# Pensions and employment

## SUMMARY

*Many studies describe the potentially adverse impact on employment of the payroll costs of financing public pension programmes. Conventionally, empirical studies treat contributions to public pension programmes as a pure tax (in, for example, calculations of the tax wedge by OECD). But this approach ignores any future rights to benefits that are perceived by contributors. In fact, public pension programmes contain both an 'actuarial' and a 'redistributive' component – the former closer to saving, the latter a tax. The paper constructs indicators of the tax component of pension programmes, both between and within generations, across a range of OECD countries and time periods. It uses these measures in a cross-country panel analysis of the determinants of age and gender-specific economic activity rates. The results reveal robust evidence that when public pension programme contributions are broken down into a tax component and a savings component, the tax component of the payroll contribution reduces economic activity rates among women while a higher retirement saving component has the opposite effect. There is little evidence that average tax rates, however constructed, have any adverse impact on the economic activity rates of men.*

— *Richard Disney*

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# Are contributions to public pension programmes a tax on employment?

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## 1. INTRODUCTION

OECD public pension programmes are in crisis. The costs of financing public pension programmes have been rising for several decades in all member states. In the face of unfavourable trends in fertility rates and increasing longevity, a specific policy concern in OECD countries is that employment growth has been sluggish (OECD, 1995). Rising participation of women in the workforce has been offset by earlier retirement, especially among men. But without increased employment rates, financing public pensions is likely to become even more difficult in the next two decades as the baby-boomers start to retire, unless governments are prepared to implement politically unpopular benefit cuts (Disney, 1996; OECD, 1996; Siebert, 2002).

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Given this context, the *design* of public pension programmes is important because badly designed public pension programmes exacerbate the difficulties arising from population ageing. Public pension spending is largely financed by current contributions levied on employers and workers – known as 'pay-as-you-go' (PAYG) financing. In many studies of employment growth, these public pension contributions are treated as a central component of the tax wedge, which differentiates the real cost of labour facing employers and the real wage received by workers. Any distortions induced by taxes on employment that impact on labour supply or labour demand are likely further to reduce the size of the workforce and thereby to heighten the pension financing problem.

### 1.1. Should contributions be treated as a tax or as retirement saving?

The paper argues that contributions to public pension programmes differ from other taxes levied on households insofar as participants perceive contributions as, in some general sense, giving them a claim to future pension benefits. To the extent that pension contributions are perceived as giving individuals rights to future pensions, the behavioural reaction of programme participants to contributions will differ from their reactions to other taxes. In fact, they might regard pension contributions as providing an opportunity for retirement saving, in which case contributions should not be deducted from households' earnings, and should not be included in the tax wedge. An issue for programme design therefore arises: if pension programmes can be designed explicitly to look like retirement saving programmes, the potentially adverse impact of higher pension contributions on employment might be alleviated.

The diversity of programme design can be illustrated by comparing two types of programme. At one extreme the Swedish public pension reform in 1998 and the Italian pension reform in 1995 (the 'Dini' reform) have tried to make their public pension programme look more like a private retirement saving system by linking individual pension entitlements very closely and explicitly to actual contributions paid. At the other extreme, in Australia public pensions are income-tested and financed out of general taxation, and participants seem to have no expectation of receiving specific benefits in return for their tax payments during the working lifetime. The contention of this paper is that these design features, as well as the overall costs of the programme, matter for employment policy.

### 1.2. The purpose of the paper

How do we know whether programme participants perceive pension contributions as a tax or not? We can ask them, but there are few surveys of this type. What limited evidence we have from such surveys of public attitudes suggest that people expect to get *something* back in the future from their public pension contributions, even if it is not exactly what they put in (Dominitz *et al.*, 2003) and even if they would have

preferred to save for retirement through a private pension plan (Boeri *et al.*, 2001). This expectation is what distinguishes public pension programmes from other general tax-financed expenditures.

In the absence of detailed cross-country surveys of attitudes, the paper adopts a different approach. It argues that the extent to which contributions to any given programme are perceived as giving rights to future entitlements depends on observed programme characteristics, as in the comparison of the diverse programmes previously. In general, the link between pension contributions and future pension rights depends on how closely benefits are related to earnings histories, which the paper terms 'actuarial fairness', and on the implicit return on public pension contributions relative to an outside investment option in a safe asset, which the paper terms 'intergenerational equity'. Section 3 describes these concepts in more detail.

The greater the departures from within-generation actuarial fairness and from intergenerational equity in the design of the pension programme, the paper argues, the greater the tax component of the pension contribution and the less the retirement saving component. But it is only the tax component of the contribution that distorts the employment decision. Therefore, in contrast to empirical studies that simply treat the whole contribution as part of the tax wedge, we should measure the tax component of public pension contributions when undertaking an empirical analysis of the relationship between payroll taxes and trends in employment or economic activity.

### 1.3. Empirical strategy

To motivate the subsequent analysis of the tax component of pension contributions, and to give a flavour of the empirical strategy, the next section examines the impact of taxes levied on households on economic activity using the conventional approach that treats pension contributions simply as a tax (described in Section 2.1). It constructs equilibrium pension contribution rates from a PAYG financing rule, since many existing studies use average contribution rates derived from administrative data and suffer from severe measurement error (Section 2.2). Cross-country panel regressions are estimated that examine the impact of payroll contributions on economic activity rates disaggregated by age and gender (Section 2.3). The results show that average contribution rates do indeed have an adverse impact on economic activity rates of women, although the implicit elasticities are quite low. There is no significant impact of contribution rates on economic activity for men. These are the 'benchmark' results against which subsequent empirical estimates are compared.

Section 3 briefly describes some methodological issues concerning the tax component of public pension programme contributions. Section 4 then constructs two indicators of the tax component of public pension programmes for 22 OECD countries in three time periods: one is a within-generation measure of departures from actuarial fairness (defined in Section 3.1) while the second measures intergenerational differences in rates of returns to contributions for successive cohorts (described in

Section 3.2). Some interesting trade-offs emerge in the process. For example, countries with low contribution rates tend to have a higher tax component to those contributions, illustrating in part the difference between 'Beveridge' and 'Bismarck' social security programmes.

Section 5 then uses these indicators to re-estimate the cross country panel regressions, but this time using indicators of the effective tax and saving components of the programmes rather than simply including the whole of the average contribution rate in the tax wedge. Public pension contributions are disaggregated into tax and saving components, with allowance made for differences in rates of returns to contributions across countries and by cohort.

### 1.4. The key findings

The results in Section 5 show that women's activity rates are highly adversely affected by the tax component of pension contributions. The implicit elasticity to the tax component is three times that calculated for the contribution rate as a whole in Section 2. Moreover economic activity rates are positively related to the saving component of contributions, measured both by greater actuarial fairness within generations and by higher rates of return to contributions to public pension programmes. These are the most striking results of the paper. For men, however, the results are not clear cut. There is less variation across countries in male participation, especially at prime ages, and men's participation is generally less responsive to tax incentives than that of women. However, there is evidence from the empirical results that male participation is responsive to other features of the retirement programme.

Overall, the paper suggests, public pension contributions are not a tax on employment *per se*, but often contain a tax component which has adverse effects on economic activity for certain groups in the labour market. Reducing the overall size of the tax wedge, as has been suggested by the European Commission and OECD, may indeed increase economic activity rates. However, an alternative, and possibly complementary, strategy in countries with high payroll labour costs is to redesign public pension programmes so that individual benefits are more closely linked to contributions, thereby reducing the tax component of the tax wedge. The paper therefore provides some empirical support for the policy reforms along such lines that have recently been enacted in several European countries.

## 2. HOUSEHOLD TAXES AND ECONOMIC ACTIVITY: THEORY AND PRELIMINARY ESTIMATES

### 2.1. Potential impacts of payroll taxes on employment

Contributions to public pension programmes – whether notionally levied on employers, workers or both – are generally treated by economists as part of the 'tax wedge' on

labour (as in OECD, 1995). Prior to considering whether this is a sensible treatment of contributions, we should consider how the tax wedge might affect employment and participation.

Higher payroll taxes on workers may reduce employment in a number of ways: if the worker bears the incidence of this payroll tax, then the wedge between the pre-tax and post-tax wage may affect participation in and hours supplied to the formal economy. 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 competitive economy with inelastic labour supply, it is straightforward to show that taxes on labour have no impact on employment, even though taxes drive a wedge between the real consumption wage and the real product wage. However, where labour supply is positively related to the real wage, the wedge between the production and consumption wages is likely to reduce employment (as illustrated in OECD, 1990, Chart 6.2.i).

This employment effect arises through a labour supply response to taxes and can take several forms. First, individuals can vary their hours supplied in response to changes in payroll tax rates, although the response should depend on the structure of *marginal* rates rather than the average tax rate and on whether out-of-work benefits are indexed to earnings or not (Pissarides, 1998).

Second, the payroll tax can affect the optimal length of the working life. Assuming a proportional contribution rate and (crucially) that entitlement to pension benefits is independent of contributions paid, Sheshinski (1978) shows that, in general, a more generous public pension programme financed by payroll contributions will lead to a shorter working life. 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. Interestingly for what follows, Sheshinski argues that designing a pension programme where benefits are more closely linked to contributions will tend to dampen the labour supply response to payroll contribution rates.

Finally, higher payroll taxes will give incentives for workers, in collusion with employees, to leave the formal economy and to engage in various untaxed activities. Leaving the formal sector may of course reduce the worker's entitlements to future pension rights but, again pre-empting the next section, even workers with inadequate contribution histories may still receive some minimum pension benefits arising from social welfare payments, dependants' allowances and the like.

To analyse the tax shifting effect, consider a unionized open economy (as in Alesina and Perotti, 1997; Daveri and Tabellini, 2000). A higher employment tax is partly shifted onto employers if unions obtain a higher nominal wage. The consequent rise in product prices, assuming prices are set as a markup over unit costs, both reduces real expenditure and also leads to a substitution of demand towards competing products (imports). Employment therefore falls, irrespective of the elasticity of supply of labour.

### 2.2. Public pension contribution rates 1955–95

A first step in examining the impact of public pension contributions on economic activity is to derive average contribution rates in public programmes for a range of OECD countries. Current published data on contribution rates are largely unsatisfactory for this purpose. Although administrative data are available on notional contribution rates in most countries, and OECD has done several calculations of the overall tax wedge, consistent information on the effective payroll costs of public pension programmes is lacking. Some countries effectively subsidize public pensions by budgetary transfers, a few (such as Australia and New Zealand) simply finance current pension spending out of general tax receipts, and other countries (such as the USA) partially pre-fund the programme so that actual contribution rates have in some periods been greater or less than those required to finance current pension spending.

To calculate the effective average contribution rate for each programme – that is, the average rate that would be required to finance current spending on public pensions without budgetary transfers or the accumulation or decumulation of public pension funds – it is possible to exploit the standard PAYG formula, by which the average effective contribution rate is equal to the average replacement rate of pensions to earnings divided by the support ratio (the ratio of pensioners to workers). The required calculations are explained in greater detail in Box 1, and in the Appendix.

#### Box 1. Calculating average contribution rates

To calculate average contribution rates, we can exploit the well-known condition of PAYG equilibrium. Write:

$$n_{t-1}\hat{b}_t = \hat{\tau} n_t \hat{y}_t \qquad (1)$$

$n$ denotes the number of contributors, with those working at $t-1$ now retired and receiving pension benefits, so that $n_t/n_{t-1}$ is the support ratio of workers to pensioners. Also, $b$ is the pension benefit, $y$ earned income and $\tau$ the contribution rate, with hats denoting averages. Thus $\hat{b}/\hat{y}$ is the average replacement rate, and the equilibrium contribution rate is derived as the average replacement rate divided by the support ratio.

