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Saving, employment and the design of public pension programmes

by

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Abstract

The paper examines how the design of public pension programmes affects economic activity rates and household saving rates in a large sample of OECD countries over time. Existing cross country studies use measures such as the average replacement rate and on average cost of the programme (the contribution to the 'tax wedge') to calculate these effects. I argue that, in a life cycle saving context, effects on household behaviour depend on programme design features such as how closely the particular pension programme mimics a private retirement saving programmes (its 'actuarial' features) and by the implicit rate of return on contributions. I augment standard measures of programme generosity by summary measures of intracohort and intercohort variations in household returns to public pension programmes, and show that public pension programmes that more closely imitate private programmes are associated with higher economic activity rates among women (but not men), and lower household saving rates. These findings are consistent with the view that more actuarially-based public programmes are treated by participants as a mandatory saving programme rather than as a tax-and-transfer system, so raising economic activity rates but also increasing their substitutability for private retirement saving.

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Saving, employment and the design of public pension programmes

1. Introduction

Basic life cycle theory and a large empirical literature argue that public pension (social security) programmes affect the behaviour of households. Public pension programmes provide benefits after a certain age financed out of general or hypothecated taxes on households. First, by driving a wedge between the pre- and post-tax wage, public pension programmes affect the gains from work and therefore the optimal length and intensity of the working life, as well as providing specific disincentives to economic activity in later life. Second, public provision of retirement income affects the propensity of individuals to engage in private retirement saving and also their wealth decumulation strategy later in life. Although studies differ in what they are testing and how they test it, there seems to be general agreement that public pension programmes will affect household economic activity in direct proportion to the general level of social security taxes (being a substantial component of the tax 'wedge'), in proportion to the generosity of the public pension programme (the average 'replacement rate') and to any specific disincentives to work and save late in life (e.g. retirement tests, income and wealth-testing of social security benefits, and the like).

In all this discussion of the impact of the scale and magnitude of the public pension programme, rather less attention has been paid in the empirical literature as to how the *design* of public pension programmes affect these dimensions of household economic activity. In fact, public pension programmes vary substantially in their provisions, including not just their average generosity but also in their degrees of explicit and implicit redistribution, both within and between generations. The implications of this heterogeneity, both across countries and over time, for household behaviour have not always been thought through.

To give an example: pension reforms have sometimes been explicitly designed to make the public programme 'fairer' in some actuarial sense (i.e. so that individual benefits are more closely matched to individual contributions). There is an implicit assumption that this will 'improve incentives' and thereby affect household behaviour. In effect, making a public tax-financed pension programme look more like a private retirement saving programme may cause individuals to interpret public pension contributions as less like a tax and more like a mandatory saving contribution. This perception may have the effect of ameliorating the perceived 'tax wedge' aspect of the programme, albeit only at the expense of making public pension benefits closer substitutes for private retirement saving, and thereby potentially reducing private retirement saving. In contrast, greater targeting of social security benefits on poorer pensioners will certainly increase the disincentives both to save and to work later in life for recipient households but, by making the programme look less like an actuarial programme, have quite the opposite effect on other groups in the population.

This paper attempts to fill this gap in the literature. It examines how actual variation in the design of public pension programmes across countries and time affects different dimensions of economic activity of households. In the absence of any large volume of literature on this topic (see Section 3 for a discussion of what literature there is), there are two broad ways of tackling this issue. First, we can match exact prospective benefit entitlements to individual households and investigate whether differences in household behaviour or in prospective behaviour (for example, the current saving rate, prospective retirement date etc.) correlate with these projected benefit entitlements. Few, if any, data sets of this type exist and in any event they beg the question of whether people understand the programme in sufficient detail to be able to make projections of their own benefits (or benefit-cost ratios) based on current criteria (and indeed, on forecasts of future government policy).[1] In addition, snapshots of household behaviour cannot exploit variation in pension regimes across time or legislative authority to examine behavioual responses.

The second broad approach, which is adopted here, is to assume that households understand the *general* provisions of the programmes to which they contribute. They broadly understand, for example, whether programme benefits and contributions are earnings-related or, Beveridge-style, designed to provide a basic income floor. Moreover, in some general sense, households understand what, in general terms, they pay into the programme relative to what they expect to get out of it. Using a representative-household approach, we can then exploit cross-country and cross-time period variation in the average characteristics of programmes in order to examine differences in aggregate (or age-specific) economic activity rates, saving rates etc. The paper shows that the design of the programme, in the twin senses of variations in within-cohort and across-

[1] See Dominitz, Manski and Heinz (2003) for an explicit attempt to model household pension expectations in the United States and, for a more general discussion of pension expectations in several countries, Boeri, Börsch-Supan and Tabellini (2001).

cohort 'returns' on contributions, do indeed affect economic activity rates (at least, of certain groups in the labour market) and household saving rates. As such, the study extends in a new direction the existing work (from OECD and others) that simply focuses on the effect of the average generosity and budgetary costs of public pension programmes.

The next section of the paper briefly examines the design of public pension programmes in a standard framework. It then suggests how design differences might be expected to affect various dimensions of household behaviour, *a priori*. Section 3 surveys the existing empirical literature (most of which ignores programme design issues completely). Section 4 then provides a brief account of the construction of the key variables; an issue more extensively discussed in my earlier attempt to examine the economic activity dimension (Disney, 2004). It then provides econometric evidence which shows quite clearly that public pension programme design matters; moreover, careful specification of these design features appears to obtain greater precision in the estimate of the 'effects' of social security – notably of the effect of the 'pension tax' on employment and of the degree of 'saving offset' arising from the public pension programmes. Section 5 then summarises the main conclusions of the paper.

2. Theory

2.1. *Some basic analytics*

In this section, I consider a two period OLG model, and initially follow the notation of Lindbeck and Persson (2003). Generations are denoted by *t* and periods of the life are denoted i=1,2. The individual consumer/household works in period 1 and is retired in period 2, with known date of mortality and no bequests.

Suppose that there is a social security programme paying benefit *b* in the second period and financed by a payroll tax proportional income tax in period 1 levied at rate τ. Second period consumption can then be written as:

$$c_t^2 = [y_t^1(1-\tau) - c_t^1](1+r) + b \qquad (1)$$

where *c* is consumption and *r* is the rate of interest, and *y* is labour income where *y=wl*; *w* is the wage rate and *l* is some measure of lifetime labour supply. Assuming that the individual cannot borrow in period 1 against future social security income, second period consumption is determined by first period saving, by the real rate of interest, and by the size of the social security benefit.

A social security programme may cause the individual to alter their behaviour in two ways. First, by affecting the marginal wage rate, the programme may affect labour supply. Second, to the extent that the social security programme offers a retirement income that substitutes for saving, private saving may also be affected by the existence of the programme. We consider these possibilities in greater detail in Section 2.2 below.

