THE EFFECTS OF TAX SALIENCE ON THE SIZE OF PUBLIC PENSION PROGRAMS

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By

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Abstract

Public pension programs in many countries face dire fiscal futures, and policymakers need new tools beyond economically painful tax hikes and harsh and unpopular benefit cuts. Tax salience—the extent to which taxpayers are aware of the full economic cost of taxes—is such a tool, and it has been shown to be effective in altering behavior in the design of other tax systems. Social Security taxes are more salient when the employee pays a greater share directly, because the full cost of these taxes is generally believed to fall almost entirely on the employee, regardless of the nominal allocation. This thesis demonstrates that allowing employees to see a more full and explicit cost of Social Security by having employees pay a greater percentage of Social Security taxes produces a program that is smaller as a percent of GDP. Because smaller programs are less costly to sustain, this change in policy is advisable for all nations concerned for the financial future of their Social Security programs.
For David M. Walker, Donald Marron,
Barry Strumpf, Ben Harris,
and of course,
Mom and Dad.

Thanks.
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1 Introduction

As the advanced economies of the world have aged, they have been confronted more and more directly by the challenges of maintaining their social safety nets. Public pension programs in particular have faced sustainability issues. Many of these programs were designed in the early-to-mid-twentieth century, and were tailored to the demographic realities of that period. Those realities, however, have not held constant. Increased life expectancy has led to extended benefit periods. Combined with lower birth rates, longer lives have resulted in a population far older than the ones for which pension programs were designed, and far less able to bear the costs (Lindbeck 2006).

The financial crisis of 2008–2009 and resulting recession have increased the immediacy of the pension sustainability problem in several countries. In 2010, the Greek government was forced to raise its public pension retirement age two years, from 61 to 63. Announcing the cuts, Labour Minister Andreas Loverdos explained, “We are changing the pensions system in order to keep it alive.” Nonetheless, this reform and the other austerity measures it accompanied were met with fierce opposition (Hadoulis 2010).

Similarly, in France attempts to reform the pension system were met with protests and even with riots. The government headed by President Nikolas Sarkozy raised the retirement age from 60 to 62, and the age for full pension benefits from 65 to 67, setting off a firestorm of controversy that in some places even turned violent. Acknowledging the unpopularity of such reforms, President Sarkozy said, “I thought carefully before I decided to go ahead with pension reform. It had been put on hold for too long and could not be put on hold any
The looming pension crisis is not confined to Europe. In South Korea, the National Pension Reform Board has recommended that the contribution rate be raised over time from 9 percent to 19.1 percent to restore that nation’s National Pension System (NPS) to solvency. Absent this change (or some other, equally effective one), the NPS will run out of funds in 2040 (Moon 2001). Nor is the United States immune from pension system woes. The United States’ Social Security program ran a one-year deficit in 2010 for the first time since 1983. In addition, the Trustees of the US Social Security program now project that the Social Security reserves will be exhausted in 2037 (Board of Trustees 2010). These cases are not exceptional; public pension programs are being similarly challenged by unfavorable demographic changes wherever they exist. As pension systems start to send out more than they take in, the need for large tax increases, large benefit cuts, or some mixture of the two will be unavoidable to keep the programs financially afloat.

Piecemeal adjustments to taxes and benefits have, for the most part, kept pension programs afloat, but they have not guaranteed retirement security for future generations (Galasso and Profeta 2004). Neither tax hikes nor benefit cuts can be endlessly extended without severely hampering economic growth on the one hand, or failing to serve the purpose of a pension plan on the other. Those looking to achieve sustainable retirement security through public pension programs must look also to the structure of these programs as objects for reform.

One part of the pension program structure that deserves study is the collection of the
taxes through which those programs are funded. Different programs are funded in different ways, and the mechanisms through which pension taxes are collected are perceived differently by those who pay them. Salience, or perceptibility to the taxpayer, of pension taxes can be expected to have an effect on behavior of both policymakers and beneficiaries (Gabaix and Laibson 2006). The issue of tax salience has attracted increasing attention in recent years, and its manipulation to achieve public policy goals is still being explored. In general, a more salient tax decreases demand for a service because the apparent price increases. Finkelstein (2009), for example, found that less salient toll taxes significantly increased total toll tax revenue because more drivers chose to drive on toll roads. The usefulness of tax salience as a tool for decreasing demand for government pension programs—and therefore increasing their sustainability—is therefore a topic ripe for study.

