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The Displacement Effect of Public Pensions on the Accumulation of Financial Assets

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Abstract

The generosity of public pensions may depress private savings and provide incentives to retire early. While there is plenty of evidence supporting the latter effect, there remains considerable controversy as whether or not public pensions crowd out private savings. This paper uses international micro-datasets collected over recent years to investigate whether public pensions displace private savings. The identification strategy relies on differences in the progressivity or non-linearity of pension formulas across countries. We also make use of large heterogeneity in earnings across education group and country. The evidence we present is consistent with previous studies using cross-sectional and time-series variation in savings and pensions. We estimate that an extra dollar of pension wealth depresses accumulated financial assets at the time of retirement by 23 to 44 cents and that an extra ten thousand dollars in pension wealth reduces the average retirement age by roughly 1 month.

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1. Introduction

In his seminal article, Feldstein (1974) argues that the generosity of public pensions may affect the amount of private savings held at the time of retirement through two effects: a displacement effect due to the fact that a marginal increase in public benefits will lead to an increased consumption over the entire life-cycle, hence leading to lower private savings; or an early retirement effect due to the increase in lifetime income which may imply larger savings at the time of retirement to finance consumption through retirement. Hence, the effect is ambiguous. Furthermore, although the standard model predicts perfect displacement (one more dollar of pension assets reduces financial assets by one dollar), conditional on a given retirement age, this will generally not hold in more general models with borrowing constraints and uncertainty.

Feldstein (1974) uses aggregate time series data from the U.S. and reports displacement effect ranging from -30 cent to -50 cent per dollar of pension benefits depending on the specification. Since then, a whole range of estimates has been reported using different identification strategies and measures of non-pension and pension assets. Estimates of the effect of pension wealth on non-pension wealth range from close to zero (Kotlikoff, 1979) to close to negative one (Gale, 1998). The bulk of those studies has been done on U.S. data but there is also international evidence exploiting pension reforms in several European countries. Attanasio and Brugiavini (2003) find evidence of a displacement effect on savings rate following the 1992 pension reform in Italy. Similarly, Attanasio and Rohwedder (2003) analyze pension reforms in the U.S. and also find evidence of a displacement effect. Kapteyn, Alessie and Lusardi (2005) find that cohort differences in accumulated wealth can in part be explained by differences in social security wealth. Some studies have also exploited cross-country differences in assets. Feldstein (1979) uses aggregate data from 12 countries and finds a displacement effect of 37 cents per dollar of pension benefits. Kapteyn and Panis (2005) consider a case study using micro data from three countries (The U.S., the Netherlands and Italy) to show that in countries where public pensions are generous, individuals in general hold less savings.

In this paper, we present new evidence on the displacement effect of public pensions by using cross-country variation in the generosity and progressivity of pensions. We use micro-datasets from many more countries than those considered in Kapteyn and Panis (2005) to construct income replacement rate and private saving measures by education level and marital status, which are good proxies for lifetime earnings. Our identification strategy exploits within-country differences in replacement rates and accumulated financial assets at the time of retirement. We estimate reduced-form models derived from a standard life-cycle model in order to quantify the displacement effect. We find evidence of a displacement effect of public pensions on accumulated financial assets ranging from 23 to 44 cent for every additional dollar of public pension wealth. We also report a substancial income effect of pension wealth on the retirement age.

The paper is organized as follows. We first present within a simple theoretical model the factors that affect the displacement and early retirement effect and derive estimable equations that can be used to assess the size of such effects on private savings. We then discuss in Section 3 our empirical strategy. Section 4 reports the results while we conclude in Section 5.

2. Theoretical Model

Assume an individual who is making decisions from time $t = 0$ to T, regarding consumption c_t and work. We assume the work decisions are lumped together such that individuals work from period $t = 0$ to some time $t = R$ at which point they retire. For simplicity we assume individuals get constant income $y_t = y$ while working. Our setup is closest to Gale (1998) and Laitner and Silverman (2007).

The public pension once retired is given by $b_t(R) = \alpha(R)\phi(y)$. The term $\alpha(R)$ is an actuarial factor which adjusts the pension to the retirement (claiming) age and $\phi(y)$ is the benefit that would be received at normal retirement age. For example, in the United States it is the primary insurance amount (PIA). In most countries, the earnings-related part of the pension function is progressive such that $\phi'(Y) < 1$, and $\alpha'(R) > 0$ such that later retirement is rewarded by higher benefits. Assuming an interest rate, r, the present value of pension benefits upon retirement is given by

$$B(R) = \alpha(R)\phi(y)\int_0^{T-R} e^{-rt}\,dt = \alpha(R)\phi(y)\xi(R).$$

The present value of benefits at retirement is actuarially fair (does not depend on R) if $\alpha(R)\xi(R) = k$ where k is a scaling parameter. In that case, pension wealth at the time of retirement is $B(R) = kf(y) = f_k(y)$.

Now assume the individual derives utility from consumption prior to retirement given by

$$u(c_t) = \frac{c_t^{1-\gamma}}{1-\gamma}, \gamma > 0$$

and after retirement $v(c_t) = u(c_t) + \Gamma$. The parameter γ captures the curvature of the utility function. Our formulation of the utility function implies that consumption and leisure are strongly separable. This simplifies the exposition without altering the main mechanisms. Finally, assume the individual has a discount rate ρ.