Assume that the social security programme is financed on a pay-as-you-go (PAYG) basis – that is, out of current taxation. Again following the standard notation, write:

$$n_t \hat{b}_t = \tau_{t+1} n_{t+1} \hat{w}_{t+1} \hat{l}_{t+1} \tag{2}$$

where hats over variables denote population averages and *n* denotes the size of the generation. This simply states that the total value of benefits paid is equal to the payroll tax rate times the total wage bill. The average 'return' on contributions for a member of generation *t* can be written as:

$$\hat{b}_t / \tau_t \hat{w}_t \hat{l}_t = (1+G) \tag{3}$$

This states that the internal rate of return on contributions, G, depends on the average stream of benefits relative to the average total value of contributions paid by a member of that generation. Substituting for *b* in (2), denoting n_{t+1}/n_t as (1+*n*) and $\hat{w}_{t+1}/\hat{w}_t$ as (1+*g*), write:

$$\frac{\tau_{t+1}\hat{l}_{t+1}}{\tau_t \hat{l}_t}(1+n)(1+g) = (1+G) \tag{4}$$

With a constant tax rate and a constant labour force participation rate, we get the standard Aaron-Samuelson result that the sustainable long run 'return' on social security contributions, *G**, is approximately equal to the growth of population and the growth of real wages. With dynamic efficiency, this rate should normally be less than *r*, and this discrepancy is sometimes called the 'implicit tax' associated with PAYG finance of social security. However, if governments can increase the participation rate of contributors within the social security programme, or else levy ever-increasing tax rates, G can exceed G* for a period of time and for particular generations (particularly the earliest ones during the evolution of the programme).

This paper argues that the design of the social security programme has implications for the potential impact of the programme on labour supply and on saving.

To illustrate this simply, I continue to assume that the payroll tax, τ, is proportional to the wage, and that specific design features can be illustrated through the formulation of the social security benefit, *b*. Assume, therefore, that the social security benefit is part-'Beveridge' and part-'Bismarck' along the lines described by Casammatta, Cremer and Pestieau (2000), as in (5):

$$\hat{b}_t = \alpha(1+G)\tau y_t + (1-\alpha)\bar{b} \tag{5}$$

Here, the average benefit paid is composed of two components. The first component, weighted by α, is the fraction of the benefit that is proportional to earnings and earns the average 'return' on contributions *R*. This is the 'Bismarck' component of the programme. The second component, weighted by $(1-\alpha)$, pays a flat benefit $\bar{b}$ (or some other formula) entirely unrelated to individuals' contributions to the programme. This is the 'Beveridge' component of the programme.

Substituting (5) into second period consumption in (1), we get:

$$c_t^2 = y_t^1[1 - \frac{(1+r-\alpha(1+G))}{(1+r)}\tau - c_t^1](1+r) - (1-\alpha)\bar{b} \tag{6}$$

To see what implications this programme design has for the average tax rate on the individual, we can consider several simplifications of this rather cumbersome formula. Suppose first that $r = G$ and $\alpha = 1$. This is the case where the public programme effectively imitates a private retirement saving programme – the last term and the term in τ drop out. So long as the mandatory retirement saving rate through the public programme does not exceed the saving that the individual would have undertaken himself or herself, the programme has no impact on individual participation in the economy although there should be a one-to-one offset on private retirement saving.

A straightforward simplification also arises if we assume $r = G$ but that $0 < \alpha < 1$. The programme departs from *actuarial fairness* only insofar as part of the pension benefit paid by the programme is unrelated to individual contributions. The lack of actuarial fairness can be measured by differences in replacement rates across individuals within a generation i.e. a departure from an actuarial basis to the programme in an *intra*generational sense. (6) then simplifies to:

$$c_t^2 = y_t^1[1 - (1-\alpha)\tau - c_t^1](1+r) - (1-\alpha)\bar{b} \tag{6a}$$

Therefore, the degree to which the system departs from actuarial fairness, as measured by *(1 − α)*, the higher the 'tax component' of the social security contribution, τ.

Conversely, suppose $r \neq G$ and $\alpha = 1$. I term this a departure from *intergenerational equity* insofar as average 'returns' to contributors differ across generations. (6) then becomes:

$$c_t^2 = y_t^1[1 - \frac{(r-G)}{(1+r)}\tau - c_t^1](1+r) \quad (6b)$$

The average tax component of the contribution is simply the difference between the return on saving and the 'return' on social security contributions as defined by (3).

In practice, social security programme contributions contain a 'tax component' arising from departures from both actuarial fairness *and* intergenerational equity, although the extent of these relative deviations depends on the design of the programme. It is measuring these departures from an actuarial programmes, and measuring the impacts of these divergences on labour supply and saving behaviour, that form the empirical part of the paper.

2.2. *Impact of pension taxes on employment and saving*

2.2.1. On employment

In the standard economic analysis of the tax 'wedge', higher social security contributions reduce employment in a number of ways. If the worker bears the incidence of the tax, then the wedge between the pre-tax and post-tax wage will affect participation in and hours supplied to the formal economy so long as labour supply is not completely inelastic (OECD, 1990). This could happen in at least three ways:

i) Changes in hours supplied in response to changes in the structure of *marginal* contribution rates and to the indexation provisions of out-of-work benefits (Pissarides, 1998).

ii) Changes in the optimal length of the working life. With a proportional contribution rate then, so long as entitlement to pension benefits is independent of contributions paid, a more generous public pension programme financed by payroll contributions will lead to a shorter working life (Sheshinski, 1978). This result arises because, in an optimal retirement model, the individual chooses the retirement age at which the marginal utility from leisure is equated to the marginal *net* wage.

iii) Higher payroll taxes will give incentives for workers, in collusion with employees, to leave the formal economy and to engage in various untaxed activities.

Alternatively, if workers have some market power and are able to pass the incidence of the payroll tax through to consumers via product prices (at least in part), there will be a direct adverse impact on product demand and therefore on the derived demand for labour. In a unionised open economy, a higher employment tax is partly shifted onto employers if unions obtain a higher nominal wage. Assuming prices are set as a markup over unit costs, the consequent rise in product prices both reduces real expenditure and also leads to a substitution of demand towards competing products (imports). Employment falls irrespective of the elasticity of supply of labour.

In contrast, in the analysis presented here and in Disney (2004), the labour supply effect depends on the *tax component* of the social security contribution rather than the whole contribution. The *inter*generational tax component arises insofar as the lower is G relative to r, the greater the penalty to lifetime incomes arising from mandatory social security contributions and therefore the greater the potential adverse impact on employment. The greater the *intra*generational departure from actuarial fairness (that is, the lower is α in (5)), the less the programme mimics a private retirement saving programme and the closer is the programme to a simple tax and transfer system. In the latter case, assuming that the departures from an actuarial programme broadly involve redistribution towards those with lower lifetime pre-tax incomes, higher income earners face a higher-than-average tax rate in the form of social security contributions that are not fully compensated by post-retirement benefits. This acts as a disincentive to participation in the programme. For lower earners, there *is* an incentive to participate in the social security programme, but the higher pensions than would otherwise have been obtained in an actuarial programme could again induce these workers to retire early.

