

# The Decline of the Welfare State: Demographics and Globalization

Assaf Razin\* and Efraim Sadka<sup>†</sup>

In cooperation with Chang Woon Nam<sup>‡</sup>

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\*Mario Henrique Simonsen Professor of Public Economics, Tel-Aviv University, Friedman Professor of International Economics, Cornell University and Research Fellow, CESifo.

<sup>†</sup>Henry Kaufman Professor of International Capital Markets, Tel-Aviv University and Research Fellow, CESifo

<sup>‡</sup>Ifo Institute for Economic Research and CESifo

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## PREFACE

The modern welfare state redistributes income from the working young to the retired old, from the rich to the poor, etc. Aging - a common contemporary phenomenon in the industrial countries - has far-reaching implications for the survival of the welfare state. Similarly, though to a lesser degree, low-skill migration attracted to the welfare state may put additional strain on it. Globalization - a widespread contemporaneous phenomenon - generates international tax competition. The consequent erosion in the tax base, especially on capital, is another blow to the finances of the welfare state.

This book provides an integrated framework with a political-economy underpinning for the analysis of the welfare state. In a unified framework, a set of important and interrelated topics are addressed: How aging, migration and globalization affect the size and sources of financing of the modern welfare state. The book demonstrates how demographics and globalization team up together to downscale the welfare state and change its various tax pillars.

In writing this book we greatly benefitted from previous collaborations with Phillip Swagel as follows: "Tax Burden and Migration: A Political-Economy Theory and Evidence," **Journal of Public Economics**, 85(2), August 2002, 167-190; "The Aging Population and the Size of the Welfare State,"

**Journal of Political Economy**, 110 (4), August 2002, 900-918; "The Wage Gap and Social Security: Theory and Evidence," **American Economic Review: Papers and Proceedings**, 92(2), May 2002, 390-395; "Political Economics of Capital Income Taxation with Aging Population," November 2001 (mimeo).

We also draw on our previous works, as follows: "Interactions between International Migration and the Welfare State," in Slobodan Djajic, editor, **International Migration: Trends, Policy and Economic Impact**, Routledge, New York (2001) and "The Stability and Growth Pact as an Impediment to Privatizing Social Security," NBER Working Paper #9278, October, 2002.

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Assaf Razin

Efraim Sadka

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## 1: OVERVIEW

In the coming decades, the population of the industrialized world is forecast to age dramatically. In the European Union, old-age dependency, defined as the ratio of the population aged 60 and older to those between ages 15 and 59, is projected to rise from 35 percent in 2000 to 66 percent in 2050. Within the European Union, aging is expected to be most pronounced in Germany, Italy and Spain, where this ratio is forecast to rise to 71, 76 and 81 percent, respectively, by 2050. Aging trends are almost as severe in Japan, where old-age dependency is forecast to rise from 36 to 70 percent over the same period. In comparison, projected population trends in the United States look almost benign. The Census Bureau currently forecasts that the old-age dependency ratio will reach 47 percent in 2050, up from 27 percent in 2000.<sup>1</sup>

The aging of the population has far-reaching implications for national pension systems.<sup>2</sup> In the continental Europe, most state pension systems are unfunded (pay-as-you-go systems) and the benefits are quite generous. This will necessitate a sharp rise in taxes if benefits are maintained largely intact. The O.E.C.D. predicts that France, for example, will have to spend 33 percent more as a share of gross domestic product than it does now.

Similarly, in many other countries, the simulated tax contribution rates

that would balance the old-age social security systems are significantly higher than the statutory rates. For example, Brugiavini (1999) reports that this simulated rate reached 44 percent for Italy in 1991.

**The Economist** (24th August, 2002) looks at another dimension of the financial burden, that is the public debt:

“On some estimates, by 2050, government debt could be equivalent to almost 100 percent of national income in America, 150 percent in the EU as a whole, and over 250 percent in Germany and France.”

To put these staggering figures in a proper perspective, recall that the Stability and Growth Pact of the EU puts a 60 percent target ceiling on public debt as a percentage of national income!<sup>3</sup>

A comprehensive study conducted recently by Jagadeesh Gokhale and Kent Smetters (2003) takes into account all current liabilities and projected future expenditures of the U.S. government and compares them with all the revenues the government can expect to collect in the future. The difference (in present value) is a staggering deficit of 44 trillion dollars, an almost quadruple of GNP.<sup>4</sup> Major contributing factors to this deficit are old-age social security and medicare.

Similarly, the widespread low-skill migration also puts a strain on the public finances of the welfare state. Being relatively low earners, migrants are typically net beneficiaries of the welfare state, that is, they are expected to receive benefits in excess of the taxes (contributions) they pay. For instance, a recent study, initiated by the U.S. National Research Council, estimates the overall net fiscal burden of migrants (aged 20-40 years, with less than high-school education on arrival) at about \$60,000-\$150,000, over their own lifetime; see Smith and Edmonston (1997).