In calculating contribution rates, data on average replacement rates are derived from Blöndal and Scarpetta (1998). Data on support ratios are derived from the ILO website, LABORSTA, using information on employment rates and size of population age groups. Not all people over pension age are eligible for pensions, and adjustments are made by the author according to programme rules governing widow(er)s and dependants as described in the US Social Security Administration Social Security Programs around the World, now updated electronically.

**Table 1. 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, see Box 1.

Table 1 illustrates the magnitude of the average contribution rates required to finance current spending on public pensions for a range of countries in each decade from the 1950s to the 1990s. It is striking that these rates have risen in all countries in the sample over the period. However, as the data in Tables A1 and A2 in the Appendix illustrate, the primary driving force behind these rises (with the clear exception of Japan) is that the generosity of public programmes has increased. Support ratios have, in general, remained roughly constant since the 1960s as declining participation of older workers, particularly men, has been offset by rising participation rates of women, especially married women. Although there is scope for increased participation of women in some countries, notably the Mediterranean countries, the possibility of rising numbers of participants offsetting demographic ageing in the future is very limited. In particular, the baby boom generation has a high employment rate by historical standards and will retire in the next two decades. Moreover, higher past participation will generally enhance eligibility for pension benefits at retirement.

### 2.3. Public pension contributions and economic activity: a preliminary empirical analysis

There is an extensive literature using cross-country panel regressions that has concluded that the tax wedge, including contributions to the public pension programme,

has an adverse impact on employment and unemployment (including Tullio, 1987; Scarpetta, 1996; Alesina and Perotti, 1997; Daveri and Tabellini, 2000). There is also an extensive empirical literature that focuses on institutional conditions as a determinant of economic activity rates or unemployment (as in Blau and Kahn, 1999; Bertola *et al.*, 2002; Blanchard and Wolfers, 2000; Nickell, 1997; Nickell and Layard, 1999).

Much of this literature argues that labour costs only affect employment or unemployment in specific institutional settings. However, all these studies implicitly include the total public pension programme contribution in the measure of the tax wedge. None of this literature directly questions whether the design of the public pension programme is itself a pertinent country-specific institution, or makes an attempt to calculate the tax component of the pension contribution as will be suggested here.

Before considering the tax component of public pension contributions further, it is useful to establish whether there is a relationship between economic activity rates and the tax wedge, and the level of public pension contributions in particular. The basic format of the empirical procedure is a pooled cross-country cross-period regression analysis in which the economic activity rates of specific age groups of workers between the ages 20 and 59 depend on various measures of the tax wedge or pension contribution rate, on the generosity of welfare benefits and on institutional factors such as the degree of trade unionism and co-ordination of bargaining.

The approach adopted here follows Bertola *et al.* (2002), in testing whether the impact on economic activity rates varies across different age groups, and between men and women, since it might be thought that these groups differ in the sensitivity of response to tax rates given differences in their outside options. The basic data set includes variables constructed by Nickell (1997) and Blanchard and Wolfers (2000) for the 22 OECD countries and the three decades averaged at 1975, 1985 and 1995. These data will be used in constructing the tax component of public pension programmes in Section 4. Where appropriate, their variables are averaged across the longer time periods as appropriate, and updated where additional data are available (for example, on union density).

The key variables are defined (with sources) in Table 2. The dependent variable is the age and sex-specific economic activity rate. Activity rates rather than employment (or unemployment) rates are chosen both for reasons of data availability and because some responses to high tax rates may take the form of transitions out of measured activity rather than simply between employment and unemployment.

The baseline regressions use the calculated contribution rate (*contribution rate*) described in Table 1. Given the previous discussion, it is assumed that higher contribution rates might lower economic activity rates through a labour supply response, although that response will depend on the degree of attachment of the age group to the labour market and the outside options available (such as early retirement benefits, the returns to non-market activity, and so on) or, if workers can pass on taxes, *via* lower labour demand.

**Table 2. Variable definitions**

| Variable | Definition and source | Predicted sign <0>,? |
|---|---|---|
| *Dependent variable* | | |
| Age-activity rates | Proportion of age group *i* at *t* economically active. Derived from *ILO statistics website LABORSTA* and from extrapolation where data unavailable e.g. Switzerland, UK | n.a. |
| *Explanatory variables* | | |
| Contribution rate | Calculated public pension contribution rate for PAYG equilibrium: see Table 1 | <0 |
| Demand shocks | The Blanchard-Wolfers (2000) measure | >0 |
| Union density | Union density. As defined by Nickell (1997), augmented by data from IR website, Cornell | <0 ? |
| Employment protection index | Employment protection indicator for country *i* at time *t* as constructed by Blanchard and Wolfers (2000) | ? |

An alternative specification was tried that used a measure of the overall tax wedge including personal taxes as well as contributions, obtained from OECD (1995), instead of the calculated contribution rate. However, the tax wedge never proved to be significant and this specification is not illustrated here. The public pension replacement rate, which is often used in such specifications, is highly collinear with the contribution rate (correlation = 0.9540) since the latter is constructed from the former (see Box 1). It is therefore also excluded here, although used in the later augmented specifications.

The other explanatory variables are the time-varying subset of the institutional and demand variables used in the literature, mostly derived from Blanchard and Wolfers (2000) and Nickell (1997). *Demand shocks* is the Blanchard-Wolfers measure of changes in aggregate demand.[1] Economic activity rates should be positively related to variation in this measure. Union activity is proxied by *Union density*, constructed by Nickell (1997) but containing 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.[2] The rationale for including this variable is that unions might deter employment among more marginal workers such as women, especially if unions adopt seniority-based strategies for maintaining employment of its members. The variable indexing stronger employment protection (*Employment protection index*) might have disparate effects for older and younger workers, since such legislation should reduce both hiring and firing rates. In particular, we might expect a positive association between stronger employment protection and employment of

[1] Described at http://econ-wp.mit.edu/RePEc/2000/blanchar/harry_data

[2] See the document http://www.ilr.cornell.edu/library/downloads/FAQ/UNIONSTATS2002.pdf.

**Table 3. Baseline regressions**

| Dep. Var: Age activity rate | 20–24 | 25–29 | 30–44 | 45–49 | 50–54 | 55–59 |
|---|---|---|---|---|---|---|
| *Women* | | | | | | |
| Contribution rate | –0.46** | –1.48*** | –0.33 | –0.48 | –0.59*** | –0.44*** |
| | (0.22) | (0.43) | (0.43) | (0.32) | (0.16) | (0.06) |
| Demand shocks | 0.26 | 1.11** | 0.01 | –0.05 | 0.14 | 0.11 |
| | (0.29) | (0.48) | (0.41) | (0.31) | (0.15) | (0.12) |
| Union density | 0.32 | 0.004 | 0.25 | 0.22 | 0.07 | 0.01 |
| | (0.25) | (0.54) | (0.22) | (0.18) | (0.15) | (0.10) |
| Employment protection index | 5.97 | 3.05 | –2.01 | –1.05 | –3.38 | 0.01 |
| | (4.35) | (4.51) | (4.42) | (4.30) | (3.76) | (2.45) |
| *Men* | | | | | | |
| Contribution rate | 0.17 | 0.01 | 0.07 | 0.06 | –0.09 | 0.02 |
| | (0.30) | (0.17) | (0.05) | (0.05) | (0.11) | (0.20) |
| Demand shocks | –0.55** | –0.06 | –0.003 | –0.06 | 0.02 | –0.03 |
| | (0.27) | (0.13) | (0.04) | (0.05) | (0.10) | (0.19) |
| Union density | 0.22 | –0.04 | 0.04 | 0.07 | 0.11 | 0.02 |
| | (0.17) | (0.09) | (0.03) | (0.05) | (0.08) | (0.15) |
| Employment protection index | 3.89 | –1.55 | 1.61** | 0.51 | 2.20 | 3.83 |
| | (4.63) | (2.32) | (0.77) | (0.80) | (1.62) | (2.59) |

*Notes:* Estimated by least squares, weighted by civilian employment; two-way fixed effects; robust standard errors in parentheses. *** = 1%, ** = 5%, * = 10% significance. $N = 66$ (22 countries in 1975, 1985, 1995).

longer tenured (older) men, with adverse effects on the employment of labour market entrants. This variable is the time-varying index constructed by Blanchard and Wolfers and described at their website cited above.

The empirical estimates depart in two respects from the existing literature. First, as described previously, the analysis focuses on disaggregated economic activity rates rather than an aggregate measure such as the overall unemployment rate. Second, it uses country and time dummies (fixed effects) rather than additional time invariant institutional indicators. In general, the use of fixed effects is preferable to a narrow range of invariant institutional indicators since the former can generally proxy a wider range of institutional features than those identified by the latter. But since the ensuing results do not describe all the coefficients for the fixed effects, the equations are less parsimonious than they appear in Table 3.

**2.3.1. Empirical results.** Table 3 provides results from a benchmark model in which age and gender-specific activity rates are regressed on the average contribution rate, time-varying demand and institutional indicators, and country and time dummies (for which coefficients are not quoted). Observations are weighted by the size of civilian employment: this accounts for the different economic relevance of small and large countries, and addresses possible heteroskedasticity problems.

For women, Table 3 in general confirms that higher contribution rates have an adverse impact on economic activity for a number of female age groups, especially

women at the extremes of the age distribution. The average elasticity across the age groups is around −0.6. This finding differs from that of Nickell and Layard (1999) who find no evidence of any relationship between public pension contribution rates and the unemployment rate. The discrepancy may arise both because economic activity rates are disaggregated here and because the administrative data on contribution rates used by those authors contains measurement error, as described previously. Among the other results for women, the variable measuring demand shocks generally has the expected positive sign but is only significant for one age group. The other institutional variables are insignificant for all age groups. The country and time dummies are jointly significant. Overall, it can be asserted that the economic activity rates of women are significantly related to contribution rates, albeit rather insensitive, but there is little pattern in the relationship to other institutional indicators.

As the second panel of Table 3 shows, however, even these regularities disappear for men. The time and country dummies are again jointly significant, but there is little pattern to the time-varying indicator variables. The contribution rate typically has the 'wrong' sign, as does the variable proxying demand shocks. Stronger employment protection is associated with higher economic activity rates for older male workers, significantly so for the age group 30–44. This accords with the possibility that higher firing costs makes it more difficult for employers to downsize by getting rid of employers with long job tenures, who are typically older men.

This is not the first set of results in the empirical literature to suggest that the overall impact of average tax rates on economic activity rates is weak. Such a view is forcibly argued by Nickell (1997), especially in relation to payroll contributions to public pension programmes. That argument needs some qualification in the light of the results for women here. The use of fixed effects here also suggests that the measured impact of institutional indicators in other studies depends heavily on specification. A number of other reasons for findings of this type are discussed in Disney (2000b), who argues that studies should focus on the economic activity of workers who are more marginal to the workforce and who face disproportionately high marginal tax rates, where such behavioural responses might be found.

The remainder of this paper considers the alternative possibility that the limited success of this empirical exercise results from treating the whole public pension contribution as a tax on households. The next two sections therefore consider the methodological and empirical issues that underlie the construction of a tax component to public pension programmes that differs according to the design of the programme.

## 3. THE TAX COMPONENT OF PENSION PROGRAMMES: METHODOLOGY

Most public pension programmes, whether wholly PAYG financed or partially prefunded, are based on the premise that participating individuals are accruing an implicit right to a future pension through their contributions. Of course, unlike many private sector retirement saving plans, contributions are not accumulated in individual

pension accounts so this promise is not a guaranteed commitment by the provider. To treat public pension contributions as a pure tax on employees, however, ignores a popular perception that is actively encouraged by governments by reference to the 'contributory principle' or generational 'solidarity'.