2.2.2. On saving

The argument that social security contributions should reduce personal saving rates is straightforward. If contributions to a social security programme are a perfect substitute for private retirement saving, social security contributions should offset private saving 1 to 1. However there are various well known *caveats* to this interpretation of social security contributions. First, some private saving may not be for retirement (e.g.

for buffer stock or precautionary motives) and so measured offset should be lower. Second, where mandatory saving (i.e. contributions to the public programme) exceeds that which the individual would have done in the absence of the public programme, lifetime consumption as well saving may be affected. Third, there are various issues concerning the correct measurement and interpretation of private saving, especially when we consider the decumulation phase of funded private pensions (e.g. Jappelli and Modigliani, 1998). And finally, there is the induced retirement effect described by Feldstein (1974) and closely related to the analysis of the preceding sub-section – that social security may induce individuals to bring forward their retirement date by additional regulations such as 'retirement tests' and thereby change the value of private wealth that the household will require at retirement.

As in the preceding analysis, the design of the social security programme should have a differential impact on the saving offset. In the intergenerational comparison, the closer the programme is to a saving programme (i.e. where $R = g$), the greater the potential offset for private saving, not only because of the substitutability of contributions between the public programme and private retirement instruments, but also because the induced retirement effect arising from a greater tax component should be lower for the reasons described in the preceding sub-section.

Where the public programme departs from an actuarial pension plan in an *intra*generational sense, the analysis of the potential offset effect is more complicated. If the public programme is highly redistributive within a generation towards lower earners, those lower earners will have an incentive to save less, whereas higher earners do not receive a return on their contributions equivalent to a private retirement plan and their saving will be hardly affected. The offset should therefore be highest among low earners. But since, as a matter of fact, most private saving is done by high lifetime earners, the average measured offset should be lower the higher the degree of redistribution within the programme. Moreover, the induced retirement effect is unlikely to qualify this conclusion. The higher wealth of low earners may induce earlier retirement than would otherwise be the case, but the higher tax component of the programme might have the same impact on high earners by the reasoning in the previous sub-section.

In principle, therefore, the direct impacts on employment and saving of the social security programme should go in opposite directions. The greater the departure of the social security programme from an 'actuarial' programme (i.e. the greater the 'tax component' of the programme), the greater the potential impact on employment. Conversely, the less the departure of the programme from an 'actuarial' programme, the greater the potential offset to private retirement saving. The only potential qualification to this reasoning is the 'induced retirement' effect arising from other rules in the social security programme such as mandatory retirement ages, 'earnings tests' and so on. However, if we can control for these features of different programmes, the original predictions should stand.

3. Previous empirical literature

3.1. *Effect of public pension progranmes (social security) on employment*

As mentioned previously, the existing empirical literature on the impact of public pension programmes on economic activity and employment is extensive but limited in its handling of the design issue. Generally, studies simply treat public pension (social security) contributions as part of the 'tax wedge' in common with other direct taxes (and sometimes consumption taxes), and then regress some measure of economic activity (employment or unemployment rates) on the 'tax wedge' and a range of other controls. Representative studies that use cross country panel data include Nickell and Layard (1999), Blanchard and Wolfers (2000) and Nickell, Nunziata and Ochel (2005). Studies that explicitly focus on activity rates of older workers such as Blöndal and Scarpetta (1998) generally include a measure of the expected average replacement rate in the public pension programme as an additional control.

Most of these studies focus on institutional features of the various economies, but not on the design of the public pension programme *per se*. Contributions to public pension programmes are simply treated as taxes and often measured at face value even though, for example, several countries do not levy separate hypothecated social security contributions. Not surprisingly, studies find little direct evidence of a relationship between average social security contributions (which are sometimes therefore measured as zero, although the country in question has a public pension programme) and economic activity rates (e.g. Nickell and Layard, 1999). The closest to a discussion of institutional differences and tax rates is in how institutional differences affect tax *incidence* – see OECD (1990) and Nickell (2004).

One paper, however, takes the issue of incidence further to examine explicitly the issue of public pension programme design and the degree of tax shifting onto employees. Although using data for only 6 countries and a rather crude measure of 'Beveridge' v.

'Bismarck' in proxying design features of public programmes, Ooghe, Schokkaert and Flechet (2003) provide some tentative evidence that contributions are shifted on to employees to a greater extent in Bismarckian programmes (that is, with a higher value of α in equation (5) above). This is compatible with the view (in this dimension at least), that in programmes that more closely match benefits to contributions, employees treat contributions more like a mandatory saving programme and less like a tax.

Since some of the data and arguments utilised in Disney (2004) are summarised later in this paper, only a few points are pertinent at this point. First that paper measures effective contribution rates exploiting the identity in equation (2). Second, inserting the effective contribution rate into regressions of age and gender-specific economic activity rates shows some evidence that higher contribution rates and higher pension replacement rates reduce economic activity rates for women, but the implicit elasticities are low and not always significant. The effects for men are mostly insignificant. However, substituting calculations of the *tax component* of contributions for these measures (as described in the next section of the present paper) yields much stronger results.

3.2. *Effects of public pension programmes (social security) on saving*

There is, again, a substantial literature on how contributions to public pension programmes affect private saving rates.[2] Again, few of these studies explicitly take account of design features of the programme that might enhance (or otherwise) the substitutability of public pension contributions for private retirement saving, although Jappelli and Modigliani (2003) do emphasise strongly that assumptions made as to the substitutability (or incidence) of contributions are central to an interpretation of the results of such studies.

A few studies calculate prospective public pension entitlements in household data sets and examine whether these values are associated with differences in household saving rates (as in, for example, Hubbard, 1986, Alessie, Kapteyn, and Klijn, 1997). The trouble with this approach is that results are quite sensitive to the calculation of expected (or current replacement rates); there has to be regime variation to examine differences in behaviour across alternative types of programmes and, thirdly, prospective pension entitlements across households are likely to correlate very strongly with other control variables that are should be used in explanations of differences in household saving rates

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[2] For a selective survey, see Disney (2000a).

(notably income and wealth). A few studies do explore the more promising avenue of using pension regime changes in order to measure offsets of private retirement saving arising from public pension programmes, notably Attanasio and Brugiavini (2003) for Italy and Attanasio and Rohwedder (2003) for the UK, but such studies are relatively unusual.

Most studies of the 'offset' between public pension programmes and private saving therefore use either time series methods, or country cross sections, or a combination thereof, and stem from the seminal work of Feldstein (1974). Feldstein estimated a time series model of consumption spending regressed on income, social security wealth (SSW; both gross and net of contributions) and other household wealth for the US economy 1929-71. Social security wealth was estimated with a constant replacement rate so time series variation in SSW was primarily driven by variations in household composition and real earnings growth. Consumption was positively associated with SSW, leading him to calculate that total private household saving is approximately halved by social security wealth during the period.