One would naturally expect that as the share of the elderly in the population rises when the population ages, their political clout would strengthen the pro welfare-state coalition. Similarly, one would expect this coalition to gain more political power as more low-skill migrants are naturalized. Thus, aging and migration seem to tilt the political power balance in the direction of boosting the welfare state, imposing a growing burden on the existing workforce. However, the theme that we put forth in this book is quite the opposite: Aging and low-skill migration generates indirectly political processes that trim rather than boost the size of the welfare state. We reach this somewhat surprising conclusion by carefully working through a conventional model of a political-economy determination of the welfare state. We also provide some

supportive empirical evidence from the EU and the U.S. for this general theme.

But what if the welfare state tries to rely more heavily on capital taxes in order to finance the social benefits it provides? Recall that the old derive most of their income from capital because they retired from work. So, at first thought, it may seem that as the share of the old in an aging population rises, then an attempt to rely more heavily on capital taxes would face a stiffer political resistance. However, after a careful scrutiny of this hypothesis we come to an unconventional conclusion: Aging plausibly tilts the political power balance in favor of larger capital-financed welfare state. We provide also supportive empirical evidence from the EU for this conclusion.

Is the latter conclusion relevant? After all, aging is not the only process witnessed nowadays. Globalization across various economies is another universal phenomena to reckon with. Can therefore high capital taxes survive international tax competition brought about by such globalization?

Evidently, in the absence of **world-wide** tax coordination and enforcement, the answer is in the negative.<sup>5</sup> As put succinctly by **The Economist** (31st May, 1997):

“Globalization is a tax problem for three reasons. First, firms have more freedom over where to locate... . This will make it

harder for a country to tax [a business] much more heavily than its competitors... . Second, globalization makes it hard to decide where a company should pay tax, regardless of where it is based... . This gives them [the companies] plenty of scope to reduce tax bills by shifting operations around or by crafting transfer-pricing... . [Third], globalization... nibbles away at the edges of taxes on individuals. It is harder to tax personal income because skilled professional workers are more mobile than they were two decades ago."

Thus, we apply our political economy model again to assess the forces of globalization. The combined forces of aging, low-skill migration and globalization seem to be too strong for the welfare state to survive in its present size.

Indeed, most of the large industrialized economies have embarked in recent years on a track of trimming the generosity of their pension and other welfare-state programs. The general rules are quite straightforward: Raise retirement age and curtail benefits. Following the report of the Greenspan Committee (January, 1983), the U.S. has gradually raised the retirement age to reach 67 in the year 2027.<sup>6</sup> Similarly, but much later France, in July 2003

decided to require public sector workers (about one-fourth of the French workforce) to contribute to the state pension system for 40 years, instead of 37.5 years. Also, Germany, which already raised its retirement age from 63 to 65, is currently contemplating raising it further to 67 between 2011 and 2035. With respect to curtailing benefits, this is usually accomplished by abandoning wage-indexation in favor of price-indexation. Naturally, as real wages rise over time (due mostly to productivity increases), price-indexation is less generous to pensioners than wage-indexation; see Cogan and Mitchell (2003) for the U.S. and Thode (2003) for Europe.

## Notes

1. These numbers are taken from Brooks (2003) who reports global trends in youth and old-age dependency in greater detail.
2. Occupational pension systems do not escape some of these implications either.
3. It is worth mentioning that the ceiling on the public deficit was in effect suspended in the November 2003 meeting of the EU ministers of finance. The ministers decided not to impose sanctions on Germany, France and Portugal for violating this ceiling. This puts doubt on whether the debt ceiling will be enforced.

4. This calculated deficit is totally different from the traditional definition of a government debt, as the latter comprises only realized liabilities (that is, those liabilities backed by explicit papers).
5. Sinn (1990) was one of the earliest economists to raise this issue; he expressed fears that the very foundation of the welfare state will disappear because of international tax competition.
6. This change was made before the U.S. fertility rate had recently started to rise; see also section 2.1.

**PART ONE: POLITICAL ECONOMICS**

## 2: AGING, MIGRATION, AND THE WIDENING WAGE GAP

### 2.1. Introduction

The modern welfare state typically redistributes income from the rich to the poor, or from the young to the old either by cash or in-kind transfers. With the aging of the population, the proportion of voters receiving social security has increased, and these pensions are by far the largest component of transfers in all industrial economies. Oeppen and Vaupel (2002) pose the question that lies at the heart of the aging process: “is life expectancy approaching its limit?” Their answer: “Many... believe it is. The evidence suggests otherwise... . For 160 years, best-performance life expectancy has steadily increased by a quarter of a year per annum, an extraordinary constancy of human achievement.”