This paper examines the hypothesis that nations with more salient pension taxes will have lower demand for public pension spending. This hypothesis is tested by calculating the effects of tax salience, as indicated by the portion of social security taxes paid directly by the employee, on two measures of the size of public pension programs: expenditures on old age and survivors benefits relative to GDP and expenditures per person of retirement age.
2 Literature Review

The question of salience in taxes is still a relatively new one, at least in terms of empirical evidence. Before the question of salience was even applied to public policy, it was examined in terms of commercial markets. Gabaix and Laibson (2006) studied what they labeled “shrouded attributes.” In theory, although not experimentally, they demonstrated that costs which are not immediately apparent to consumers will cause them to behave as though the actual costs for a good are lower than they really are, and that competition is not always sufficient to counteract this effect. They argued, for example, that a firm might exploit naive consumers by offering a rebate which those consumers are unlikely to redeem. Furthermore, these firms will be exploited by sophisticated consumers who immediately redeem the rebate. Competition does not resolve the problem because a firm can set the rebate at or above the price advantage of the cheaper good.

Similarly, Hossain and Morgain (2006) considered the effects of shipping and handling costs on demand. Hossain and Morgain conducted paired sales of CDs and video games on the online auction site eBay. One item in each pair would have a higher starting bid, but lower shipping and handling. The other item would have a lower starting bid, but higher shipping and handling costs. They found that the lower-bid, higher-shipping items attracted more bidders and more revenue. While Hossain and Morgain are perhaps too brief in their dismissal of other contributing factors (particularly the game-like incentive they label “the love of winning”), their findings are consistent with the idea that salience of prices affects behavior.
Chetty, Looney, and Kroft (2009) took up the specific question of tax salience by empirically testing behavioral responses to commodity taxes. Observing the effects of posting prices including sales tax as opposed to posting the pre-tax price, the authors found that demand decreased by approximately 8 percent when taxes were included. They argued that their results could be explained by the introduction of variables representing the mental cost of calculating actual price which offset the benefit of determining the optimal output. Moreover, they noted that demand was less when consumption taxes were included in the posted price, despite the fact that many consumers were well-informed about the applicable sales tax level, and about its applicability to different items. They concluded that the difference in salience primarily caused the drop in demand, and suggested that future studies on the behavioral response to taxes needed to take salience into account.

Finkelstein (2009) carried out another important experiment in tax salience when she observed toll rates in regions which employed electronic toll collection (ETC) cards, such as the E-ZPass system. ETCs, she argued, decrease salience of tolls by preventing the need for drivers to physically count out toll amounts. Observing toll rates across 123 stations in the United States before and after the introduction of ETC systems, she found that tolls were between 20 and 40 percent higher after the introduction of ETCs than they would have been under a wholly manual toll system.

Saez (2009) observed that tax filers bunch at the first “kink point” created by the earned income tax credit (EITC). These kink points occur when the marginal effect on the increase in income changes because of the EITC means-testing formula, most notably when the phase-
in is complete and when the phase-out begins. Saez noted that, while tax filers tended to
bunch at the first kink point, they did not do so at later kink points. He concluded that this
phenomenon occurred because the first kink point was far more salient than later ones—
its effect was felt most directly by the tax filer. Chetty and Saez (2009) further studied
salience in the context of the EITC in a randomized experiment among tax filers at H&R
Block. Filers assigned to the treatment group were given a two-minute summary of the
EITC program. Chetty and Saez found that this information caused a significant increase in
bunching at the first EITC kink point among filers in the treatment group, demonstrating a
reaction to perceived—as opposed to actual—tax and benefit levels.

Mulligan, Sala-i-Martin, and Gil (2010) obliquely approached the question of tax salience
and pension programs in an article examining the relationship between democracy and pen-
sion programs. Their major finding for that study was that the fact that a government was
democratic did not translate into larger public pension programs. One of the variables they
considered, however, was the employee share of the payroll tax, which is an indicator for
salience. Mulligan, Sala-i-Martin, and Gil found that democracies were likely to put slightly
more of the explicit tax burden on the employee; however, they did not formulate any general
observations about the connection between payroll tax share and the size of Social Security
programs.

