Choice for Public Pensions

Each of the models discussed here is based on the common paradigm of public choice theory that participants in the political decision process vote to maximize their utility over lifetime consumption. All are compared to a benchmark case in which the single decisionmaker is a benevolent dictator, and all are similar in that they describe a small open economy where the wage and interest rate are exogenously given and constant over time, and where workers supply one unit of labor to the market. The models cover

an infinite number of discrete time periods t (t = 0,1,2,...), with the distance between two adjacent points corresponding to the age difference between two subsequent generations. The term "generation t" refers to the group of individuals who are in their first working age in period t. Only persons in this age group can have children. If M_t is the reproduction rate of the society in period t-1 (i.e., the ratio of the number of people in generation t to generation t-1), then a sequence of numbers M_t (t = 1,2,...) describes the population path.

If τ_t is the per capita contribution of workers to the unfunded pension system in period t, then the payment to each pensioner is

(2.1) $P_t = \tau_t M_t$.

Each worker's and each pensioner's consumption (where c_t is a worker's and z_t is a pensioner's consumption in period t, and s_t is a worker's savings) is

(2.2) $c_t = w - \tau_t - s_t$ and

(2.3) $z_t = Rs_{t-1} + P_t$.

Pensioners do not save, since there is no bequest motive.[3]

We test the following four models: a) benevolent dictator, b) direct democracy with majority rule, c) horizontal redistribution, and d) rational family.

a. Benevolent Dictator

A benevolent dictator model compares the rates of return on contributions to a pay-as-you-go system (i.e., the population growth rate plus the growth rate of wages due to technical progress) to the rate of return on capital, which equals the interest rate. In a world of uncertainty, capital has the additional disadvantage of providing no protection against unanticipated inflation. Therefore, a benevolent dictator would choose a larger unfunded system, the higher the sum of the rates of population growth and productivity

[3] Some results rely on the continuous-time model, a different and mathematically more complex version of the theory in which each individual lives for A periods as a worker and for T-A periods as a retiree.

growth relative to the rate of interest, and the higher (and more volatile) the inflation rate.

The same conclusion holds for any model in which politicians behave as if they maximize a weighted sum of the utilities of the citizens, as they do in Verhoeven and Verbon (1991).

b. Direct Democracy with Majority Rule

In the simplest public choice model of Browning (1975) and Greene (1974), each person votes for the pension system that promises the largest lifetime utility. The major two assumptions of this model are 1) the voter believes that the program he votes on will continue at least until he retires, and 2) liquidity constraints prevent borrowing against the value of future pension claims.[4] The voter's beliefs are, in an important sense, irrational in this model. If demographic changes occur, then there is strong evidence that the new voting structure will imply a different contribution level from the one currently being voted on. Thus, voters believe in a system that is not even consistent within the context of their own model. Sometimes, as in Browning (1975) and others, this irrational expectation is defended on the ground that voting takes place infrequently, ensuring stability of the benefit.

We discuss the model in a continuous-time version. In this case, the desired contribution level from a voter's point of view increases monotonically with age; thus, the median voter is generally an older worker. An increase in the population growth rate has two separate effects: [5] First, the median voter becomes younger, which tends to depress the equilibrium contribution level. Second, the population growth rate becomes higher, which increases the growth rate of the economy. From this second effect, the

[4] Browning's model and other similar ones that followed (e.g., Boadway and Wildasin [1989]) use this assumption to explain that the program size is not even higher. An alternative explanation would be that present voters take into account the negative effects of too-high contribution rates on the work effort of future generations.

[5] The comparative-static implications of this type of model have been examined by Townley (1981) and Wickström (1984) for the case of a constant growth rate.

contribution level desired by an individual voter will increase (stay constant, decrease) if the elasticity of the marginal utility of consumption exceeds (is equal to, falls short of) unity in absolute terms.

Thus, the effect of a change in the reproduction rate on the level of social security contributions in a direct voting equilibrium is indeterminate. Also, the change in the size of the desired pension *benefit* following an increase in the reproduction rate can be positive even if the change in the contribution level is negative, since the rate of return rises. Furthermore, an increase in the rate of productivity growth differs from an increase in the rate of population growth insofar as it raises the rate of return to pay-as-you-go pensions without decreasing median voter age. Therefore, although the effect of the reproduction rate on the optimal values of τ_t and P_t is indeterminate as such, it should be equal to the conditional effect of a change in M_t, holding median voter age constant.

c. Income Heterogeneity and Horizontal Redistribution

In some public pension systems, notably that of the Netherlands, retirement benefits are practically the same for every retiree, whereas contributions are collected from workers in strict proportion to their wage income. This feature is used by Tabellini (1990) in a two-period overlapping generations model with no intertemporal dependence of contribution rates. Hence, the results would hold even if there were no future after the period under consideration, meaning that the model is essentially static. The society consists of a number of retirees ("parents"), each of whom has the same number of working-age descendants. There is mutual altruism between parents and descendants, but it is so weak that, in the absence of a social security system, private transfers are zero in either direction. However, workers are allowed to save for their retirement consumption as well as to borrow against future pension benefits.