Indeed, as mentioned in the previous chapter, the median age in Europe is forecasted to rise from 37.7 now to 52.7 in 2050 (**The Economist**, August 24th, 2002, p. 22). Similarly, the ratio of the elderly (aged 60 years and over) to the working-age population (aged 15-59 years) in West Europe is expected to double from 20 percent in the year 2000 to 40 percent in the year 2050 (op. cit, p. 22). These demographic trends are driven by declining fertility rates:<sup>1</sup>

“At present, West European countries are following what seems

to be a normal demographic path: As they became richer after the 1950s, so their fertility rates fell sharply. The average number of children borne by each woman during her lifetime fell from well above the "replacement rate" of 2.1 - the rate at which the population remains stable - to less than 1.4 now" (op. cit. p. 11).

The income redistributive feature of the welfare state makes it an attractive destination, particularly for low-skill immigrants. For example, a study by Borjas (1994) indicates that foreign-born households in the U.S. accounted for 10% of households receiving public assistance in 1990, and for 13% of total cash assistance distributed, even though they constituted only 8% of all households in the U.S.

The growth of the welfare state coincided with increased returns to education, and thus broader wage differentials between workers with relatively high levels of skills or education and those without. These differentials were further boosted by skill-biased technical changes and globalization.

This chapter provides a political-economy framework which conceptually connects these phenomena. We show how in a democratic framework the aging of the population, the widening of the wage gap, and low-skill migration, all affect the political-economy determination of the tax rates and the

generosity of transfers.

We uncovered similar effects of both aging population and low-skill migration on the political-economy equilibrium tax rates and transfers. On the one hand, an aging population or a higher share of low-skill migrants mean a larger pro-tax coalition, because the retired and low-skill migrants are net beneficiaries of transfers from those who are employed. On the other hand, an aging population or a higher share of low-skill migrants put a higher tax burden on the people around the median voter, because it becomes necessary to finance transfers to a larger share of the population. People for whom the costs of higher taxes outweigh benefits shift to the anti-tax coalition. Hence, it may well be the case that the second factor dominates and the political-economy equilibrium tax rate declines when the dependency ratio or the share of low-skill migrants rise.

The effect of a widening wage gap on the political-economy equilibrium tax and benefit depends on whether the median voter is skilled or not: When she is skilled, the tax rate and the benefit decline; the opposite is true when she is not skilled. These hypotheses are supported by our empirical analysis.

Using panel data on the United States and ten European countries in the 1970s-1990s, we provide supportive empirical evidence.

## 2.2. Tax-Transfer Policy in a Political-Economy Equilibrium

Consider a standard overlapping-generations model in which each generation lives two periods: a working period and a retirement period. Following Saint-Paul (1994) and Razin and Sadka (1995), we assume a stylized economy in which there are two types of workers: skilled workers who have high productivity and provide one efficiency unit of labor per each unit of labor time, and unskilled workers who have low productivity and provide only  $q < 1$  efficiency units of labor per each unit of labor time. Workers have one unit of labor time during their first period of life, but are born without skills and thus with low productivity. Each worker chooses whether to acquire an education and become a skilled worker or remain unskilled. After the working period, individuals retire, with their consumption funded by savings from their earnings and a government transfer discussed below.

There is a continuum of individuals, characterized by an innate ability parameter,  $e$ , which is the time needed to acquire an education. By investing  $e$  units of labor time in education, a worker becomes skilled after which the remaining  $1 - e$  units of labor time provide an equal amount of effective labor. Less capable individuals require more time to become skilled and thus find education more costly in terms of lost income (education is a full-time activity).

We assume a positive pecuniary cost of acquiring skills,  $\gamma$ , which is not tax deductible.<sup>2</sup> The cumulative distribution function of innate ability is denoted by  $G(e)$ , with the support being the interval  $[0, 1]$ . The density function is denoted by  $g = G'$ .

Suppose that the government levies a flat tax on labor income in order to finance a flat grant,  $b$ . The literature [e.g., Mirrlees (1971)] suggests that the best egalitarian income tax can be approximated by a linear tax which consists of a flat rate,  $\tau$ , and a lump-sum cash grant,  $b$ . The tax rate and generosity of the grant are linked through the government's budget constraint. In a multi-period setting, this simple specification captures the spirit of a pay-as-you-go, tax-benefit (transfer) system. The features of the transfer can include a uniform per capita grant (either in cash or in-kind, such as national health care), as well as age-related benefits such as old-age social security and medicare, or free public education.<sup>3</sup> If an  $e$ -individual (namely, an individual with an education-cost parameter  $e$ ) decides to become skilled, then her after-tax income is  $(1 - \tau)w(1 - e) + b - \gamma$ , where  $w$  is the wage rate per efficiency unit of labor. If she remains unskilled, her after-tax income is  $(1 - \tau)qw + b$ . Note that acquiring a skill is more attractive for individuals with low cost of reduction than for individuals with higher costs.

Thus, there exists a cutoff level,  $e^*$ , such that those with education-cost parameter below  $e^*$  invest in education and become skilled, whereas everyone else remains unskilled. The cutoff level is the cost of education parameter of an individual who is just indifferent between becoming skilled or not:

$$(1 - \tau)w(1 - e^*) + b - \gamma = (1 - \tau)qw + b.$$

Rearranging terms gives the cutoff level for the education decision:

$$e^* = 1 - q - \frac{\gamma}{(1 - \tau)w}. \quad (2.1)$$

Note that the higher is the tax rate the lower is  $e^*$ . That is, the fraction of skilled in the labor force falls with the tax rate.