This article spawned a good deal of controversy concerning methodology, data and estimation methods. Apart from a flaw in the programming, subsequently corrected (e.g. Feldstein, 1996), the key question concerned the measurement of the replacement ratio (RR). In particular Leimer and Lesnoy (1982) argued that the measure of the replacement ratio should take account of the cohort-by-cohort variation in expected RRs rather than simply assuming a constant RR (bar the major change in benefit rules that occurred in 1972). This issue of whether calculations should use average programme parameters, *current* programme parameters (such as observed RRs) or projected parameters by cohort is an important issue in modelling programmes, and reverts to the question of whether programmes participants are assumed to take current outcomes or future prospective outcomes (if these can be measured) as their measure of SSW.

Kotlikoff (1979) uses cross section data from a sample of US heads of households aged 45-59 in 1966 to examine the impact of social security wealth or household private net worth. He calculates two values for each household: the value of accumulated social security taxes (ASST) and the future *net* return from social security which equals the present value of future benefits less future social security taxes and less ASST. Since this net return is discounted at the real interest rate, then the 'implicit tax' from PAYG funding (see Section 2.1 above) should imply that the average value of this measure of SSW is negative, although intra-cohort departures from actuarial fairness will ensure that there is household variation in the variable. Kotlikoff finds that household net worth is negatively correlated with ASST (coefficient = −0.67) which is compatible with a model in which payments of social security taxes are at least partly perceived as providing a future entitlement to a retirement pension, but the coefficient on his net SSW measure is positive and insignificant which, he argues "…cast doubt on the ability of people to accurately project their Social Security benefits and their age of retirement; large differences in lifetime wealth generated by the social security system do not appear to influence savings" (*ibid.* p.408).

Another influential paper for the present analysis from this early literature is that of Feldstein (1987) who calculates the trade-off for various parameter values between a means-tested public pension programme that encourages some households to stop retirement saving completely but which requires a lower contribution rate, and a comprehensive Bismarck-style earnings-related programme that requires a higher contribution rate and which encourages *all* participants to reduce their retirement saving by some fraction. In general, his simulations suggest that the net impact of programmes on household saving will be higher in a comprehensive public pension programme (that is where α and τ are higher, in the terminology of Section 2) that in programmes where benefits are specifically targeted, although of course in the latter case, some households will not save at all in order to avoid the prospective impact of the means test in retirement.

Finally, we can note that several papers approach the issue of public pension programmes and retirement saving using cross-country data sets, with mixed results. Early post-Feldstein studies such as Barro and MacDonald (1979) and Koskela and Viren (1983) use, respectively, a cross section of countries and a short panel. They find no evidence that more generous public pension programmes (proxied simply by social security/GDP ratios with additional demographic controls) reduce household saving, although the latter study finds evidence that more generous public pensions reduce economic activity of the 65 and over age group. In contrast, a short panel analysis of 12 OECD countries by Feldstein (1980) suggests that a '10% percentage increase in the benefit-to-earnings ratio reduces the saving rate by approximately 3 percentage points' (*ibid*, p.236). In more recent studies, Callen and Thimann (1997) suggest that demographic dependency, the ratio of direct taxes to GDP and the ratio of gross transfers to GDP all have adverse effects on household saving in a long panel of 21 OECD countries, although public pension programmes *per se* are not identified as the culprit. More recent studies with greater samples of countries and greater econometric sophistication (e.g. Loayza *et al*, 2000) find evidence that private and household savings rates are affected by demographics but do not include any variables that reflect social security wealth or other proxies. No studies, therefore, to the author's knowledge, utilise public pension programme design as a variable in cross country estimates of the determinants of household saving.

4. Empirical estimates

4.1. *Data and methods*

The empirical analysis here is conducted for 22 OECD countries for which consistent data are available over along period. We consider a 'representative agent' retiring in each country in three periods: the 1970s, 1980s and 1990s (I take mid-points of the decades) and define the variables in turn. For the public pension replacement rate (**Pension RR**), I use rates calculated by Blöndal and Scarpetta (1998). These are the average replacement rates expected by workers in their mid-50s when they retire in each period and country (the authors provide several replacement rates at each point in time, the variation in which I exploit shortly).

I do not use actual reported public pension programme contribution rates, as these are often notional rates (including zero). Instead, I use data from the ILO (with some adjustments, described in the Appendix to the present paper) to construct ratios of workers to pensioners in each period (see Appendix Table A1; this is the variable **support ratio** in some tables below. Given the average replacement rates from Blöndal and Scarpetta, these support ratios can then be used to calculate 'effective' contributions rates using equation (2) above – these are the contribution rates that are effectively being levied to finance the current outgoings of the public pension programme given the demographics and expected current replacement rates. These calculated values, described in Table A2, are the **contribution rate** used in the later empirical estimates. Note that estimates of internal rates of return to pension contributions (see below) require that this calculation of contribution rates be made for each decade from the 1950s to the 1990s.

Several variables are used to capture the design features of the public pension programme. The first is designed to measure the deviations of rates of return *within* cohorts arising from variations in replacement rates across household types. This variable, named **Pension tax**, is intended to capture the term $(1 - \alpha)$ in equation (5), and therefore to measure departures from what I termed *intra*generational 'actuarial fairness' in Section 2. It is calculated as the coefficient of variation of replacement rates across several household types in the same country and year (delineated by level of income and number of people in the household) using the data contained in Blöndal and Scarpetta (1998) for several household types. If every household type receives the same replacement rate, the 'pension tax' is zero; the highest value is for Australia in 1995, where the coefficient of variation is almost 0.4.[3]

The second variable is intended to capture differences in *inter*generational rates of return over time and country, and involves rather more computation. It is termed **IRR at 65** in the ensuing tables, and involves estimating, for a representative agent in each country and period, the expected internal rate of return from retiring at age 65, akin to the *G* in equation (3) above.[4] The method of constructing these internal rates of returns is described in a little more detail in the Appendix. It extrapolates the average replacement rates constructed by Blöndal and Scarpetta (1998) to construct expected pension replacement rates for three cohorts born in 1920, 1930 and 1940 and, therefore, broadly retiring in the mid 1980s, 1990s and 2000s. The method then utilises the effective average contribution rates constructed as described previously for each decade since 1950 to the 1990s, taken at midpoints.

Given contribution rates over time, calculating internal rates of return for our three cohorts for the 22 countries is reasonably straightforward. In each decade, the contribution rate is applied to average earnings, which grow in each decade in real terms (the earnings index is obtained from OECD data). It is assumed that the first cohort, born 1920, only starts contributing in 1950 (to capture the advantage accruing to the earliest generation) but that subsequent generations contribute until they are aged 65. This gives the total value of contributions paid. The replacement rate is then applied to real earnings at retirement, and the pension is increased in line with subsequent earnings growth if earnings indexation is in place. Expected age of death is taken from Blöndal

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3 Other higher values of this 'pension tax' include New Zealand, the UK and Ireland, all of which have 'Beveridge'-type pension regimes. See Disney (2004) for graphical illustrations.