Mulligan, Sala-i-Martin, and Gil’s paper is typical of the traditional method of trying
to explain the variations in size of public pension programs by analyzing the distribution of
political power. Tabellini (2000) looks at Social Security programs as a means of redistri-
bution, both within and between generations. Comparing data across countries, he found that public pension programs were larger both in countries that had larger proportions of the population aged 65 or over, and in countries with larger wealth disparities. Tabellini suggests that the dual redistributive effect of public pension programs produced natural political constituencies for such programs among the elderly and the poor. This argument, especially as regards the elderly, is broadly representative of the political economy narrative of pension programs.

Perotti and Schwienbacher (2008) also consider political determinants for the size of pension programs. They present a model for the size of Social Security programs which takes into account the economic circumstances of nations between 1900 and 1970, the period in which most pension programs were created. In particular they consider whether periods of extremely high inflation before the creation of such programs was likely to affect their eventual sizes. Comparing data across countries, they find that those nations which had experienced high inflation made policy choices which led to larger programs. They argue that these choices were made because of the loss of political faith in private retirement schemes, which can suffer greatly in high-inflation periods.
3 Conceptual Framework

This paper examines the relationship between pension tax salience and the demand for pension benefits. Tax salience is a particular subset of the more general price salience, which is a measure of what portion of the true price for a good or service is directly apparent to the consumer. When a price is made less salient, consumers believe that that price is lower than it actually is, because some portion of that price is “shrouded.” Consequently, consumers react in the same way that they would to a lower price: by increasing the quantity purchased. Quantity is therefore increased even though the true supply and demand curves have not changed at all.

Studies of tax salience apply this same mechanic to government services, which are paid for by taxes. Rationally, one would expect more demand for services from the government if the price—i.e., the tax rate—is lower. A less salient tax would appear lower to taxpayers, and taxpayers would therefore be expected to react by increasing demand for those services. Less apparent taxes might also have other effects particular to the arena of government, such as increasing public tolerance for expensive programs from which some portion of the tax base receives little or no benefit. These other effects, however, are less relevant in the study of pension programs because these programs sometimes present themselves as a mandatory savings program, partially analogous in appearance (if not in actual mechanics) to a private-sector pension.

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1It is possible, of course, for a less salient tax policy to cause taxpayers to respond as if taxes were higher then they actually are. The expected effects would therefore be reversed.

2This analogy is by no means perfect. Public pension programs are seen as a redistributive form of social insurance as well as a mandatory savings program, and different countries and cultures stress different goals for their programs. Many taxpayers, however, see a direct connection between money paid in every month,
If less salient taxes increase the demand for government services, it would follow that less salient pension taxes would increase the demand for pensions, all other things being equal. Social Security taxes are usually split between the employee and the employer. Most economists believe, however, that all or nearly all of the burden of these taxes are shifted back from the employer in the form of wage reduction and falls entirely on the employee (Gruber 1997). Put simply, an employer sees a cost for each employee, which consists of wages, benefits, taxes, and any other costs. A rise in taxes does not alter the employer’s demand or willingness to pay for a worker, and so the employer is willing to pay some amount less in benefits and wages that is roughly equivalent to the difference in taxes. This understanding of Social Security tax incidence is supported by a long literature. Gruber (1997), for example, found that payroll tax decreases in Chile were reflected entirely in wages and not at all in employment.

The example of the United States can illustrate this concept. U.S. Social Security taxes are assessed at 6.2 percent of wages both to the employer and to the employee up to a certain cap. In the United States, the cap for 2010 was $106,800 (Board of Trustees 2010) A worker earning $10 an hour pays 62 cents in Social Security taxes, as does the employer. In reality, however, this indicates that the employer is willing to pay $10.62 for that employee, of which the employee loses $1.24 because of Social Security taxes—a true loss of 11.7 percent. What taxpayers think of as a good deal for 6.2 percent of their paycheck would probably seem far less favorable at the higher rate, leading taxpayers to push politically for a smaller program and seek out more favorable private sector alternatives. This paper tests the hypothesis that and the money they collect at the end of their careers, and to that degree the analogy is illuminating.
more salient pension taxes result in less demand for public pensions, all else equal.
4 Data and Methods

4.1 Data

The primary source of data for this paper is the Organization for Economic Co-operation and Development (OECD). The OECD collects data on its member-states and other nations for the purposes of statistical analysis through an exhaustive annual questionnaire completed by the governments of the member-states, and this data is widely considered to be authoritative. The OECD data is extensive; statistics are collected on economic indicators, national accounts, finance, health, labor, the environment, and many other attributes of the OECD’s members. Data on social expenditures originates from the OECD’s Social Expenditure Database (SOCX). SOCX collects data from individual governments except those in the European Union. For EU nations, SOCX uses EU-maintained statistics as verified by local governments. As its name suggests, SOCX collects data exclusively on various types of social expenditures by government, including welfare, education, health, and old-age programs.