Workers differ with respect to their wage incomes, and thus a flat-benefit, proportional-contribution social security scheme involves a transfer from workers to pensioners and from high-income to low-income earners. If voted on in isolation, the

first kind of transfer would be accepted by all pensioners and rejected by all workers, since the ratio at which a worker's gift is converted to a benefit to his parent is the same as in private transfers, and, by assumption, altruism is so weak that these are ruled out. In contrast, the second kind of transfer, if available on its own, would be accepted by all families with below-average income earners and rejected by everyone else.

Because the two types of transfers are available only in combination, voters' preferences with respect to alternative contribution rates can be determined in the following manner: Among workers, the median-income voter will definitely reject any positive tax rate τ_t, but below a certain income threshold (which is lower than the median), workers will prefer positive taxes because the ratio of their taxes to their parent's retirement benefits becomes favorable. Moreover, the lower the income, the higher is the optimal value of τ_t. Conversely, while the parent of a median-income earner will favor a positive tax rate, the tax rate desired by a pensioner will be a declining function of his descendant's income, and above a certain threshold, the optimal τ_t will be zero.

Consequently, there is a value of the tax rate, τ_t^*, such that exactly half the voters (i.e., more than 50 percent of pensioners but less than 50 percent of workers) would prefer a higher and half would prefer a lower tax rate. Because of the single-peakedness of individual preferences, τ_t^* constitutes a political equilibrium. Tabellini (1990, section 5) shows that, among other influences, a *positive* value of τ_t^* is more likely (and, if positive, its value is larger), the greater the pre-tax income inequality and the lower the population growth factor M_t (the ratio of young to old voters). Thus, a higher median voter age would reflect a slower growing population and a larger program.

d. Rational Family

All the above models of democratic decisionmaking on public pensions are based on the assumption that each voter, before casting his vote on a particular proposal, behaves rationally by comparing the costs and benefits accruing to himself alone. In this comparison, private annuities are considered to be the only alternative to mandatory public pension plans on a pay-as-you-go basis. Breyer and Schulenburg (1987, 1990) propose an alternative model of majority voting on a mandatory public pension scheme in which each family is treated as a decisionmaking unit. Here, a different type of social contrivance is considered as an additional substitute to public pensions, namely, the within-family pay-as-you-go system. For a given family, this approach will provide a higher rate of return than the nationwide system if the ratio between workers and pensioners within the family itself is higher than in society at large.

The demographic structure of the society is described by the following assumptions. Each individual lives for three periods (as child, worker, and pensioner). Therefore, in any period t, society is composed of members of three different generations. Each worker can have up to two children, where the probabilities of having one or two children, q_t and p_t, are time dependent but do not differ across members of the same generation. For society as a whole, the individual fertility probabilities can be interpreted as relative frequencies. Thus, in period t, the *reproduction rate* of the population (the average number of children per working-age person) is given by

$$(2.4) \quad M_t = 2p_t + q_t.$$

If a "family" is defined as a group consisting of one pensioner and all his direct descendants, then the assumptions mentioned above imply that in every period, there are nine types of families that differ in their generational composition, the relative frequencies of which depend on the fertility parameters of the present and previous interval.

Analysis of the voting process is simplified by the assumption that in each period, there is just a *yes-no* decision on the existence of a mandatory public pension scheme, but

no decision on the level of contributions and benefits. Instead, it is assumed that as long as such a system survives, the contribution per worker is fixed at τ, whereas the retirement benefit is determined endogenously by obeying the budget equation for the pension plan.

All workers and pensioners are eligible to vote in this direct-majority decision, and it is assumed that all members of a specific family type will vote for abolishing the system if the discounted value of all present and future contributions from family members exceeds the corresponding value of their total retirement benefits.