4 Of course, actual average retirement age is typically less than age 65 but will be endogenous to the economic activity and saving rates, which we want to explain, so I use **IRR at 65** as a proxy for this. For a comparison of calculations of average IRRs at average expected retirement ages and calculated IRRs at age 65, see Disney (2004).

and Scarpetta (checked on ILO data) with survivors' benefits paid at the appropriate rate for that country until the spouse's expected age of death.

The internal rate of return is then computed as that rate of return at which the present value of the (negative) stream of contributions paid is equal to the present value of the (positive) stream of pension benefits. Appendix Table A3 gives the calculated values. Note the wide variations across countries but the almost universal fall in IRRs after the first decade. At just over 1%, the average IRRs for the generations born in 1930 and 1940, are likely to be well below r in equation (1), illustrating the 'implicit tax' from PAYG financing and the above-average returns obtained by the first generation. However *actual* cohort IRRs have typically been higher than those calculated in Table A3 because individuals have been permitted to retire early than age 65 (see Disney, 2004, for evidence and discussion).

The matrix of coefficients below show how these various measures of the public pension programme are correlated. First, there is very strong positive correlation between the average generosity of the programme, as measured by Pension RR, and the contribution rate. Remembering that the latter is calculated from applying equation (2) above using the support ratio and the average replacement rate, this tells us that variations in contribution rates are almost wholly driven by variations in replacement rates rather than by differences in demographics – indeed the correlation of support ratios and contribution ratios is negative. So the table shows that there would be a significant collinearity problem if we were to include both replacement rates and contribution rates in the same regression (quite apart from any econometric issues arising from the construction of the latter variable).

Correlation coefficients for calculated variables

Correlation	Contrib. rate	Pension RR	Pension tax	Support Ratio	IRR at 65
Contrib. rate	1.0000	-	-	-	-
Pension RR	0.9500	1.0000	-	-	-
Pension tax	–0.4834	–0.5673	1.0000	-	-
Support Ratio	–0.6440	–0.3932	0.0854	1.0000	-
IRR at 65	0.0513	0.1431	–0.2586	0.1455	1.0000

Second, there is a negative correlation (although not so strong) between the 'pension tax' variable and the contribution rate. This simply suggests that countries with highly redistributive (Beveridge) programmes have less costly public pension programmes than countries that link benefits more closely to earnings (Bismarck). Thirdly, and gratifyingly from an econometric point of view, the calculated 'IRRs at 65' do not strongly correlate with the other pension variables.

Two other variables characterising the public pension programme are included in the regressions The first, **Retirement test index**, measures the intensity with which a retirement test is applied to those over state pension age. This indicator variable uses information from OECD and the US Social Security Administration's description of country-specific pension programmes and takes 4 values as follows:

0 = no retirement or earnings test
1 = retirement or earnings test but deferral of pension permitted and earnings threshold for test>0
2 = retirement or earnings test but *either* deferral permitted *or* some earnings exempt from test
3 = full retirement test – pension receipt conditional on full retirement; no opportunity for deferral of pension.

The second, **Earliest pension age**, is the earliest age at which individuals can obtain the normal state pension, taken from the same source.

Other control variables are included (although some are omitted from the illustrated specifications due to lack of significance. These include the Blanchard-Wolfers (2000) measure of **Demand shocks**, and the **Employment variation index**, and a time-varying measure of **Union density**, as well as measures of the average growth of GDP and the unemployment rate. Given that our specifications utilise country fixed effects as well as time dummies, only institutional differences that have time variation can be included.

4.2. *Empirical estimates*

4.2.1. Impact of programme design on economic activity rates

Table 1 presents economic activity rate regressions for the 22 countries over the 3 periods, with the emphasis on the role of pension design variables in the explanation of these activity rates.[5] The priors (see Section 2.2) are that a lower value of **pension tax** and a higher value of **IRR at 65** induce greater participation because they reduce the 'tax

[5] The results differ slightly from Disney (2004) by reason of estimation method and minor data corrections. There is no equivalent on Table 2 in that paper. Current ongoing research is intended to update the results by adding a fourth time period.

component' of the public pension programme, thereby making work more attractive. This is because they lower $(1 - \alpha)$ and $(r - G)$ respectively (see Section 2.1).[6] Likewise, and in standard fashion, a higher value of **Pension RR** might reduce participation rates among older workers (although perhaps inducing higher participation earlier in the working life in order to increase eligibility).[7] A more stringent **retirement test index** might induce *greater* participation among older people pre-public pension age, since they should substitute work in the period before pension age for work after. A higher value of the **earliest pension age** should probably raise economic activity rates among age groups close to that age, although with contradictory effects on younger groups, for the reasons rehearsed in the previous case.

For the other control variable, a positive coefficient on **demand shocks** is anticipated; **union density** is a traditional control variable in cross country regressions, possibly having an adverse impact on employment and therefore economic activity. The **employment protection index** has uncertain effects *a priori* (see Nickell and Layard, 1999) although we might expect differential effects for men and women given likely tenures – protecting the jobs of older men with perhaps the opposite effect on groups, such as women, with more fragmented career histories. Note too that the equations contain fixed effects, so that within-group variation is driving the parameter estimates.

With these in mind, what does Table 1 show? For women aged 50-54 and 55-59, the results almost all conform with the priors, which is fairly striking given the limited number of degrees of freedom and the nature of the indicators used to proxy underlying pension design characteristics. In particular, a lower value of the pension tax raises economic activity rates (although the result is not significant for age group 55-59) and a higher value of IRR at 65 significantly raises economic activity rates for both age groups. A more generous replacement rate on pension benefits significantly lowers economic activity rates. The positive sign on the retirement test index is also consistent with priors although the normal pension age has no impact.

The time dummies confirm that there is a trend towards rising economic activity rates among older women (once we condition on the pension programme variables). Demand shocks are positively signed but insignificant, union density negative but also

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[6] This abstracts from the adverse income effect arising from a higher tax burden on the household. However, it is arguable that, for older households, the substitution effect should outweigh the income effect – see, again, Sheshinski (1978).

[7] Among younger workers, the 'tax component' of the programme may still be pertinent but the relevant 'outside option' should be UI benefits or equivalent.

insignificant. Interestingly, the severity of the employment protection index reduces economic activity rates among older women – not significantly, but the contrast with men is described below. Overall, however, the results for women strikingly confirm most of the original hypotheses.

