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PUBLIC PENSIONS AND INTRA-EU MOBILITY: AN UNFINISHED AGENDA

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Public Pensions and Intra-EU Mobility: An Unfinished Agenda

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Abstract: We distinguish two ways in which national public pension systems can distort intra-EU movements of workers. First, each national pension system may display an inherent mobility bias. We propose the 'Lodge Test' to identify any such bias and show that many national pension systems in the EU are not mobility neutral. Second, mobility distortions may arise from differences between national pension systems. Using the CESifo pension model, we estimate both average and year-by-year implicit tax rates for select national pension systems in the EU. We then discuss how the observed differences in implicit tax rates on income may distort mobility and might even give rise to age-specific tax competition.

Non-technical summary

Cross-border mobility in the EU remains relatively low, despite EU citizens having the legal right to work anywhere in the EU as if it were one country. One long-recognised reason for distortions in intra-EU mobility choices is the fact that tax, social insurance and pension systems differ across the EU. In recent decades, the EU has through basic coordination of different national systems started to address some of the most blatant problems for workers who move within the EU. But the work is far from complete, even for systems where substantial EU level coordination is already in place.

This paper shows this by looking at mobility distortions due to public pension systems. We chose public pension systems for two reasons. First, they are financially typically by far the most important social insurance system. Second, public pension systems are already ingeniously coordinated at the EU level using the principles of totalisation and pro-ratisation so that all the obvious problems have already been addressed. This makes pensions an instructive test case to brings out the conceptually more subtle mobility distortions once first generation coordination has been achieved at the EU level.

To identify the remaining problems with public pensions, we distinguish between two sources of mobility distortions. First, each national pension system may display an inherent mobility bias. We propose the 'Lodge Test' to identify any such bias and show that many national pension systems in the EU are not mobility neutral. Second, mobility distortions may arise from differences between national pension systems. Using the CESifo pension model, we estimate both average and year-by-year implicit tax rates for select national pension systems in the EU. The observed differences in implicit tax rates on income could substantially distort mobility and might even give rise to age-specific tax competition.

A systematic European monitoring of barriers, as seen through the lens of the Lodge Test and implicit taxation, would be desirable in order to promote an incremental agenda designed to reduce mobility distortions – not only for pensions but also for other parts of European welfare

states. From that could flow non-binding European guidelines on desirable characteristics that could influence national decision-making without replacing it.

The implementation of this agenda will not be easy for two reasons. First, there is enormous legal complexity associated with national systems and their interactions across borders, with the result that many issues of practical relevance remain to be identified and, in time, resolved by the European courts. Second, most voters in EU member states still do not engage in intra-EU mobility, there may be political economy incentives for governments to persist in retaining – and even creating from scratch – aspects of the welfare state that are skewed towards the immobile at the expense of the mobile.

However, the conceptual framework presented in this paper can help to cut through the complexity and thus make it more difficult for any systematic mobility bias to go undetected for long.

1. Introduction

Cross border mobility in the EU remains relatively low, despite the legal right for EU citizens to work anywhere in the EU, as if it were one country. While mobility is not an end in itself, many serious obstacles to mobility within the EU remain that distort mobility choices. During the past decades, the EU has already looked at many of these practical obstacles to internal mobility. In doing so, some of the most blatant obstacles have now been removed, including through basic coordination of tax and welfare systems in the event of mobility and the mutual recognition of professional skills.

The remaining obstacles are therefore likely to be more subtle, sometimes politically sensitive, and often only lending themselves to an incremental approach. But in sum and over time, even such incremental progress could contribute substantially to actual worker mobility. During recent years, this unfinished agenda of further improving intra-EU mobility has been somewhat overshadowed by the discussion on transitional arrangements for workers from the new EU member states. But as these transition periods gradually expire and intra-EU migration comes to be regarded again as a two-way street, a renewed political focus on the remaining practical barriers that workers face when moving inside the EU can be expected.

Structure of the paper

Against this background, this paper takes another look at the possible distortive effects of public pensions on intra-EU mobility. Conceptually, there are two different ways in which such distortions can arise. First, each national pension system may display a mobility bias if its formula inherently discriminates between mobile and immobile workers. Second, mobility distortions may arise from differences between national pension systems, even if each of the national pension formulae involved were mobility-neutral.

In section 2, we explore the first channel, namely the inherent mobility bias any national pension system may display in its pension formula. Perhaps most importantly, practically all pension systems require a minimum number of years of contribution for any pension benefit to be paid at

all. If contribution periods in other countries are not recognised, this could lead to a situation where internationally mobile workers might not receive any pension at all despite having duly paid their pension contributions for 30 or even 40 years. As early as 1971, this major obstacle to mobility was comprehensively addressed within the then EC with the ingenious directive 1408/71, which comprehensively introduced the principle of totalisation of contribution periods within the EU. This raises the question whether other, perhaps more subtle, mobility distortions remain in national pension formulae.

While the existing literature contains hints at such distortions[1] that survive the provisions of directive 1408/71 and subsequent EU regulation, we present a comprehensive formal treatment designed to identify any remaining mobility bias. In order to do so, we examine the impact on national pension systems of a hypothetical job exchange across borders, with two (or more) individuals of equal productivity exchanging their place of work. A national pension system is said to pass the 'Lodge Test[2]' of mobility neutrality if its cash flow is not altered by such hypothetical job exchanges. On that basis, we derive necessary and sufficient conditions for pension systems in the EU to be mobility neutral. We find that many public pension systems in the EU continue to display aspects that fail the Lodge Test. The potential for future steps to move towards full mobility neutrality is discussed.

In section 3, we explore the second channel, namely mobility distortions that may arise from differences between national pension systems even if they were, by themselves, mobility neutral according to the Lodge Test. In many ways, mobility distortions arising from international differences in national pension systems are closely related to the distortions that may arise from international differences in redistributive taxation in an integrated labour market as analysed in the seminal papers of Wildasin (1991, 1994). However, the effective burden on labour income in a pay-as-you-go (PAYG) pension system in a setting with migration is not straightforward to calculate. The reason is that both contributions and benefits explicitly depend on the relative sizes of each generation, which in turn are influenced by migration. Homburg and Richter (1993) show how PAYG pensions levy an implicit tax on labour income and how, other things

[1] eg Holzmann *et al* (2005), page 17
[2] After David Lodge, the author of the novel 'Changing Places' offering an amusing account of such an international job exchange.

being equal, workers tend to migrate to the country with the lowest implicit pension tax. Jousten and Pestieau (2002) describe the resulting race to the bottom that can drive contribution rates of the PAYG system to zero, thereby forcing the shift to a fully funded pension system. Finally, Breyer and Kolmar (2002) show that the imposition of equal contribution rates is a sufficient condition to avoid such a race to the bottom and restore the efficient allocation of labour.

In order to explore the empirical relevance of differences in implicit tax rates, we use the CESifo pension model. Expanding on Fenge and Werding (2004), who estimate the lifetime average implicit income tax rates for public pensions in a number of countries, we estimate not only the average but also the annual implicit tax rates of select public pension systems within the EU. We confirm that the differences in both average and annual implicit tax rates between EU countries are sufficiently large that they could plausibly influence mobility decisions. Based on differences in annual tax rates, we discuss the possibility of age-specific tax competition since implicit tax rates (as opposed to normal income tax rates) can be conditional not only on income but also on age. As mobility costs fall, this could potentially give rise to an aggressive form of tax competition that specifically targets certain age groups and may make European policy intervention desirable.

The concluding section 4 of this paper further explores potential policy implications from the previous sections.

Related issues

Before turning to the analysis proper, there are some important aspects of the interplay between public pensions and intra-EU mobility that are not comprehensively covered in this paper but nevertheless deserve to be discussed in relation to the research agenda of the present paper.

First, there is the issue of the income tax treatment of pension contributions and pensions. If one country taxes pension contributions and leaves pension payments untaxed and another country leaves pension contributions tax-exempt but taxes pensions, this can induce major mobility incentives, not least at the time of retirement. We decided not to cover this taxation problem in

order to keep the complexity of our empirical analysis manageable. To some extent this can also be justified by the fact that EU member states are generally moving towards deferred taxation of pensions, making contributions tax-exempt and only taxing pension payments.

Second, there is the issue of portability of pension schemes from the 'second pension pillar' of supplementary pension schemes. They are usually company- or sector-specific, and are mostly funded schemes. The treatment of this second pillar under intra-EU mobility was recently the subject of a much discussed draft directive of the European Commission.[3] We decided not explicitly to cover the second pillar because much of the analysis for the first pillar would not be substantially different for the second pillar. But perhaps more importantly, it seems plausible that some of the second pillar pension schemes serve objectives that go beyond providing an income in old age. For example, it might be efficient for companies and employees to agree on reduced portability of company pensions in order to provide better incentives for the company to invest in the (portable) skills of its employees. But equally plausibly, limited portability of public pensions could result from a governance of occupational pension schemes often dominated by the interests of an immobile majority tempted to exploit a mobile minority of workers. Carefully disentangling legitimate and not-so-legitimate reasons for improving the portability of existing contracts *ex post* – which is what the EU level policy debate currently revolves around – would have been beyond the scope of this paper.

Third, we also do not cover civil service pensions. The reason is again that limited portability of civil service pensions can have efficiency reasons in terms of efficiency wage theory. This is not to say that portability cannot be a major issue here. Quite the reverse: for example, it is difficult to imagine a functioning EU labour market for university professors inside the EU unless the portability of public sector pensions is substantially improved. However, in this paper we focus on the normal first pillar of the pension system where the objective function is clearly focused on providing for old age and mobility neutrality can easily and universally be defended as the relevant efficiency benchmark.

[3] Proposal for Directive COM (2005) 507 of 20th Oct. 2005; Amended Proposal COM (2007) 603 of 9th October 2007.

2. Totalisation of Pensions and the Lodge Test

This section formalises the totalisation principle that is used as a basis to calculate old age pension entitlements for workers who move inside the EU. It then explores which types of pension formulae do not unduly distort mobility when the totalisation principle is applied. It proposes a simple formalised test of non-distortion for national pension systems: the 'Lodge Test' in honour of David Lodge, the author of the novel 'Changing Places' that offers a humorous account of an international job swap of two academics. A national pension system is said to pass the Lodge Test if cross-border job swaps between workers of identical productivity which do not change the aggregate cash flow into that national pension system also do not change the aggregate cash flow out of the pension system in the form of old age pensions once totalisation is applied.

To explore the structural implications of the Lodge Test, one necessary and one sufficient condition for a national pension formula to meet the Lodge Test are derived. On that basis, the possible policy implications of the Lodge Test are discussed.

Totalisation

To reduce the notational and conceptual complexity, we make a number of simplifying assumptions. First, we assume that an individual is only ever contributing to at most one pension system in one EU member state at a time and that moves between countries or changes of employment status only ever take place at the end of a full year. Second, we assume away non-working qualifying periods such as years of university study or child-raising periods. Third, we assume that the working age extends from 20 to 65 years for everybody.