What is interesting for our purposes is, first, how the percentage of "no" votes behaves when M is decreased, holding the distribution of children constant. Surprisingly, this percentage does not fall monotonically, so an equally clear-cut result as in most of the models discussed above does not emerge. What can be said, however, is that for steady-state populations, a majority of votes *always* goes against the pay-as-you-go system if the population is shrinking ($M < 1$), whereas this is not the case if it is growing ($M > 1$), as long as children are fairly evenly distributed. Furthermore, the percentage of "no" votes is larger the more unevenly children are distributed, i.e., the greater is the variance of the variable "number of children in a family" in the society.

With respect to the other important determinants of voter behavior, the interest rate and the rate of productivity growth should play the same role as in the benevolent dictator model, since the capital reserve system remains as a second alternative to the public pay-as-you-go system. Predictions resulting from the respective models are summarized in table 1.

3. Empirical Results

3.1 Description of the Data

Theories of social security determination offer unique problems in empirical testing. Unlike a community tax, where different regional observations are possible,

social security is decided at the national level. An observation must reflect the voting of the entire economy. Yet, unlike the money supply, for example, a social security program rarely changes, making the use of frequent time series for a single economy problematic. Our solution is to use a set of similar economies. The low frequency allows us to assume that the parameters for the economy are exogenously given to the voter. Over a 10-year span, it is assumed that voters have enough time to change the program to reflect the outcome of the public choice mechanism. The years chosen are 1960, 1970, 1980, and 1990, which enables us to use detailed demographic data from the decennial censuses that many countries conducted during these years.

We use OECD data for a variety of reasons. First, more data are available from these than from other countries, and the information is more reliable and more comparable between countries than in a data set with more diverse nations. Also, the political regime is generally democratic in these countries, with a few exceptions that we exclude from the sample. This allows us to interpret the public pension program as an outcome of the democratic process.

We measure the size and structure of a pay-as-you-go system along several dimensions, amounting to five different dependent variables. We use total social security tax contributions, total benefits paid, and total pensions paid by the government (all as a fraction of GNP) to measure the size of the program. We also use total benefits per person over age 60 and total pensions paid by the government per person over age 60 (both in thousands of 1982 U.S. dollars) to determine the benefit received by each pensioner.

Each of these measures has advantages and disadvantages. The terms *social security contributions* and *social security benefits* can have a variety of meanings to different countries at different times. Most countries include a measure of the cost of medical insurance for the elderly in these data. This is clearly a general transfer from the young to the old and represents much of the outcome of a public choice mechanism that

would determine the size of the social security program. However, the reported figures for social security contributions and benefits have the disadvantage that the variance in the definition of the program creates noise and makes estimates less precise.

Contributions and benefits do not include such items as military retirement benefits, railroad retirement funds (in the United States), or civil service pension benefits. The public pension data do include these figures, but do not encompass medical transfers to the elderly. While programs such as military retirement are a transfer to older people, the transfer is not sufficiently general to match most public choice models of social security. In this sense, public pension data are less useful than contributions and benefits. They have the additional disadvantage of being unavailable for 1990.

Our data set also includes the percentage of social security tax paid by employers via a hidden employment tax. This variable may account for the fiscal illusion common among voters of not counting employer contributions as a cost of the program. Over the full sample period, each dollar of social security tax paid by U.S. workers was matched by a dollar contributed by employers (50 percent of the total tax). Australia and New Zealand, which paid for social security out of general tax revenues, were the only OECD countries not to fund social security with a designated tax.

Table 2 presents the changes in several measures of the public pension system for our sample of 20 countries.[6] The same variables for the more generally known program in the United States are also shown for comparison. Benefits and contributions measured as a fraction of GNP rose dramatically during this period for both the United States and the OECD sample as a whole. The experience in the United States was consistent with that of the rest of the OECD countries in that the largest growth in the program occurred from 1980 to 1990.

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[6] The countries are Australia, Austria, Belgium, Canada, Denmark, France, West Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

Over the entire sample period, the mean values of contributions and benefits as a share of GNP for the OECD mask great variations in the time-series patterns within a country. Although public pensions as a fraction of GNP rose for each country with the passing of every decade, some nations actually cut the size of their program when measured by contributions or benefits as a fraction of GNP. Others saw explosive growth in social security during the 1980s, while still others matched the time-series pattern of the United States. Thus, there is large within-country variation in the size of public pension programs. This is true for the benefits per capita and benefits per pensioner measures as well. The U.S. program, at between 6 and 7 percent of GNP in 1990, is relatively small compared to those of most other OECD countries. In 1985, the size of public pension expenditures ranged from 2.1 percent of GNP in Portugal to 14.5 percent of GNP in Austria. Social security contributions showed the same wide range in 1990, running from 2 to 17 percent of GNP.