To obtain analytical results, we must further use a specification in which factor prices are not variable.<sup>4</sup> Thus, for analytical tractability, we assume that the production function is effectively linear in labor,  $L$ , and capital,  $K$  :

$$Y = wL + (1 + r)K, \quad (2.2)$$

where  $Y$  is gross output. The wage rate,  $w$ , and the gross rental price of capital,  $1 + r$  are determined by the marginal productivity conditions for factor

prices ( $w = \partial Y / \partial L$  and  $1 + r = \partial Y / \partial K$ ) and already substituted into the production function. The linearity of the production function can arise as an equilibrium outcome through either international capital mobility or factor price equalization arising from goods' trade. For simplicity, the two types of labor are assumed to be perfect substitutes in production in terms of efficiency units of labor input, and capital is assumed to fully depreciate at the end of the production process.

We assume that the population grows at a rate of  $n$ . Because individuals work only in the first period, the ratio of retirees to workers is  $1/(1 + n)$ , and the (old-young) dependency ratio - retired as a share of the total population - equals  $1/(2 + n)$ . Note also that  $(1 - q)w$  is a measure of the wage gap. Our analysis focuses on the effects of the dependency ratio and the wage gap on the political-economy equilibrium.

Each individual's labor supply is assumed to be fixed, so that the income tax does not distort individual labor supply decisions at the margin. The total labor supply does, however, depend on the income tax rate, as this affects the cutoff cost-of-education parameter  $e^*$  and thus the mix of skilled and unskilled in the economy. This can be seen from equation (2.1) which implies that  $e^*$  is declining in  $\tau$ , so that the tax-transfer is distortive.<sup>5</sup> Note

also that an increase in  $\tau$  reduces the share of the skilled individuals in the labor force. This, in turn, reduces the effective labor supply and output. In period  $t$ , the total labor supply is given by:

$$\begin{aligned} L_t &= \left\{ \int_0^{e_t^*} (1 - e) dG + q[1 - G(e_t^*)] \right\} N_0(1 + n)^t \\ &= \ell(e_t^*) N_0(1 + n)^t \end{aligned} \quad (2.3)$$

where  $N_0(1 + n)^t$  is the size of the working age population in period  $t$  (with  $N_0$  the number of young individuals in period 0), and  $\ell(e_t^*) = \int_0^{e_t^*} (1 - e) dG + q[1 - G(e_t^*)]$  is the average (per worker) labor supply in period  $t$ . This specification implies that for each  $e$  and  $t$ , the number of individuals in period  $t$  with a cost-of-education parameter less than or equal to  $e$  is  $(1 + n)^t$  times the number of such individuals in period 0.

The government's budget is balanced period by period. Since the income tax is levied on labor income, the wage bill,  $wL_t$ , constitutes the tax base. The cash grant is paid to both workers and retirees, so that the government budget constraint implies:

$$\begin{aligned}
b_t N_0 [(1+n)^{t-1} + (1+n)^t] &= \tau_t w L_t \\
&= \tau_t w l(e_t^*) N_0 (1+n)^t .
\end{aligned}$$

Therefore, the lump-sum grant equals:

$$b_t = \tau_t w l(e_t^*) (1+n) / (2+n). \quad (2.4)$$

The assumption that the benefit is paid to both the young and the old is essential for obtaining an equilibrium with positive tax and benefit. For if the benefit is paid only to the old, then in the political-economy equilibrium the young, who outnumber the old in a growing economy, will drive the tax and the transfer down to zero. An alternative specification is to assume that the benefit is paid only to the old, but that there is a credible implicit social contract according to which the current young expect to receive a retirement benefit equalling the one that they are presently voting on to pay the current old. We may thus conjecture that “bundling” together benefits to the young

and old is essential for establishing an incentive-compatible social contract or norm in which the current young engage in redistribution to the old with the anticipation that the future young will honor the “contract.” In reality, some “bundling” together of benefits to the young and old indeed occurs. For example, the payroll social security tax serves to finance both old-age transfers and unemployment benefits (and national health care in many countries).

For any tax rate ( $\tau$ ), dependency ratio (as indicated by  $n$ ) and wage gap (as indicated by  $q$ ), equations (2.1) and (2.4) determine  $e_t^* = e^*(\tau_t, q)$  and  $b_t = b(\tau_t, n, q)$  as functions of  $\tau_t$ ,  $n$ , and  $q$ . The population growth rate,  $n$ , and the productivity parameter,  $q$ , are exogenous, but we shall explore the effect of changes in these parameters on the political-economy equilibrium.