On this basis, let $\vec{w} = \begin{pmatrix} w_{20} \\ \vdots \\ w_{64} \end{pmatrix}$ be the vector of annual earnings of an individual. And let

$C = \begin{matrix} c_{20} & 0 & \cdots & 0 \\ 0 & c_{21} & \ddots & \vdots \\ \vdots & \ddots & \ddots & 0 \\ 0 & \cdots & 0 & c_{64} \end{matrix}$ be the diagonal matrix of contribution periods such that the diagonal entry $c_i = 1$ if it was a contribution period in any EU member state and $c_i = 0$ otherwise. Furthermore, let $C_1 + ... + C_{27} = C$ be the partition of contribution periods among the EU member states for the individual in question. Accordingly, the earnings vector in each EU member state *i* can be written as $\vec{w}_i = C_i \vec{w}$.

In order to calculate each national pension for a mobile individual by means of totalisation, a virtual earnings history is constructed. This virtual earnings vector $\vec{v}_i(\vec{w}_i, C)$ is calculated according to directive 1408/71 and subsequent regulations. Only contribution periods are shared between member states. Annual earnings and pension contribution data are not. Therefore, foreign earnings data cannot (and must not) be used for the construction of the virtual earnings vector. Instead, the virtual earnings vector is constructed by extrapolating from the actual national earnings history, and the average earnings during that period in particular. However, these average earnings are to be adjusted for inflation, wage growth or other parameters depending on the logic of the underlying national pension formula, as specified by EU regulation.

On the basis of the virtual earnings vector $\vec{v}_i(\vec{w}_i, C)$, a virtual pension is then calculated using the standard national pension formula $p_i(\vec{v}_i(\vec{w}_i, C), C)$ of country *i* applied to the virtual earnings vector. This virtual pension is then pro-rated with the fraction of national contribution years over the total number of EU contribution years $\frac{tr(C_i)}{tr(C)}$ where tr is the trace function that sums the diagonal elements of a matrix. Each national pension entitlement P_i is then calculated in

accordance with EU regulation as the maximum of the pension claim based on totalisation and pro-ratisation $p_i(\vec{v}_i(\vec{w}_i, C), C)\frac{tr(C_i)}{tr(C)}$ and the purely national pension claim $p_i(\vec{w}_i, C_i)$:

$$P_i = \max\left[p_i(\vec{w}_i, C_i), p_i(\vec{v}(\vec{w}_i, C), C)\frac{tr(C_i)}{tr(C)} \right]$$

The maximum function guarantees that an individual's pension claim derived from totalisation and pro-ratisation is never lower than without any EU regulation. The totalised pension of a mobile individual is then calculated as $P = \sum_{i=1}^{27} P_i$ with $P_i = 0$ for all countries *i* where no contribution was made.

Lodge Test

This method of totalisation immediately raises the question of which kinds of pension systems it will work properly for, in the sense that it unduly discriminates neither against mobility nor immobility. Conceptually, the key question is how to compare like with like in detecting any undue discrimination. Surely, if an individual moves to a different country, both the salary level and the pension system will in general be different, and there is generally nothing wrong with that. However, there clearly would be something wrong if two individuals with identical skill-sets who swap countries and jobs in a way that does not collectively change the contributions into both national pension systems were then, collectively, to receive different pension claims in either of the two pension systems compared to a situation where each would have stayed at home. The Lodge Test is met if, and only if, such changes of place of individuals with identical skills and earnings would, under no circumstances, alter the cash flow of the national pension systems in question[4].

[4] The Lodge test is logically closely related to notion of 'social insurance twins', see for example Holzmann et al. (2005), page 17.

To illustrate the Lodge test formally, suppose that A and B are two individuals with identical skills and therefore identical potential earnings vectors $\vec{w}_1$ in country 1 and $\vec{w}_2$ in country 2. Variables of individuals are denoted by a superscript while country variables remain indicated by a subscript. As a benchmark, we examine the situation that individual A spends all his working life in country 1 earning $\vec{w}^A = \vec{w}_1$ while B spends all his working live in country 2 earning $\vec{w}^B = \vec{w}_2$. Hence, country 1 has to pay a total pension $P_1 = p_1(\vec{w}_1, C)$ and country 2 a total pension of $P_2 = p_2(\vec{w}_2, C)$ to A and B respectively.

As a next step, assume that A and B change places with each other either once or several times. The matrix of contribution periods C for both individuals is now split between the two countries so that $C_1^A + C_2^A = C = C_1^B + C_2^B$ with the job swap condition $C_1^A = C_2^B$ and $C_2^A = C_1^B$. As a consequence, the annual earnings vector of individual A is transformed to $\vec{w}^A = C_1^A \vec{w}_1 + C_2^A \vec{w}_2$ and that of individual B is transformed to $\vec{w}^B = C_1^B \vec{w}_1 + C_2^B \vec{w}_2$.

Using the totalisation principle, the total pension claim (by A and B together) on country 1 then amounts to

$$P_1 = \max\left[p_1(C_1^A \vec{w}_1, C_1^A), p_1(\vec{v}_1(C_1^A \vec{w}_1, C), C)\frac{tr(C_1^A)}{tr(C)} \right] + \max\left[p_1(C_1^B \vec{w}_1, C_1^B), p_1(\vec{v}_1(C_1^B \vec{w}_1, C), C)\frac{tr(C_1^B)}{tr(C)} \right]$$

and the total pension claim (by A and B together) on country 2 amounts to

$$\mathrm{P}_2 = \max\left[\mathrm{p}_2(\mathrm{C}_2^{\mathrm{A}} \vec{\mathrm{w}}_2, \mathrm{C}_2^{\mathrm{A}}), \mathrm{p}_2(\vec{\mathrm{v}}_2(\mathrm{C}_2^{\mathrm{A}} \vec{\mathrm{w}}_2, \mathrm{C}), \mathrm{C})\frac{\mathrm{tr}(\mathrm{C}_2^{\mathrm{A}})}{\mathrm{tr}(\mathrm{C})} \right] + \max\left[\mathrm{p}_2(\mathrm{C}_2^{\mathrm{B}} \vec{\mathrm{w}}_2, \mathrm{C}_2^{\mathrm{B}}), \mathrm{p}_2(\vec{\mathrm{v}}_2(\mathrm{C}_2^{\mathrm{B}} \vec{\mathrm{w}}_2, \mathrm{C}), \mathrm{C})\frac{\mathrm{tr}(\mathrm{C}_2^{\mathrm{B}})}{\mathrm{tr}(\mathrm{C})} \right]$$

For the Lodge test to be satisfied, the exchange should not lead to any change in the cash flow of either of the two pension systems. On the contribution side, this is generally satisfied since total earnings subject to contributions have not changed as $\mathrm{C}_1^{\mathrm{A}} \vec{\mathrm{w}}_1 + \mathrm{C}_1^{\mathrm{B}} \vec{\mathrm{w}}_1 = \vec{\mathrm{w}}_1$ and $\mathrm{C}_2^{\mathrm{A}} \vec{\mathrm{w}}_2 + \mathrm{C}_2^{\mathrm{B}} \vec{\mathrm{w}}_2 = \vec{\mathrm{w}}_2$. However, on the pension side this is only satisfied if

$$p_1(\vec{w}_1, C) = \max\left[p_1(C_1^A \vec{w}_1, C_1^A), p_1(\vec{v}_1(C_1^A \vec{w}_1, C), C) \frac{tr(C_1^A)}{tr(C)} \right] + \max\left[p_1(C_1^B \vec{w}_1, C_1^B), p_1(\vec{v}_1(C_1^B \vec{w}_1, C), C) \frac{tr(C_1^B)}{tr(C)} \right]$$

and

$$p_2(\vec{w}_2, C) = \max\left[p_2(C_2^A \vec{w}_2, C_2^A), p_2(\vec{v}_2(C_2^A \vec{w}_2, C), C) \frac{tr(C_2^A)}{tr(C)} \right] + \max\left[p_2(C_2^B \vec{w}_2, C_2^B), p_2(\vec{v}_2(C_2^B \vec{w}_2, C), C) \frac{tr(C_2^B)}{tr(C)} \right]$$

which is already a non-trivial demand on national pension systems. But the Lodge test has an even stronger implication:

Proposition 1: A necessary condition for the Lodge test to be met by a national pension system is that its pension formula p can be written additively separably in annual earnings w_k, $k = 20,...,64$:

$$(2.1) \qquad p(\vec{w}, C) = \sum_{k=20}^{64} f_k(w_k, C)$$

Proof: Imagine a 'job switch' arrangement whereby for 45 individuals with an identical skill set that leads to an earnings vector $\vec{w}_i$ in the country *i* whose pension formula we are interested in. Let each of the $j = 1,...,45$ individuals consecutively work in the country *i* for exactly one year such that each C_i^j has one diagonal element $c_k = 1$, for $k = 20,...,64$, and all other elements are zero. In this case, a necessary condition for the Lodge test to be satisfied is that

$$(2.2) \qquad p_i(\vec{w}_i, C) = \sum_{j=1}^{45} \max\left[p_i(C_i^j \vec{w}_i, C_i^j), \frac{p_i(\vec{v}_i(C_i^j \vec{w}_i, C), C)}{45} \right]$$ for all possible earnings vectors $\vec{w}_i$.

But each summand in this formula depends only on the earnings of one particular year of an individual's working life. Hence, the pension formula can indeed be written in an additively separable way in annual earnings as stated in proposition 1. □

The requirement for the pension formula to meet the Lodge test can be pushed even further using a natural assumption, namely that the national pension formula uses contribution periods merely to determine whether a minimum qualification period Q has been met so that a pension will be paid at all. In practice, this is generally the case for real-life pension formulae. With the help of this assumption, equation 2.1 can be re-written as

$$(2.3) \qquad p(\vec{w}, C) = \begin{cases} \sum_{k=20}^{64} \tilde{f}_k(w_k) & \text{if } tr(C) \geq Q \\ 0 & \text{if } tr(C) < Q \end{cases}$$

On that basis, we now aim to construct a sufficient condition for the Lodge Test to be satisfied. In order to do so, we first need to make a suitable construction of the virtual earnings vector explicit.

Virtual Earnings Vector

The virtual earnings vector $\vec{v}(C_i \vec{w}, C)$ with C_i being the matrix of contribution periods in country *i* is to be constructed on the basis of an auxiliary virtual earnings vector $\vec{\tilde{v}}$ as follows. For notational convenience we define $\vec{\tilde{w}} = C_i \vec{w}$, and introduce that $\tilde{v}_j$ and $\tilde{w}_j$ denote the j^{th} entry of the $\vec{\tilde{v}}$ and the $\vec{\tilde{w}}$ respectively. We then define $\vec{\tilde{v}}$ such that

$$(2.4) \qquad \tilde{f}_k(\tilde{v}_k) = \frac{1}{tr(C_i)} \sum_{\substack{n \text{ with} \\ c^i_{nn} \neq 0}} \tilde{f}(\tilde{w}_n) \text{ for all } k.$$

In other words, $\tilde{v}_k$ is chosen so that its pension value is equal to the average pension value over all years in which the individual in question was subject to the pension system in country *i*.