Moreover, it is hard to see why a number of countries, such as Italy and Sweden, would go to the trouble of introducing reforms to their public programmes designed to make their programmes appear more like private plans if their legislatures thought that participants' interpretation of programme finance as a pure tax would remain unchanged. In both these countries, as well as others, contributions to the public programme will be notionally deposited in individual accounts, which then earn a 'return' related by a formula to the growth of real GDP. Since no actual fund is accumulated, the sum of accumulated contributions and interest that is converted into a pension on retirement is merely notional. But by linking the indexation parameters to perceived indicators of sustainability, and length of retirement to expected longevity, the reformers have argued that public programmes can be put on a sound basis and that public trust in the programme can be restored.

In reality, however, no public pension programme can operate exactly like a private retirement saving programme, in which benefits are actuarially linked to contributions – that is, a programme that is 'actuarially fair'.[3] Every public programme exhibits some deviations from an actuarially fair programme, and it is these deviations that introduce an effective tax component into the contribution to the programme.

### 3.1. Actuarial fairness and tax component defined

What are the key components of actuarial fairness (or a zero tax component) in public programme design? An actuarially fair programme would match individual entitlements exactly to lifetime earnings. Suppose, for example, that individual pension entitlements are exactly determined by the number of accumulated points, and that points are linked precisely to the value of each year's earnings and number of years of service (not unlike, in general terms, the design of the French and German public programmes). As long as points accumulated are thereby exactly proportional to contributions, then the programme does not redistribute in favour of any subgroup within any generation and so the programme can be considered to exhibit actuarial fairness within any generation.

This, in itself, does not rule out there being a tax component to the programme. Two other conditions are required. First, the programme should credit the accumulated

[3] In practice, private pension plans also depart from 'actuarial fairness', notably company plans and plans for public sector workers that pay benefits that are determined by a measure of earnings over a part of the lifetime, such as 'final salary' plans. Moreover, throughout the analysis, we ignore the notional incidence of contributions – how, for example, the contribution is notionally shared between the employer and the employee, since we follow standard tax theory in assuming that effective incidence depends solely on the relevant supply elasticities and on the absence or otherwise of market imperfections.

contributions with an annual interest rate that exactly matches the rate of return that the participant could have obtained by investing in, for example, a risk-free asset on the open market (this assumption departs from all programmes including those of France and Germany and indeed is not feasible in the long run in a public programme for reasons described shortly). As demonstrated in Box 2 with a simple life cycle model of saving, however, a programme designed along these lines would also not contain any tax component arising from the differential treatment of different generations. Section 3.2 discusses further this second intergenerational benchmark of a programme, which it terms 'intergenerational equity'.

This stylized programme, therefore, does not impose any tax on the individual: it is a form of mandatory retirement saving plan. There are only two senses in which such a programme might depart from an individual retirement saving plan. First, it might require the individual to contribute more of their income than they would have otherwise wished to do over their lifetime. Second, the individual might have wished to invest in a more risky portfolio than the interest rate credited to the programme. The first constraint cannot be unravelled if the individual cannot borrow against pension contributions and the second if the individual cannot rearrange their asset portfolio to offset the balance between risk and return implied by programme contributions. In all other respects, however, such a programme has no tax component.

Contrast this with a programme where there is little or no relationship between lifetime earnings and individual pension entitlements and where rates of return to contributions differ systematically between generations. Clearly this second type of programme effectively taxes some individuals through the pension programme and redistributes to others.

### Box 2. A stylized model of the tax component of contributions to public pension programmes

Using the notation of Lindbeck and Persson (2003), consider a model in which an individual lives for two periods, and obtains employment income $y$ in the first period, on which a proportional contribution to a pension programme is levied, $\tau$. In the second period, he or she lives off the savings from the first period and receives a benefit from the pension programme, $b$. Define the market rate of interest as $r$ and consumption as $c$. The consumption possibilities in the two periods can be written as:

$$c^2_{t+1} = [y_t(1-\tau) - c^1_t](1+r) + b_{t+1}$$
$$c^1_t \leq y_t(1-\tau) \qquad (2)$$

The first equation simply derives from the lifetime budget constraint with no bequests, and states that second period consumption comprises saving from the first period (plus interest earned at the market rate) and the pension benefit. The second equation states that individuals cannot borrow against their future pensions. If the latter constraint exists, some individuals may be *liquidity constrained* in the sense that their contribution to the pension programme exceeds the amount that they would have saved and may alter the timing of the labour supply and/or consumption. This constraint may bind whether the programme is public or private, and funded or unfunded.

If the programme is 'actuarial', in the sense that (1) an individual's contributions are exactly matched by the programme to their individual pension benefits and (2) contributions 'earn' the market rate of interest $r$, then the pension benefit is:

$$b_{t+1} = (1 + r)\tau y_t \tag{3}$$

Substitution of (3) into (2) yields the revised budget constraint:

$$c^2_{t+1} = (y_t - c^1_t)(1 + r) \tag{4}$$

Note that (4) does not include the tax rate, $\tau$. Because benefits exactly correspond to contributions plus the market return earned on them, the marginal effective tax rate arising from the pension contribution is zero. As the budget constraint is not affected by this actuarial pension scheme, the individual's savings and labour supply choices are independent of the level of the pension contribution as long as liquidity constraints are not binding.

Now consider a very different scenario. Assume the pension programme is run by the government, levies a contribution rate proportional to earnings, $\tau$, but then pays everyone the same benefit, $\bar{b}$ in the second period. Then second period consumption in (2) can be written as:

$$c^2_{t+1} = [y_t(1 - \tau) - c^1_t](1 + r) + \bar{b} \tag{5}$$

Here each individual receives a benefit that is entirely unrelated to his or her contributions – this I term a 'non-actuarial' programme. In the individual's budget constraint, the effective marginal tax on the individual's work effort is positive at $\tau$, and smaller rewards for work can affect labour supply and employment in the ways described in the paper.

Every public pension programme exhibits some deviations from an actuarial programme, such as floors and ceilings to benefits and contributions, additional allowances for dependants, and so on. In general, it can be said that every programme contains an *effective tax component*, which lies between 0 and $\bar{\tau}$, the average payroll contribution, depending on how far the programme deviates from actuarial fairness.

### 3.2. The meaning of intergenerational equity

How public pension programmes distribute resources across generations has been central to the pension literature since the seminal paper of Samuelson (1958). The intergenerational burden of pension programmes is also closely related to the issue of 'generational imbalance' in the literature on Generational Accounts, as described in Auerbach *et al.* (1999). Generational Accounts use the government's intertemporal budget constraint to compute how much future generations must pay in net taxes. They state that the present value of all future government spending must equal the present value of future net tax payments plus the present value of net government wealth. The shortfall of net payments not covered by taxes paid by current generations must be met by future generations, which is the source of the generational imbalance described above.

Is generational balance the same as actuarial balance in a public pension programme? Not exactly. In a fully funded pension programme, the present value of net wealth invested in the pension plan discounted at the market rate of interest, $r$, equals the present value of liabilities. This constitutes an 'actuarial' programme in the sense described in the previous subsection, and in Equations (2) to (4) in Box 2. In an unfunded, or PAYG programme, however, the only requirement for balance is that *current* receipts equal current outgoings, as in Equation (1) in Box 1. If, given the other parameters of the public pension programme, contribution rates are forecast to rise over time in order to satisfy PAYG equilibrium in future years and for future generations this is strong evidence of generational imbalance, in the sense of Generational Accounting. The only *sustainable* long-run 'return' on contributions is where projected $\hat{\tau}$ is constant for given $\hat{b}$, as in Box 1. This sustainable return is approximately equal to the sum of the rate of growth of the labour force, $n$, and the rate of growth of real income (productivity), $y$. Call this combined growth rate $g$.

As Box 3 shows, when this growth rate falls short of return rates on private investments (that is when $r > g$, the economy's dynamic efficiency condition) there is always a deviation from actuarial fairness. Fenge and Werding (2003) call this difference in pension benefits, between a sustainable PAYG programme earning $g$ and a funded programme earning $r$, the 'implicit tax' arising from PAYG financing (although, as shown here, this is not the only tax arising from programme design). The consequences of $r \neq g$ are central to the pension literature on the merits or otherwise of funded and PAYG pension programmes in steady state.

But the central concern in the present paper is to find a measure of how *actual* returns to contributors depart from actuarial 'fairness', defined as $r$ in Box 2 above. Actual returns to generations, which can be denoted $\hat{r}$, can deviate from both $r$ and $g$. In a number of countries, steadily rising contribution rates over time indicate that $\hat{r}$ can exceed $g$ (and, possibly, $r$) for long periods. In other countries, actual $\hat{r}$ seems to be very low, possibly well below $g$. The first generation in the programme almost always appears to benefit, since it generally receives benefits without paying full

**Box 3. The implicit tax arising from PAYG financing**

Again following the notation of Lindbeck and Persson (2003), assume that contributions earn the sustainable 'return' $g$: i.e.:

$$b_{t+1} = (1 + g)\tau y_t \tag{6}$$

Then substituting into (2), as before, an actuarial system gives second period consumption of:

$$c_t^2 = y_t \left[ (1 - \tau) \frac{r - g}{1 + r} - c_t^1 \right] (1 + r) \tag{7}$$

If $r > g$ (i.e. the economy is dynamically efficient), there is an average effective tax rate on each successive generation of $\tau(r - g)/(1 + r)$ even if the programme has no 'generational imbalance' and even if it is sustainable in the long run. Of course, an actuarial programme will still have a lower effective tax component than a non-actuarial programme, as a comparison of (7) and (4) in Box 2 makes clear.

contributions, but subsequent generations may gain or lose depending not only on demographics, but also on their political capacities to engineer low contribution rates when they are workers and high contribution rates when they are old (Galasso and Profeta, 2004).

For the purposes of this paper *intergenerational equity* or fairness is defined as when a generation retiring in a particular period receives a return $\hat{r}$ as least as high as some international risk free rate of interest, which is assumed to proxy $r$. The argument for this measure is that, where $\hat{r} \geq r$, the contributor is at least as well off (subject to the liquidity constraint) as would be the case were he or she to rely on private retirement saving. Where $\hat{r} < r$, the contributor faces an effective tax, amounting to $y_t(1 - \tau)[(r - \hat{r})/(1 + r)]r$. So, the higher the calculated $\hat{r}$ of the programme, the lower (all else being equal) the tax component to that generation's pension contributions.

## 4. TAX COMPONENT OF PUBLIC PENSION PROGRAMMES: MEASUREMENT

### 4.1. Public pension programme design

How can a public pension system be designed so as to incorporate elements of this individual measure of actuarial fairness into a collective or social programme? The brief discussion of recent reforms such as those in Italy and Sweden give some illustrations of what would be needed to construct an 'actuarially fair' public programme:

- Accrued pension rights should be proportional to contributions;
- For different population groups with different mortality risks within a generation, accrual rates should broadly allow for time variation in life expectancies;
- The revaluation of accumulated contributions, and of pensions in payment, should be in some way related to a feasible risk-free rate of interest;
- First age of receipt of state pension should be indexed to between-generation differences in expected longevity.

In reality, no public pension programme fully conforms to this criterion of fairness. The existence of benefits for non-working spouses, widow(er)s benefits, ceilings and floors in both contribution and pension schedules, and *ad hoc* departures from actuarial fairness in indexation and revaluation of benefits guarantee that there is effectively a tax component to almost all public pension programmes. Empirical illustrations of departures from actuarial fairness in specific countries using household microdata are provided by Burkhauser and Warlick (1981) for the USA, Creedy *et al.* (1993) for the UK, and Börsch-Supan and Reil-Held (2001) for Germany. Nevertheless, public pension programmes differ widely in their provisions relative to this benchmark of actuarial fairness, as will be shown shortly.