Denote by  $W(e, \tau_t, \tau_{t+1}, n, q)$  the after-tax lifetime income of an individual born at period  $t$  with education-cost parameter  $e$ . This is a strictly decreasing function of  $e$ , for the skilled worker; and constant for the unskilled worker. (Note that for all people who remain unskilled, the education-cost parameter is irrelevant and they all have the same after-tax lifetime income.)

This net after-tax lifetime income is given by:

$$W(e, \tau_t, \tau_{t+1}, n, q) = \begin{cases} (1 - \tau)w(1 - e) - \gamma + b(\tau_t, n, q) + \frac{b(\tau_{t+1}, n, q)}{(1 + r)} \\ \text{for } e \leq e^*(\tau_t, q) \\ \\ (1 - \tau)wq + b(\tau_t, n, q) + \frac{b(\tau_{t+1}, n, q)}{(1 + r)} \\ \text{for } e = e^*(\tau_t, q), \end{cases} \quad (2.5)$$

(See Figure 2.1).

A young individual born in period  $t$  chooses her first- and second-period consumption  $u(c_{1t}, c_{2t})$ , subject to the lifetime budget constraint,  $c_{1t} + c_{2t}/(1 + r) = W(e, \tau_t, \tau_{t+1}, n, q)$ .

Second-period consumption of a retiree born in period  $t - 1$  (that is, consumption of a retiree in period  $t$ ) is given by:

$$c_{2,t-1}(e, n, q) = S_{t-1}(e, n, q)(1 + r) + b(\tau_t, n, q), \quad (2.6)$$

where  $S_{t-1}(e, n, q)$  denotes this individual's savings in period  $t - 1$ .

Because the government's budget constraint is balanced period by pe-

riod, it follows that the transfer in period  $t + 1$ ,  $b(\tau_{t+1}, n, q)$ , is independent of the tax rate  $\tau_t$  in period  $t$ . In voting on the tax rate  $\tau_t$ , individuals living in period  $t$  therefore take  $b(\tau_{t+1}, n, q)$  as exogenous, because there is no serial correlation between  $b(\tau_t, n, q)$  and  $b(\tau_{t+1}, n, q)$ . The political economy equilibrium for the tax rate,  $\tau_t$ , is then determined by majority voting of individuals alive in period  $t$ , without being affected by preceding or future generations.

We therefore calculate the effect of taxes on the income of any young individual in order to find how she will vote on a proposed change in the tax rate. Differentiating  $W(e, \tau_t, \tau_{t+1}, n, q)$  with respect to  $e$  and  $\tau_t$ , we find that:

$$\frac{\partial^2 W(e, \tau_t, \tau_{t+1}, n, q)}{\partial e \partial \tau_t} = \begin{cases} w & \text{for } 0 \leq e < e^*(\tau_t, q) \\ 0 & \text{for } e^*(\tau_t, q) < e < 1 \end{cases}.$$

Therefore, if  $\partial W / \partial \tau_t > 0$  for some  $e_o$ , then  $\partial W / \partial \tau_t > 0$  for all  $e > e_o$ . And, similarly, if  $\partial W / \partial \tau_t < 0$  for some  $e_o$ , then  $\partial W / \partial \tau_t < 0$  for all  $e < e_o$ . This implies that if an increase in the income tax rate benefits a particular young (working) individual (because the resulting higher transfer more than offsets the tax hike), then all young individuals who are less able (that is, those who have a higher education-cost parameter,  $e$ ), must also gain from this tax increase. Similarly, if an income tax increase hurts a certain young individual

(because the increased transfer does not fully compensate for the tax hike), then it must also hurt all young individuals who are more able (i.e., who have a lower education-cost parameter).

As long as raising the tax rate in period  $t$  (that is,  $\tau_t$ ) generates more revenues and, consequently, a higher grant in that period,  $b(\tau_t, n)$ , it follows from equation (2.6) that the old (retirees) in period  $t$  always opt for a higher tax rate in that period. As long as  $n > 0$ , it follows that there are always more young (working) people than old (retired) people. These considerations imply that the median voter—the pivot (decisive voter) in determining the outcome of majority voting—is a young (working) individual. That is, the political-economy equilibrium tax rate maximizes the after-tax lifetime income of the median voter who is a young (working) individual<sup>6</sup>.

Denote the education-cost parameter of this median voter by  $e_M$ . There are  $N_0(1+n)^t G(e_M)$  young individuals with education-cost parameter  $e \leq e_M$  (more able than the median voter), and  $N_0(1+n)^t [1-G(e_M)]$  young individuals with an education-cost parameter  $e \geq e_M$  (less able than the median). There are also  $N_0(1+n)^{t-1}$  retired individuals in period  $t$  who always join the pro-tax coalition. Hence,  $e_M$  is defined implicitly by:

$$N_0(1+n)^t G(e_M) = N_0[1+n]^t [1-G(e_M)] + N_0(1+n)^{t-1}.$$

Dividing this equation by  $N_0(1+n)^{t-1}$  and rearranging terms yields the education-cost parameter for the median voter:

$$e_M(n) = G^{-1} \left[ \frac{2+n}{2(1+n)} \right]. \quad (2.7)$$

As noted, the political equilibrium tax rate,  $\tau$ , in period  $t$  [denoted by  $\tau_o(n, q)$ ] maximizes the after-tax lifetime income of the median voter:

$$\tau_o(n, q) = \arg \max_{\tau} W[e_M(n), \tau, n, q]. \quad (2.8)$$

For given  $n$  and  $q$ , the political-economy equilibrium  $\tau$  is constant over time, so that the time subscript  $t$  is suppressed henceforth. As  $\tau_{t+1}$  is exogenous in period  $t$ , we likewise drop it from the arguments of  $W$ .