The percentage of social security financed by employers is as large as it has ever been, on average. Again, the pattern varies from country to country. Belgium, for example, cut the fraction paid by employers between 1960 and 1970 and then increased it between 1970 and 1990, while Canada increased the fraction between 1960 and 1970 and cut it thereafter. In short, the 20 countries show wide variation in all dimensions of their public pension programs. This is true not only in terms of absolute levels, but also in terms of time patterns within each country. Clearly, there are differences in the data that the theories need to explain.

Research suggests that a number of explanatory variables should be important in determining the size of a public pension program. The demographic situation of a country is represented by two variables: age of the median voter and ratio of the 40- to 60-year-old population to pensioners, which is an approximation of the variable M_t.[7]

[7] The variable "ratio of population 20 to 40 years of age to population 40 to 60 years of age," which approximates M_{t+1}, is highly correlated with median voter age and thus

This reflects the shape of the age distribution above the age of the median voter. (The mean of the median voter age is 42.) If this number is high, then the distribution above the median voter is more concentrated toward the working population (and less toward pension recipients), if one holds the median voting age constant.

The interest rate, growth rate, and inflation rate are all represented by five-year averages of the five years preceding and including the year of observation. The interest rate is the real rate on the longest government security for which data are available, the growth rate is the real growth rate of GNP, and the inflation rate is the growth rate of the Consumer Price Index. These variables, plus those describing the size of the public pension system, could be obtained for 76 core observations representing 20 countries.

The variables measuring variance of children and variance of income are less straightforward. We found limited household data on the proportion of the population living in households of four or less for 56 of the 76 core observations.[8] This turns out to be a good approximation for the variance of household size within a population, as a closely fitted regression suggests.[9] We measure income inequality via the Gini coefficient, which has been shown to be closely related to the variance of income in the OECD countries.[10] The Gini coefficient is calculated on the basis of pre-tax income for 51 of the 76 core observations.[11] All variables are included in a sample of 44 observations. Means and standard deviations of our sample are reported in table 3 for the 76 observations.

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cannot be included in an equation with the two other demographic variables.

[8] Richer household size data are not available for many observations.

[9] The regression is PROPORTION IN HOUSEHOLDS OF SIZE 4 OR LESS = 1.03 - .1313 VAR (HOUSEHOLD SIZE), with an R^2 of .89 (t-stats are under estimates).
(39.6) (16.5)

[10] See Sawyer (1976).

[11] Of course, a problem connected with both the Gini coefficient and the share of the population living in households of four or less is that both are affected by the size of the public pension program (the latter because public pensions increase the independence of the aged) and thus are not necessarily exogenous.

3.2 Estimates

The estimation procedure breaks the error term into a classic components scheme:

(3.1) $P = X\beta + e_i + e_{it}$,

where P is public pension size, β is the vector of parameters of interest, X is the explanatory variable matrix, e_i is the country-specific unobserved error, and e_{it} is a random error uncorrelated with X. If e_i is assumed to be uncorrelated with X, then we use a random-effects estimator for β.[12]

Because the random-effects model is heavily influenced by international variation in the variables, we call these estimates explanations of cross-country differences in public pension programs. If e_i is assumed to be correlated with X, then a fixed-effect estimate of β is more appropriate, and we call these estimates explanations of within-country differences in public pension programs. Our prior belief was that the within-country estimates are more reliable tests of which public choice models are supported by the data, because each country has a distinct set of institutions and data measuring conventions and procedures, which are likely to be correlated with some of the elements of X. For example, the Gini coefficient is calculated from income figures based on tax returns from the individual countries. Some countries treat the family as the basic unit of taxation, while others tax the individual. Clearly, this error -- a component of the individual country effect e_i -- will be correlated with the Gini coefficient.

This prior belief is not supported by the data, however. The last rows in tables 4 and 5 include p-values for the Wald test of the hypothesis that the data could have been

[12] Both the random-effects and fixed-effects estimates are modified to be consistent and efficient given the unbalanced panel design, where some countries include more observations than others. Estimates of the standard errors are also modified to be efficient and consistent under any reasonable assumption about the time-series structure of the error term, $COV(e_{it},e_{i\,t+s})$, for any value of s.

generated by a random- rather than a fixed-effects model.[13] The high values listed here should not be interpreted as evidence that the random-effects model provides more reliable estimates than the fixed-effects model, but rather as a sign that our data do not provide precise enough fixed-effects estimates to distinguish between the two models statistically. The main reason for this appears to be the loss in degrees of freedom in a fixed-effects estimation, considering the relatively limited sample size.