Public pension programmes differ widely across OECD countries. A comprehensive description of programme features can be found in the US Social Security Administration's regular publication *Social Security Programmes around the World*. However, there are some common features that provide a broad demarcation of programmes and that bring out strongly the differences in tax components associated with programme design.

**4.1.1. 'Bismarckian' public pension programmes.** In what are generally termed 'Bismarckian' public pension programmes, pensions are intended to replace earnings in retirement and therefore rely on a strong link between individual contributions from earnings and individual pensions. In France and Germany individual pension entitlements derive from 'points' accumulated from contributions related to years of service and earnings, although these points have not been revalued in a manner consistent with the criterion of sustainability described in the previous section (the German pension reform proposed in 2003 is intended to reform the points system along such lines – see Börsch-Supan and Wilkie, 2003). In recent reforms in countries such as Italy and Sweden, this process is taken a stage further by attributing each individual with a notional pension 'account' with the government. These accounts are then credited with the individual's contributions, which 'earn' a return approximately equal to $g$, the sustainable return (see Disney, 1999).

There are, however, deviations both from intergenerational equity and actuarial fairness in such regimes. Most fundamentally, different generations are treated differently, with earlier generations in particular earning a higher return on contributions than later generations. In terms of actuarial fairness, there are often benefit floors and

differential retirement provisions for various groups of workers, especially among the Mediterranean countries, where public sector workers have often retired earlier and with more favourable benefits.

A further important characteristic of Bismarck-style social security is that there is very little private pension provision. Indeed the evidence strongly suggests that public pensions 'crowd out' private provision in such regimes (Disney, 2000a).

**4.1.2. 'Beveridgean' public pension programmes.** The other generic type of public pension programme is that associated with Beveridge.[4] Here public pension benefits are often almost wholly unrelated to contributions. The spectrum of programmes under this heading ranges from Australia, in which benefits are financed from general tax receipts and are income-tested, through countries with flat benefits, such as the Netherlands and New Zealand, to countries with two-tier or multi-pillar combinations of flat and earnings-related benefits (such as Canada, Ireland, Japan, Switzerland and the UK), and countries with unified but highly non-linear benefit regimes (such as the USA).

Whereas Bismarckian regimes have typically departed substantially from intergenerational equity, but are somewhat closer to within generation actuarial fairness, Beveridge-style programmes typically depart substantially from the intragenerational criterion of actuarial fairness but may or may not depart from intergenerational equity. Moreover Beveridge regimes are typically accompanied by substantial *private* funded provision of retirement benefits, and therefore accord more closely to the mixed public-private provision of retirement incomes advocated by the World Bank (1994).

Box 4 provides a classification of the OECD countries that will be used in this empirical study into these two general 'regimes'. Any such distinctions are of course somewhat arbitrary given the spectrum of regimes, but this seems to capture the key design features that are important in measuring the 'tax component' of programmes.

## 4.2. An intergenerational measure of the tax component of contributions

This section measures the intergenerational (between generation) tax component of contributions to public pension programmes that are to be used in the subsequent empirical analysis. This internal rate of return to contributions, which was characterized as $\hat{r}$ in Section 3.2, is calculated for a 'representative agent' in each of three generations across the 22 OECD countries depicted in Box 4.

[4] Sir William Beveridge is commonly perceived as the 'father' of social security in the UK. He was instrumental in the early development of public 'social insurance' in 1911 in the UK and in its comprehensive adoption after 1946. Any pension programme that contains a high degree of explicit redistribution is usually termed 'Beveridgean' (as in Cremer and Pestieau, 2000) and that nomenclature is adopted here. It should, however, be noted that Beveridge's original programme included flat benefits *and* contributions, entitlements based wholly on contributions and voluntary provision for retirement saving over and above the programme of flat benefits and contributions. None of these features survive in the UK programme today, or indeed anywhere else. (New Zealand is perhaps the closest, having initiated its programme even earlier than the UK.)

**Box 4. A classification of countries by type of public pension programme in OECD countries**

| 'Bismarck'-style public pension programmes, characterized by: high 'actuarial fairness'; significant departures from inter-generational equity; limited private provision of retirement benefits. | | 'Beveridge'-style public pension programmes, characterized by: significant departures from 'actuarial fairness'; variable (across countries) extent of inter-generational equity; significant provision of private retirement benefits. | |
|---|---|---|---|
| *Austria* | *Italy* | | |
| *Belgium* | *Luxembourg* | *Australia* | *The Netherlands* |
| *Finland* | *Norway* | *Canada* | *New Zealand* |
| *France* | *Portugal* | *Denmark* | *Switzerland* |
| *Germany* | *Spain* | *Ireland* | *United Kingdom* |
| *Greece* | *Sweden* | *Japan* | *United States* |

The method of constructing these internal rates of returns is described in detail in the Appendix. It extrapolates the 'synthetic' 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 early 1980s, 1990s and 2000s, depending on average expected date of retirement (again obtained from data in Blöndal and Scarpetta). The method then constructs effective average contribution rates, as described in Box 1, by using Equation (1) and the adjusted data on participation and employment rates from the ILO website, LABORSTA 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 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. 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.

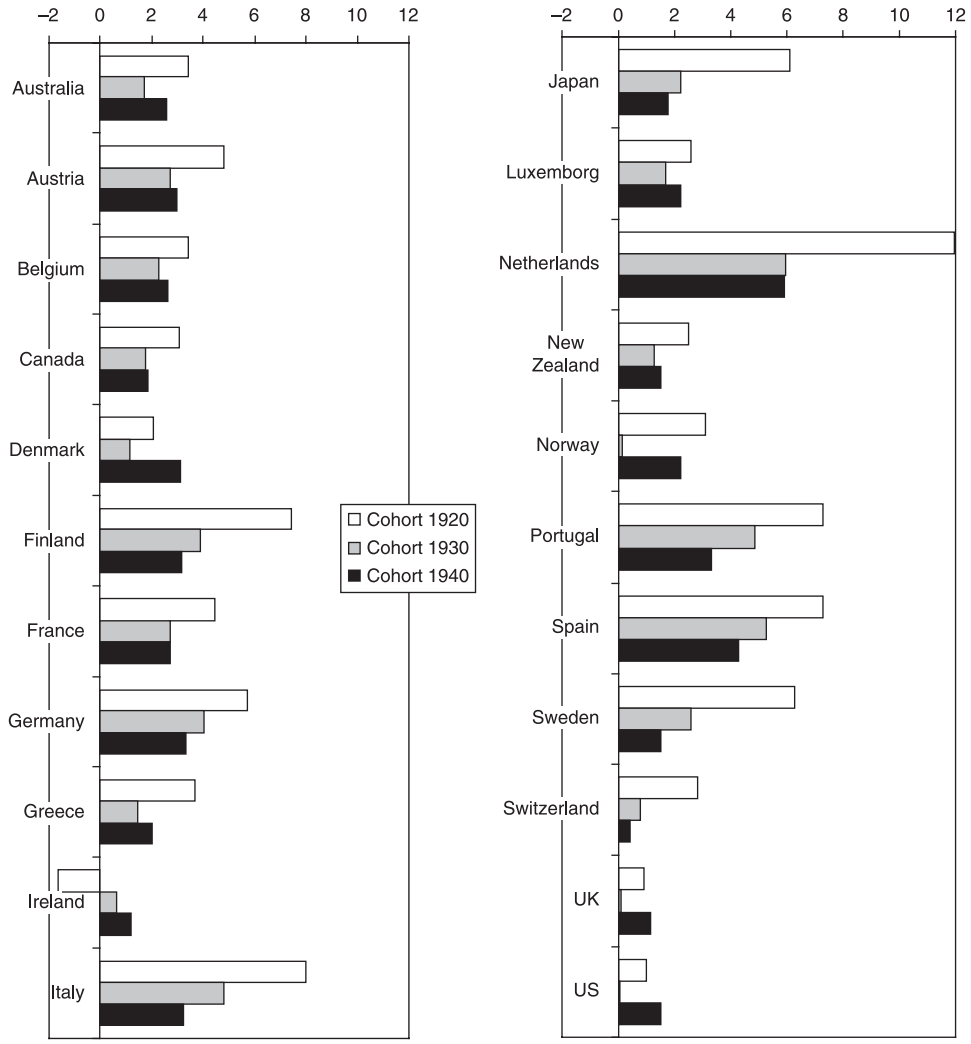


**Figure 1. Internal rates of return (IRRs) to pension contributions, by country and cohort (generation)**

Figure 1 illustrates the internal rates of return (IRRs) for the 3 cohorts in the 22 countries constructed by these methods. Since the effective contribution rates that are required for PAYG balance are used in the construction of the IRRs, we should not expect that generous programmes (such as Greece) necessarily offer exceptionally high IRRs to participants. It is noticeable, however, that the earliest cohort (generation) tends to obtain a higher return than subsequent cohorts in most countries, although the greatest variance of returns also arises among the earliest cohort. A number, but by no means all, of the 'Beveridge' countries tend to have low IRRs to every generation (but compare Ireland, the UK and the USA on the one hand with the Netherlands on the other).

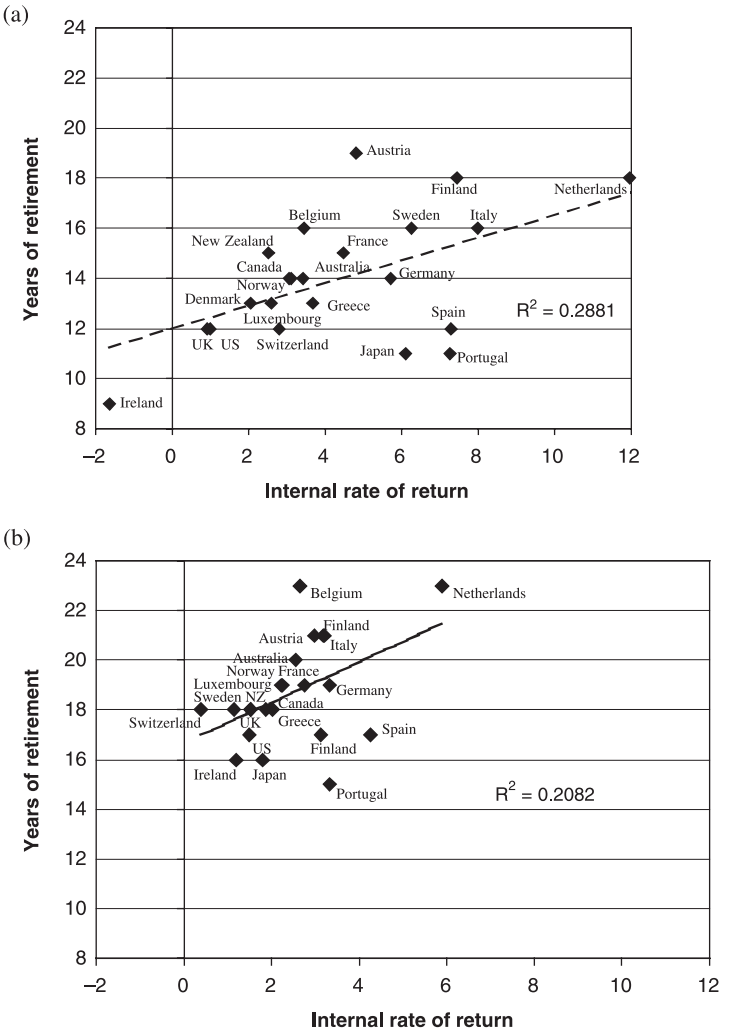


**Figure 2. Correlations between average lengths of retirement periods and internal rates of return (a) by cohort born 1920; (b) by cohort born 1940**

In general, the IRRs depend on how generously benefits are indexed in retirement and on the length of the retirement period. Indexation provisions were typically more generous to the first cohort (born 1920) and least generous to the last cohort (born 1940). Moreover each successive generation has seen average life expectancy increase while in several countries effective retirement ages have fallen. There is a cross-country positive correlation between the length of the retirement period (from average age of retirement to death of the original beneficiary) and the calculated IRR. Figure 2 plots these correlations for the cohorts born in 1920 and 1940.