A $\tilde{v}_k$ satisfying equation 2.4 will always exist (even though possibly not be uniquely defined) if all the ranges of the $\tilde{f}_j$ are the same interval of real numbers. The connectedness in this unique interval assures that a $\tilde{v}_k$ always exists so that $\tilde{f}_k(\tilde{v}_k)$ is equal to any average of other $\tilde{f}$. Using this assumption, the virtual earnings vectors can now be written as

(5) $\quad \vec{v}=(C-C_i)\vec{\tilde{v}}+\vec{\tilde{w}}.$

This assures that for all within country contribution periods $v_j=\tilde{w}_j$, for foreign contribution periods $v_j=\tilde{v}_j$, and for all other periods $v_j=0$. Provided that the virtual earnings vector is thus constructed, in line with regulation 1408/71, we arrive at

Proposition 2: A sufficient condition for the Lodge test to be met is that each national pension formula can be written as in equation 2.3 and that the ranges of the $\tilde{f}_j$ are the same interval of real numbers for all *j*.

Proof: Take any immobile individual earning $\vec{w}$ during working life C in the country in question. Now assume that instead these working periods and earnings were arbitrarily split between *n* mobile people $C^1+C^1+...+C^n=C$ with identical skills. By totalisation, the pension of individual *i* in this case equals $\sum_{j=20}^{64}\tilde{f}_j(v_j^i)$. With the notation $\vec{\tilde{w}}^j=C^i\vec{w}$ and using equations 2.4 and 2.5 we obtain:

$$\frac{tr(C^i)}{tr(C)}\sum_{j=20}^{64}\tilde{f}_j(v_j^i)=\frac{tr(C^i)}{tr(C)}\left[\sum_{\substack{k\text{ with}\\ \tilde{w}_k^i=0}}\tilde{f}_k(\tilde{v}_k^i)+\sum_{\substack{k\text{ with}\\ \tilde{w}_n^i\neq 0}}\tilde{f}_k(\tilde{w}_k^i)\right]$$

$$=\frac{tr(C^i)}{tr(C)}\left[\frac{tr(C)-tr(C^i)}{tr(C^i)}\sum_{\substack{k\text{ with}\\ \tilde{w}_k^i\neq 0}}\tilde{f}_k(\tilde{w}_k^i)+\sum_{\substack{k\text{ with}\\ \tilde{w}_k^i\neq 0}}\tilde{f}_k(\tilde{w}_k^i)\right]$$

$$=\sum_{\substack{k\text{ with}\\ \tilde{w}_k^i\neq 0}}\tilde{f}_k(\tilde{w}_k^i)$$

Then, summing the totalised pension claims over all splits we obtain

$$\sum_{i=1}^{n}\sum_{\substack{k\text{ with}\\ \tilde{w}_n^i\neq 0}}\tilde{f}_k(\tilde{w}_k^i)=\sum_{j=20}^{64}\tilde{f}_j(w_j)$$

where the right hand side is the pension claim that would have occurred without any swapping movements. □

These findings suggest that for mobility neutrality in pension systems to be achieved, substantial structural restrictions on national pension formulae would need to be imposed. But for this to be a robust insight, one needs to be certain that it is not an artefact of the (possibly imperfect) principles of directive 1408/71 and subsequent regulation. Put differently: could a 'better' totalisation regime be found that would then impose much lighter restrictions (if any) on national pension systems for them to pass the Lodge Test? In particular, could a more complete transmission of not only qualifying periods but also earnings information between member states help?

It turns out that this is not to be the case regarding the necessary condition of additive separability from Proposition 1. Essentially, the result follows from the logic of the Lodge Test quite independently of the specifics of the European totalisation regime, as a closer inspection of equation 2.2 in the proof makes clear. Furthermore, adding foreign earnings information as

arguments on the left-hand-side of equation 2.2 will at best be irrelevant when it comes to assuring equality with the right-hand side, since foreign earnings do not appear as an argument there.

By contrast there is, in principle, potential marginally to relax the requirements of the sufficient condition somewhat if the current European totalisation/proratisation could be amended. Specifically, a more direct approach could be used instead of totalisation in cases where pensions are additively separable along the lines of equation 2.3. In that case, instead of totalisation and proratisation one could instead directly refer to the annual pension entitlements $\tilde{f}_k$ for the calculation of the pension benefit of a mobile individual. Thereby, one would be able to eliminate the prerequisite for totalisation in Proposition 2 that for each country all $\tilde{f}_k$ would have to have the same range.

Possible Policy Implications

In this section, we explore the policy implications of the robust link between additive separability and mobility neutrality. At first glance, it would appear that the restrictions imposed by additive separability are relatively weak, still allowing for a very wide range of pension systems with a wide range of distribution characteristics. According to equation 2.3, different generations could still be taxed differently, and the implied annual tax could vary widely. Also, a full range of distributive options is compatible with equation 2.3, ranging from Bismarckian pensions with a strong link between contribution and benefits and Beveridgian systems with a weak link or no link between contributions and benefits.

However, it turns out that in practice the restrictions imposed by additive separability are far from trivial. Compliance with it would in fact require pension reforms in a large number of member states. In the following, we will discuss the most important aspects of pension systems that would need to be changed to move towards additive separability.

First, an important number of member states as shown in Table 1 currently base their pension calculation on a limited number of ‘best years of earning’. Clearly, this ‘best years of earning’

notion cannot be written into a pension formula that is additively separable in annual earnings. Such systems therefore do not meet the necessary condition for the Lodge Test to be satisfied.

Phasing out such 'best years of earning' elements in national pension formulae would clearly be desirable from a worker mobility perspective, as such elements represent a systematic discrimination against mobility. The reason is that under the Lodge Test the individual pension claim based on 'best years of earning' is transformed into a fragmented and pro-rated pension claim that is in effect based on the lower 'average earnings'. As a result, fragmented pension claims of the mobile are systematically below the non-fragmented pension claims of the immobile.

Table 1: Select aspects of EU pension systems in conflict with mobility neutrality

	Best Years of Earnings	Pension Cap*	Pension Floor*
Austria			Yes
Belgium			Yes
Bulgaria	Yes		Yes
Cyprus			Yes
Czech Republic	Yes		Yes
Denmark		Yes	Yes
Estonia			Yes
Finland		Yes	Yes
France	Yes	Yes	Yes
Germany			
Greece	Yes	Yes	Yes
Hungary			Yes
Ireland		Yes	Yes
Italy			Yes
Latvia			Yes
Lithuania			
Luxemburg		Yes	Yes
Malta	Yes	Yes	Yes
Netherlands			Yes
Poland	Yes		Yes
Portugal	Yes		Yes
Romania			
Slovak Republic			
Slovenia	Yes		Yes
Spain	Yes	Yes	Yes
Sweden		Yes	Yes
United Kingdom		Yes	Yes

Source: Missoc

* We indicate all countries that have explicit pension minimum and maximum pensions according to Missoc. There is no guarantee that both minimum and maximum pension are binding in any given year, such that the Lodge Test would actually be violated.

Nevertheless, certain features of the 'best years of earning' approach may be desirable. For example, it may be argued that the 'best years of earning' pension formula provides a useful incentive for education and life-long learning that increase peak productivity at an advanced age at the expense of earnings earlier in life. Such incentives for education could be argued to be particularly important in a country with a strongly progressive tax system that heavily discriminates against peaked earnings (possibly as a result of education and risk-taking) compared to earnings spread out more evenly over time. However, it may eventually be preferable to address such concerns head on through education and tax policy instead of pension policy.

Overall, we think that the prospects that member states will progressively fade out 'best years of earnings' are good. In recent years, many countries in the EU (eg Italy, Austria and France) have either faded out their 'best years of earnings' approach completely or increased the number of 'best years' to be taken into account substantially. The political motivation for these changes has often had more to do with the fact that pension benefits needed to be cut in view of demographic pressures. Clearly, replacing the average earnings during a small number of best years to earnings by the average earnings over a larger number of years in the pension formulae is one convenient way to achieve such a reduction in benefits.

Second, some member states impose a cap p_{max} on the total pension even when the logic of the pension formula would call for a higher pension. The pension formula in such a country *i* can typically be written as $p_i(C_i\vec{w}, C_i) = \max(\tilde{p}_i(C_i\vec{w}, C_i), p_{max})$ with $p_{max} < \max_{C_i\vec{w}, C_i}(\tilde{p}_i(C_i\vec{w}, C_i))$ so that the cap is binding. Clearly, this maximum operation in the pension formula cannot be written in a way that is additively separable in earnings. It therefore violates the Lodge Test. Sometimes there may even be conceptual ambiguity whether these pension caps are to be applied before or after totalisation. Interestingly, such pension caps tend to be biased in favour of mobility. Take the Danish basic pension as an example: each year of residence is worth 1/40th of the standard pension, with a minimum qualifying residence of 3 years. However, the pension is capped at the standard pension so that anybody with more than 40 years of residence within the relevant age bracket still receives the standard pension. Hence, if somebody with 40 years of residence 'changes places', he should, according to the basic principles of totalisation, still receive the full

standard pension from Denmark. In addition, his migration counterpart who now has residence in Denmark for another 5 years is entitled to $1/8^{th}$ of the standard Danish pension. Hence, to the extent that the principles of the EU regulation are applicable to the Danish case, there is a total pension claim on Denmark of $9/8^{th}$ of the standard pension with mobility compared to only the standard pension without mobility.

The political intention of this is unlikely to be to subsidise mobility. Perhaps the idea is simply to ensure that a basic pension will be provided for every typical inhabitant (who is assumed to have spent less than 5 years of his life abroad). However, the threshold of 5 years abroad seems somewhat arbitrary and the economic advantages of this arrangement are not immediately obvious, although they may have to do with the way in which, for example, the Danish welfare state interacts with the basic pension. While the devil is always in the detail, it would seem promising for countries with such pension caps to explore viable and at the same time mobility-neutral alternatives.

Third, many EU member states have arrangements to top-up pensions that are deemed to be too low when calculated under the normal pension formula to a pension floor p_{min}. The pension formula in such a country *i* can typically be written as $p_i(C_i\vec{w}, C_i) = \min(\tilde{p}_i(C_i\vec{w}, C_i), p_{min})$ with $p_{min} > \max_{\text{over all eligible work biographies}}(\tilde{p}_i(C_i\vec{w}, C_i))$ so that the floor is binding. Clearly, this minimum operation in the pension formula cannot be written in a way that is additively separable in annual earnings. It therefore violates the Lodge Test. Also there can again be conceptual ambiguity whether these minima should be applied before or after totalisation. These top-up benefits are usually intended to fight poverty in old age and also to reward low-income earners who have often diligently worked for decades instead of relying on the welfare state. Clearly, special benefits for relatively poor people in old age generally make good redistributive sense. However, they need not be delivered in a way that is incompatible with the Lodge Test.