As indicated,  $\tau_o(n, q)$  is implicitly defined by the first-order condition:

$$\frac{\partial W[e_M(n), \tau, n, q]}{\partial \tau} = B[\tau, n, q] = 0, \quad (2.9)$$

and the second-order condition is:

$$\frac{\partial^2 W[e_M(n), \tau_o(n, q), n, q]}{\partial \tau^2} = B[\tau_o(n, q), n, q] < 0, \quad (2.10)$$

where the  $B_\tau$  is the partial derivative of  $B$  with respect to its first argument.

Recalling equation (2.5), we can see that  $B(\tau, n, q)$  depends on whether the median voter is skilled or unskilled:

$$B(\tau, n, q) = \begin{cases} -w[1 - e_M(n)] + \frac{w(1+n)}{(2+n)}l[e^*(\tau, q)] + \frac{\gamma\tau(1+n)g[e^*(\tau, q)]}{(2+n)(1-\tau)}\frac{\partial e^*}{\partial \tau}, \\ \text{if } e_M(n) < e^*(\tau, q) \\ \\ -wq + \frac{w(1+n)}{(2+n)}l[e^*(\tau, q)] + \frac{\gamma\tau(1+n)g[e^*(\tau, q)]}{(2+n)(1-\tau)}\frac{\partial e^*}{\partial \tau} \\ \text{if } e_M(n) > e^*(\tau, q), \end{cases}, \quad (2.11)$$

where

$$l[e^*(\tau, q)] = \int_0^{e^*(\tau, q)} (1 - e)dG + q\{1 - G[e^*(\tau, q)]\},$$

and, by equation (2.1):

$$\frac{\partial e^*}{\partial \tau} = -\frac{\gamma}{(1-\tau)^2 w} < 0.$$

The interpretation of expression (2.11) is straightforward.  $B$  measures the effect of a rise in the tax rate on the life-time (that is,  $\partial W/\partial \tau$ ) of the median

voter (or more generally, on any individual). The first term in the expression for  $B$  is the direct effect caused by the additional tax payment. It is equal to either  $-w(1 - e)$  or  $-wq$ , depending on whether the individual is skilled or unskilled, and it is naturally negative. The next two terms measure the indirect effect generated by the increase in the transfer (that is,  $b$ ) which is made possible by the increase in the tax rate. This indirect effect is decomposed into two terms. The first of these two terms [that is, the second term on the right-hand-side of equation (2.11)] reflects the increase in the tax revenues that would occur had the tax base (or  $e^*$ ) not changed. This term is always positive: A higher tax rate on a fixed tax base increases revenues. The remaining term indeed reflects the decrease in tax revenues, induced by the reduction in the tax base that is caused by the higher tax rate. In essence, this is the distortionary effect caused by the tax. It is negative, as  $\partial e^*/\partial \tau < 0$ .

One can also relate the welfare state equilibrium tax rate,  $\tau_o(n, q)$ , to the difference between median income ( $I_M$ ) and average income ( $I_A$ ), as predicted by the standard models of the determinants of the size of government. (Note that this difference is related to the skewedness of the income distribution.) For example, in the case where the median voter is an unskilled worker,  $B(\tau, n) = 0$  in the second part of equation (2.11) implies:

$$I_M = \frac{\partial(\tau I_A)}{\partial\tau}$$

or

$$\tau \frac{\partial I_A}{\partial\tau} = I_M - I_A, \quad (2.12)$$

where  $I_M = wq$  is the pre-tax median wage and  $I_A = l(e^*)/(2 + n)$  is the pre-tax average taxable income. When there is no income inequality - the limiting case with no old and where  $G$  is concentrated around its mean, and hence  $I_M = I_A$  - the equilibrium tax rate is zero, because there can be no pro-tax coalition. As the median income is typically smaller than the average income ( $I_M - I_A < 0$ ), and because a labor tax is detrimental to labor supply and pre-tax labor income (that is,  $\partial I_A / \partial \tau < 0$ ), it follows that the equilibrium tax rate is positive [see also Meltzer and Richard (1981)].<sup>7</sup>

### 2.3 The Effect of Aging

In this section we examine the effect of aging on the welfare state equilibrium. In our model, the share of the elderly in the population is  $N_0(1 + n)^{t-1} / [N_0(1 + n)^{t-1} + N_0(1 + n)^t] = 1/(2 + n)$ . That is, the share of the elderly is inversely related to the population growth rate ( $n$ ). Aging

usually means a process where this share rises over time with a variety of dynamic patterns. In this section we assume that the number of the current young fell relative to the number of current old. This means that we assume that a fall in  $n$  took place one period before the present. As explained above, there is no correlation between policies across periods (because factor prices are exogenous by the small country assumption). Therefore, it does not matter whether the change in  $n$  that we assumed was anticipated or not. Therefore, our analysis is relevant to the reality of an anticipated, persistent aging of the population.