Our criterion of a generational tax component to the public pension programme was where $\hat{r}$, the measured IRR, fell short of the market rate of interest, $r$. As argued

**Table 4. Internal rates of return by cohort: common retirement age at 65**

| | Cohort b. 1920 | Cohort b. 1930 | Cohort b. 1940 |
|---|---|---|---|
| *Country* | | | |
| 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: see text and Appendix.

earlier, *r* should ignore any equity premium or exchange rate risk and should not be country-specific if retirement savings could, in principle, be estimated in world capital markets. In which case, we could treat *r* as a constant, say of the order of 2 to 3%. By this criterion, measured IRRs in a number of countries fall well below this benchmark, although contributors in some countries (such as Italy, the Netherlands, Portugal and Spain) seem to fare much better. However the correlation of retirement age and IRRs pose a problem for this interpretation of the results. Since one dimension by which the tax component of pensions may adversely affect labour supply (or demand) is through shortening the length of the working life, the IRRs and the employment rates are jointly determined. This suggests that the IRRs should also be calculated for a fixed, exogenous retirement age, such as age 65.

The results of fixing retirement age at 65 and re-estimating the IRRs are shown in Table 4 and are striking. While the earliest generation still obtains high returns (even with retirement at 65) as a result of the shorter working life, only 7 of the 22 country cohorts born in 1930, and 3 born in 1940, obtain rates of return in excess of 2%. For these cohorts, average IRRs barely exceed 1%. Those generations that particularly lose out (in comparison to the calculations in Figure 1, which are based

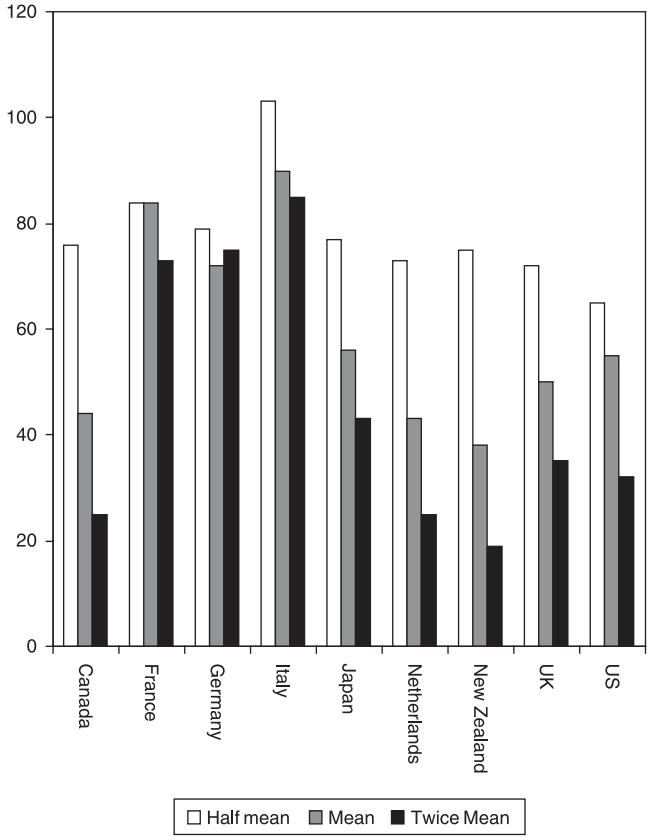


**Figure 3. Net replacement rates from public pension programmes by level of earnings: Selected countries**

on *actual* retirement dates) are those with very early actual retirement and below-average life expectancy, such as the three cohorts in Luxembourg.

### 4.3. Measuring the within-generation tax component

The basic approach to within-generation variations in actuarial fairness is to ask whether individuals (or households) receive the same replacement rate at different points in the earned income distribution. If the contribution rate is proportional to earnings, and replacement rates are identical across the earnings distribution then, in this dimension at least, the programme contains a low tax component. This is of course only one dimension of actuarial fairness since, even within a generation, there will be additional departures from actuarial fairness arising from differential longevity across earnings groups, from non-linear contribution schedules and from the treatment of spouses, but it is an important and intuitive dimension.

The data in Figure 3 for a number of OECD countries illustrate this dimension of actuarial fairness. They are obtained by taking household data to construct income

distributions and then calculating the hypothetical replacement rates, based on current 'rules', that would accrue to people at the average household income, at twice the household income, and at half the average income (in Italy, a quarter and three times), net of personal taxes. The data are mostly for the period 1994–95 and therefore exclude recent reforms (they are taken from Disney and Johnson, 2001, Table 1.1).

In general, for this select group of countries, there is a clear distinction between the 'Bismarck' countries (France, Germany and Italy), which provide similar replacement rates at all parts of the income distribution, and the remaining 'Beveridge' countries, where replacement rates are considerably higher for low income groups.

These data are illuminating but cover a limited range of countries. The regressions below use Blöndal and Scarpetta's data (1998, Table A.7) which, although providing only 'synthetic' averages based on administrative data rather than household data, cover a greater range of OECD countries (22) and several time periods (1961, 1975, 1997). They 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 versus couples). Compare this with Australia where the respective replacement rates are 37%, 24%, 62% and 41%, and where there are departures in both dimensions.

A useful quantitative indicator of the relevant differences can be computed as follows. If the four Blöndal and Scarpetta expected replacement rates are identical for each country-time observation, the programme is approximately actuarially fair (in this dimension). 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, or what was termed the tax component of the pension programme (the normalization does not affect the ranking: a similar ordering would occur if, say, the mean square error was used). Figure 4 illustrates these calculated 'tax components' for each country and each year.

Again, Figure 4 illustrates the discrepancies between the 'Beveridge' and 'Bismarck' countries, with the former having much higher tax components (deviations from actuarial fairness). In Table 1, however, the 'Bismarck' countries have higher contribution rates. So there is a clear trade-off between the tax component of the pension programme and the effective contribution rate. This is illustrated very clearly in Figure 5 for the 66 observations (22 countries and 3 time periods) reported in the last three columns of Table 1.

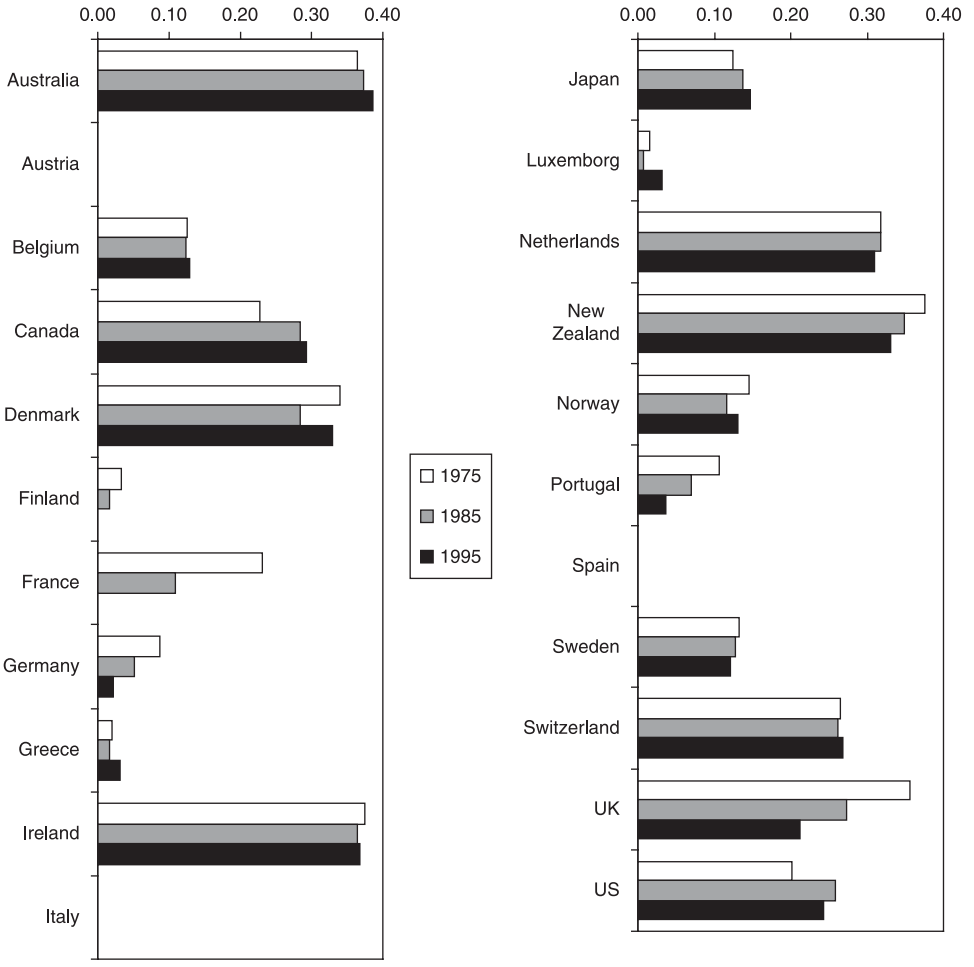


**Figure 4. Effective tax components, from inter-household variations in replacement rates**

This last result gives one intuitive reason as to why the statistical analysis of the impact of contributions to public pension programmes on economic activity rates may be empirically weak (apart from the use of mismeasured contribution rate data). In countries where contribution rates are high, tax components are low, and vice versa. If we take the effective tax rate as the contribution rate multiplied by the tax component, then the absolute dispersion of tax rates is lower than the dispersion of contribution rates. If a variable has less dispersion, it is less likely to prove significant in explaining differences in economic activity rates. This relationship between these various indicators of the 'tax component' and generosity of the public pension programme on the one hand, and economic activity rates on the other, is the topic of the next section.

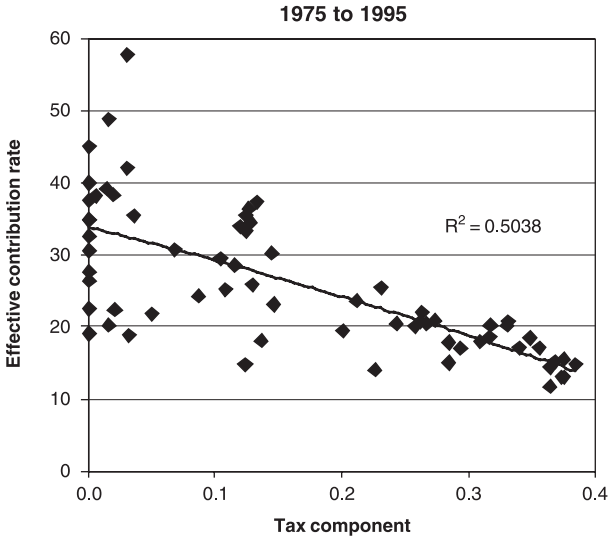


**Figure 5. Correlation of effective contribution rate and tax component of contributions, within generations**

## 5. ECONOMIC ACTIVITY RATES AND THE TAX COMPONENTS OF PUBLIC PENSION PROGRAMMES

This section examines the impact of the tax component of public pension programmes on economic activity rates in the standard cross-country and time period regression framework outlined earlier in Section 2. The set of explanatory variables is expanded to include both within- and between-generation measures of the tax component of public pension programmes. The object is to test whether the results in Table 3 are altered, and indeed improved, by utilizing indicators that differentiate the tax and retirement saving components of pension contributions, as described in the previous section.