For a start, top-up payments for old age pensions can be organised as part of social assistance instead of being part of the pension system. Of course, there may be political concerns about the stigma attached to receiving social assistance in old age. To assuage such concerns, Germany initially developed an insular solution for its ‘Grundsicherung’ (needs-based minimum pension benefit) that was legally neither part of the pension system nor part of social assistance.

However, owing to legal and administrative difficulties, this separation was later abandoned and the 'Grundsicherung' is now fully integrated into the social assistance law.

In addition, the degree of redistribution within the pension system can, over a large range, be influenced simply by the responsiveness of pension entitlements to pension contributions without resorting to the instrument of a pension top-up. As already pointed out, pretty much the whole range of redistribution choices is available in a mobility-neutral form. If even a flat Beveridgian pension were deemed not to be redistributional enough, even the extreme Hayek pension[5] where pension claims correlate negatively with average earnings and contributions could be implemented in a manner that satisfies the Lodge Test.

However, the separation of pension systems in the proper sense and needs-based arrangements for old age is not only legally and politically challenging. Its positive effects in the sense of mobility neutrality are also unclear unless satisfactory mobility arrangements were in place for means-tested support in old age as part of the general welfare state.

Furthermore, there are many mobility distortions that the Lodge Test might partially be able to capture in areas that we have assumed away for ease of exposition. For example, there remains the difficult question how periods of child-rearing that count towards pension entitlements are allocated among countries in the presence of mobility. There is the unresolved challenge of different retirement ages across the EU with present arrangements routinely failing the Lodge Test. There are the multiple interactions between the pension system and other parts of the welfare state, such as special health care arrangements for pensioners or long-term care insurance. Finally, there is the fact that the mobility arrangements between the EU and the rest of the world are insufficiently integrated with the provisions on intra-EU mobility and therefore also fail the Lodge Test.

[5] See Weizsäcker (2003)

3 Implicit Taxes of Public Pensions and Mobility Incentives

Even if two pension systems pass the Lodge Test, their differences in design may still have the potential to distort mobility. This section will explore the mobility incentives that might arise from differences in pensions systems by translating the features of pension systems into the vocabulary of taxation. Specifically, we estimate both average and year-by-year implicit tax rates for select national pension systems in the EU using the CESifo pension model. We then discuss how the observed differences in implicit tax rates on income may distort mobility and might even give rise to age-specific tax competition.

This raises the question to what extent national pension systems must be coordinated in order to prevent distortions of labour migration. The existing literature regarding this question builds on the seminal papers about redistributive taxation of mobile workers in an integrated labour market by Wildasin (1991, 1994). However, there is an important difference between analysing the impact of redistributive wage taxes and public pension schemes on migration decisions. A PAYG pension scheme generates a much more complicated effective burden on labour income. The reason is that both contributions and benefits depend on the relative sizes of each generation which in turn are influenced by migration. Homburg and Richter (1993) consider the efficient international labour allocation in the presence of public pension schemes when labour is completely mobile. They show that each national pension scheme levies an implicit tax on the wage income of its members, which is determined by the difference between the net present value of pension contributions and pension benefits. Other things equal, workers will tend to migrate to the country with the lowest implicit tax. In this sense, public pension schemes have the potential to distort migration decisions.

Jousten and Pestieau (2002) then go on to describe the resulting race to the bottom that can drive contribution rates of the PAYG system to zero, thereby forcing the shift to a fully funded pension system. The dynamic is that young workers will flock to the country with the lowest implicit tax rate. And, as some young people leave from countries with high implicit tax rates, this will further increase the implicit tax rates in their countries of origin, thereby strengthening the incentive of the remaining young workers also to emigrate. Building on that analysis, Breyer and

Kolmar (2002) show that the imposition of equal contribution rates is a sufficient condition to avoid this race to the bottom and restore the efficient allocation of labour. Breyer and Kolmar also analyse the case of restricted mobility where only a part of the national populations is mobile. The results are a little more complicated since there emerge several subcases for which the differences in fertility rates and the amount of maximum migration become relevant. However, they show that in none of those cases does a full centralisation of the pension system become necessary. In all cases, the coordination or equalisation of contribution rates remains a policy sufficient to ensure the efficient allocation of labour.

In the next section we show that the average implicit tax varies considerably within the EU. Furthermore, we find that variations of average implicit taxes are not the only problem. In addition, there are substantial differences in the annual implicit tax rates from which, taken together, the average implicit tax rates are calculated. This opens up the possibility that, even if there were no differences in average implicit tax rates, the observed differences in annual implicit tax rates across countries could still prevent an efficient allocation of labour across countries.

Defining implicit tax rates

Contribution payments to PAYG pension systems can be regarded as an investment that yields a pension entitlement for old age. The average size of this entitlement is determined by the sum of contributions paid by the younger generation and the number of fellow pensioners with which these payments need to be shared.

Denoting the contribution rate by c, the contribution from average wage income W is given by $c \cdot W$. This contribution entitles workers to receive a pension p in retirement. Assume individuals live two periods, working in the first one and being retired in the second one. In period t there live N_t individuals with population growth factor $1+n_t = N_t / N_{t-1}$. Then the PAYG-pension budget is given by $N_{t-1} p_t = N_t c_t W_t$. The internal rate of return of contribution

payments to the PAYG system is defined as $i_t = \left(p_t / c_{t-1} W_{t-1}\right) - 1$. Substituting from the pension budget the average pension in this definition the internal rate turns out to be:

$$i_t = \frac{N_t c_t W_t}{N_{t-1} c_{t-1} W_{t-1}} - 1. \tag{3.1}$$

In a defined contribution system, $c_t = c$ for all periods *t*, and with a growth rate of wage income $1 + g_t = W_t / W_{t-1}$ the internal factor of return is equal to the growth factor of the wage sum: $1 + i_t = (1 + n_t)(1 + g_t)$.[6] Hence, changes in the internal rate of return can be decomposed in changes of the population growth and changes of the wage (or productivity) growth.

Migration between different countries and pension systems means that individuals are subject to compulsory investments in pension schemes with varying returns contingent upon differences in institutional setting, population developments and average wage income growth in the countries. If any of these determinants differ between countries, as they typically do, this can induce incentives to migrate to the country with the highest internal rate of return, other things being equal. These incentives typically lead to an inefficient allocation of labour as they prevent the equalisation of gross wages. And this distortion adds to the distortion by explicit taxes on wages.

Different rates of return of the pension systems can be translated into different implicit tax rates of the pension systems. We define the implicit tax of pension schemes by comparing the return of pensions systems with investment return on an international capital market, given by the interest rate r. Assuming again that a generation *t* lives two periods, a working period *t* and a retirement period *t+1*, the implicit tax rate θ_t of a pension system in a country is defined as the difference between contribution and pension entitlement as a ratio of wage income:

$$\theta_t = \frac{c_t W_t - p_{t+1} / (1 + r_{t+1})}{W_t} \tag{3.2}$$

[6] For defined benefit systems, $p_t / W_t = q$ for all *t*, the contribution rate is $c_t = q / (1 + n_t)$ so that the internal rate of return is $i_t = (1 + n_{t-1})(1 + g_t) - 1$.

Using the PAYG budget equation for p_{t+1} we find that the implicit tax rate is just the difference between the return of an investment to the amount of contribution on the capital market (at the long-term interest rate r_{t+1}) and the return of (compulsory) contribution payments into the pension scheme (at the growth rate of the contribution sum):

(3.3) $$\theta_t = \frac{c_t}{1+r_{t+1}}\left(r_{t+1} - i_{t+1}\right)$$

If long-term investments on the capital market are more profitable than contributions to the pension scheme this implicit tax rate is positive which means that the government of a country effectively taxes individuals by forcing them into the pension system and reducing the return to their old-age investments. If the interest rate is lower than the growth rate of contribution revenues the implicit tax rate is negative and constitutes a subsidy on old-age investments.

Extending the concept of the implicit tax to make it applicable to real-world pension systems a representative individual of generation *t* is assumed to start working and paying pension contributions in the year *t* and to become retired in year *R* until he dies in year *T*. With the same notation as before the lifetime implicit tax rate θ_t is defined as the difference between contributions paid during the working periods and pensions received during the retirement periods in present values in ratio to the wage income in present value:

(3.4) $$\theta_t = \frac{\sum_{s=t}^{R-1} \frac{c_s W_s}{\prod_{j=t+1}^{s}(1+r_j)} - \sum_{k=R}^{T-1} \frac{p_k}{\prod_{j=t+1}^{k}(1+r_j)}}{\sum_{s=t}^{R-1} \frac{W_s}{\prod_{j=t+1}^{s}(1+r_j)}}$$

In an unfunded pension scheme θ_t denotes the implicit tax rate of generation *t* levied on the lifetime wage income. This rate indicates the part of the contribution rate which does not yield the rate of return on the capital market and is therefore perceived by the individual as a tax on

wage income, due to the compulsory nature of the pension system. In the following we are interested in the age-specific or annual implicit tax rate that an individual faces during her lifetime. In order to derive those annual tax rates and their relationship to the lifetime implicit tax rate it is important to know how much of the annual pension entitlements can be attributed to contributions made in each working period. By using the definition of the periodic internal rates of return to earlier contributions, i_t, the annual pension in year *k*, p_k, can be written in terms of a generic benefit formula:

$$p_k = \sum_{s=t}^{R-1} \prod_{j=s+1}^{k} (1+i_j) c_s W_s \quad \text{for } k = R,...,T-1 \tag{3.5}$$

Inserting this expression for the annual pension we can reformulate the average lifetime implicit tax rate in terms of the average annual implicit tax rate

$$\theta_t = \frac{\sum_{s=t}^{R-1} \tau_s \frac{W_s}{\prod_{j=t+1}^{s}(1+r_j)}}{\sum_{s=t}^{R-1} \frac{W_s}{\prod_{j=t+1}^{s}(1+r_j)}} \tag{3.6}$$

where the annual implicit tax rate τ_s is given by:

$$\tau_s = c_s \left(1 - \sum_{k=R}^{T-1} \prod_{j=s+1}^{k} \left(\frac{1+i_j}{1+r_j} \right) \right) \tag{3.7}$$

It is straightforward that the annual implicit tax rate is positive if the internal rate of return *i* is smaller than the interest rate *r* in each period, $i_j < r_j$ for all *j*. Moreover, the tax rates decline over time, $\tau_s > \tau_{s+1}$, if the contributions rates are constant , $c_s = c$ for all *s*, and the contribution-benefit link remains unchanged (see Wrede, 1999; Fenge et al., 2006).