Macroeconomic data is available from the OECD to cover the period between 1950 and the present. Data does not exist, however, for all nations in all years; most nations begin reporting in some year after 1950 and continue annually thereafter. The same phenomenon exists, although to a lesser degree, with the SOCX data, which covers from 1980 to the present. The data can be safely combined because SOCX uses OECD data as its reference set. The most important limitation of the combined data set is unreported data; however, this problem is small for the years and countries being studied, and is therefore unlikely to
cause significant bias in the results.

Data on the year in which public pension programs were established is collected from the Social Security Programs Throughout the World series published by the US Social Security Administration in collaboration with the International Social Security Association (ISSA). These publications are updated biannually, with one of four volumes being updated every six months. Updates are based on surveys carried out by ISSA (Social Security Administration 2011). Because the only data being used from this source is the year in which programs were established—a matter of historical record and not prone to measurement error—it is appropriate to combine it with the OECD data.

4.2 Analysis Plan

This paper tests the hypothesis that nations which collect pension taxes in a more salient manner will have less demand for public pension programs, resulting in smaller programs. Four specifications are used to test this hypothesis over two dependent variables. The dependent variable for Specifications 1–3 is public expenditures on old age and survivors benefits as a percentage of GDP. Public expenditures on pensions can be used to quantify public demand for pensions, which is expected to be reduced by greater tax salience. The OECD data gives some of these values simply as “close to zero,” and these are coded as zero in the data. The dependent variable for Specification 4 is “Social Security spending per person of retirement age.” The primary independent variable is “percent of pension contributions paid by employees.” This variable is an indicator for salience; the greater portion of the tax
burden which is presented directly to the worker, the more apparent the true tax burden is, and therefore the greater salience.

Most previous studies have found that the single most important factor in the size of public pension programs is the age profile of the population, and the percentage of the population age 65 and above is therefore controlled for in Specifications 1, 3, and 4. In specification 2, this variable is replaced by the ratio of the size of the population which is retirement-age (65) or above to the size of the population which is working age (15–64). A lower ratio indicates an older population, which one would expect to be associated with a larger pension program relative to GDP. Because wealth can be expected to have an effect on both the generosity of and available substitutes for public pension programs (Mulligan, Gil, and Sala-i-Martin 2010), all specifications control for GDP per capita, in constant dollars. GDP per capita gives a rough estimation of national wealth, and keeping dollars constant allows for comparison across time. Tabellini (2000) notes in particular the effect of familiarity of programs on public support for them, and so all specifications control for the number of years a program has been in existence. All specifications also control for unemployment, as nations with high unemployment are likely to have more demand for larger, more distributive pension programs. Specification 3 includes non-Social-Security social spending as a general indicator of a nation’s willingness to spend on social welfare.

OECD data exists for all members of that organization. The hypothesis which this paper tests, however, is only meaningful for those states which actually have public pension programs. The model, therefore, does not include years and states where data was not
reported for the dependent variables. If, in a specific year, a country does have a program but reports only a very small percentage of GDP, that data point is not excluded; only points for which there is nothing to report are excluded. In addition, data points that are missing information for other variables are also excluded. The following countries are included in the analysis: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

The model used to test the proposed hypothesis is an OLS regression of panel time-series data. Because the independent variable is already measured as a proportion of GDP, it is unnecessary to logarithmically transform the data to compare economies of different sizes. Fixed effects regressions are used for all specifications. Fixed effects models account for the difficult-to-quantify inherent differences between nations which have an effect on the size of their public pension programs.
5 Results

5.1 Descriptive Results

Twenty-eight OECD countries were included in the analysis, with data covering the years between 1980 and 2007. Total social spending on old age pensions ranges from 0.58 percent to 11.14 percent of GDP, with a mean of 5.56 percent, with a normal-shaped distribution (see Figure 1). Expenditures per person of retirement age ranges from $1,139 to $26,292 in constant 2000 US dollars, with a mean of $3,980, also with a normal-shaped distribution (see Figure 2). These two variables are used as the dependent variables in the four specified
The primary independent variable, the percent of Social Security taxes paid by employees, runs from 0 percent to 100 percent, with an average of 39.34 percent. Employee percentage is bimodally distributed, with local maxima at around 25 percent and 50 percent. The drop-off above 50 percent, however, is very sharp, and relatively few data points exist above it.