Assuming the individual starts with zero assets, a_0 =0 and has to die with non-negative assets, $a_T \geq 0$, he solves the following optimization problem

$$\begin{gathered} \max_{R,\{c_s\}_{s=0,\dots,R}} \int_0^R e^{-\rho t} u(c_t)\,dt + \psi(a_R + B(R), R) \\ s.t. \\ \dot{a}_t = ra_t + y_t - c_t, a_0 = 0 \end{gathered} \quad . \tag{1}$$

The post-retirement indirect utility ψ in turn is given by solving the maximization problem

$$\begin{gathered} \psi(a_R, R) = \max_{\{c_s\}_{s=R,\dots,T}} \int_R^T e^{-\rho t} v(c_t)\,dt \\ s.t. \\ \dot{a}_t = ra_t - c_t \\ a_R = A + B(R), a_T \geq 0 \end{gathered} \tag{2}$$

The solution for consumption, given the retirement age, can be directly derived from the first-order conditions to (1) and (2). The solution is given by

$$\frac{\dot{c}_t}{c_t} = \frac{r-\rho}{\gamma} = \eta, \;\; c_0 = \delta[Y(R) + e^{-rR}B(R)] \tag{3}$$

where $\delta = \lambda / (e^{\lambda T} - 1),\ \lambda = \eta - r,\ Y(R) = y\int_0^R e^{-rs}ds$. Assuming $r = \rho$ to focus on pension-induced savings, we see that consumption is constant over the life-cycle: in each period the individual consumes a constant fraction of his life-time income. In that case, the fraction does not depend on preferences. But life-time income may depend on preferences as it is affected by the choice of the retirement age.

The first-order condition for the timing of retirement takes the form

$$c_R^{-\gamma}[y + B'(R)] = \Gamma \tag{4}$$

where B' denotes the derivative with respect to R. The left-hand side represents the marginal benefit from delayed retirement (additional income converted into utility using the marginal utility of consumption) and the right-hand side represents the marginal cost of leisure foregone by retiring later.

Substituting optimal consumption and taking logs we get

$$\log[y + B'(R)] - \gamma \log[Y(R) + e^{-rR}B(R)] = \log\Gamma - \log[\delta^*] \tag{5}$$

where $\delta^* = \delta^{-\gamma}$. This equation implicitly defines the retirement age. The first term captures the "accrual" effect of postponing retirement: more income directly from earnings, and the accrual in the present value of pension benefits. Gruber and Wise (1999) document this term and find that in most countries there is a penalty to continuing work (i.e. B'(R)<0). The second term on the right-hand side captures the income effect. The income effect increases with the concavity of the utility function.

A closed-form solution to R will generally not be possible. Differentiation of (5) with respect to ϕ, which amounts to an increase in the generosity of the pension system, shows that increasing generosity will reduce the retirement age provided B'(R) is either small or negative as is the case in many countries.

The effect of changing the replacement rate on the consumption path can be found analogously. Let $B(R) = f_k(y)$ for simplicity. Then, differentiating yields,

$$\frac{dc_0}{d\phi} = \delta e^{-rR}[\phi_k^{'}(y) + (y - r\phi_k(y))\frac{dR^*}{d\phi}] \tag{6}$$

The first term within the brackets represents the displacement effect. The individual can consume the marginal increase in his retirement benefit (discounted) and spread it over the entire life-cycle. Hence savings decrease. However, there is a second effect due to induced earlier retirement. If the income effect is large, the individual will retire earlier which leads to a drop in lifetime income. This is financed by an increase in savings during the working life. The net effect of increasing the replacement rate on savings is therefore unclear and depends on preferences as well as the extent to which pensions replace earnings.

3. Empirical Strategy

To derive testable implications it is first useful to rewrite the solution in terms of assets. Assets around the time of retirement, say $t = R$, is:

$$a_R = y\pi(r,R) - c_0\pi(\lambda,R) \tag{7}$$

where $\pi(s,t) = e^{st}\frac{e^{-st}-1}{-s}$. Substituting the solution for initial consumption we obtain

$$a_R = (1 - \theta(\lambda,R))y\pi(r,R) - \theta(\lambda,R)e^{-rR}\phi_k(y) \tag{8}$$

where $\theta(\lambda,t) = \dfrac{e^{\lambda t} - 1}{e^{\lambda T} - 1}$. Equation (8) implies that, provided one knows λ, regressing assets on adjusted pension wealth should yield a coefficient of negative one, i.e. perfect displacement. Gale (1998) shows that omitting the adjustment factor $\theta(\lambda,R)$ affects the estimate of the displacement effect. Since $\theta(\lambda,R)$ is between zero and one, using uncorrected pension wealth leads to an attenuation bias towards zero. Even if the true displacement effect is not one, for example due to capital market imperfections, Gale shows that adjustment is still necessary in order to interpret correctly the offset effect. Attanasio and Rohwedder (2003) make a similar point when looking at the effect of pension reform on savings. With a discount factor of 3%, life expectancy of 80, start age of 20, retirement age of 60, this factor q is 0.93. Obviously it is larger at younger ages *t*. An alternative specification involves dividing both sides of (8) by earnings, yielding a simple bivariate relationship

$$\frac{a_R}{yp(r,R)} = a(l,R) - q(l,R)\frac{e^{-rR}kf(y)}{yp(r,R)} \tag{9}$$

The left hand-side is the ratio of assets to lifetime earnings. The right hand side is the adjusted ratio of pension wealth to lifetime earnings.