Table 1:

Economic activity regressions for older workers, by tax components of pension programme

Dep. Variable: Age-activity rate	Women 50-54	Women 55-59	Men 50-54	Men 55-59
Pension tax	−1.34***	−0.35	0.20	1.60***
	(0.37)	(0.30)	(0.17)	(0.29)
Pension RR	−0.20***	−0.17***	−0.14***	−0.14***
	(0.07)	(0.05)	(0.03)	(0.05)
IRR at 65	0.91**	0.89***	−0.54***	−0.28
	(0.36)	(0.29)	(0.17)	(0.49)
Retirement test index	5.07**	4.59***	2.29**	4.39***
	(1.97)	(1.60)	(0.91)	(1.53)
Earliest pension age	0.15	−0.01	0.53***	−0.09
	(0.38)	(0.31)	(0.18)	(0.29)
Demand shocks	0.19	0.10	0.17***	0.04
	(0.12)	(0.10)	(0.06)	(0.09)
Union density	−0.07	−0.06	0.07	0.03
	(0.11)	(0.09)	(0.05)	(0.08)
Employment protection index	−2.06	−1.32	3.73***	5.38***
	(2.00)	(1.62)	(0.93)	(1.55)
1980s	8.89***	4.44***	−1.42***	−6.56***
	(1.06)	(0.87)	(0.49)	(0.82)
1990s	19.00***	11.75***	−1.01*	−6.95***
	(1.14)	(0.92)	(0.53)	(0.88)
Log likelihood	−135.40	−122.40	−86.94	−119.30
Wald $\chi^2(30)$	2360.0	3141.6	1113.6	1666.2
	(0.0000)	(0.000)	(0.0000)	(0,000)

Notes
Estimated by generalised least squares, weighted by civilian employment; country fixed effects; standard errors in parentheses.

***=1%, **=5%, *=10% significance. N=66 (22 countries in 1975, 1985, 1995).

For men, the results do not confirm the hypothesis that the design of the public pension programme matters. True, the replacement rate has the predicted adverse impact on economic activity, and the employment protection index has the expected positive sign. Demand shocks now enter significantly and positively for 50-54 year old men. However the two measures of the 'tax component' of the public pension programme enter either insignificantly or perversely. It should be noted that the same perverse or insignificant results apply if we enter the 'traditional' measures of the tax wedge, including the pension contribution rate (not shown here, but see Disney, 2004, for some illustrations). Insignificance can be explained simply by the well-known result that men's participation is less responsive to post-tax wages than women's, but the perverse signs, although not universal, cannot so easily be explained.

Other, plausible, parameters in the equation suggest that there is a downward trend in participation over time, especially among the 55-59 year olds, and on contrast to women. In addition, increased strength of the employment protection legislation is associated with higher economic activity rates, in complete contrast to women, suggesting that, on balance, such legislation protects workers with longer tenures.

4.2.2. Impact of programme design on household saving rates

This section provides new results on the impact of the design of the public pension programme on household saving rates. It departs from the traditional literature in Section 3.2 in considering explicitly the impact of the parameters of the programme as opposed to simply including the generosity of, and contributions to, the programme. Note that we are here assuming that *current* household saving is associated with the *current* parameters of the pension regime. It might be argued that a forward-looking young household would save with a view to the prospective pension regime at the point at which they retire, and of course, the current regime may give little guide to this outcome.[8] There are three responses to this view in the present context: first, we do not have age-specific saving data for enough countries; second, this seems a more pertinent critique of the traditional indicators of the public programme since some of these (such as the contribution rate) are likely to be time-varying, but it seems a less pertinent issue with design features (such as whether the programme is basically Beveridge or Bismarck); third, most of the saving in the economy is probably done by working households in the latter part of their working life, who are closer to retirement.

Table 2 provides both two 'traditional' specifications of the life cycle model that examines the impact of the public programme programme on the household saving rate, in which, respectively, the public pension contribution rate and the public pension replacement rate are included (not simultaneously, given the correlation matrix described previously). The 'standard' model suggests that a higher **contribution rate** and/or a higher **pension RR** in the public programme should reduce private household saving,

8 This is, in effect, the source of the dispute between Feldstein (1974) and Leimer and Lesnoy (1982) alluded to earlier.

with a likely 'offset coefficient' of between 0 and 1. Standard life cycle theory also suggests that a higher **support ratio** raises household saving. The LCH theory also suggests that other variables, such as the growth of GDP, should affect saving, but the results are generally insignificant.[9] Higher **demand shocks** might increase saving, if there is a transitory component. There should also be country-specific effects and time period effects. These variables characterise the 'baseline' specifications in Table 2, columns (1) and (2) – preceded by the means and standard deviations of the variables.

The 'traditional' model in Table 2 suggests that a higher contribution rate to the public programme (column 1) and a higher public replacement rate (column 2) reduce household saving rates. The coefficients are significant, but not large. Household saving rates are strongly positively associated with variations in the support ratio, as theory would suggest. The positive association with demand shocks is also consistent with theory. There are large country-specific effects (not included) and evidence of a fall in household saving rates, *ceteris paribus*, in the later decades relative to the 1970s. These results suggest that the data generate plausible results for the standard model of saving offset, although the implicit offset coefficient is rather low.

Now consider the final column (3) of Table 2, where public pension programme design features are included. Again, from the discussion in Section 2.2, we consider the offset to be greatest where the public programme is a close substitute to private saving. This substitutability, I argued, is highest where $(1 - \alpha)$ is low (i.e. **Pension tax** is low) and $(r - G)$ is also low (i.e. **IRR at 65** is high). So we should expect a *positive* impact of pension tax on household saving and a *negative* impact of IRR at 65 on saving. This is exactly what Table 2 illustrates, with large well-specified parameter values. As before, the support ratio is positively and strongly associated with household saving, there are time effects (strengthened relative to the results in columns (1) and (2)) and demand shocks enter with the correct sign. The two variables concerning the parameters of the retirement regime appear to have no effect. This, perhaps surprisingly conclusive, result suggests that the design of public pension programmes matters if we are to understand the impact of such programme on household saving rates.

[9] This is true when using the Blanchard-Wolfers measure, which may correlate with demand shocks, which are included. I intend to experiment further with alternative GDP level and growth measures.

Table 2:

Household saving rates, by components of pension programme

Dep. Variable: Household saving rate	Mean of Var. (Std dev)	(1) Coeff. (Std. Err)	(2) Coeff. (Std. Err)	(3) Coeff. (Std. Err)
Contribution rate	25.08	0.14**	-	-
	(9.55)	(0.07)		
Pension RR	59.84	-	0.06*	-
	(17.32)		(0.04)	
Pension tax	3.39	-	-	0.64***
	(2.28)			(0.19)
Support ratio	2.47	4.25***	3.28***	7.99***
	(0.36)	(0.77)	(0.66)	(0.99)
IRR at 65	2.02	-	-	–1.16***
	(2.22)			(0.21)
Retirement test index	1.24	-	-	–0.80
	(1.07)			(0.87)
Earliest pension age	61.63	-	-	–0.25
	(3.39)			(0.18)
Demand shocks	0.21	0.12*	0.11*	0.11**
	(7.39)	(0.06)	(0.07)	(0.05)
1980s	-	–2.02***	–2.08***	–3.98***
		(0.47)	(0.50)	(0.55)
1990s	-	–2.28***	–2.82***	–3.82***
		(0.52)	(0.56)	(0.46)
Log likelihood		–107.47	–101.94	–90.15
Wald χ^2(25 or 28)		1145.5	1127.6	1668.2
		(0.000)	(0.0000)	(0.0000)

Notes:
Mean of household saving rate: 11.38 (6.21)

Estimated by generalised least squares, weighted by civilian employment; country fixed effects included; standard errors in parentheses.