The dependent variables, which measure the size of the public pension program, include total benefits as a fraction of GNP and benefits per pensioner.[14] Table 4 contains estimates of the former and table 5 includes estimates of the latter. We report estimates both from the full sample of 76 observations, which does not have observations for the household size variable or Gini coefficient, and from the reduced sample of 44 observations, which includes all of the explanatory variables.

The most striking result in table 4 lies in the strong and significant positive effect of median voter age on program size. This empirical pattern is consistent with only two of the theoretical models discussed in section 2 -- the majority voting model of Browning and the horizontal redistribution model of Tabellini.

Holding median voter age constant, the nondemographic variables contribute considerably to explaining differences in the size of the pay-as-you-go system. In the benevolent dictator model, efficiency considerations predict that increasing the economy's long-run growth rate should have a positive effect, that increasing the long-run interest rate should have a negative effect, and that increasing the inflation rate (and thus the variability of return on the competing real capital assets) should have a positive effect on the public pension program. Table 4 shows that the estimates are consistent with these

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[13] This test, first suggested by Hausman and Taylor (1984) in a balanced panel design, has been modified to reflect the unbalanced design of our data.

[14] Equations with the dependent variable "contributions as a fraction of GNP" yield essentially the same result as those with the dependent variable "benefits as a fraction of GNP."

conjectures, with one exception. The effect of rising interest rates on benefits as a fraction of GNP is insignificant in the full sample and negative and significant only in the reduced sample.

Column 3 shows that, given median voter age, the size of the program increases significantly with the ratio of pensioners to older workers. This effect might have a public choice explanation: Political decisionmakers in a representative democracy are responsive to constituencies with a large fraction of pensioners even if these constituencies are not pivotal in forming a majority *on this particular issue*. However, the significance of this variable suggests that public choice theories which rest solely on the age of the median voter are not rich enough to describe the determination of the size of the public pension program. The mapping between the age distribution of the electorate and program size clearly relies on aspects of the distribution other than its median.[15]

The last two columns of table 4 contain the results for the reduced sample, which can be used to test the last two theories.[16] A Gini coefficient increases with the variance of income, which the horizontal redistribution theory predicts should have a positive effect on the size of the public pension program (if indeed this has a redistributive nature). Unlike Tabellini (1990), we think that the best way to test this proposition is to include an interaction term ("Gini coefficient for a flat benefit rate"), defined as the product of the Gini coefficient and the dummy variable, which is 1 when the program provides a flat benefit, and 0 otherwise. Column 4 shows that this variable has the predicted positive sign and is not quite significant at the 10 percent level, whereas the Gini coefficient itself is insignificant (which is clear from column 5). Thus, this finding provides weak support for the horizontal redistribution model as an explanation

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[15] The variable "fraction of contributions paid by employer" is insignificant. Including it, however, has no effect on the other estimates.

[16] Results from regressions that include M_t as a right-hand variable yield essentially the same results, except that standard errors are wider.

of the size of the public pension program: Countries with a flat benefit schedule have larger public pension programs when there is more heterogeneity in income.[17]

The family voting model predicts that an increase in the variance of the number of children should decrease the size of the public pension program. Greater variance in the number of children is associated with a decrease in the proportion of people living in households of four or less, so that the family voting model predicts that this variable should have a positive coefficient. Indeed, the cross-country estimates show this variable to be positive and significant.

Table 5 contains the estimates with respect to the dependent variable "benefits per person over age 60." This variable is also positively related to median voter age, although the effect is now generally insignificant. This result is due to the strong negative correlation between median voter age and the proportion of pensioners in the population, which by itself reduces benefits per pensioner, as shown in equation (2.1). In the full sample, the effects of the other three variables related to the relative rates of return of the two alternative pension financing systems have the sign predicted by the benevolent dictator model in the random-effects estimation, whereas in the fixed-effects estimates, only the inflation rate is significant and of the predicted sign. The ratio of pensioners to older workers has no significant effect on benefits per pensioner.

All estimates of the time trend clearly indicate that the size of the public pension program experienced a secular increase. In fact, this result is the strongest of all our findings. The secular tendency for public pension programs to grow, even after accounting for the usual suspects of growth in income or a change in demographic structure, is puzzling. One is reminded of the crude political arguments against social security in the 1930s, when opponents predicted that government programs would grow on their own. Indeed, the coefficient of the time trend is usually about 0.002 when

[17] The countries with flat retirement benefits are Australia, Ireland, the Netherlands, and New Zealand.