First assume we have access to cross-sectional data at the time of retirement where we observe $z_i = (y_i, a_i, R_i),\ i = 1,...,N$ and can compute the quantities $A = a_R / yp(r,R),\ REP = q(-r,R)\frac{e^{-rR}kf(y)}{yp(r,R)}$ assuming $r = r$ so that $l = -r$. Then the following regression

$$A_i = \alpha_0 + \alpha_1 REP_i + \varepsilon_i,\ i = 1,...,N \tag{10}$$

should yield a coefficient estimate of $a_1 = -1$ if the model is correctly specified and $l = -r$. In practice, studies focusing on cross-sectional variation within a country identify the effect from covariation in z_i but not in $f()$. The covariation in z_i is problematic if there is for example unobserved heterogeneity in tastes for leisure and consumption. An alternative source of identification is available if data from multiple countries are available. In that case variation across countries in REP could help identify a_1. Following Feldstein (1979), one could run a cross-country regression of the form

$$A_c = \alpha_0 + \alpha_1 REP_c + \varepsilon_c, \; c = 1, ..., C \tag{11}$$

This strategy deals with unobserved heterogeneity across individuals; other-country differences might explain the cross-country differences in replacement rate and asset-to-income ratio.

Another possibility is to pool cross-sectional observations across countries. This strategy exploits similarities across individuals in different countries in terms of tastes, leisure, and economic opportunities. One possibility is to group individuals by education level and marital status. This allows us to restrict the source of variation used to identify a_1 to within-country and group differences in A and REP. We estimate the following specification

$$A_{i,c} = a_{0,c} + a_{0,i} + a_1 REP_{i,c} + e_{i,c}, i = 1, ..., N, c = 1 ..., C \tag{12}$$

where both group and country fixed effects are included. The key identifying assumption is that differences in unobserved tastes across groups are the same across countries. Assuming that k, R are the same across countries, the key source of variation in replacement rates is given by deviation in $f(y)/y$ from their country mean and group means. If replacement rates do not depend on earnings, there will be no variation in replacement rates in response to deviation from their country or group means. Hence, progressivity is crucial.

Estimation of the asset equation above effectively controls for the retirement age since we substituted the solution for optimal consumption conditional on the retirement age. In that sense it allows us to estimate the partial displacement effect. However, the net effect depends on the magnitude of the income effect of pensions on retirement age. We also estimate the income effect by following a similar retirement strategy. In particular, we use the following specification:

$$RET_{i,c} = b_{0,i} + b_{0,c} + b_1 SSW_{i,c} + b_2 y + u_{i,c}, i = 1,\ldots,N, c = 1,\ldots,C \qquad (13)$$

where $RET_{i,c}$ is the average retirement age for cell (*i*,*c*) and $SSW_{i,c} = k_c f_c(y_{i,c})$. Of course, b_1 is a mix of income and substitution effect, in particular when estimated using ex-post social security wealth. If social security wealth depends on the retirement age (k varies with age) then the coefficient b_1 should be biased upwards.

3.1. Data Sources

We use data from a combination of micro-data sources to implement our empirical strategy. To merge these data sources together, we aggregated data by cells defined by education level and marital status (defining observations *i*). We used three education categories as defined by the ISCED classification (primary, secondary, and tertiary) and two marital status categories (married/partner, single). The rationale for using those characteristics is that education level and marital status are powerful measures of lifetime earnings. Variation in lifetime earnings ultimately allow us to exploit cross-country differences in the progressivity of pension formulas. Furthermore, we use net rather than gross measures because additional variation is created through differences in the progressivity of the income tax function across countries.

We aggregate data on assets and retirement ages from aging surveys in 12 countries covering the age 50+ population: the Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA) and the Survey of Health, Ageing and Retirement in Europe (SHARE) which cover 10 continental European countries (Austria, Belgium, Denmark, France, Greece, Germany, Italy, Netherlands, Spain, and Sweden). We use data collected in the 2004 wave of each survey (wave 7 of HRS, wave 2 of ELSA, and wave 1 of SHARE). The sample includes retired males aged 65 to 75. By that age, most males have retired and thus provide an adequate sample to measure assets and retirement age (a_R, R).

We computed a measure of median financial assets, a_R, comparable across countries. The data appendix gives details on the construction of the variable. Financial assets such as savings, stocks, and retirement accounts are relatively liquid and one would expect the displacement effect to operate for those in particular. Other assets, most notably housing, are much less liquid, and participation in the housing market likely differs across countries and groups for reasons other than the generosity of pensions. Some studies have argued against using narrow definitions of wealth in cross-sectional regressions (e.g. Gale, 1998). They find larger effects with more inclusive measures. However, it is not clear why estimates are larger with more inclusive measures. It depends on whether different types of assets have different degree of substitutability with pension wealth. We constructed the retirement age, R, using self-reports from HRS, ELSA, and SHARE. For SHARE, no direct question asked about the retirement age, but a question asks about the date when the last job ended. We used this question to construct the retirement age.