The other independent variables describe the demographics and economic conditions which are the main drivers of the size of Social Security programs. GDP per capita, in constant 2000 US dollars, began at $6,942 and runs to $65,140, with the mean at $23,240, generally normally distributed with a long tail to the right. The percentage of the population
aged 65 or older ranges from 5.05 percent to 21.50 percent, with the mean at 13.22 percent, normally distributed. An alternate measure of population age, the ratio of those who are 65 and older to those aged 15-64, runs from 7.39 percent to 35.68 percent, with the mean at 19.89 percent and also normally distributed. The age of the program varied from 17 to 118 years, with the mean at 70.89 years. Finally, the percent of non-Social-Security social spending as a percentage of GDP ranges from 2.13 percent to 27.90 percent, with the mean at 14.33 percent, normally distributed with a maximum around 7 percent and a long tail to the right.

A few brief national profiles may be illuminating. The United Kingdom will serve as an about-average nation in the aspects being examined. In the UK over the measured period, social expenditures on old age and survivors benefits averaged 4.07 percent of GDP, with a standard deviation of around 0.21 percentage points. Employees paid, an average of 43.15 percent of social security taxes collected, with a standard deviation of 2.56 percentage points. Unemployment averaged 7.56 percent with a standard deviation of 2.41 percentage points, and the percent of the population over age 65 averaged 15.68 percent, with a standard deviation of 0.27 percentage points. The average GDP per capita throughout the period was $23,408 in constant 2000 USD.

In Japan, expenditures varied more widely, averaging 5.06 percent with a standard deviation of 1.48 percentage points. Employee percent of collected social security taxes was fairly standard at an average of 44.86 percent and a standard deviation of 3.16 percentage points. Unemployment was enviably low over the period in question, averaging 3.32 percent,
with a standard deviation of 1.09 percentage points. The population was slightly younger than the UK’s; the percent of the population over age 65 averaged 14.31 percent with a large standard deviation of 3.91 percentage points. GDP per capita averaged $22,947 in constant 2000 USD—about the same as the UK and near the sample average.

Turkey is an example of a country with somewhat lower expenditure levels, averaging only 2.77 percent of GDP with a standard deviation of 1.22 percentage points. This is to be expected, since the percent of the population over age 65 was also much lower over the observed period, averaging only 6.03 percentage points with a standard deviation of 0.61 percentage points. The employee-employer split remained in the same range as the UK and Japan, as employees directly paid an average of 42.14 percent of social security taxes collected, with a standard deviation of 2.64 percentage points. Unemployment was far higher in Turkey than in either the UK or Japan, averaging 8.41 percent over the observed period with a standard deviation of 1.24 percent. GDP per capita was also rather lower, with a mean of $8,639 in constant 2000 USD.

Italy, on the other hand, is a nation with relatively high expenditures on old-age and survivors benefits. Italy spent, on average, 9.50 percent of GDP on benefits, with a standard deviation of 1.25 percent. Unlike in Turkey, population age is not the primary driver of the difference, as the percentage of the population over age 65 had a mean of 15.90 percent over the observed period, with a standard deviation of 2.26 percentage points—a slightly smaller proportion than in the UK. Italy’s GDP per capita was comparable to the UK and Japan’s over the observed period as well, averaging $22,475 in constant 2000 USD. However,
employees in Italy paid a relatively low 21.41 percent of social security taxes collected, with a standard deviation of 1.07 percentage points, far lower than in the UK, Japan, or Turkey. Unemployment was even higher than in Turkey, averaging 9.99 percent with a standard deviation of 1.75 percent.