"benefits as a fraction of GNP" is the dependent variable. This means that, ceteris paribus, each decade has seen a secular increase of 2 percent of GNP in the size of the pay-as-you-go system, making social security the kudzu of government programs.[18] Another possible explanation for the strong positive time trend is that social security programs were phased in gradually. In Norway, for example, claims to benefits are to some extent related to previous contributions.

Finally, the coefficient on average income displays a robust pattern with respect to the data set and estimation technique. As income per capita increases, the proportion of benefits in GNP falls and the benefit per pensioner rises. Thus, if the public choice mechanism expresses a demand for public pensions, the total public pension is a normal necessity.

4. Conclusion

From the many models of public choice of social security, we have listed a subset that contains empirical predictions along with the expected sign of the explanatory variables. The bottom line of the exercise is that none of the theories is strongly rejected when confronted with data that should be well suited to measuring its predictions. OECD data support the Browning majority-voting model in its most definite prediction -- that median voter age has a positive impact on retirement benefits as a fraction of GNP. Given median voter age, estimates of variables measuring the efficiency of the public pension program vis-à-vis the competing capital markets generally support the intuition provided by a benevolent dictator model. Higher growth rates are associated with larger public programs, whereas higher real interest rates are associated with smaller programs.

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[18] A specification that uses a dummy for each time period has essentially the same results reported here. Further, the linear specification of a time trend follows the pattern of the time dummies very well for the fixed-effect estimates. For random-effect estimates, the pattern of the time dummies shows greater change in the program between 1970 and 1980 than during the other intervals.

The model proposed by Tabellini, which emphasizes the intragenerational transfers implicit in many social security programs, gets only weak support for its central prediction, namely, a positive impact of income heterogeneity on the size of these programs. Family voting, by contrast, gets confirmed with the caveat that we can measure its most important explanatory variable -- variance of children -- only indirectly.

The strongly positive time trends pose a further puzzle for theories of public choice. Why did public pension programs experience a secular increase during this period that was not accounted for by demographic, financial, or inequality factors typically considered to be predictors of program size? What mechanism or underlying change in the structure of the OECD countries can explain the positive time trend?

Clearly, theories can be formulated that account for the empirical patterns found in our research. To explain the coefficient patterns of the demographic variables, one might investigate a model in which generations feel responsible for the care of only their immediate parents. A challenge for public choice theory is to develop a model that is consistent with our empirical findings, that has additional empirical hypotheses to which it can be subjected, and that has strong predictions which can aid in policymaking. Even in the absence of such a model, however, our work has pointed to several predictions in a reduced-form context. Shrinking populations, if they mean a reduction in the size of the young cohort relative to the elderly, should increase the size of the social security program. Events that heighten the efficiency of the public pension program relative to a private savings alternative, whether an increase in the economy's long-run growth rate, a decrease in the interest rate, or an increase in the rate of inflation, should also boost the size of the program. Finally, we find a disturbing secular tendency for public pension programs to rise rapidly both as a share of GNP and in terms of the average benefit paid.

Data Appendix: Sources

1. Demographic variables, such as population size, are taken from various issues of the *United Nations Demographic Yearbook.* This is also the primary source for the household size variable, although where possible, it is supplemented with data from demographic yearbooks of the individual OECD countries.

2. The growth rate, GNP, inflation rate, and interest rate are computed from the *International Monetary Fund Financial Statistics* series on CD-ROM. The interest rate is the five-year average of the longest rate available on the disc. Price data are supplemented by purchasing-power-parity figures taken from the OECD publication *Purchasing Power Parity in the OECD, 1986.* When this clearly makes no difference in our results, we use simple exchange-rate data from the CD-ROM.

3. Contributions and benefits for social security programs come from a variety of sources. The primary source is the OECD publication *National Accounts, Detailed Tables.* However, these data were augmented where necessary with information from various publications, including statistical yearbooks for individual countries. In addition, we use data on the size of public pension programs reported in the OECD study *Reforming Public Pensions, 1988*, which was made available to us by the OECD.

4. Descriptions of the individual public pension programs are largely taken from various issues of *Social Security Programs around the World,* published by the U.S. Social Security Administration.

5. Sawyer (1976) is a primary source for the Gini coefficients. In addition, we use tax data from two OECD publications: "Income Tax Schedules -- Distribution of Taxpayers and Revenues," in *OECD Studies in Taxation, 1981;* and "The Personal Income Tax Base: A Comparative Study," in *OECD Studies in Taxation, 1990.* We also use data from the World Bank's annual *Yearbook*, and statistical yearbooks from individual countries when they are available and contain income distribution or tax data.