The aging surveys we use have limited measures of lifetime earnings. Hence, we constructed pre-retirement net earnings from longitudinal surveys in the same set of countries. For the U.S., we used the 1994 to 1997 Panel Study of Income Dynamics (PSID), while for European countries, we use the 1994 to 1997 waves of the European Community Household Panel (ECHP) for European countries. We used net individual and household earnings and top-coded the 99th percentile of each cell. The ECHP asks directly for net household and individual annual earnings. The PSID asks only about gross household and individual annual earnings. We used the OECD tax calculator to compute net earnings. We used average earnings from age 25 to 55 as a measure of permanent earnings, y. We constructed the lifetime measure of earnings using an interest rate of 0.03, a start age of 20, and the average retirement age within each cell.

Aging surveys ask retired individuals about their current gross pension benefits. However, in some countries benefits are more often cashed out rather than annuitized, and it is not clear how to compute net benefits from the gross amount reported. Instead, we used data from the OECD on net replacement rates as a function of relative net average lifetime earnings. The OECD calculates these net replacement rates, defined as net benefit divided by net average lifetime earnings. We obtained a complete mapping for each country. These replacement rates are calculated on an individual basis and do not include spouse benefits. We used net earnings computed from the ECHP and PSID to map a replacement rate to each spouse and compute household net pension benefits, $f(y)$.

We computed pension wealth assuming a discount factor of 3% and using country and gender specific survival probabilities. We used mortality rates from the Human Mortality Database for the year 2004 (www.mortality.org). This formed our estimate of k. Pension wealth was then defined as $SSW = kf(y)$. The factor $q(-r, R)$ was estimated using the average retirement age in each cell, a discount rate of 3% and T equal to life expectancy as of age 20 (roughly 56-60 years). The estimated factor ranges from 0.91 to 0.96. The remaining variables A and REP were constructed by dividing each quantities by lifetime earnings. Table 1 gives descriptive statistics by country on the main variables used to derive A and REP.

We use the number of observations in each cell to weight observations in the regressions. This was done to reflect the uncertainty in the cell estimates for those with few observations. We discard cells with fewer than 5 observations. The point estimates were generally robust to the cut-off used but slightly more dependent on whether we weighted or not. The HRS and ELSA have much larger samples than other surveys, which tended to increase the influence of these cells relative to smaller cells representing some European countries (particularly among the highly educated and the unmarried). The results were however robust to scaling U.S. and England counts back to the average cell size among other European countries.

4. Results

We first present evidence that OECD net replacement rates reveal substantial differences in progressivity. In Figure 1 we present net replacement rates, defined as net pension benefits divided by annual net earnings $f(y)/y$, as a function of relative annual earnings

y for 12 OECD countries (OECD Pension at a Glance, 2005). In general, replacement rates decline with earnings, reflecting progressivity but the degree of progressivity is also quite different across countries. This is crucial to the identification strategy in equation (9).

4.1. Assets

We estimate three different regressions of A and REP. First, we aggregate up at the country level and perform a country-level regression. This is quite similar to the cross-country regressions done by Feldstein (1977, 1978) although it uses age-group-specific asset (those age 65-75) and earnings information (from age 25-55 in 1994). Figure 2 plots the estimates of A and REP for each country in the analysis along with a regression line. A negative relationship is clearly visible and the regression estimate reported in column 1 of Table 2 suggest an estimate of $\hat{a}_1 = -0.245$ [t=1.85]. Using a similar strategy, Feldstein (1977) reports an estimate of -0.37 which is fairly close given the uncertainty in regressions with 12 observations.

We then estimate a pooled regression where we include education and marital status fixed effects but no country fixed effects. This is more akin to empirical specifications using cross-sectional variation in earnings although it also uses variation in replacement rates across countries. Column 2 of Table 2 reports the results. The estimate is now $\hat{a}_1 = -0.228$ [t=2.88]. Hence, the estimate is fairly robust to using the cross-country vs. cross-sectional variation. However, both these strategies make important assumptions about the presence of unobserved differences across countries and groups. The last column of Table 2 reports estimates of equation 9 with both country and group fixed effects. These estimates rely primarily on differences in the progressivity of the pension benefit formula across countries. The estimate of the displacement effect is $\hat{a}_1 = -0.44$ [t=2.16]. For each dollar increase in pension wealth, this estimate suggests that financial wealth decreases by roughly 44 cents. This is substantially larger than the estimates in the first two columns of Table 2. In Figure 3, we check whether the effect identified is due to any particular outlier. To accomplish this we first regress both left-hand side (asset to income ratio) and right-hand side (replacement rate) on country and cell specific fixed effects. We then take the residuals from those regressions. Due to properties of least-squares, regressing the asset residual on the replacement rate residual yields the same estimate of α_1. We plot those residuals in Figure 3 along with the regression line. We also include an indication of the size of each cell. The larger the "bubble" around a cell, the larger is the number of observations used in the cell. One can see that the results are not driven by any particular observations. Rather, there is a very clear negative relationship between these residuals. Overall, using different identification strategies, we estimate an effect ranging from -23 to -44 cents per additional dollar of pension wealth.