Total differentiation of equation (2.9) with respect to  $n$  implies:

$$\frac{\partial \tau_o(n, q)}{\partial n} = -\frac{B_n[\tau_o(n, q), n, q]}{B_\tau[\tau_o(n, q), n, q]}, \quad (2.13)$$

where  $B_n$  is the partial derivative of  $B$  with respect to its second argument. Because  $B_\tau[\tau_o(n, q), n, q] > 0$  [see equation (2.10)], it follows that the direction of the effect of changes in  $n$  on the equilibrium tax rate,  $\tau_o$ , is determined by the sign of  $B_n[\tau_o(n, q), n, q]$ .

By differentiating equation (2.11) with respect to  $n$ , we conclude that:

$$B_n[\tau_o(n, q), n, q] = \begin{cases} w \frac{de_M}{dn} + wl\{e^*[\tau_o(n, q), q]\} \frac{1}{(2+n)^2} + \tau \frac{\gamma}{(1-\tau)} \frac{g\{e^*[\tau_o(n, q), q]\}}{(2+n)^2} \frac{\partial e^*}{\partial \tau} \\ \text{if } e_M < e^*[\tau_o(n, q), q] \\ \\ wl\{e^*[\tau_o(n, q), q]\} \frac{1}{(2+n)^2} + \tau \frac{\gamma}{(1-\tau)} \frac{g\{e^*[\tau_o(n, q), q]\}}{(2+n)^2} \frac{\partial e^*}{\partial \tau} \\ \text{if } 1 > e_M > e^*[\tau_o(n, q), q], \end{cases} \quad (2.14)$$

where  $\frac{de_M}{dn} = -\frac{1}{2g(e_M)(1+n)^2} < 0$ , by equation (2.7).

If the sign of  $B_n[\tau_o(n, q), n, q]$  is positive, then aging (namely, a decline in  $n$ ) lowers the political-economy equilibrium tax rate,  $\tau_o$ , and consequently, the amount of the per-capita transfer,  $b$ .<sup>8</sup> On inspection of the right-hand side of equation (2.14), we can see that it contains one term -  $wl\{e^*[\tau_o(n, q), q]\}/(2+n)^2$  - which is positive, whereas the other terms are negative (because  $de_M/dn$  and  $\partial e^*/\partial \tau$  are both negative). Thus, the sign of  $B_n[\tau_o(n, q), n, q]$  cannot be determined **a priori**. When this is positive, aging of the population (namely, a decrease in  $n$ ) **lowers** the political-economy equilibrium tax rate and the per capita transfer.

The rationale for this result is as follows. Consider for concreteness the case in which the median voter is a young, skilled individual ( $e_M \leq e^*$ ),

and suppose that the population growth rate (which is inversely related to aging) rises. In this case, there is a decline in the amount of tax revenue collected from the median voter that “leaks” to the retirees, who with the higher  $n$  become a smaller share of the population. This leakage term [that is,  $w\ell(e^*)/(2+n)^2$ ] is unambiguously a pro-tax factor. However, the median voter now becomes more able (because  $de_M/dn < 0$ ), and therefore opts for a lower tax and transfer. Moreover, the per-capita marginal efficiency cost of distortionary taxation,  $\tau \frac{\gamma}{(1-\tau)} \frac{g\{e^*[\tau_0(n, q), q]\}}{(2+n)^2} \frac{\partial e^*}{\partial \tau}$ , rises as well, as can be seen in the last terms on the right-hand sides of equation (2.11) and (2.14).<sup>9</sup> This is also an anti-tax factor. When the negative terms  $de_M/dn$  and  $\partial e^*/\partial \tau$  are sufficiently small, the pro-tax factor dominates the anti-tax factors and  $\partial \tau_0/\partial n$  is positive. In this case, a higher population growth rate raises the political-economy equilibrium tax rate and per capita transfer. Conversely, aging of the population lowers the political-economy equilibrium tax rate and transfer.

If the median voter is an unskilled worker,  $B_n[\tau_0(n, q), n, q]$  does not include the anti-tax term  $de_M/dn$ , because the change in the median voter toward a less able individual is of no consequence, as all of the unskilled have the same demand for redistribution regardless of their cost-of-education parameter

(see Figure 2.1).<sup>10</sup> If, furthermore, the distortionary element  $\tau \frac{\gamma}{(1-\tau)} \frac{g\{e^*[\tau_0(n, q), q]\}}{(2+n)^2}$   $\frac{\partial e^*}{\partial \tau}$  is sufficiently small and  $q$  is large enough, then  $B_n[\tau_0(n, q), n, q]$  is positive.<sup>11</sup>

It then follows that aging of the population lowers the political-economy equilibrium tax rate and the per capita transfer,  $\tau$  and  $b$ .