References

Aaron, H. (1966), "The Social Insurance Paradox," *Canadian Journal of Economics and Political Science,* 32: 120-145.

Boadway, R., and D.E. Wildasin (1989), "A Median Voter Model of Social Security," *International Economic Review*, 20: 307-328.

Breyer, F., J.-M. Graf v.d. Schulenburg (1987), "Voting on Social Security: The Family as Decision-Making Unit," *Kyklos,* 40: 529-547.

Breyer, F., J.-M. Graf v.d. Schulenburg (1990), "Family Ties and Social Security in a Democracy," *Public Choice,* 67: 155-167.

Breyer, F. (1994), "The Political Economy of Intergenerational Redistribution," *European Journal of Political Economy*, 10: 61-84.

Browning, E.K. (1975), "Why the Social Insurance Budget Is Too Large in a Democracy," *Economic Inquiry,* 13: 373-388.

Congleton, R.D., and W.F. Shughart II (1990), "The Growth of Social Security: Electoral Push or Political Pull?" *Economic Inquiry,* 28: 109-132.

Greene, K.V. (1974), "Toward a Positive Theory of Intergenerational Income Transfers," *Public Finance,* 29: 306-324.

Hausman, J., and W.E. Taylor (1984), "Panel Data and Unobservable Individual Effects," *Econometrica*, 49: 1377-1398.

Rizzo, I. (1990), *The Hidden Debt*, Kluwer Academic Publishers, Dordrecht.

Sawyer, M. (1976), *Income Distributions in OECD Countries*, Organisation for Economic Co-operation and Development, Paris.

Tabellini, G. (1990), "A Positive Theory of Social Security," NBER Working Paper No. 3272, National Bureau of Economic Research, February.

Townley, P.G.C. (1981), "Public Choice and the Social Insurance Paradox: A Note," *Canadian Journal of Economics,* 14: 712-717.

Turner, Z.A. (1984), "Population Age Structure and the Size of Social Security," *Southern Economic Journal*, 50: 1131-1146.

Verhoeven, M.J.M., and H.A.A. Verbon (1991), "Expectations on Pension Schemes under Non-Stationary Conditions," *Economics Letters,* 36: 99-103.

Wicksträm, B.A. (1992), "Population Age Structure and the Size of Social Security," mimeo, University of Linz.

Table 1

Signs of Comparative-Statics Influences in

Public Choice Models of Social Security

		Independent Variable						
Model	**Dependent variable**	**Median voter age**	**M_t**	**Growth rate**	**R**	**i**	**v(ch)**	**v(inc)**
Benevolent dictator	τ_t	0	+	+	-	+	0	0
	P_t	0	+	+	-	+	0	0
Majority rule	τ_t	+	+/-	+/-	-	0	0	0
	P_t	+	(+)	+/-	-	0	0	0
Horizontal redistrib.	τ_t	+	-	0	0	0	0	+
	P_t	+	+/-	0	0	0	0	+
Rational family	τ_t	0	+/-	0	0	0	-	0
	P_t	0	(+)	0	0	0	-	0

\+ impact positive
\- impact negative
+/- impact indeterminate
(+) positive impact likely

M_t present (older) workers per pensioner
R long-run interest rate
i long-run inflation rate
v(ch) variance of number of children
v(inc) variance of income (Gini coefficient)

Source: Authors.

Table 2

Social Security Programs in the OECD

Social Security Measure	1960	1970	1980	1990
Full Sample -- OECD Countries				
Benefits per GNP	0.0633	0.0708	0.110	0.119
Contributions per GNP	0.0553	0.0634	0.0983	0.110
Public pensions per GNP	0.0462	0.0588	0.0924	---
Fraction paid by employer	0.457	0.383	0.400	0.580
Real benefit per capita	0.293	0.530	0.976	1.362
Real contribution per capita	0.265	0.466	0.869	1.271
Public pension per capita	0.228	0.433	0.810	---
Real benefit per pensioner	1.962	3.186	5.713	7.157
Public pension per pensioner	1.546	2.583	4.653	---
United States				
Benefits per GNP	0.0351	0.0453	0.0658	0.0709
Contributions per GNP	0.0400	0.0456	0.0608	0.0746
Public pensions per GNP	0.0410	0.0518	0.0681	---
Fraction paid by employer	0.500	0.500	0.500	0.500
Real benefit per capita	0.368	0.628	1.001	1.2970
Real contribution per capita	0.419	0.632	0.925	1.364
Public pension per capita	0.430	0.718	1.036	---
Real benefit per pensioner	2.783	4.450	6.608	7.735
Public pension per pensioner	3.252	5.086	6.841	---

Source: Authors' calculations.