## 5.2 Regression Results

The proposed hypothesis was tested using four different model specifications. In Specification 1, “Old Age Social Spending as a percentage of GDP” is the dependent variable. Dependent variables are the employee percentage, GDP per capita, unemployment, and the percent of the population aged 65 or older. Using a fixed effects model, this specification shows that each additional percentage point of Social Security taxes paid directly by the employee is associated with a 0.011 percentage point decrease in the size of a Social Security program relative to GDP, which is significant at the 95 percent confidence level. For a coun-

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**Table 1: Descriptive Statistics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Security Expenditures (% GDP)</td>
<td>5.564</td>
<td>2.195</td>
<td>.582</td>
<td>11.136</td>
</tr>
<tr>
<td>Social Security Expenditures ($ per retiree)</td>
<td>$9,072</td>
<td>$3,980</td>
<td>$1,139</td>
<td>$26,292</td>
</tr>
<tr>
<td>Employee Percent of Social Security Taxes</td>
<td>39.339</td>
<td>8.526</td>
<td>.003</td>
<td>100</td>
</tr>
<tr>
<td>GDP Per Capita</td>
<td>23.223</td>
<td>8.101</td>
<td>6.943</td>
<td>65.140</td>
</tr>
<tr>
<td>Unemployment Rate</td>
<td>7.527</td>
<td>4.50</td>
<td>1.481</td>
<td>23.883</td>
</tr>
<tr>
<td>Percent of Population over 65</td>
<td>13.818</td>
<td>2.779</td>
<td>5.500</td>
<td>21.495</td>
</tr>
<tr>
<td>People aged 65+ (per 100 aged 15-64)</td>
<td>20.672</td>
<td>4.224</td>
<td>7.390</td>
<td>33.083</td>
</tr>
<tr>
<td>Non-Social Security Social Spending (% GDP)</td>
<td>14.326</td>
<td>4.758</td>
<td>2.127</td>
<td>27.89</td>
</tr>
<tr>
<td>Program Age (years)</td>
<td>70.885</td>
<td>18.338</td>
<td>17</td>
<td>118</td>
</tr>
</tbody>
</table>

Source: OECD and OECD Social Expenditure Database
try like the United States, which has a statutory 50 percent split between employees and employers, moving to a 100 percent employee share would be expected to produce a Social Security program that was 0.550 percent of GDP smaller. Since the GDP of the United States was around $14.72 trillion for 2010, the difference would be about $81 billion.

In addition, Specification 1 finds that a $1,000 increase in GDP per capita is associated with a 0.112 percent decrease in the size of the public pension program as a share of GDP, that an additional percentage point of unemployment is associated with a 0.042 percent increase in the size of the program as a share of GDP, that an additional percentage point of the population age 65 or over is associated with a 0.334 percent increase in the size of the program as a share of GDP, and that each additional year of age of the program is associated with a 0.058 percent increase in the size of the program as a share of GDP.

In Specification 2, the measure of population age is changed to the ratio of the size of the retirement-age population to the size of the working-age population. Using a fixed effects model, this specification finds that each additional percentage point of Social Security taxes paid by the employee is associated with a 0.014 percentage point decrease in the size of a Social Security program relative to GDP, which is significant at the 99 percent level. Again taking the example of the United States moving from an even employer-employee split to a 100 percent employee share, according to this specification one would expect a 0.700 percentage point of GDP decline in program size, which is roughly equivalent to $103 billion in 2010.

Specification 2 further finds that a $1,000 increase in GDP per capita is associated with
a 0.116 percent decrease in the size of the public pension program as a share of GDP, that an additional percentage point of unemployment is associated with a 0.039 percent increase in the size of the program as a share of GDP, that an additional percentage point in the retiree-to-worker ratio or over is associated with a 0.192 percent increase in the size of the program as a share of GDP, and that each additional year of age of the program is associated with a 0.070 percent increase in the size of the program as a share of GDP.

Specification 3 used the same model as Specification 1 with non-Social-Security spending added in as an additional control. Using a fixed effects model, this specification finds that each additional percentage point of Social Security taxes paid by the employee is associated with a 0.022 percentage point decrease in the size of a Social Security program relative to GDP, which is significant at the 99 percent level. For the example of the United States this specification would expect the size of the Social Security program to decline by 1.100 percent of GDP, which is equivalent to about $162 billion.