### 5.1. Variables and definitions

Table 5 gives the definitions of the additional variables used in the analysis (Table A3, in the Appendix, gives summary statistics for the variables).

The overall hypothesis is that economic activity rates are lower the higher the tax component and the lower the saving component of the contribution. There are several indicators of lack of actuarial fairness (the within-generation tax component of the public programme) and of the differences in rates of returns across generations that can be constructed. The variable used here for the within-generation tax component, *Pension tax*, is an indicator that measures the fraction of the total contribution that is a tax component rather than a retirement saving component, and is

**Table 5. Additional variable definitions**

| Variable | Definition and source | Predicted sign |
|---|---|---|
| Pension tax | Contribution rate × effective tax components *it* (see text Figure 4) | <0 |
| Pension RR | Average expected public pension replacement rate at age 55: from Blöndal and Scarpetta (1998) | <0 |
| IRR at 65 | Internal rate of return on pension contributions at retirement age of 65: see Table 5 | >0 |
| Retirement test index | Categorical variable taking 4 values 0 to 3 reflecting increasing intensity of retirement test | >0? |
| Earliest pension age | Earliest age of receiving *normal* pension benefits | >0 |

constructed by multiplying the calculated contribution rates in Table 1 by the proportionate tax components in Figure 4.

To examine intergenerational equity, it is possible to use the internal rates of return constructed in Section 4.2. A *higher* internal rate of return signifies a lower tax component to the programme. The regressions do not include the variable *IRR* (illustrated in Figure 1) because this indicator, measured at actual retirement, is endogenous to economic activity. Instead, the regressions include the rates of return for fixed retirement age at 65: *IRR at 65* (see Table 4).

The variable *Pension RR* measures benefit generosity, and in particular the attractiveness (or otherwise) of the retirement option. This should be particularly significant for those close to retirement age, but may also have some impact for younger age groups if it proxies the generosity of the general welfare regime. Although this variable correlates strongly with *Contribution rate* (used in Table 3), it does not correlate strongly with *Pension tax*, as is apparent from Figure 5.

Two other control variables related to the design of the public pension programme should be noted. One variable measures the intensity with which a retirement test is applied to those over state pension age (*Retirement test index*). This indicator variable uses information from OECD and the US Social Security Administration's descriptions of country-specific pension programmes and takes 4 values as follows:

0 = no retirement or earnings test
1 = retirement or earnings test but deferral 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

The effect of this variable on economic activity rates of age groups just below age of first pension receipt might be positive insofar as restrictions on work after pension age should encourage workers to substitute work pre-pension receipt for work after retirement. A *caveat* with this variable is that its time variation is limited, although

there is some (for example, the abolition of the retirement test in the UK in 1989). However, some experimentation suggested that its omission has little impact on the other key variables.

The second control variable is the earliest age at which individuals can obtain the normal state pension (*Earliest pension age*). For older age groups, it might be expected that this variable raises economic activity rates, although the impact for younger age groups is less clear, *a priori*. As we shall see, this variable has little impact, suggesting that economic activity among older age groups is driven by other features of the retirement regime.

Experiments with a dummy variable capturing whether the country had a 'Beveridge' or 'Bismarck' regime, using the classification of countries described in Box 4, suggested that this variable had no additional explanatory power.

## 5.2. Empirical results

Table 6 presents regressions of economic activity rates for all age and gender groups, utilizing measures of the tax component of the public pension programmes, the generosity of programme benefits, the retirement regime indicators and the additional demand and institutional variables described in Table 2 and used in the regressions in Table 3. Separate panels describe the results for women and men.

**5.2.1. Women.** For women, *Pension tax* (the within generation measure) has a significantly negative impact on economic activity of all but two age groups. Moreover, the elasticity of the response of economic activity to the pension tax rate calculated here is on average about three times that for the average contribution rate in Table 3 (around −1.8 rather than −0.6). The other side of the coin is that a higher saving component to public pension contributions, as proxied by *IRR at 65* (the between generation measure), tends to have a significant and positive effect on economic activity rates. These results suggest that the exercise of disaggregating public pension contributions into a tax component and a saving component is justified by the data.

The impact of the pension replacement rate *Pension RR* on economic activity is significantly negative for younger and older women, although the responsiveness of economic activity is less than that to the pension tax rate. Of the two additional indicators of the retirement regime, only the intensity of the retirement test has any impact on economic activity rates: it is highly significant, negatively so for the two age groups of women 20–24 and 25–29, and positively signed thereafter. The results for the younger age groups are not intuitive, but the results from the groups aged 30 and above suggest some evidence of intertemporal substitution of labour supply ahead of a more intensive retirement test. The *caveat* should be restated that there is only limited time variation of this variable. Perhaps surprisingly, the variable *Earliest pension age* never has a significant impact, although it should be emphasized that this

**Table 6. Economic activity regressions, augmented by tax component of contributions**

| Dep. Var: Age activity rate | 20–24 | 25–29 | 30–44 | 45–49 | 50–54 | 55–59 |
|---|---|---|---|---|---|---|
| *Women* | | | | | | |
| Pension tax | –2.54*** | –2.66 | –1.75** | –1.99*** | –1.34** | –0.36 |
| | (0.86) | (1.68) | (0.81) | (0.70) | (0.58) | (0.30) |
| Pension RR | –0.19* | –0.58** | 0.14 | –0.01 | –0.20** | –0.17** |
| | (0.11) | (0.26) | (0.18) | (0.13) | (0.08) | (0.06) |
| IRR at 65 | 0.92 | 3.18* | 0.99 | 1.18 | 0.91 | 0.90** |
| | (0.79) | (1.62) | (1.18) | (0.89) | (0.61) | (0.37) |
| Retirement | –6.80** | –18.0** | 9.01** | 7.94** | 5.07* | 4.59*** |
| test index | (3.11) | (6.97) | (4.26) | (3.08) | (2.64) | (1.15) |
| Earliest | 0.48 | 0.03 | 0.20 | –0.01 | 0.15 | –0.02 |
| pension age | (1.25) | (1.74) | (0.84) | (0.68) | (0.62) | (0.44) |
| Demand shocks | 0.37 | 1.10** | –0.12 | –0.11 | 0.19 | 0.10 |
| | (0.22) | (0.54) | (0.39) | (0.30) | (0.18) | (0.15) |
| Union density | 0.32 | 0.27 | 0.02 | –0.01 | –0.07 | –0.06 |
| | (0.18) | (0.38) | (0.20) | (0.16) | (0.13) | (0.10) |
| Employment | 3.09 | –3.54 | –3.42 | –3.38 | –2.07 | –1.35 |
| protection index | (3.86) | (7.17) | (4.51) | (3.98) | (3.53) | (3.08) |
| *Men* | | | | | | |
| Pension tax | –0.28 | 0.68 | –0.16 | 0.11 | 0.19 | 1.60*** |
| | (1.21) | (0.52) | (0.13) | (0.15) | (0.23) | (0.20) |
| Pension RR | 0.14 | 0.06 | 0.01 | –0.02 | –0.14** | –0.14** |
| | (0.19) | (0.09) | (0.02) | (0.02) | (0.05) | (0.06) |
| IRR at 65 | 0.82 | 0.75 | –0.36** | –0.50*** | –0.54*** | –0.44 |
| | (0.93) | (0.53) | (0.15) | (0.16) | (0.24) | (0.49) |
| Retirement | 4.26 | 1.55 | 1.33** | 0.87 | 2.30*** | 4.39*** |
| test index | (4.31) | (3.02) | (0.64) | (0.63) | (0.63) | (1.53) |
| Earliest | –1.00 | –0.64 | 0.11 | 0.30 | 0.53 | –0.10 |
| pension age | (1.31) | (0.69) | (0.12) | (0.22) | (0.37) | (0.54) |
| Demand shocks | –0.72** | –0.23 | 0.05 | 0.01 | 0.17* | 0.04 |
| | (0.33) | (0.16) | (0.05) | (0.04) | (0.09) | (0.12) |
| Union density | 0.12 | –0.01 | –0.01 | 0.05 | 0.07 | 0.03 |
| | (0.16) | (0.09) | (0.04) | (0.05) | (0.06) | (0.10) |
| Employment | 1.18 | –2.95 | 2.21** | 1.66* | 3.71** | 5.39* |
| protection index | (5.78) | (2.90) | (0.82) | (0.87) | (1.82) | (2.91) |

*Notes:* Estimated by least squares, weighted by civilian employment; two way fixed effects; robust standard errors in parentheses. *** = 1%, ** = 5%, * = 10% significance. $N = 66$ (22 countries in 1975, 1985, 1995).

variable measures the first age at which an individual can receive *normal* pension benefits and this everywhere lies above the age range considered in the regressions.[5]

Finally, the additional institutional variables can be considered. The pattern of coefficients on these variables is broadly similar to those in Table 3, but there are

[5] The issue of 'neutrality' of the retirement regime is not considered further here, although a further dimension of the tax component of the pension programme revolves around the effective marginal return arising from the accrual of additional years of service above the first date of retirement where there is a flexible retirement age. For further discussion of retirement incentives, and of the conditions under which 'actuarial neutrality' is pertinent, see Blöndal and Scarpetta (1997, 1998), Gruber and Wise (1999), Burkhauser and Turner (1978), Johnson (2000) and Disney and Bridges (2004).

exceptions. Demand shocks are now positively signed, and significant for one of the young age groups. The puzzling significantly positive effect of employment protection in Table 3 for the youngest age group is eliminated: the coefficients on this variable are generally negative, as intuition might suggest, but not significant. Overall, the time-varying institutional and demand variables have limited explanatory power. The key drivers in explaining economic activity, other than the country and time dummies, are the pension and tax variables. This result, obtained in a demanding fixed-effects specification, is novel and interesting.

**5.2.2. Men.** In contrast to the results for female economic activity, the results of the regressions for men in the second panel of Table 6 are very mixed. This should not be too puzzling as the literature on the labour supply of men finds that male economic activity is rather unresponsive to the tax regime. Indeed the lack of response should not be too surprising in this data set simply because the variance of men's economic activity rates is low. The descriptive statistics in Table A3 indicate the average coefficient of variation of activity rates across female age groups is 0.287, over three times as high as that of men at 0.087.

The results for men can be summarized as follows. The variable *Pension tax* is highly significant only for the oldest age group and generally has a 'perverse' sign, in that a higher tax component of the public pension programme is associated with higher economic activity rates rather than the reverse. In contrast, the replacement rate variable *Pension RR* enters with the expected negative sign, and is significant, for the two oldest age groups.

The measure of the between generation return to contributions, *IRR at 65*, enters both positively and negatively for various age groups, but has the wrong sign when significant. This is surprising as the secular fall in internal rates of return across successive cohorts (Table 5) should be associated with a fall in male economic activity rates over time. However, this association seems to be largely captured through the time dummies, which are strongly significant and negative for men, unlike the case of women.

The results on the *Retirement test index* are more consistent than those of women, with no sign reversal at age 30. Here a tighter retirement test appears to be associated with significantly higher economic activity rates, especially in the latter half of the working life. This was hypothesized earlier to be a possible intertemporal substitution effect. The variable *Earliest pension age* is more significant than in the case of women, but there is no clear pattern to the coefficients. In contrast to the fairly robust and intuitive results for women, for men there is some evidence that benefit generosity and the design of the retirement regime have an impact on economic activity rates, but the tax and saving components of the contribution generally have no effects or else perverse effects.