In real-world pension systems those conditions are clearly not always satisfied. We expect to find negative annual implicit tax rates when in some years during retirement the growth rate of the wage sum – the rate of return to pension contributions – is larger than the interest rate so that the compounded internal rate of return exceeds the compounded interest rate (in equation 7 the term on the right-hand side in brackets is larger than 1). This is the case if either the employed population or the wages (productivity) or both increase significantly. For some generations born between 1940 and 1950 and in some countries this relationship can be observed so that in the early years of employment the annual implicit tax rate for those age cohorts is negative. For generations born later than 1950 the tax rates remain in general positive across the full life cycle. Due to the fall of population growth in most industrialised countries after the late 1960s the internal rate of return continued to fall short of the long-term interest rates on capital markets in the last decades. (Übelmesser, 2004)

However, this does not imply that falling implicit tax rates over the life cycle are the general pattern. Until the 1990s, unfunded pension schemes were expanded considerably so that the contribution rates rose. This effect counteracted the impact of a shrinking population so that implicit tax rates increased sharply or at least did not fall over the lifetime of generations depending on the country where they were born. Furthermore, the degree of actuarial fairness linking pension benefits to contributions affects the size of the implicit tax. A very weak link, and thus a low internal rate of return compared to the capital market rate of return, implies a high implicit tax at the margin. For example, in a system with flat-rate benefits without any link, a high share of the contributions must be regarded as an implicit tax. In contrast, a very strong link, and thus a rate of return close to the market rate of return, results in a low implicit tax. Increasing degrees of actuarial fairness can be achieved either by funding a larger part of the pensions which means to invest some of the contributions in the capital market or by shifting the unfunded pension scheme from a flat-rate pension (Beveridgian) scheme to a contribution-related pension (Bismarckian) scheme.

Until the mid-1990s, pension systems in most industrialised countries were predominantly unfunded pay-as-you-go schemes and flat-rate elements played a bigger role in the benefit formulas. Recent reforms in some countries show a tendency to strengthen the contribution-

benefit link (Fenge *et al*., 2002; Lindbeck and Persson, 2003) which results in a lower implied tax in those pension schemes.

Given the changing growth rates of population and wages and to discretionary policy reforms the empirical lifecycle structure of annual implicit tax rates for each age cohort is rather different from the simple falling profile predicted in our OLG model above.

Simulation model: assumptions and data

The aim of this section is to offer a comparison of the actual lifetime profiles of annual implicit tax rates in social security systems of the following EU countries: Austria, France, Germany, Italy, the Netherlands, Sweden and the United Kingdom. Differences in those profiles can be used as a measure of pension-induced incentives or disincentives for migration. Effectively, we look at the annual implicit tax rates τ_s where *s* denotes the years of employment of age cohorts between 1940 and 2000 for all selected countries.

In order to calculate those taxes we use projections of the future pension budgets in the countries. For example, the age cohort born in 1950 will normally go into retirement at the age of 65 in 2015. Thus, for computing the implicit taxes for this age cohort we need knowledge about the future contribution rates until 2015 and the prospective pension benefits the age cohort is afterwards entitled to. Those data have to be simulated under some assumptions. For the simulation we use the CESifo Pension Model developed for the Advisory Board of the German Federal Ministry of Economics (Wissenschaftlicher Beirat, 1998)[7]. The model is based on a simple accounting approach suited to forecasting pension budgets that are operated on a pay-as-you-go basis. The rules and pension parameter values of all European pension systems considered here are implemented in the model.

Taking most aspects of individual behaviour as exogenous the model allows a simulation of the future development of the pension schemes depending on population, employment and retirement forecasts. The average tax burden of individuals can be derived using those

[7] For more details see Thum and von Weizsäcker (2000), or Fenge and Werding (2004).

simulations. Regarding past and present developments of all relevant parameters, we can use historical data. Concerning the future development our simulations are based on the population projections by Eurostat: EUROPOP2004 (see Eurostat, 2006). Future labour force participation and employment have been adopted from forecasts that were made on a national level. For the future development of productivity and wages we assume a real annual increase of 1.75 percent. For the real interest rate we set a value of 4 percent p.a. for the future. For all countries we project the legal status quo of the public pension systems in 2006 into the future.

For the sake of brevity, we do not describe the details of all the social security systems that are considered in the following. Comprehensive descriptions, including broad-based international comparisons of existing pension systems, can be found in regularly updated tables of the Mutual Information System on Social Protection (MISSOC) provided by the DG Employment and Social Affairs of the EU Commission[8]. Further national sources of information are denoted in Appendix A.

As a representative agent in each age cohort we construct an individual with a stylised biography and working career which we do not alter over time, ie across generations (see Table 1). Basically, we consider a male worker who enters his active period of life at age 20, earning just the average wage of all workers throughout his career. He is fully active until into his 50s, when he is expected to become disabled with some positive probability (given by the ratio of people of working age receiving disability benefits over the population aged 53-64). With what is left of his earnings capacity, he goes on working until age 65. Upon retirement, he is entitled to receive old age pension benefits for himself and, where appropriate, for his spouse. When he dies, his widow will receive survivor's benefits for several more years. Mortality assumptions are based on conditional life expectancy for males and females at relevant ages.

[8] http://ec.europa.eu/employment_social/social_protection/missoc_tables_de.htm

Table 1: Basic assumptions of the representative agent

Age 20–52	Full-time employment with average earnings → Contributions paid to the pension scheme on a full-time basis	33 years
Age 53–64	Reduced probability of full-time employment → Reduced contributions based on 83.4 %* of full-time earnings → 16.6 %* of (full) disability benefits received	12 years
Age 65–74*	Period of retirement → Old-age pension benefits payable based on prior work record and earnings	10 years
Age 75(–85*)	Death at age 75* → Survivor benefits payable to the surviving spouse	11 years

* Basic assumptions for Germany; specific adaptations for other countries

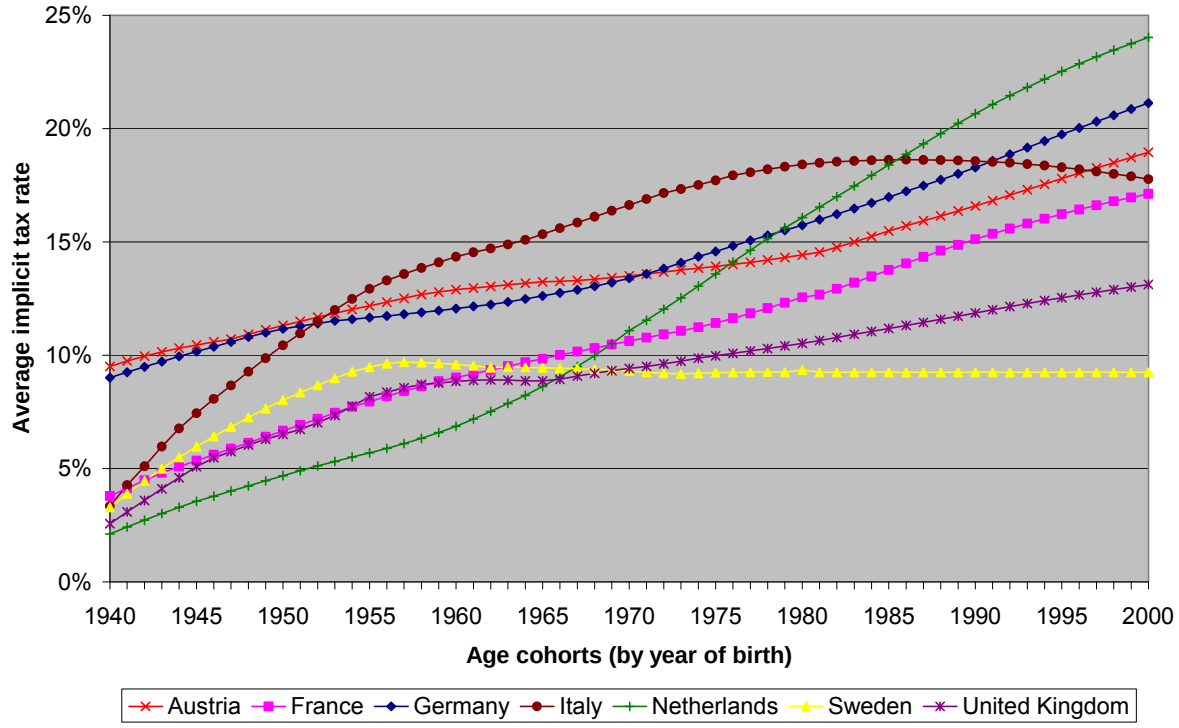
As a result, three main types of pension benefits – disability pensions, old-age pensions and survivor benefits – are included in the model. The standardised individual is based on a number of assumptions which may not appear to be natural in each of the countries. Yet, we were reluctant to adapt them when switching from one country to another. The chief purpose of our analysis is to compare the effects of different institutions – over time and across countries – and not the impact of differences in behaviour. Therefore, we made a number of adjustments with respect to disability rates and life expectancy, the latter being particularly important for our results. At the same time, we tried not to stray too far from a uniform design so as to keep complexity manageable.

Estimated differences in average implicit taxes

Figure 1 gives the estimated national average implicit taxes. Their differences give the percentage of lifetime earnings that an individual with a particular year of birth would lose or

gain by migrating from one country to another before entering working life (other things being equal). According to Figure 1, and based purely on implicit tax considerations, the age cohorts born between 1940 and 1966 would like to spend their lifetime in the Netherlands, the age cohorts 1967 and 1968 in the UK and the age cohorts from 1969 to 2000 in Sweden.

Figure 1: Average implicit social security tax of age cohorts 1940 – 2000; selected EU countries



The average implicit tax rates are increasing for younger cohorts in almost all countries considered here. The only exceptions are Italy and Sweden (see the discussion below). This predominant upward trend of the tax rates shows that the implicit burden of the social security systems is an aggravating problem, essentially due to demographic trends. For the age cohort born in 2000 from 9 up to 23 percent of the lifetime income have to be paid in order to service the implicit debt of the pension schemes. This is a considerable amount that would need to be added to the explicit taxes to calculate the total tax burden. But in contrast to explicit taxes there are no public goods, no public education or other services in return which are financed by the implicit pension taxes. Those taxes are purely losses from the individual point of view because

they are just needed for the redemption of past debts[9]. Furthermore, the differences between countries increase significantly. The maximum difference for age cohort 1940 is about 7 percentage points while it rises for age cohort 2000 up to 14 percentage points. As a result, the relevance for migration of these differences in implicit tax rates is increasing rapidly. [10]

What can be done about the differences in average implicit taxes which distort migration? It can be shown that the present value of the sum of average implicit taxes across all generations is equal to the introductory gains of the first pensioner generations (Sinn, 2000). The introduction or extension of PAYG pension systems endows the first generations with pension claims which are windfall profits because they have never paid contributions for these entitlements. All future generations redeem this so-called implicit debt of PAYG pension schemes by paying implicit taxes.