***=1%, **=5%, *=10% significance. N=66 (22 countries in 1975, 1985, 1995).

5. Conclusion

This paper represents a first attempt to examine the impact of the design of public pension programmes on *both* economic activity rates and household saving rates, using a short panel of OECD countries. The past literature that considers the impact on pension programmes on household economic activity, with very few exceptions, simply treats public pension contributions as a tax, which are added to the 'tax wedge' and added as a RHS regressor to a model of economic activity (or unemployment) and the cross-country variation in institutions. The contention here is that public pension contributions are not simply another 'tax' and nor are they a pure form of retirement saving, since returns to those contributions differ both within and across generations. By measuring how far such returns differ from those in an 'actuarial' scheme in any given setting, we are able to measure the 'tax component' of those contributions and show that, at least for women, it is the tax component that is the determining factor in the relationship between the public pension programme and the economic activity rate. However, a note of caution arises insofar as the hypothesis does not work so well for men. These points are explained at greater length in Disney (2004).

The second part of the paper attempts to apply exactly the same argument to the literature as to whether contributions to public pension programmes have an offsetting impact on private retirement saving. Here, with a few exceptions, the maintained hypothesis in the literature seems to be the opposite of the literature on economic activity and unemployment. In the economic activity literature, public pension contributions are normally seen as a tax, whereas in the saving offset literature, the 'tax' elements of public pension (social security) contributions are largely ignored (that is, the departures from an 'actuarial' programme) and the contributions are largely seen as substitutes for retirement saving. However, the paper again makes the same argument, that in different countries and time periods, public pension programme contributions have varying 'tax components' relative to their retirement saving component. When we make the appropriate calculations, the results strongly suggest that public pension programme design makes a big difference to the degree of which contributions offset private retirement saving.

Using cross country analyses with averages of behavioural variables and various indicators of programme design is inevitably a very 'broad brush' approach to examination of the impacts of pension regimes on economic activity rates and household saving rates. It would be interesting, for example, to focus country-by-country on age-specific saving rates, or to examine the impact of *marginal* tax rates on behaviour – average rates give a limited guide to the margins where decisions as to how much to work and save may be important. I have made this point elsewhere (Disney, 2000b). Nevertheless it is important to emphasise that calculations that utilise differences in programme design must have some variation – whether across countries or time – to exploit in order to investigate the hypothesis. It is no surprise that it is in countries where we have seen public pension programme reforms that differentially affect cohorts (such as in Italy and the UK) where comparable studies using microdata become feasible.

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Appendix

Definitions of variables

Age-activity rate: Proportion of age group *i* at *t* economically active. Derived from *ILO* statistics website *LABORSTA* and from extrapolation where annual data unavailable e.g. Switzerland, UK.

Household saving rate: Average household saving rate as a % of GDP over the decade. Derived from OECD online data and (for 1970s) from Callen and Thimann (1997).

Pension RR: These are the average expected gross public pension replacement rates constructed by Blöndal and Scarpetta (1998), Table III.3 for 1961, 1975 and 1995. They are stylised indicators of what a 55 year old at each date could expect, in terms of public pension benefits relative to earned income at retirement, if that individual started work at age 20 (*ibid*, Box III.1). By interpolation (with adjustments where pension reforms seem to have had significant impacts, as in the United Kingdom in the late 1970s) and by extrapolation to the mid-1950s, I have used these data to construct mid-decade estimates of expected replacement rates for a 55 year old in 1955, 1965, 1975, 1985 and 1995. The resulting data are given in Table A2. It is both striking how much replacement rates differ across countries, and also how, in many countries, these rates have increased systematically over time.

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The support ratio: ILO data on activity rates gives the ratio of actual workers aged 15-59 to people aged over 60. To convert this ratio into an effective support ratio, I make a couple of additional assumptions. First, I remove all workers aged under 20 and over 60, on the grounds that their contribution to total contribution revenue is likely to be low (low incomes and/or low hours). Secondly, it should not be assumed that all people over 60 receive a pension from the public programme – as described earlier, most countries have a contribution requirement underpinning eligibility for benefits. As an approximation, I take all men as eligible for a pension, and the proportion of women eligible as equivalent to the highest rate of participation observed in each decade's cross-section of participation rates for women. So, for example, if the highest 5 year age band participation rate is 70%, I assume that this percentage will receive a full pension. Since non-contributors are generally entitled to *some* benefits, especially widows (and widowers without their own pension rights), I use information on rights to survivors benefits (which varies across these countries from 0% to 100% of the original award) from the US Social Security Administration's *Survey* of country pension programmes.

The data are depicted in Table A1.

Actual contribution rates, although sometimes used in 'tax wedge' calculations, are almost useless for purposes of estimating effective tax rates. Some countries, such as Australia and New Zealand, do not levy separate contributions at all – in these countries, public pensions are financed out of general taxation. In other countries, such as Greece and Italy, effective contribution rates have understated the 'true' costs of paying pensions, for many years being subsidised by direct budgetary transfers and borrowing. Finally, in some other countries, assets are accumulated within the public pension programme (such as the US social security Trust Fund), which implies that the measured contribution rate exceeds that required to finance current pension expenditure. In contrast, some countries, such as Japan, have systematically run down accrued public pension assets over time. Finally, some countries (such as the United Kingdom) can more-or-less automatically adjust contribution rates to finance outgoings, whereas other countries (such as the United States) require legislation to vary contribution rates, and approval is not always forthcoming.

Pension contribution is *Pension RR* divided by *The Support Ratio*

Pension tax: Blöndal and Scarpetta (1998) report expected pension replacement rates for four categories of 55 year old contributors – single people and couples, on average earnings and at 66% of average earnings. These calculations capture two dimensions of departures from intragenerational actuarial fairness – that contributors at different earning levels are treated differently and that contributors in couples may or may not get differential benefits relative to contributions (especially when their partners are not working). To give an example from the Blöndal and Scarpetta data, the 1995 figures for replacement rates for Belgium are singles at mean earnings: 60%, at 66% of mean earnings: 60%; couples at mean earnings: 75%, at 66% of mean earnings: 75%. Clearly in one dimension there is approximate actuarial fairness (earnings level) but not in another (singles v. couples). Compare this with Australia where the respective replacement rates are 37%, 24%, 62% and 41%, and where there are departures in both dimensions.