4.2. Retirement Age

In Table 3, we present regression results for the effect of pension wealth on retirement. The first column uses country-level observations as in Table 2. The point estimate is - -0.006 but fairly imprecisely estimated (t=0.6). In the second column, we pool cells from all countries and obtain a similar estimate, -0.007 but now statistically significant at the 5% level (t=2.05). Finally, the last column of Table 3 reports estimates with country and group fixed effects. The estimate is somewhat larger (-0.011) and still precisely estimated (t=-3.24). Figure 4 shows that this is not due to any particular outlier. This suggests a substantially large income effect. For a ten thousand dollar change in pension wealth, the retirement age decreases by roughly one month. Take two countries with vastly different generosity of public pensions, the Netherlands and England. Our estimate of mean pension wealth in the Netherlands is $317.6 thousand while it is $222.2 thousand in England. The Dutch retire earlier than their British counterparts: the average retirement age is 59.1 in the Netherlands compared to 61.2 in England. The effect from the third specification in Table 3 yields a predicted difference of 1.06 years while the actual difference in 2.1 years. Hence, this would explain 50% of the gap in the retirement age between the two countries. Overall, this suggests that the early retirement effect is also important.

5. Conclusion

This paper provides novel evidence on the displacement and early retirement effects of public pensions using both cross-country and within-country variation in the generosity of public pensions. Earlier evidence either relied on within-country variation across individuals or over time, or on aggregate cross-country data. Our estimates suggest a displacement effect of roughly -25 to -45 cents of financial assets for every additional dollar of pension wealth and an early retirement effect of approximately 1 month for every additional $10,000 in pension wealth. These estimates provide new evidence which confirms that public pensions likely depress asset accumulation, although by less than what the standard life cycle theory predicts. There are many reasons why this offset is imperfect but little research has examined those in detail. One interesting avenue for further research is to exploit other institutional differences across countries, such as the degree of borrowing constraints and labor market regulations, to enrich our understanding of the reasons behind the imperfect displacement effect. Our modeling of retirement and saving decisions was simple for reasons of tractability and because of data limitations. But with additional waves of aging surveys, and retrospective life histories, one important avenue for further research is to enrich structural models of life cycle decision making with variation in institutions across countries.

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Data Appendix

Our analytic dataset is derived from a number of sources. Our Household Wealth measures are derived from “aging” surveys: Wave 1 (2004) of the Survey of Health, Ageing and Retirement (SHARE), Wave 2 (2004-2005) of the English Longitudinal Study of Ageing (ELSA), and Wave 7 (2004) of the Health and Retirement Survey (HRS). Our Household Pre-Retirement Net Earnings measure is derived from the European Community Household Panel (ECHP) (1994-1997) and the Panel Survey of Income Dynamics (PSID) (1994-1997). Our pension information comes from replacement rate calculations as a function of net pre-retirement earnings made available to us by OECD. Finally, we use the 2004 period life tables for males from the Human Mortality Database (www.mortality.org).

Sample

We define cells for each country by marital status (defined as married/partnered or single) and three education level (primary, secondary, tertiary) following the ISCED classification. The definition of these variables is comparable across the various datasets we used. We select men aged 65-75 and not working in the aging surveys and select men aged 25-55 in the ECHP/PSID surveys.

Financial Wealth

Our Financial Wealth variable includes bank account balances, the values of stocks and bonds, and money saved in individual retirement accounts. Values are expressed in 2004 dollars and are adjusted for Purchasing Power Parity using OECD comparative price levels. We compute the median wealth within each country-education-marital status cell. The original variables used are as follows:

	HRS	**ELSA**	**SHARE**
Bank Accounts	HQ344-HQ348	IASAVA	HBACCV
Stocks	JQ316-JQ320	IASS, IAUIT	HSTOCV, HMUTFV
Bonds	JQ330-JQ334, JQ356-JQ360	IANPB, IANS, IABG	HBONDV
IRAs	JQ162, JQ165_1 - JQ169_3	IASISA, IATI, IACISA, IAIP	HIRAV

Pre-Retirement Net Earnings

Our Pre-Retirement Net Earnings variable is derived from earnings data from four waves of ECHP and PSID, 1994 - 1997. Values are expressed in 2004 dollars, PPP-adjusted, using OECD wage growth data and PPP-adjusted exchange rates. The variable is a mean value for net earnings within each country-education-marital status cell. The sample consists of households (single and married couples) headed by a male aged 25-55. Individuals with missing data on education, marital status, or work status were dropped. Earnings were topcoded at the 99th percentile within each country. Gross earnings data for the United States from PSID was converted into net earnings using the OECD tax calculator.

Public Pension Net Benefits

Our Public Pension Net Earnings Replacement Rate variable is derived using replacement rates calculated by the OECD. The OECD analysis maps levels of pre-retirement earnings (expressed as a multiple of the earnings of a representative worker) to the replacement rate provided by each country's mandatory public pension system.[2]

OECD has been publishing data using their current definition of representative worker earnings since 2000[3]. We converted cell level mean earnings from ECHP and PSID into 2000-level national currency using OECD wage growth data. This was then converted into a multiple of representative worker earnings using OECD earnings data.

The OECD mapping from earnings to replacement rate was then used to calculate the household replacement rate directly for unmarried men. For married men, additional steps were necessary, as the OECD mapping is given only with regards to individuals. We calculated individual replacement rates for the husband and wife separately, converted them into the implied individual benefits, added them together to get total household benefits, and divided the result by total household earnings to get a household earnings replacement rate. This does not include "spouse" benefits which are common in some countries.