Other than partially expropriating existing pension claims by lowering benefits, the only other way to equalise average implicit taxes would be to share the unequal national burden of implicit debt equally within the EU. However, this would in effect imply cross-country transfers between member states with a comparatively low implicit debt to countries with comparatively high implicit debt. But this would be neither politically feasible nor particularly desirable in terms of reform incentives as it would tend to reward pension reform laggards. Against this background, we see little potential for a European initiative to deal with migration incentives due to difference in average implicit tax rates.

However, our estimates may still be policy-relevant for individual countries. Often, it is argued domestically that immigration might be a suitable way to make an otherwise unsustainable pension system sustainable. Our findings challenge the realism of this approach because it is precisely those countries with the deepest pension crisis as measured by implicit taxes that are

[9] However, money is fungible and so it not impossible that some public goods were implicitly financed by lower subsidies to the public pension system from the budget leading to higher implicit taxes for the active generation.

[10] These calculations confirm former results. Wildasin (1999) estimates the change in the present value of lifetime wealth for representative workers in 7 European Union countries that results from switching from one public pension scheme to another. He shows that moving between certain countries can result in an increase of 15% or even more in lifetime wealth. As he points out, differentials in net benefits create fiscal incentives for inefficient labour allocation.

likely to experience the lowest immigration and the highest emigration rates. So it may be exactly the other way round, namely that a credible immigration strategy to cushion the effects may in fact require prior pension reforms.

Differences in annual implicit taxes

As mobile costs shrink, migration is becoming less and less a once in a lifetime decision. Hence, the average implicit tax may increasingly become less relevant for migration choices and annual implicit tax rates of the pension system might instead become more relevant. In order to quantify the relevant migration costs due to the pension system if an individual can move each year of his life to another country we have to calculate the annual implicit tax rates of an age cohort in each year of age for all countries. In Figures 2 – 4 those annual implicit tax profiles are shown for the age cohorts 1950, 1970 and 1990. Given the portability rules implemented in the EU and assuming that a person were choosing to live in one of the seven countries considered here the representative individual of age cohort 1970 for example could minimise his tax burden by starting his working life from the age of 20 to the age of 28 years in the Netherlands, moving for one year at the age of 29 to Sweden, then working at the age of 30 to 38 in France and between 39 and 43 years in the United Kingdom, and finally spending the rest of his working life again in Sweden (see Figure 3).

Figure 2: Annual implicit tax profile of age cohort 1950 in selected EU countries

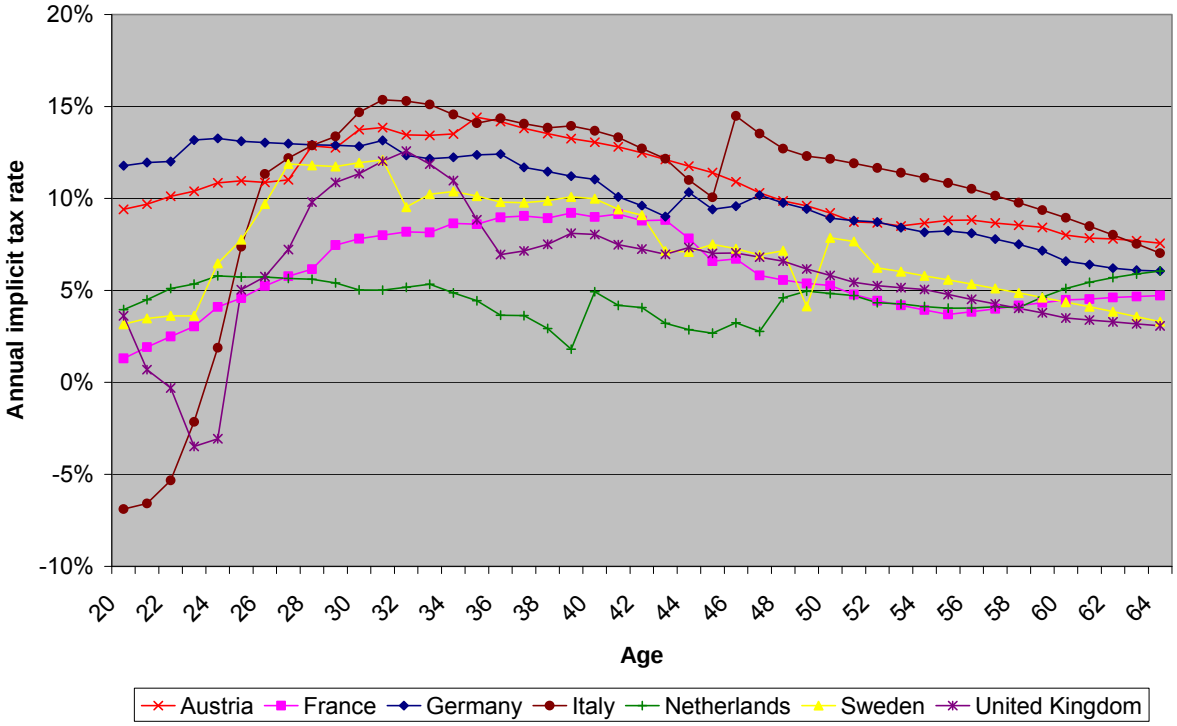


Figure 3: Annual implicit tax profile of age cohort 1970 in selected EU countries

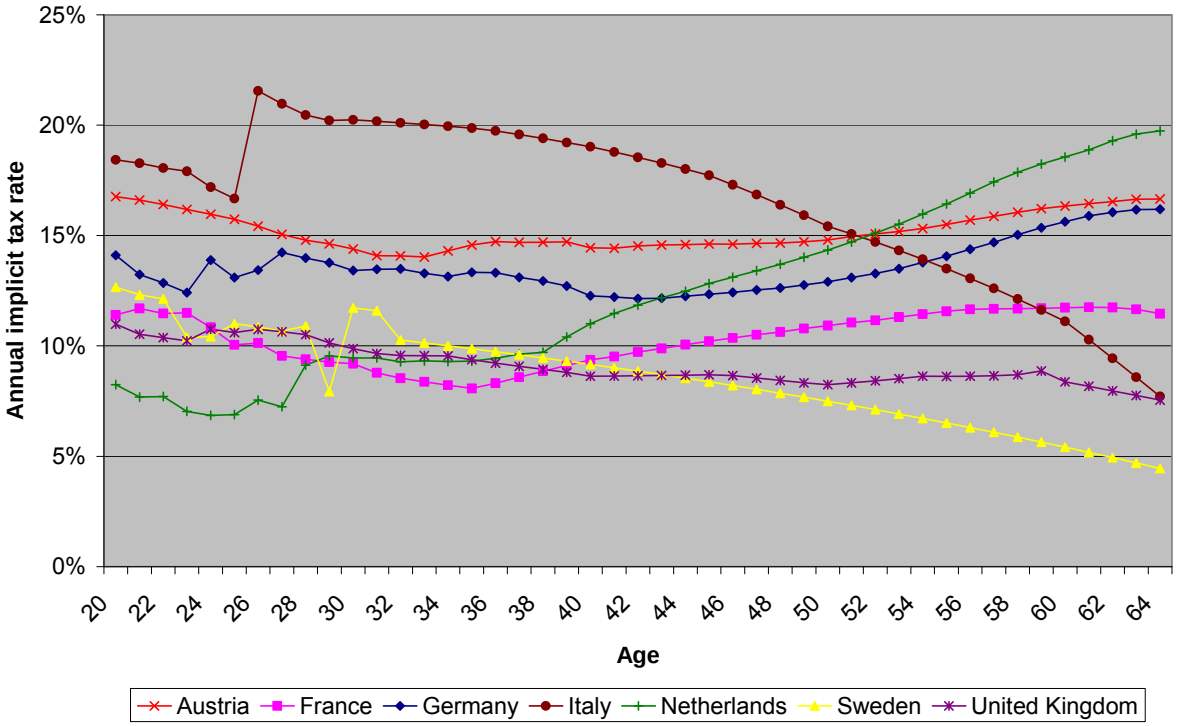
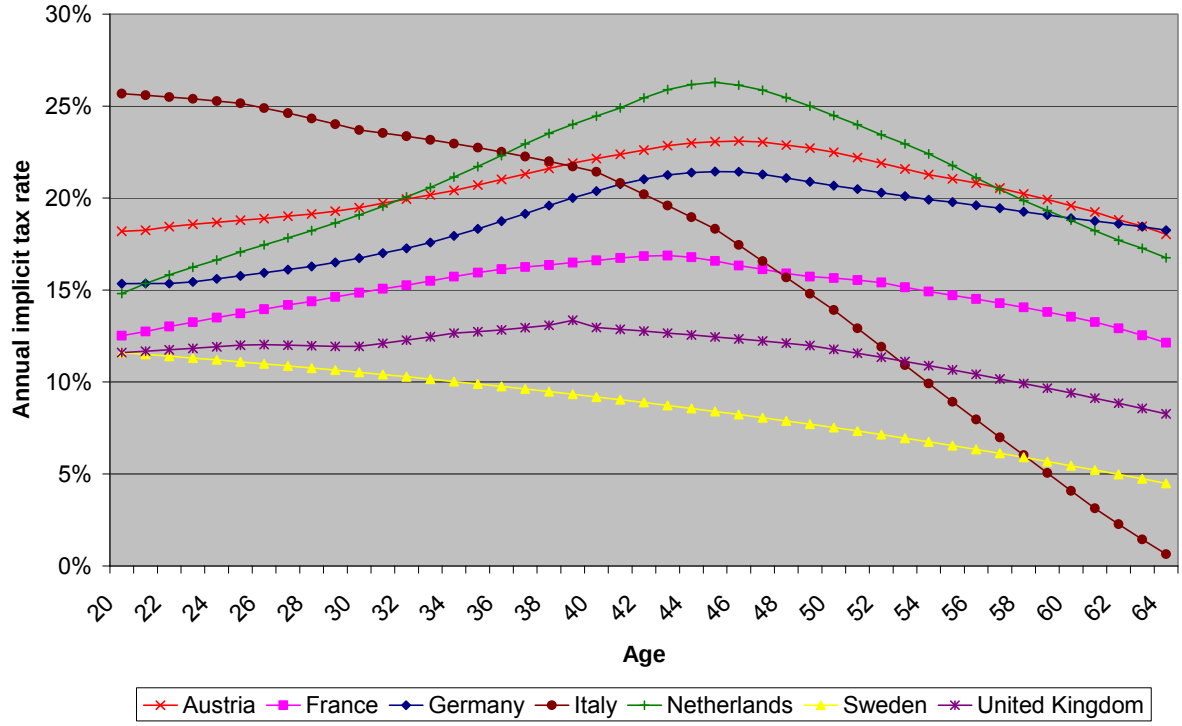


Figure 4: Annual implicit tax profile of age cohort 1990 in selected EU countries



A comparison of the annual tax profiles for the three age cohorts in Figures 2, 3, and 4 shows that there is a clear upward shift in the level of annual taxes for younger age cohorts. This confirms our observation from Figure 1 that the tax burden increases due to the population aging. In some countries the annual implicit taxes are negative in early working years of the age cohort 1950, representing a gain of the compulsory investment in the pension system (see figure 2). This gain is generated by country-specific favourable returns of the pension scheme. In Italy, for example, the wage growth rate was very high in the 1970s, which rendered high internal rates of return to the pension scheme in those years for older age cohorts.