In the case of the institutional and demand variables, a comparison of the second panels of Tables 3 and 6 suggests little change. *Demand shocks* are either perversely

signed or insignificant (except for age group 50–54). *Union density* no longer has any significant effect in the regressions in Table 6 compared to those in Table 3. In Table 6, however, the results concerning the positive impact on men's economic activity of a tougher *Employment protection index* are strengthened. A comparison between the two panels of Table 6 in terms of the implications of a tougher employment protection regime is illuminating, with an entirely different response for men and women. This provides tentative evidence that employment protection legislation operates in an asymmetric fashion in the labour market. It tends to raise the economic activity rates of middle aged and older men, who typically have longer job tenures and labour market attachment, and reduce that of women, who generally have shorter job tenures and longer interruptions to their lifetime employment (Bertola *et al.*, 2002).

## 6. CONCLUSIONS

Many governments, especially in Europe, have been preoccupied by the affordability of public pension programmes, and in particular by the potentially adverse impact of high contribution rates of unfunded programmes on employment and economic activity rates. A substantial existing empirical literature appears to confirm the proposition that high payroll taxes may indeed harm the employment prospects of these countries.

The tax component of such programmes should, however, be carefully measured. A central thrust of the present paper stems from a recognition in public policy that the adverse effect of public pension programmes for work incentives may be ameliorated by designing programmes where individual benefits are more closely linked to individual contributions, as a result of which there is a higher saving component to contributions to the programme. This may be especially pertinent in countries that have in the past adopted a broadly 'Bismarckian' strategy of public pension provision for comprehensive replacement of earnings at work; it is perhaps less relevant to countries that have adopted a 'Beveridge'-type pension programme where benefits provide a floor to other, funded, provision and where contribution rates to the public programme are lower. Current reforms to the public programme in Germany, Italy and Sweden illustrate the ideas of implementing greater actuarial fairness in practice.

The major contribution of the present paper has been to construct, and apply in cross-country and time empirical analyses, measures of the tax component and saving component of contributions to public pension contribution programmes. The paper searches for evidence that the degree of actuarial fairness matters when the impact of pension costs on economic activity rates is examined empirically. The paper constructs a number of intergenerational and within-generation measures of returns to, and the tax component of, public pension programmes.

It implements the standard empirical strategy that examines the impact of tax and benefit structures on activity rates across countries and over time, differing only in using fixed effects rather than time-invariant institutional indicators. The results

suggest that specifications in which age and sex-specific activity rates are related to the standard measures of the average payroll contribution rate and benefit replacement rate perform relatively poorly: results are not always significant and coefficients do not accord with prior predictions.

When the constructed measures of the tax component and the saving component of the average pension contribution are included, however, the econometric results are much improved and accord with priors. Both higher replacement rates *and* a higher tax component to public pension contributions reduce economic activity rates, especially among women. A higher rate of return to contributions across generations is also generally associated with *higher* economic activity rates, as theory would also suggest. The results for men are not robust, but this confirms the common finding in the empirical literature that male economic activity rates are largely insensitive to tax rates, and that there is simply not enough variance in male activity rates to obtain significant results.

The results therefore provide some justification for the pension reform strategy that is currently being implemented in a number of countries, intended to bring Bismarckian programmes closer to measured actuarial fairness. For Beveridge-type countries, such reforms are less pressing because, although programmes are more redistributive and contain a higher tax component, overall contribution rates are significantly lower. However, reforms that are intended to increase actuarial fairness are of recent origin and it will be some years before data are available that allow a more systematic analysis of the impact of 'treatments' to public pension programmes along such lines.

# Discussion

## Tito Boeri

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Empirical studies on cross-country differences in employment rates typically feature, among explanatory variables, a 'labour tax wedge' measure that includes compulsory contributions to public pension systems. As pointed out by Richard Disney, this approach ignores the fact that contributions to public pensions are, at least partly, a form of deferred consumption. Exploiting his deep institutional knowledge of public pension arrangements in OECD countries Disney offers alternative decompositions of compulsory contributions to public pensions, disentangling the redistributive (tax) component of payroll contributions from their actuarial (forced saving) components. These decompositions will be very valuable for further research on labour market participation decisions, especially by older workers. Disney then evaluates whether the two components enter differently in aggregate labour force participation equations. He expects to find that the tax component, but not the saving component,

reduce activity rates. This turns out to be the case for women but not for men, whose activity rates if anything appear to increase in response to higher 'pension taxes'.

When assessing the effects of alternative institutional features, it is always useful to characterize in the first place the role that these institutions are supposed to play. The paper does not address the issue of why different countries offer sharply different combinations of the tax and saving components. Do departures from actuarial fairness result from the bargaining power of specific groups of workers, who succeed in extracting intra-generational transfers from other workers? Or are pension systems that tax and discourage work by older workers an industrial policy tool, aimed at offsetting labor market rigidities in countries or industries where it is very costly to terminate employment? Or do the pension taxes implied by pension systems where replacement rates are much lower at higher income levels reflect strong inequality aversion in those same countries?

These questions are potentially relevant in guiding specification and interpretation in empirical work. For instance, a perverse sign of the tax component in the male activity rate equation may be explained by the fact that pension systems encouraging early retirement reduce the tax on the capital of firms associated with the provision of employment protection. It would be interesting to study employment (and unemployment) as well as activity rates from this perspective, and interacting the tax component of public pension contributions with other institutional features may capture this effect. Data and information are of course limited but, fortunately for researchers (if not for the individuals facing sharp regulatory changes), countries struggling to reform their pensions systems are doing so very gradually. Such incremental reforms result in many-tiered public pension systems, so that within each country different individuals face different tax and savings mixes. In both Italy and Sweden, the switch from defined benefit to defined contribution systems 'grandfathered' the entitlements of a large fraction of the workforce. Comparing participation decisions by workers before and after the reforms, and across the age (and seniority contribution) thresholds allocating workers to the two regimes, can offer further insights on the employment effects of pensions.

## Tullio Jappelli

Università di Salerno, CSEF and CEPR

Richard Disney tackles an important issue regarding the relation between social security arrangements and labor market outcomes. Since contributions entitle the worker to deferred compensation, workers should not regard social security contributions (or at least part of those contributions) as a tax, but as mandatory saving. So economic activity rates should not be discouraged by the conventional tax wedge, as found in previous studies, but by a revised tax wedge net of contributions toward pension plans, private or public.

The paper then examines the empirical literature on the negative employment effects of the payroll tax and proposes new cross-country evidence on the relation

between activity rates of young and old workers and various definitions of the payroll tax. It finds, at least for women, that indicators of generous pension returns positively affect employment rates, after controlling for the negative effect of the 'conventional' tax wedge. For men, the results are much less clear-cut.

Whether employment reacts to taxes depends on the bargaining process between firms and workers, the institutions governing that process, and the elasticity of labor supply. Since ultimately the theory does not deliver unambiguous predictions, revisiting the robustness of the empirical correlations is an important and useful exercise. A preliminary question, however, is to what extent workers perceive payroll taxes as deferred compensation; that is, to what extent mandatory contributions are a substitute for private accumulation. I will focus my comment primarily on this issue.

## The actuarially fair portion of social security

Disney is right in pointing out that many economists have routinely relied on the customary definition of after-tax wages. This definition excludes from wages not only general-purpose taxes, but also all contributions to pension institutions which, though part of the worker's pay, are generally not received in the form of cash. This point is well taken, and also explains why, for the elderly, pensions are instead generally included in income: they are paid in cash, though are not part of the current pay.

The analysis is based on the proposition that contributions to pension plans – whether public or private – are to be regarded as a component of total saving and therefore income, because, like any other type of life-cycle saving, they constitute a portion of current income that is not consumed but used to build up reserves for later consumption. One might challenge this point of view on the ground that true saving should result in an increment in national wealth or capital. Yet, in many pension systems that rely on pay-as-you-go financing, there is no automatic connection between contributions and benefits. To address the issue one must therefore provide measures of the effective tax rate, and analyze empirically the effect of the revised wage on labour market outcomes.

Disney proposes to distinguish total contributions into an 'actuarially fair' portion of contributions – or saving portion – and a true tax (or transfer) portion. This attempt bears a close relation with the intergenerational accounting framework, which measures how much existing generations can be expected to pay and to receive from the government over their remaining lifetimes (Auerbach *et al.*, 1999). Generational accounts provide measures of cohort-specific receipts and payments that can be used to evaluate the intergenerational redistributive impact of fiscal policy and social security. An important insight of this literature is that, at any given point in time, contribution rates, internal rates of return and replacement rates are cohort-specific. A second insight is that, for older cohorts, the receipts largely exceed their contributions. This is highlighted in Disney's Table 5, showing that in many countries the internal rate of return of social security is quite substantial, especially in the earlier period.

## Accounting definitions

The conventional definition includes in taxes all pension contributions. But, as noticed, to the extent that part of the contributions represent deferred compensation in the form of annuitized pensions, they should be added back to wages. Like any other type of life-cycle saving, they constitute a portion of current income that is not consumed but used to build up reserves for later consumption. The other side of the coin is that after retirement pension benefits should be counted as depletion of accumulated pension wealth, not as income of the elderly.

To clarify what this implies for the income and saving definitions, assume that the interest rate on private wealth is a constant $r$ and that there are no taxes except for social security contributions $\tau$. Consider then the conventional definition of saving as the change in wealth $a$, or $\dot{a} = ra + w - \tau + b - c$, where $y = ra + w - \tau + b$ is the conventional definition of disposable income, that is, capital income plus wages minus contributions plus benefits, and $c$ is consumption. Note that for most workers $b = 0$, while for most of the retired $\tau = 0$.

An alternative definition of saving recognizes that mandatory contributions entitle workers to receive a pension in the future. Define mandatory saving as change in pension wealth $p$, $\dot{p} = \tau - b + \rho p$, where $\rho p$ is an 'old-age' tax or transfer. If $\rho > r$ benefits received exceed the cohort past contributions, while if $\rho < r$ benefits received are less than the cohort past contributions. If $\rho = r$ the return on pension wealth equals the return on private wealth, and – barring liquidity constraints and all forms of uncertainty – the worker should be indifferent between investing in one form or wealth or another, as in the paper's Box 2. Total saving then equals the change in total wealth, $\dot{a} + \dot{p} = ra + \rho p + w - c$.

This accounting framework does not consider pension benefits as income, but as depletion of accumulated pension rights. Symmetrically, workers' contributions – or at least part of those contributions – are not considered a tax, but saving for later consumption. Note also that the treatment of mandatory contributions towards the National Health System entails similar issues: health-related contributions during the working life – or part of them – should be regarded as accumulation of rights to deplete the stock of health care in old age.

Similar definitions are adopted in Gokhale *et al.* (1996), who report US propensities to save out of two definitions of income. In their terminology, conventional disposable income is the sum of labour income, capital income and pension income less taxes. Alternative disposable income classifies social security contributions as loans to the government, and social security benefits as the repayment of principal plus interest on past social security loans, less an old age tax.