Table 3

Means and Standard Deviations

Variable	Mean	Standard Deviation
Benefits per GNP	0.0902	0.0455
Contributions per GNP	0.0811	0.0511
Public pensions per GNP (53 observations)	0.506	0.387
Log real benefit per pensioner[a]	1.182	0.0871
Log real public pension per pensioner (53 observations)[a]	0.820	0.862
Ratio of 40- to 60-year-olds to elderly	1.437	0.0253
Median age	42.87	2.12
Long-run real interest rate	0.0178	0.0336
Long-run real growth rate	0.0436	0.0247
Inflation rate	0.0546	0.0422
Log real GNP per capita[a]	1.918	0.648
Portion households 1-4 (59 observations)	0.664	0.124
Gini coefficient (54 observations)	0.378	0.0760

a. In thousands of 1982 U.S. dollars.
Source: Authors' calculations.

Table 4

Dependent Variable:
Benefits as a Fraction of GNP

	(1)	(2)	(3)	(4)	(5)
Constant	-0.227 (2.659)	-0.331 (4.580)	-0.168 (2.027)	-0.381 (9.531)	-0.304 (6.883)
Interest rate	0.202 (1.254)	-0.133 (1.009)	-0.193 (1.447)	-0.619 (2.673)	-0.545 (2.407)
Real growth rate	0.103 (0.910)	0.267 (2.823)	0.238 (2.388)	0.546 (5.434)	0.402 (3.585)
Inflation rate	0.431 (2.456)	0.303 (2.382)	0.174 (1.254)	0.200 (0.856)	0.0766 (0.313)
Log GNP per capita	-0.033 (1.269)	0.00321 (0.772)	0.000405 (0.107)	-0.00903 (0.839)	-0.0190 (1.938)
Median voter age	0.00389 (2.235)	0.00589 (4.072)	0.00396 (2.761)	0.00519 (5.679)	0.00427 (3.969)
M_t (Ratio of 40- to 60- year-olds to elderly)	* *	* *	-0.0357 (2.953)	* *	* *
Time trend	0.00251 (3.372)	0.00195 (6.957)	0.00171 (5.929)	0.00152 (2.808)	0.00174 (3.684)
Gini coefficient for flat-benefit rate	* *	* *	* *	0.0616 (1.627)	* *
Gini coefficient	* *	* *	* *	* *	-0.0492 (1.310)
Portion households 1-4	* *	* *	* *	0.222 (3.582)	0.212 (4.591)
Number of observations	76	76	76	44	44
Error scheme	Fixed	Random	Random	Random	Random
P-value for random effects		0.462	0.305	0.775	0.267

Note: T-statistics are in parentheses under the estimated parameter.
Source: Authors' calculations.

Table 5

Dependent Variable:
Benefits per Pensioner

	(1)	(2)	(3)	(4)
Constant	-2.81	-3.47	-2.56	-4.33
	(2.615)	(3.811)	(2.690)	(6.358)
Interest rate	0.521	-2.88	-3.08	-7.15
	(0.292)	(1.683)	(1.928)	(2.741)
Real growth rate	2.8	4.45	4.52	6.54
	(1.487)	(2.895)	(2.991)	(3.465)
Inflation rate	6.58	4.77	4.5	3.76
	(3.063)	(2.598)	(2.455)	(1.263)
Log GNP per capita	0.462	1.08	1.05	0.855
	(1.612)	(19.796)	(21.092)	(6.167)
Median voter age	0.012	0.0262	0.015	0.0208
	(0.469)	(1.340)	(0.806)	(1.853)
M_t (Ratio of 40- to 60-	*	*	-0.226	*
year-olds to elderly)	*	*	(1.363)	*
Time trend	0.0301	0.0171	0.0164	0.0201
	(3.733)	(4.530)	(4.269)	(3.573)
Gini coefficient	*	*	*	-0.396
for flat-benefit rate	*	*	*	(0.713)
Portion households 1-4	*	*	*	2.210
	*	*	*	(3.534)
Number of observations	76	76	76	44
Error scheme	Fixed	Random	Random	Random
P-value for random effects		0.564	0.233	0.551

Note: T-statistics are presented in parentheses under the estimated parameter.
Source: Authors' calculations.