Looking at the migration incentives, the differences of annual tax rates across countries at different ages of the age cohorts are important. For the age cohort 1950 in Figure 2, those differences were especially high in the first working years from 20 to 25 (above 15 percentage points at the maximum), and they decreased afterwards gradually to a maximum difference of 4 percentage points at the age of 64 years. Thus the incentive to migrate was high at younger ages and diminished thereafter.

This picture changes when considering the younger age cohorts born in 1970 and in 1990. For the age cohort 1970 the maximum difference was more or less constant at 15 percentage points in all working years and - leaving the outlier Italy aside - increased from 9 to 15 percentage points with increasing age. The age cohort 1990 faced a maximum difference of 14 percentage points at the start of working life which increased to 18 percentage points at the end of working life. Without Italy, the gap between annual tax rates rose from 7 to 14 percentage points over a working life. Hence, the migration incentives became progressively stronger for older individuals while they diminished for younger persons. Figure 4 also displays impressively that the implicit tax rates reach a peak over the lifecycle around 2035 when the baby boom generations are in retirement and population ageing is at its height.

For all three age cohorts, Austria and Germany are among the countries with the highest annual implicit tax rates whereas the Netherlands and Sweden face the lowest implicit tax profiles. The social security systems in the former countries exert strong incentives for the age cohorts during their entire lifetime to migrate to other countries.

Another significant feature of all three figures is that Italy and Sweden managed to make successful reforms to achieve low implicit taxes for middle-aged and young age cohorts. Both countries undertook fundamental reforms of their pension systems: they shifted the unfunded pension system from a defined benefit scheme to a notionally defined contribution scheme, thereby introducing a link between contributions and benefits and increasing the actuarial fairness of the system.

Italy, with a big problem of ageing population and one of the most generous social security systems, started from a defined benefit scheme (‘Fondo pensione lavoratori dipendenti’) where pensions depended on the average wage received by the employee in the last five years prior to retirement and on the number of years of contribution. During the 1990s, major reforms aimed at stabilising the ratio of pension expenditure to GDP (see Franco, 2002). The main features of the Amati reform in 1992 included a change of the rules for increasing pension benefits from wage to price indexation, a rise in the retirement age (from 55 to 60 for women and 60 to 65 for men) and in the minimum contribution period for pension eligibility from 15 to 20 years. Furthermore, the reference wage in the pension benefit formula was moved from the average wage over the

last five years prior to retirement to the average wage over the entire work career. The Dini reform in 1995 completely redesigned the architecture of the Italian social security system. The defined benefit nature of the scheme was abandoned in favour of a notional defined contribution system. While the pension scheme remained unfunded, the individuals' pension benefits became directly linked to their lifetime contributions to the system. The system works *as if* every worker has a personal account where the contributions are accrued during the working career. These contributions are capitalised at an interest rate, which is computed as a five-year moving average of nominal GDP growth. At retirement, the accumulated asset value is transformed into an annuity through a conversion coefficient, which depends negatively on the expected longevity and positively on the retirement age. Furthermore, eligibility rules were revised. The minimum number of years of contribution to be eligible for a pension was reduced to 5 years, but at the same time it was introduced that only individuals aged between 57 and 65 years are entitled to pensions. These measures have partially reduced the incentives to retire early, since pension benefits depend on retirement age through an actuarial adjustment factor – ranging from 4.72 to to 6.136 percent per year – which is included in the pension benefit's conversion coefficient. In 1997, the Prodi reform extended the share of the workforce coverage and reduced the length of the transition period implemented by the Dini reform. A further reform under the Berlusconi government in 2004 modified the system by introducing tax incentives to postpone retirement and by increasing the minimum retirement age.

The Swedish pensions system was originally organised as a mixed system until the 1990s with a tax-financed basic pension ('Folkpension') for everybody and a mainly employer-financed additional pension for employees ('Allmän Tilläggspension') on the basis of an unfunded defined benefit system. In the early 1990s, financial sustainability became more and more endangered and a public debate about how to reform the system (see Palmer, 2002) resulted in three directions. First, benefits should be based on contributions paid. Second, benefits should grow in accordance with the growth rate of the wage sum, and third, annuities even within an unfunded pension scheme should reflect rising life expectancies. In 1994, the Swedish parliament enacted a reform on the basis of these principles, which comprised an unfunded notional defined contribution system as the first pillar, supplemented by an obligatory funded second pillar. So, both pillars are based on individual accounts. The difference is that for the first unfunded pillar

('Inkomstpension'), similar to the rules in Italy after the Dini reform, the accounts are notional, ie there is no fund, and the internal rate of return corresponds to the growth rate of GDP, while for the second pillar ('Premiepension'), contributions are invested in the capital market and yield the market rate of return. In both cases, however, the accounts are illiquid in the sense that the benefits can only be claimed at the time of retirement. Then, benefits are converted into an annuity which takes into account changes in life expectancy. The contributions in the Swedish system are fixed at 18.5 percent, with 16 percent going to the unfunded part and 2.5 percent to the funded part. This level is supposed to remain unchanged in the future. Risks of financing the benefits when individuals approach their retirement age have to be carried by the members of each generation themselves.

The main characteristic of the Italian and the Swedish pension reforms is the introduction of a quasi-actuarial link between contributions and benefits. This shift to notional defined contribution schemes in combination with tightened eligibility rules and limits for future benefits explains the success in dampening the implicit tax burden of the social security systems. Two implications of this result are, first, the reduction of labour market distortions which means better labour supply incentives and, second, low implicit taxes for immigrants which may attract individuals to the both countries.

However, as our results show, the reform in Italy will be much more gradually effective than the Swedish reform. Only from 2015 onwards will the new system be relevant for most individuals, and not before 2050 will all pension benefits be calculated according to these new rules. The growth of pension expenditure will not be significantly limited and contribution rates are fixed at a very high level of 32.7 percent. But apart from the long transition period the Italian as well as the Swedish reform constitute promising avenues for changing the rules of public pension schemes in order to reduce the implicit tax burden for the generations.

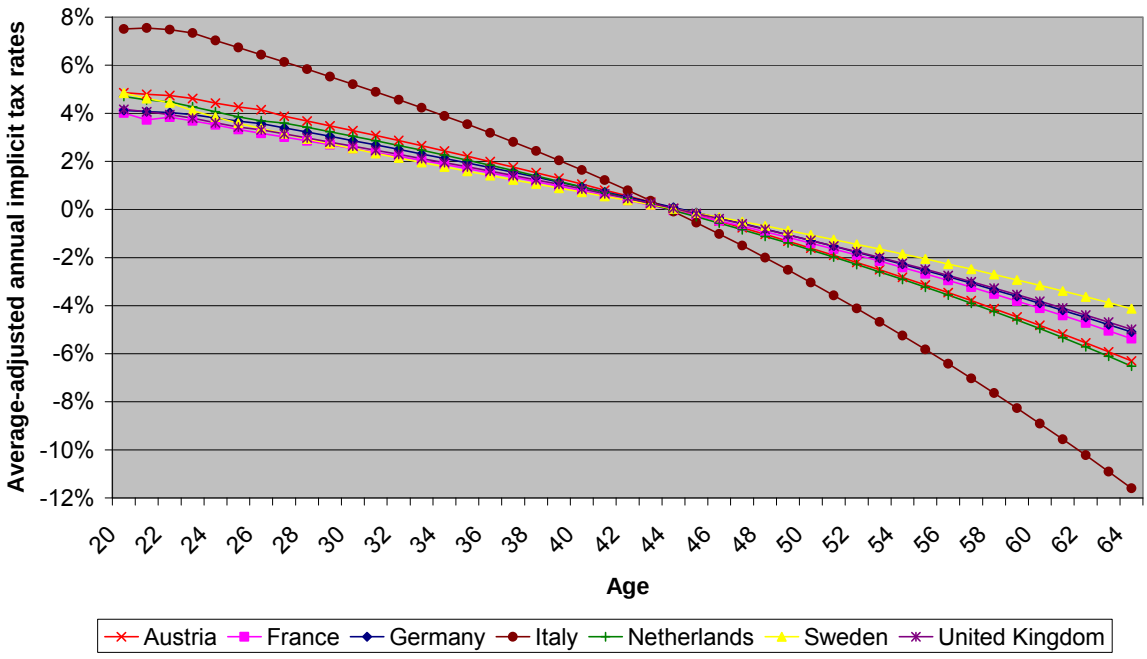
Migration incentives in the long run

So far migration incentives due to annual implicit tax rates have been considered. One may argue that these incentives are a transitory phenomenon since in a long-run migration equilibrium the wages net of implicit taxes will be equalised across countries. In the following we show that even

in such a steady state equilibrium there exist age-specific differences in annual implicit tax rates across countries so that incentives to migrate may arise. To demonstrate this we assume the average annual implicit tax rates to equalise across countries for each year of employment of the age cohort 1975. We calculate the average annual implicit tax rate of all working generations in each year of employment of age cohort 1975 and take the difference to the annual tax rate of cohort 1975 in that year.

The age-specific deviations of annual tax rates from the average are shown in Figure 5. For example, in 1995, the first year of employment of the age cohort 1975, all generations born between 1931 and 1975 are engaged in the labour market and pay contributions to the pension scheme. Since the representative individual of age cohort 1975 is the youngest participant in the labour market, his implicit annual tax rate is the highest. Compared to the average the annual implicit tax rate is 4.1 percentage points higher in Germany and 7.5 percentage points higher in Italy. In the following years the annual implicit tax rate of age cohort 1975 approaching the age of 44 shifts more and more to the average. In 2019, all generations born between 1955 and 1999 are employed and the annual implicit tax rate of age cohort 1975 matches the average annual tax rate. Thereafter, age cohort 1975 belongs more and more to the older generations on the labour market with tax rates below the average of the increasing annual tax rates of younger workers. Figure 5 shows the profile of the average-adjusted implicit annual tax burden of age cohort 1975 which decreases with age.

Figure 5: Average-adjusted annual tax rates of age cohort 1975 in selected EU countries



The profiles in Figure 5 show that even if migration equalises the average tax burden across countries there remain age-specific differences of annual tax rates. Those differences in the long run are small, 1 to 2 percentage points, for all countries with the exception of Italy. For Italy a major migration problem may arise since the young workers with annual taxes up to 2 percentage points higher than in other countries have an incentive to emigrate while older workers with annual tax rates of up to 8 percentage points lower than in other countries have an incentive to move to Italy. Thus the pension system in Italy induces a migration which may alter the age pattern of the Italian labour force. As a result the average age of the labour force may increase significantly.