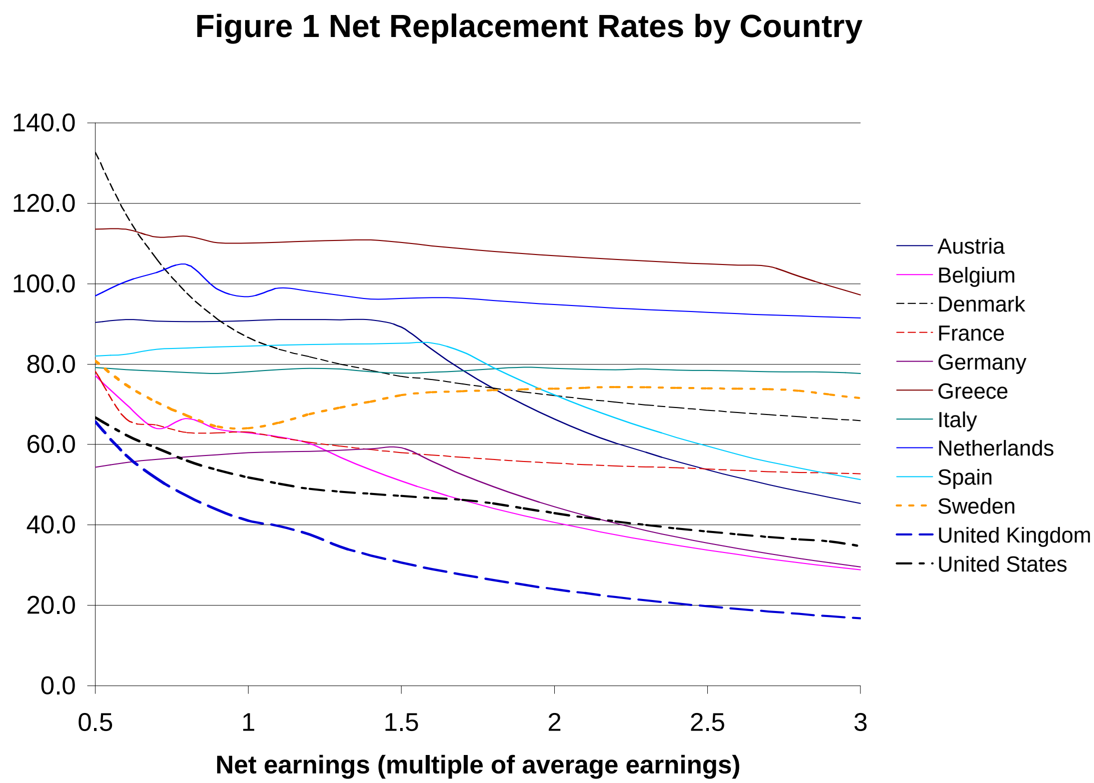
Assumptions Regarding Mortality and Discounting

We compute the present value of pension benefits using the males' survival rates derived from the Human Mortality database and assuming a discount rate of 3%. We discounted back to the average age at interview within each cell. Other present values assumed a discount factor of 3% as well.

[2] This analysis is used in the OECD's "Pensions at a Glance" series; we received access to tables relating income to replacement rates with increments of 0.1*representative-worker-income.

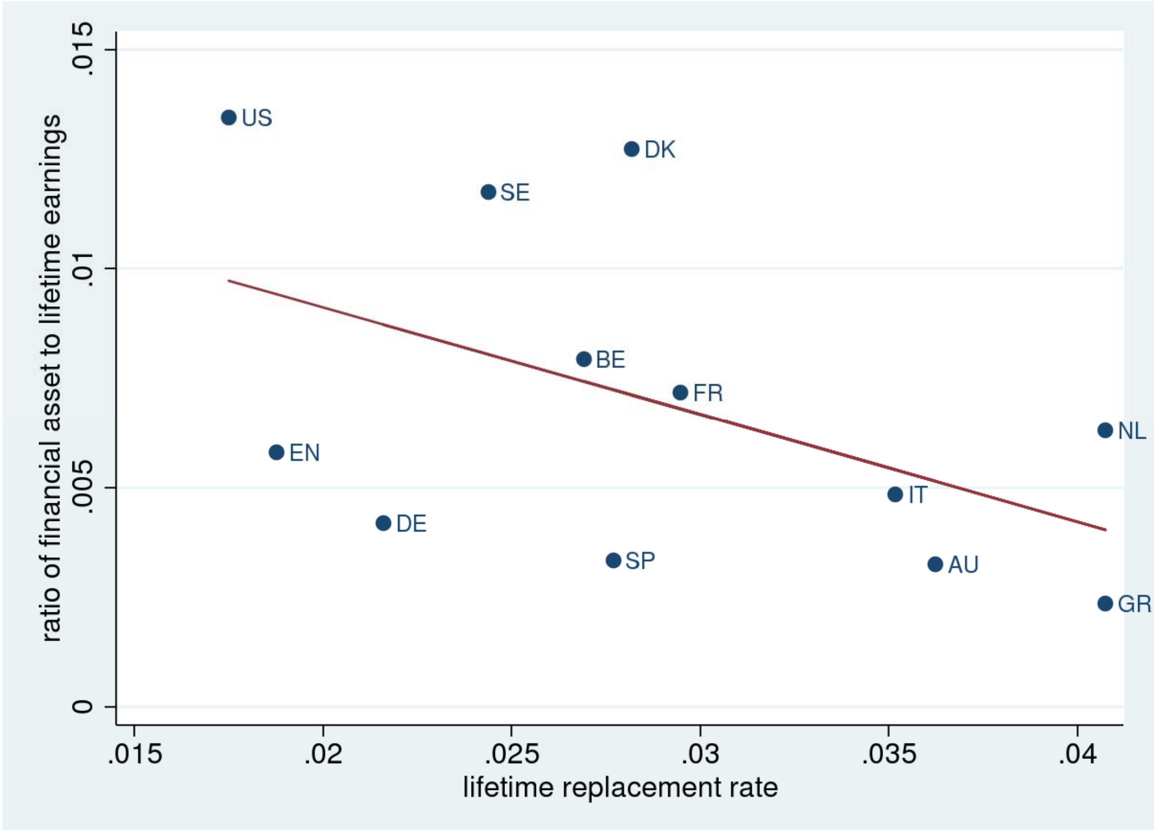
[3] Reflecting the changing balance of economic sectors, the definition of representative worker now includes the full-time service workers in addition to the traditional full-time production workers