The following indicator is constructed: if the four Blöndal and Scarpetta expected replacement rates are identical for each country-time observation, *Pension tax* is zero. If the rates vary, then the coefficient of variation of the replacement rates gives an approximate measure of the departure from actuarial fairness in each country and time period (the normalisation does not affect the ranking – a similar ordering would occur if, say, the mean square error was used).

IRR at 65: For each of the 22 countries examined in this study, the average replacement rates serve two purposes. First, they permit us to construct expected pension benefits for three cohorts of individuals in each country – those aged 55 in respectively, 1975, 1985 and 1995. I term these three cohorts as those born in 1920, 1930 and 1940, who are assumed to retire in, respectively, the mid- 1980s, 1990s and 2000s.

Given these values, the internal rates of return are constructed as follows. In each decade, the contribution rate is applied to average earnings, which grow in each decade in real terms at the average rate reported in OECD data. It is assumed that the first cohort, born 1920, only starts contributing in 1950 (to capture the advantage accruing to the earliest generation) but that the subsequent generations contribute into their fourth (or even fifth) decade of work, depending on average retirement age. The replacement rate is then applied to real earnings at retirement, and the pension is increased in line with subsequent earnings growth if earnings indexation is in place. Many countries indexed benefits to earnings until the 1980s; thereafter shifts to price indexation or partial indexation are common. Expected age of death is taken from Blöndal and Scarpetta (checked on ILO data) with survivors' benefits paid at the appropriate rate for that country until the spouse's expected age of death.

The internal rate of return is then computed as that rate of return at which the present value of the (negative) stream of contributions paid is equal to the present value of the (positive) stream of pension benefits. In Disney (2004), I present some calculations from other sources of IRRs for particular cohorts to compare with these numbers (e.g. from

Germany, Italy and the UK – most other countries in this sample have had no comparable calculations to my knowledge).

Retirement test index and *Earliest pension age* are described in the text.

Demand shocks is the Blanchard-Wolfers (2000) measure of changes in aggregate demand, as described at http://econ-wp.mit.edu/RePEc/2000/blanchar/harry_data/.

Union density, as described by Nickell and Layard (1999) contains only cross-country variation in that source. Time variation for this variable was obtained by exploiting information on union density across countries over time held at Cornell University. See the document: http://www.ilr.cornell.edu/library/downloads/FAQ/UNIONSTATS2002.pdf.

Employment protection index: This variable is the time-varying index constructed by Blanchard and Wolfers (2000) and described at their website cited above.

Table A1
Effective economic support ratios (%), 1955-95

Country	*1955*	*1965*	*1975*	*1985*	*1995*
Australia	2.63	2.68	2.82	2.80	2.78
Austria	2.61	2.12	2.12	2.28	2.28
Belgium	2.12	1.93	1.99	2.07	1.96
Canada	3.08	3.07	3.20	3.20	3.05
Denmark	2.82	2.37	2.46	2.76	2.79
Finland	4.12	3.26	3.13	2.94	2.66
France	2.46	2.29	2.46	2.53	2.34
Germany	2.95	2.37	2.45	2.62	2.46
Greece	3.22	2.44	2.09	2.05	2.08
Ireland	2.21	1.94	2.21	2.37	2.61
Italy	2.90	2.43	2.35	2.18	2.00
Japan	4.42	4.05	3.68	2.94	2.25
Luxembourg	2.50	2.10	2.05	2.27	2.22
Netherlands	2.27	2.27	2.37	2.53	2.56
New Zealand	2.77	2.63	2.78	2.83	2.95
Norway	2.35	1.96	2.03	2.13	2.32
Portugal	2.63	2.20	2.61	2.60	2.34
Spain	3.16	2.55	2.61	2.46	2.22
Sweden	2.35	2.05	2.06	2.08	2.19
Switzerland	2.63	2.39	2.35	2.43	2.41
UK	2.27	2.09	1.98	2.01	2.10
US	2.68	2.53	2.53	2.63	2.75
Average	*2.78*	*2.44*	*2.47*	*2.49*	*2.42*

Source: ILO online data and own calculations as described in Disney (2004).

Table A2
Effective contribution rates to public pension programmes in OECD countries 1955-95 (%)

Country	*1955*	*1965*	*1975*	*1985*	*1995*
Australia	7.3	9.2	11.6	13.2	14.7
Austria	30.5	37.5	37.5	34.9	34.8
Belgium	34.2	37.1	35.4	33.3	34.4
Canada	10.2	12.0	14.1	15.1	16.9
Denmark	12.7	16.2	17.2	17.9	20.1
Finland	8.5	13.6	18.7	20.2	22.5
France	20.3	24.1	25.4	25.2	27.7
Germany	20.4	25.3	24.3	21.9	22.4
Greece	15.5	25.4	38.2	48.8	57.7
Ireland	17.4	17.9	13.1	14.4	15.2
Italy	20.7	25.0	26.4	32.5	40.0
Japan	5.6	9.0	14.7	18.1	23.2
Luxembourg	32.0	38.1	39.1	38.1	42.1
Netherlands	14.2	17.0	20.2	18.6	17.9
New Zealand	11.6	13.8	15.5	18.4	20.8
Norway	10.7	20.2	30.2	28.4	25.8
Portugal	32.4	37.2	29.5	30.7	35.4
Spain	15.8	19.6	19.1	30.5	45.0
Sweden	22.9	30.8	37.4	36.3	33.9
Switzerland	10.8	15.8	22.0	20.8	20.4
UK	14.7	16.0	17.1	20.8	23.7
US	14.6	17.0	19.4	20.0	20.4
Average	*17.4*	*21.7*	*23.9*	*25.4*	*28.0*

Source: Author’s calculations, using Table A1, interpolated data from Blöndal and Scarpetta (1998), and text equation (2).

Table A3
Internal Rates of Return to public pension programme contributions by cohort: Common retirement age at 65

Country	*Cohort b.1920*	*Cohort b.1930*	*Cohort b.1940*
Australia	1.63	-0.01	1.19
Austria	2.71	1.05	1.11
Belgium	1.06	0.12	1.10
Canada	2.10	0.41	0.74
Denmark	1.67	-0.05	1.42
Finland	5.34	1.75	1.60
France	3.03	1.03	1.20
Germany	4.58	2.35	1.34
Greece	3.04	0.14	0.60
Ireland	-0.30	0.32	0.08
Italy	5.84	2.87	0.99
Japan	6.73	2.66	1.79
Luxembourg	-0.26	-1.39	-0.24
Netherlands	10.32	5.67	3.32
New Zealand	0.50	-0.30	0.35
Norway	2.86	-0.16	1.51
Portugal	6.80	4.34	2.66
Spain	7.04	4.42	3.59
Sweden	5.40	2.10	0.89
Switzerland	2.56	0.09	-0.53
UK	0.39	-0.42	0.35
US	0.45	-0.41	1.09
Average	*3.34*	*1.21*	*1.19*

Source: author's calculations