Second-best implicit tax rates and labour supply

Optimal taxation theory has shown (see Sandmo, 1974) that the welfare loss of distortive taxes as for example wage taxes can be minimised by taxing those activities relatively more which are more inelastic with respect to prices. In terms of the annual (implicit) wage tax this means that tax rates should be higher in periods where labour supply is relatively inelastic with respect to net

wages while lower tax rates should apply in periods where labour supply strongly responds to net wages.

The elasticity of labour supply is high at the start and the end of a working career and relatively low at the prime age (see Fenge *et al*, 2006). If working is not attractive (the tax burden on wage income is too high) the start of working life can be postponed by deciding to prolong education in universities or to take up an apprenticeship. By the same token a worker approaching retirement usually has many options to use early retirement paths in order to evade working before the standard retirement age. In the middle of the working career the labour supply of men is relatively inelastic which means that they would work anyway, irrespective of economic incentives.

The main question is whether, for a given age cohort, the time-path of annual implicit tax rates is optimally adjusted to the life-cycle profile of labour-supply elasticities[11]. According to the considerations above, a second-best profile of annual implicit tax rates would be hump-shaped. This means the tax burden for younger and older workers should be low in order to prevent distortions of their elastic labour supply decisions while workers at their prime age (with less elastic labour supply) should ideally be taxed more heavily.

Figures 6 and 7 display the annual implicit tax profiles of the age cohorts 1950, 1970 and 1990 in France and Austria, respectively. These examples show that for some age cohorts the implicit tax profiles do not display the desirable pattern of age-dependent variants in taxation. In fact, the implicit tax profile is U-shaped instead of hump-shaped for the age cohort 1970 in both countries. This is likely to be the outcome of poor pension reform planning that did not have the life-time profile of implicit taxes in view when contribution increases and benefit cuts were set.

However, it also raises the broader issue of whether such inefficient implicit tax profiles could result from tax competition in implicit taxes.

[11] In Fenge *et al* (2006) a careful exposition of this exercise has been carried out for Germany.

Figure 6: Annual implicit tax profiles of age cohorts 1950, 1970 and 1990 in France

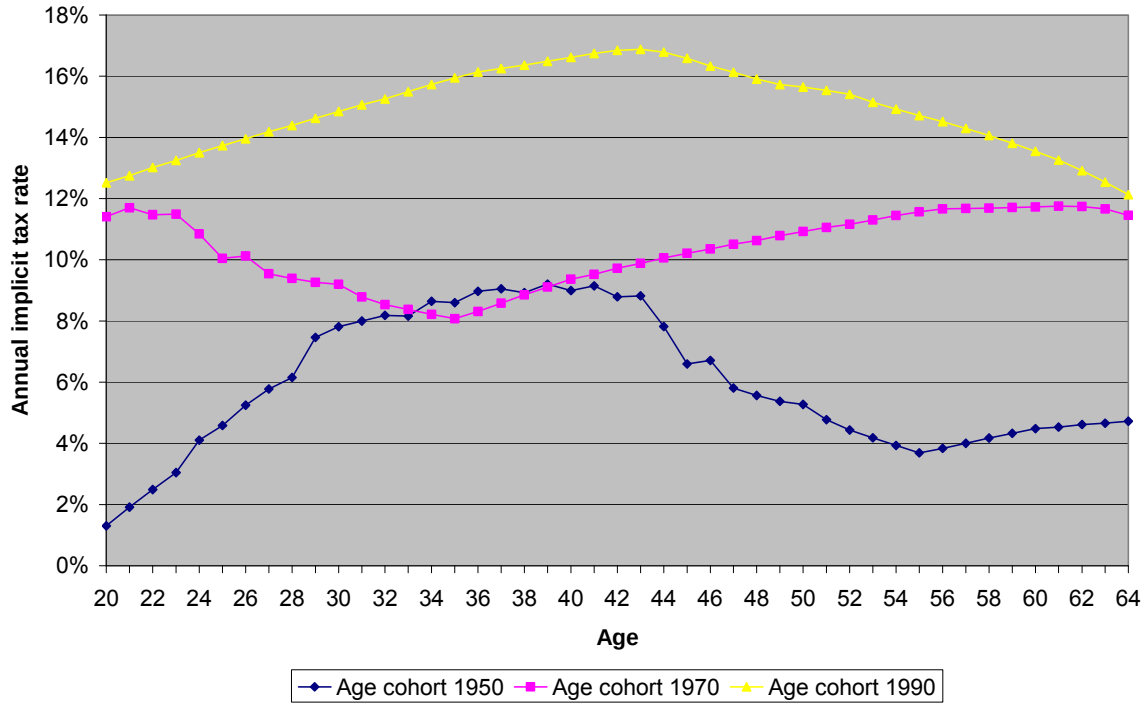
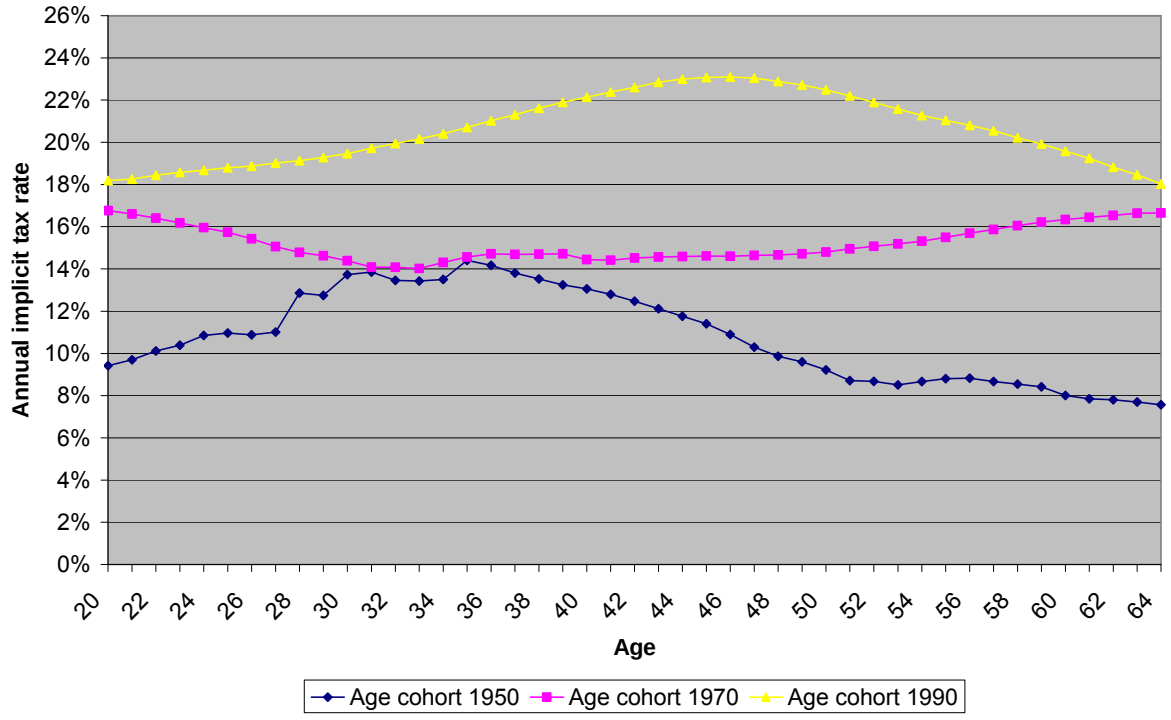


Figure 7: Annual implicit tax profiles of age cohorts 1950, 1970 and 1990 in Austria



In tax competition, countries may have an incentive to design their pension system in a way that targets attractive workers with low age-specific implicit taxes and fiscally unattractive migrants with high taxes. In particular, could be that this age-specific tax competition would focus on attracting those ages which are most likely to be net contributors to the tax system and the welfare states. These are most likely to be workers in their prime between the ages of 30 and 50 so that there would be an incentive to lower the implicit tax burden for them, potentially leading to the U-shape (instead of the efficiently hump-shaped profile) under tax competition. Hence, a trade-off between the attraction of favourable age groups of workers and second-best taxation which minimises labour supply distortions emerges.[12]

[12] For a similar tax competition argument with average implicit taxes see Jousten and Pestieau (2002), p..[…]

4. Conclusion

Overall, it would be unrealistic to expect all pension systems in Europe to become mobility-neutral in the foreseeable future. But systematic European monitoring of barriers, as seen through the lens of the Lodge Test and implicit taxation, would appear to be desirable in order to promote an incremental agenda designed to reduce mobility distortions - not only in the area of pensions but also for other parts of European welfare states. From that could flow non-binding European guidelines on desirable characteristics that could influence national decision-making without replacing it.

The implementation of this agenda will not be easy for two reasons. First, the legal complexity of national systems and their interactions across borders is enormous, with the result that many issues of practical relevance remain to be identified and, in time, resolved by the European courts. Second, because the majority of voters in EU member states still does not engage in intra-EU mobility, there may be political economy incentives for governments to persist in retaining - and even creating from scratch - aspects of the welfare state which are skewed towards the immobile at the expense of the mobile.

However, the conceptual framework presented in this paper may help to cut through the complexity and thus make it more difficult for such problems to go undetected for long.

Appendix A: Sources of data and information regarding national pension schemes

1. Population projections and economic variables

Population projections for the seven EU countries are taken from the long-term population projections at the national level (EUROPOP2004: baseline scenario) by Eurostat (see Eurostat, 2006).

Historical data regarding labour-force participation, employment, wage growth and interest rates are taken from the OECD database regularly published in the *Economic Outlook*. Regarding future developments of participation rates and unemployment rates, we basically rely on assumptions agreed upon for the parallel projects run by the OECD (2001) and the Economic Policy Committee of the European Union (2001). Regarding future real wage growth and real interest rates, we use the assumptions reported in section 2b (1.75 percent and 4 percent p.a., respectively).

2. National pension systems

General information about rules and parameters of the national pension schemes has been collected from the Mutual Information System on Social Protection (MISSOC) provided by the DG Employment and Social Affairs of the EU Commission (see website http://ec.europa.eu/employment_social/social_protection/missoc_tables_de.htm). For specific information regarding the national pension schemes the following national sources have been used:

- Austria: Österreichische Sozialversicherung and Pensionsversicherungsanstalt (www.sozialversicherung.at and www.pensionsversicherung.at)
- France: Caisse Nationale d'Assurance Vieillesse (www.retraite.cnav.fr and www.legislation.cnav.fr)
- Germany: Deutsche Rentenversicherung (www.deutsche-rentenversicherung.de)
- Italy: Istituto Nazionale della Previdenza Sociale (www.inps.it)
- Netherlands: Sociale Verzekeringsbank (www.svb.nl)
- Sweden: Försäkringskassan (www.fk.se)
- United Kingdom: Department for Work and Pensions (www.dwp.gov.uk and www.thepensionservice.gov.uk)

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