Figures and Tables



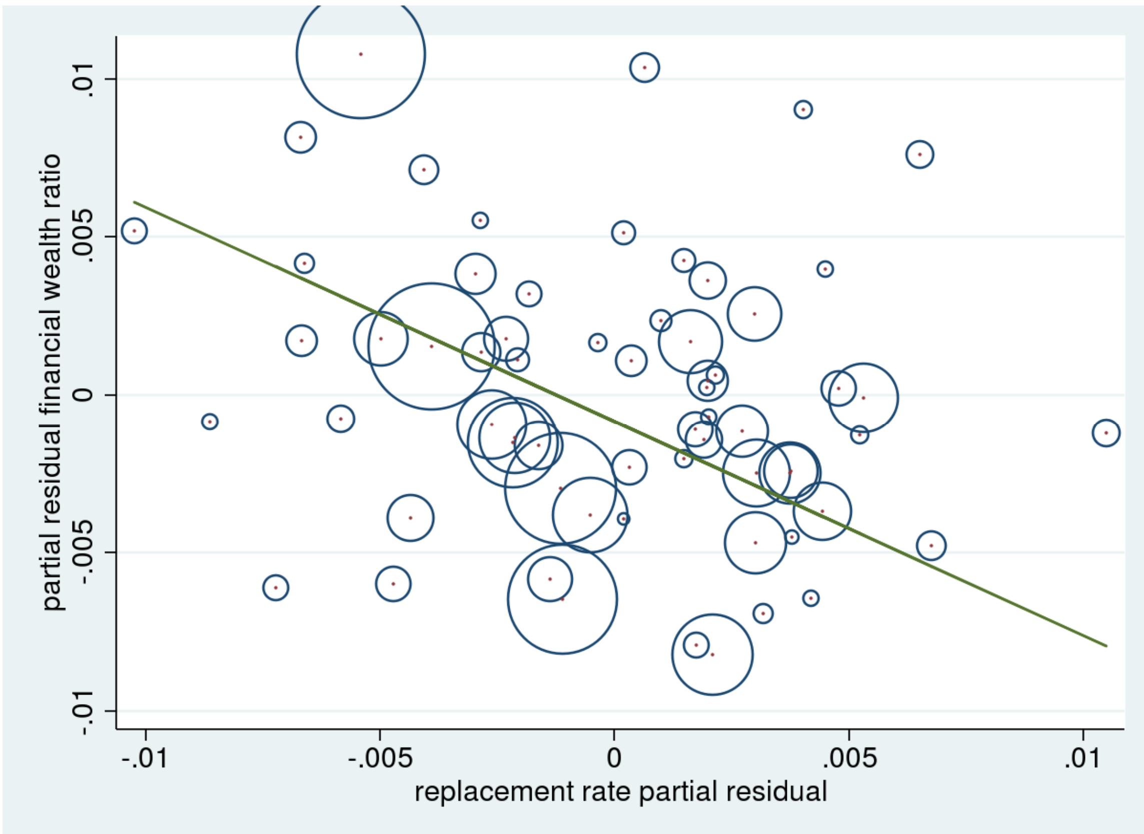
Notes: OECD net replacement rates as a function of multiple of average earnings as reported in the OECD publication "Pension at a Glance". Net replacement rate defined as the ratio of net pension benefits and net earnings.

Figure 2 Country Level Relationship between Lifetime Replacement Rate and the Ratio of Financial Wealth to Lifetime Earnings



Notes: AU Austria, BE Belgium, DE Germany, DK Denmark, EN England, FR France, GR Greece, IT Italy, NL Netherlands, SP Spain, SE Sweden, US United States. The solid line represents a regression line from regressing the ratio of financial wealth to lifetime earnings (A) on the lifetime replacement rate (REP).

Figure 3 Relationship between Replacement Rate and the Ratio of Financial Wealth to Earnings: After Controlling for Group Differences



Notes: Each dot in the figure represents a cell's partial residuals for the ratio of financial wealth/ life time earnings and the net replacement rate as calculated using the formula in the text. The residuals are computed by regressing each variable on a set of indicators for education, household type, and country. The size of the "bubble" around each dot is proportional to the size of the cell (in terms of observations). The solid line denotes the regression line from regressing the financial wealth ratio residual on that for the replacement rate. Its slope is equal to the point estimate reported in column 3 of Table 2 by construction.