Specification 3 also shows that a $1,000 increase in GDP per capita is associated with a 0.159 percent decrease in the size of the public pension program as a share of GDP, that an additional percentage point of unemployment is associated with a 0.052 percent increase in the size of the program as a share of GDP, that an additional percentage point of the population age 65 or over is associated with a 0.334 percent increase in the size of the program as a share of GDP, and that each additional year of age of the program is associated with a 0.136 percent increase in the size of the program as a share of GDP. The coefficient for non-Social-Security spending is not significant.
Specification 4 uses the same independent variables as Specification 1, but an alternate
dependent variable: old age social expenditures per person of retirement age. Using a fixed
effects model, the only variable significant at the 95 percent level is program age, of which
each additional year is associated with a $146.15 increase in expenditures per person of
retirement age.
Table 2: Regression Results for Specifications 1–3

<table>
<thead>
<tr>
<th>Specification 1</th>
<th>Specification 2</th>
<th>Specification 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>β (Std. Dev.)</td>
<td>Variable</td>
</tr>
<tr>
<td>Employee Percent</td>
<td>-0.011 (0.004)*</td>
<td>Employee Percent</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>-0.112 (0.013)*</td>
<td>GDP per capita</td>
</tr>
<tr>
<td>Unemployment</td>
<td>0.042 (0.012)*</td>
<td>Unemployment</td>
</tr>
<tr>
<td>Percent Age 65+</td>
<td>0.334 (0.031)*</td>
<td>Retiree-to-Worker ratio</td>
</tr>
<tr>
<td>Program Age</td>
<td>0.058 (0.010)*</td>
<td>Program Age</td>
</tr>
<tr>
<td>Non-SS Social Spending</td>
<td></td>
<td>Non-SS Social Spending</td>
</tr>
</tbody>
</table>

Coefficients marked with * are statistically significant at $p <= 0.05$.

Table 3: Regression Results for Specification 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>β (Std. Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee Percent</td>
<td>-2.576 (9.992)</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>25.050 (29.881)</td>
</tr>
<tr>
<td>Unemployment</td>
<td>33.500 (26.558)</td>
</tr>
<tr>
<td>Percent Age 65+</td>
<td>-21.133 (69.504)</td>
</tr>
<tr>
<td>Program Age</td>
<td>146.145 (23.694)*</td>
</tr>
</tbody>
</table>

Coefficients marked with * are statistically significant at $p <= 0.05$. 

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6 Policy Implications

These findings support the proposed hypothesis that increasing the percent of Social Security taxes paid directly by the employee decreases the size of Social Security programs relative to GDP. This result suggests that as the true costs of Social Security programs becomes more salient, the program demand decreases, and policymakers adjust the programs to the adjusted demands. Moreover, these results are largely in line with prior research on the major determinants of Social Security program size; age and economic status of the population dominate the model, and familiarity with programs matters as well. Salience is, then, a factor to be added into more traditional models of Social Security, rather than an idea that will overturn them.

The primary policy implication of this finding is that in salience, policymakers have a tool not previously employed to help Social Security programs achieve sustainability over the long term. The possible savings for the United States estimated by Specifications 1–3, which range from about $81 billion to about $162 billion, give some indication of the usefulness of tax salience in this context. While this is not enough savings to declare salience a magic bullet, it is certainly helpful. Historically, public pension programs have been very difficult to reform, with both benefit cuts and tax increases facing stiff political opposition. By revealing more clearly to the public the full price that they are paying for public pensions, policymakers can, to some degree, lower that political barrier as other options for pensions begin to look comparatively more attractive to citizens.

This thesis does not explain how long it takes for changes in salience to affect public
demand for public pension programs and thereafter the size of these programs. One would reasonably expect, however, some degree of lag; in any case, one should expect no miracles. Moreover, while these findings suggest that a more salient distribution of Social Security taxes will lower political barriers to making Social Security programs more sustainable, it does not make any claims about the political barriers to altering that distribution.

These findings seem to confirm the implications of earlier studies that have touched on salience; namely, wherever taxes matter, salience matters. Further research incorporating the salience concept into studies of the design of revenue mechanisms can only add to our understanding of how they work. Within the context of public pension programs, it should be noted that while percent of taxes paid by employees is one measure of salience, it is not the only measure. Other aspects of the revenue mechanism, such as how many workers do not see a line item for pension taxes (through use of direct deposit, for example, or because it is simply not printed), would be interesting and useful indicators of salience, that might suggest policy steps above and beyond those recommended by this analysis. Moreover, there is significant room for research on how and why different political entities choose different levels of salience. Finally, it is interesting to note that those factors which had a significant effect on the size of public pension programs as a share of GDP did not seem to have the same effects on Social Security expenditures per person of retirement age. Examining the reasons for this discrepancy, at least in the models specified above, may provide yet further insights into how public pension programs grow, and how they might be made more sustainable for the future.
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