To provide a sense of the magnitudes involved in the different definitions, consider the case of Italy, where contributions are extremely high (over 30% of gross wages) and benefits are correspondingly quite generous. Figure 6 (taken from Jappelli and Modigliani, 1998) for expository purposes assumes that the rates of return on private

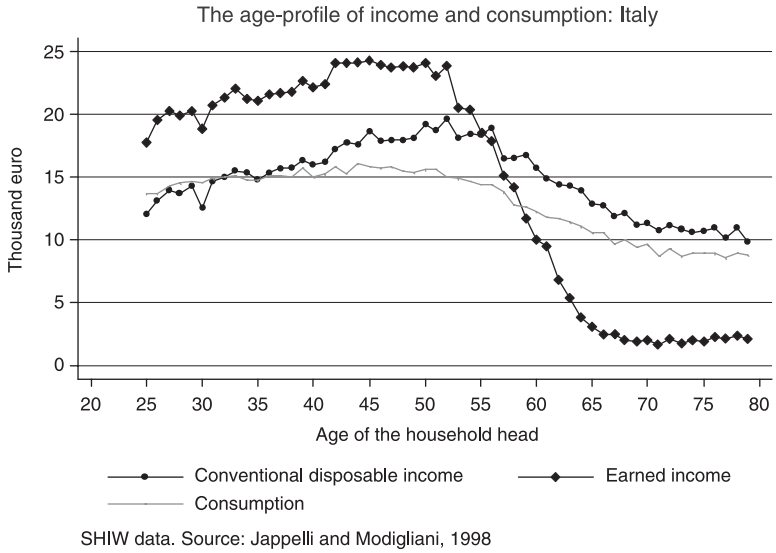


**Figure 6. The age profile of income and consumption: Italy**

*Source:* Jappelli and Modigliani (1998).

and pension wealth are the same. Earned income is obtained by adding to disposable income mandated contributions to social security. In contrast to consumption and disposable income, the profile of earned income is very hump-shaped. During working life the large difference between disposable income and earned income represents mandatory saving, which depends on the high contributions levied on Italian workers. The gap between conventional disposable income and earned income in old age is mandatory dissaving through the decumulation of pension wealth, and depends on the generous benefits to which workers are entitled. Note also that, up to retirement, total saving (the difference between earned income and consumption) is considerably greater than conventional saving (the difference between disposable income and consumption). During retirement, total saving turns negative, while conventional saving stays positive through life.

## From accounting definitions to behavioural response

From an accounting point of view, mandatory saving – or part of it – can be treated as part of total saving. But by how much does mandatory saving increase total wealth? The effect depends not only on how much a cohort is expected to receive over its remaining lifetime, but also on the degree to which discretionary wealth is a substitute for private wealth, and on the expectation of pension reforms. The relevant question therefore is: what is the impact of a change in pension contributions on discretionary saving?

There is by now substantial evidence that the substitution between pension wealth and private wealth is far from complete, about 0.5 or less. But, most importantly, the degree to which people regard social security contributions as saving depends on the specific definitions of pension rights, countries and methods of estimation: see, for example, Gale (1998) and Attanasio and Brugiavini (2003). This literature also suggests that cohort-differences in pension rights and differential response by age groups can be quite substantial. A pension reform, for instance, affects considerably young workers, but has often more limited effects on workers close to retirement age.

A related empirical issue is that the perception of pension rights depends not only on what is coded in the legislation, but also on people' expectations and on how these expectations are shaped by pension reforms. Again, these perceptions are likely to be correlated with employment and age groups, inducing a further source of variability in the empirical measures used.

The empirical strategy of the paper is to focus on groups with more elastic labour supply to uncover the relation between activity rates and various measures of taxes and contributions. The point is that the extent to which people regard contributions as taxes or deferred income depends not only on legislated programmes, but also on the degree to which deferred income is perceived as a substitute for private saving. The paper's approach uncovers signs of empirical relevance. Future cross-country research on the relation between private and mandatory saving might be able to shed further light on this issue considering, for example, that in actuarially fair systems as defined in the paper the internal rate of return – reflecting cohort differences in productivity growth rates, contribution rates, and pension eligibility rules – should vary across countries and over time but also across different age and employment groups.

## Panel discussion

Piero Cipollone suggested that, to ascertain whether pension contributions are perceived as taxes, it might be possible to compare their coefficients to those of income taxes in labour supply regressions. Marcel Thum thought that an implicit tax measure would be most relevant for labour supply decisions. Richard Disney replied that such a measure refers to actuarial neutrality, rather than fairness, and is not as relevant to the individual labour supply choices from the paper's perspective.

Jaume Ventura noted that it might be possible to assess the tax component of pension schemes by comparing a financial market-based valuation of the pension stream (as an asset) to its contribution costs. Francesco Daveri was interested to see that the tax component varied across countries, and thought empirical analysis should focus on the changes over time, rather than across countries. Ludger Schuknecht pointed out that several subtle elements of social security schemes could be important from the paper's point of view: for example, the German government pays pension contributions for

unemployed workers. Pietro Reichlin remarked that life expectancy is related to income, and therefore the actuarial fairness of pension schemes would in principle need to be assessed on the basis of more complex indicators than those considered in the paper.

## APPENDIX

### Construction of the internal rates of return to public pension programmes used in Section 4.2

The starting points in the calculations are the average expected gross public pension replacement rates constructed by Blöndal and Scarpetta (1998), Table III.3 for 1961, 1975 and 1995. These are stylized 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). They also provide expected replacement rates for different household types at these three intervals, information which will be used in the next subsection to construct measures of departure from within-generation 'actuarial fairness'. By interpolation (with adjustments where pension reforms seem to have had significant impacts, as in the UK 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 A1. It is both striking how much replacement rates differ across countries, and also how, in many countries, these rates have increased systematically over time.

For each of the 22 countries examined in this study, these 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. Depending on average expected retirement dates (for which I use the information in Blöndal and Scarpetta Table II.1 for men and women, weighted by economic activity rates), these correspond to individuals retiring in, respectively, the early 1980s, 1990s and 2000s.[6]

The second use of these average replacement rates is to permit calculation of effective contribution rates. *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 subsidized 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

[6] Of course some of these individuals will not have retired on full old-age pension benefits, but typically the evidence on 'actuarial neutrality' suggests that most countries in the sample permit early retirement provisions on actuarially favourable terms (relative to normal state pension age).

**Table A1. Replacement rates (%), 1955–95**

| Country | 1955 | 1965 | 1975 | 1985 | 1995 |
|---|---|---|---|---|---|
| Australia | 19.1 | 24.6 | 32.8 | 36.9 | 40.9 |
| Austria | 79.5 | 79.5 | 79.5 | 79.5 | 79.5 |
| Belgium | 72.6 | 71.8 | 70.5 | 69.0 | 67.5 |
| Canada | 31.3 | 36.8 | 45.1 | 48.4 | 51.6 |
| Denmark | 35.9 | 38.5 | 42.3 | 49.3 | 56.2 |
| Finland | 34.9 | 44.4 | 58.6 | 59.3 | 60.0 |
| France | 50.0 | 55.0 | 62.5 | 63.7 | 64.8 |
| Germany | 60.2 | 60.0 | 59.6 | 57.3 | 55.0 |
| Greece | 50.0 | 62.0 | 80.0 | 100.0 | 120.0 |
| Ireland | 38.6 | 34.7 | 28.9 | 34.3 | 39.7 |
| Italy | 60.0 | 60.8 | 62.0 | 71.0 | 80.0 |
| Japan | 24.6 | 36.4 | 54.1 | 53.1 | 52.1 |
| Luxembourg | 80.0 | 80.0 | 80.0 | 86.6 | 93.2 |
| Netherlands | 32.2 | 38.5 | 48.0 | 46.9 | 45.8 |
| New Zealand | 32.0 | 36.4 | 43.0 | 52.2 | 61.3 |
| Norway | 25.3 | 39.7 | 61.2 | 60.6 | 60.0 |
| Portugal | 85.0 | 81.8 | 77.0 | 79.8 | 82.6 |
| Spain | 50.0 | 50.0 | 50.0 | 75.0 | 100.0 |
| Sweden | 53.8 | 63.1 | 77.1 | 75.8 | 74.4 |
| Switzerland | 28.4 | 37.7 | 51.7 | 50.5 | 49.3 |
| UK | 33.4 | 33.6 | 33.8 | 41.8 | 49.8 |
| US | 39.1 | 43.1 | 49.1 | 52.6 | 56.0 |
| *Average* | *47.5* | *51.2* | *56.7* | *61.1* | *65.4* |

*Source:* Calculated from Blöndal and Scarpetta (1998, Table III.3).

as the UK) can more or less automatically adjust contribution rates to finance outgoings, whereas other countries (such as the USA) require legislation to vary contribution rates, and approval is not always forthcoming.

This apparent hurdle can be overcome by noting the requirement of a PAYG public pension programme, that the effective contribution rate is given by the average replacement rate divided by the effective support ratio of workers to pensioners, as in Equation (5) above. We know the former and the latter can be obtained from ILO data on activity rates, which gives the ratio of actual workers aged 15–59 to people aged over 60.

To convert the latter 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.

**Table A2. 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:* Each cell in Table A1 is divided by the corresponding cell in Table A2, as implied by text Equation (5).

Table A2 gives the constructed effective support ratios. Given the underlying demographic ageing of the OECD population, it is striking as to how few countries have a *fall* in the support ratio. Japan, where the support ratio halves over the period, is perhaps the most striking example. The table in general illustrates that, until the present time, demographic ageing has largely been offset by rising participation rates, especially among married women. However, when the baby boom, with its historically high economic activity rates, retires from 2010 on it is likely that economic support ratios will start to fall sharply unless offset by later retirement.

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.

**Table A3. Descriptive statistics for Sections 2 and 5**

| Variable | Mean | Std Dev. | Minimum | Maximum |
|---|---|---|---|---|
| *Economic activity rates* | (%) | (%) | (%) | (%) |
| Men 20–24 | 77.49 | 9.78 | 49.0 | 91.2 |
| Men 25–29 | 92.07 | 3.55 | 81.2 | 97.8 |
| Men 30–44 | 95.73 | 2.00 | 91.0 | 99.0 |
| Men 45–49 | 93.61 | 2.57 | 86.9 | 98.4 |
| Men 50–54 | 89.69 | 4.08 | 79.7 | 97.5 |
| Men 55–59 | 77.95 | 10.21 | 52.7 | 95.0 |
| Women 20–24 | 65.76 | 9.31 | 38.0 | 85.5 |
| Women 25–29 | 63.66 | 13.95 | 35.0 | 89.5 |
| Women 30–44 | 60.02 | 17.54 | 21.0 | 89.5 |
| Women 45–49 | 57.67 | 19.01 | 20.0 | 90.5 |
| Women 50–54 | 51.79 | 17.60 | 22.7 | 87.5 |
| Women 55–59 | 39.68 | 15.80 | 14.9 | 77.5 |
| *Pension and tax variables* | | | | |
| Pension RR (%) | 61.06 | 17.87 | 28.90 | 120.0 |
| Contribution rate (%) | 25.75 | 9.83 | 11.63 | 57.72 |
| Tax wedge (% of GDP) | 20.76 | 6.11 | 8.70 | 35.90 |
| Pension tax (rate, %) | 3.27 | 2.29 | 0.02 | 6.88 |
| IRR (%) | 3.07 | 2.27 | −1.39 | 10.32 |
| IRR at age 65 (%) | 1.91 | 2.24 | −1.64 | 11.96 |
| Retirement test index | 1.23 | 1.05 | 0 | 3 |
| Earliest pension age (years) | 61.63 | 3.35 | 55.00 | 68.00 |
| *Additional variables* | | | | |
| Demand shock (%) | 0.20 | 7.22 | −30.58 | 14.27 |
| Union density (%) | 42.54 | 19.33 | 14.59 | 90.00 |
| Employment protection index | 2.36 | 1.18 | 0.2 | 4 |

*Notes:* Variables as defined in Tables 2 and 5.

There are very few studies against which to compare the IRRs constructed here and depicted in Figure 1. Estimates from Disney and Whitehouse (1993) for the UK give estimates of IRRs for cohorts of men that decrease from 2% to −1% over the period considered here. The calculations here are comparable. Fornero and Castellino (2001, Tables A4 and A5) report an estimate for the cohort born 1943 of an IRR of around 3.5%, which is almost exactly that calculated here. On the other hand, for a fixed benefit rate, Börsch-Supan *et al.* (2001, Figure 5.4) report cohort IRRs of around 2.8% for the cohort born 1930 and 1.8% for the cohort born 1940. My figures are higher at 4.2% and 3.3% respectively.

The dataset is available at http://www.economic-policy.org.

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