Figure 4 Relationship between Pension Wealth and Average Retirement Age: After Controlling for Group Differences

Notes: Each dot in the figure represents a cell's partial residuals for average retirement age and pension wealth. The residuals are computed by regressing each variable on a set of indicators for education, household type, and country and household pre-retirement net earnings. The size of the "bubble" around each dot is proportional to the size of the cell (in terms of observations). The solid line denotes the regression line from regressing the average retirement age residual on that for pension wealth. Its slope is equal to the point estimate reported in column 3 of Table 3 by construction.

Table 1 Descriptive Statistics by Country

Country	Education Level (%) Primary	Secondary	Tertiary	Married (%)	Median Financial Wealth	Mean replacement rate $\phi(y)/y$	average net household earnings	Average Retirement Age
Austria	23.5	53.9	22.6	80.7	10541	91	39889	59.13
Belgium	56.3	21.3	22.4	82.9	20241	66	32021	58.64
Denmark	18.9	52.7	28.4	72.3	43420	90	35727	61.39
England	56.5	32.4	11.1	77.7	21194	57	39478	61.22
France	55.7	27.1	17.2	83.3	24565	65	36571	58.37
Germany	6.6	65.2	28.3	86.9	12963	57	37208	60.46
Greece	72.5	15.5	12.0	85.8	4225	112	21889	60.87
Italy	86.7	10.5	2.7	92.9	8768	79	20365	58.77
Netherlands	56.0	28.2	15.8	90.1	15415	99	30420	59.17
Spain	90.9	4.3	4.7	86.6	5694	82	18609	61.64
Sweden	65.2	20.9	14.0	88.9	29809	71	29875	62.20
United States	27.9	36.1	36.0	81.8	85054	51	59913	61.74

Notes: The sample consists of retired men aged 65-75 in 2004, from Wave 1 of SHARE, Wave 2 of ELSA, and Wave 7 of HRS. Average net household earnings (pre-retirement) was calculated using a pooled sample of working men aged 50-55, using the 1994-1997 waves of the European Community Household Panel (ECHP) and Panel Survey of Income Dynamics (PSID). Sample weights used. Gross income measures in PSID were converted to net income using the OECD tax calculator. Education levels are based on the International Standard Classification of Education (ISCED 1997): Primary = ISCED 0,1 ; Secondary = ISCED 2,3; Tertiary = ISCED 4,5,6. The average retirement age does not include those not yet retired. Financial wealth includes bank account balances, the value of stocks and bonds, and money saved in individual retirement accounts. All monetary figures are 2004 dollars, PPP-adjusted.

Table 2 Regression Results –Replacement Rate

Model	(1)	(2)	(3)
Replacement Rate	-0.245	-0.228	-0.441
	1.85	2.88	2.16
Fixed Effects			
Country	No	No	Yes
Education & Household Size	No	Yes	Yes
N	12	64	64
R-sq	0.182	0.654	0.787

Notes: Results are from regression of the ratio between median financial wealth and mean household earnings on the net replacement rate provided by mandatory public pensions. The first regression uses country-level aggregated measures. The second uses disaggregated data and fixed effects for each education*marital status combination. Education has three categories based on the International Standard Classification of Education (ISCED 1997): Primary (ISCED 0,1), Secondary (ISCED 2,3) and Tertiary (ISCED 4,5,6). Marital status is dichotomous for currently married or not currently married. The last specification includes both group and country fixed effects. Replacement rates are calculated using pension data from OECD and pre-retirement mean household earnings. Pre-retirement mean household earnings is derived from the European Community Household Panel (ECHP) and the Panel Survey of Income Dynamics (PSID). The sample consists of retired men aged 65-75 in 2004, from Wave 1 of SHARE, Wave 2 of ELSA, and Wave 7 of HRS. Absolute t statistics are below the parameter estimates. Regressions use cell counts (number of observations) as weights. Cells with fewer than 5 observations are discarded (8 cells).

Table 3 Regression Results – Retirement Age

Model	(1)	(2)	(3)
Pension Wealth (in thousands)	-0.006	-0.007	-0.011
	0.68	2.05	3.24
Fixed effect controls			
Country	No	No	Yes
Education and household type	No	Yes	Yes
N	12	64	64
R-sq	0.071	0.298	0.915

Notes: Results are from regression of the average retirement age on the pension wealth provided by mandatory public pensions. The first regression uses country-level aggregated measures. The second uses disaggregated data and fixed effects for each education*marital status combination. Education has three categories based on the International Standard Classification of Education (ISCED 1997): Primary (ISCED 0,1), Secondary (ISCED 2,3) and Tertiary (ISCED 4,5,6). Marital status is dichotomous for currently married or not currently married. The last specification includes both group and country fixed effects. Pension wealth is calculated using pension data from OECD and pre-retirement mean household earnings. Pre-retirement mean household earnings is derived from the European Community Household Panel (ECHP) and the Panel Survey of Income Dynamics (PSID). The sample consists of retired men aged 65-75 in 2004, from Wave 1 of SHARE, Wave 2 of ELSA, and Wave 7 of HRS. Absolute t statistics are below the parameter estimates. Regressions use cell counts (number of observations) as weights. Cells with fewer than 5 observations are discarded (8 cells).