We have so far assumed that  $n > 0$ , so that the median voter is a member of the working-age population. For completeness, we will also consider briefly the case in which the median voter is among the retired population. In our setup, this happens when  $n < 0$ . We can see from equation (2.6) that the political-economy equilibrium tax rate in this case maximizes the transfer,  $b(\tau, n, q)$ , because retirees' savings from the previous period are already determined. In contrast, when the median voter was a member of the working-age population, the political-economy equilibrium tax rate maximizes  $b(\tau, n, q)$  plus another term which is after-tax ( $\tau$ ) labor income. This term—either  $(1-\tau)w(1-e_M)$  or  $(1-\tau)wq$ —is decreasing in  $\tau$ . Thus, the political-economy equilibrium tax rate “jumps” upward when the old become a majority; that is, as  $n$  switches from being positive to being negative.

This effect is along the lines of the theory of Meltzer and Richard (1981), who attribute the increase in the size of the welfare state to the spread of the right to vote (franchise), which increased the number of voters with relatively

low income and thus a natural incentive to vote for higher taxes and transfers. The increase in the number of social security recipients has an expansionary effect similar to the extension of the franchise in expanding the size of the welfare state. Meltzer and Richard conclude that: “In recent years, the proportion of voters receiving social security has increased, raising the number of voters favoring taxes on wage and salary income to finance redistribution. In our analysis the increase in social security recipients has an effect similar to an extension of the franchise.” However, if the median voter is not among the retirees—as is probably still the case in all western countries—then the increased size of the non-working population may well lead to lower taxes and transfers, as the median voter is adversely affected because she is a net contributor to the welfare system.

#### **2.4. The Effect of the Wage Gap**

We now turn to examine the effect of a widening in the wage gap on the welfare state equilibrium. Such a change can be formulated in a variety of ways. For instance, it may take the form of a decline in  $q$ . Indeed, this will widen the wage gap, but at the same time it also reduces the average skill (productivity) in the economy, because the low-skill people become less productive, whereas the productivity of the high skill people remains unchanged. However, this is

not the experience of the 1990s in which the gap widened because of skill-biased technical changes. We therefore assume that it is the high-skill people whose productivity rises, whereas the productivity of the low-skill people remains unchanged.

Specifically, we denote the productivity of the low-skill individuals by  $q_1$  and that of the high-skill individuals by  $q_2$ , where naturally  $q_1 < q_2$ . Hence, the cutoff cost-of-education parameter now becomes:

$$e^* = 1 - \frac{q_1}{q_2} - \frac{\gamma}{(1 - \tau)q_2 w}. \quad (2.1')$$

We wish to sign  $\partial\tau_0(n, q_1, q_2)/\partial q_2$ .

Following the same procedure as in the preceding section, we find that this derivative is now:

$$\frac{\partial\tau_0(n, q_1, q_2)}{\partial q_2} = -\frac{B_{q_2}[\tau_0(n, q_1, q_2), n, q_1, q_2]}{B_\tau[\tau_0(n, q_1, q_2), n, q_1, q_2]}, \quad (2.15)$$

where  $B_{q_2}$  is the partial derivative of  $B$  with respect to  $q_2$ .

Because  $B_\tau \neq 0$  [see condition (2.10)] it follows that the sign of  $\partial\tau_0/\partial q_2$  is equal to the sign of  $B_{q_2}$ . This derivative is found from equation (2.11). For the sake of simplicity, assume that  $e$  is uniformly distributed over the interval

$[0, 1]$ . In this case, we have:

$$\ell[e^*(\tau, q_1, q_2)] = q_2 e^*(\tau, q_1, q_2) - \frac{1}{2} q_2 [e^*(\tau, q_1, q_2)]^2 + [1 - e^*(\tau, q_1, q_2)] q_1,$$

and

$$g(e) = 1.$$

Therefore, equation (2.11) becomes:

$$B(\tau, n, q_1, q_2) = \begin{cases} -wq_2(1 - e_M) + \frac{w(1+n)}{(2+n)} \ell[e^*(\tau, q_1, q_2)] \\ -\frac{\tau(1+n)\gamma^2}{(2+n)(1-\tau)^3 w q_2} \text{ if } e_M(n) < e^*(\tau, q_1, q_2) \\ -wq_1 + \frac{w(1+n)}{(2+n)} \ell[e^*(\tau, q_1, q_2)] \\ -\frac{\tau(1+n)\gamma^2}{(2+n)(1-\tau)^3 w q_2} \text{ if } e_M(n) > e^*(\tau, q_1, q_2). \end{cases} \quad (2.11')$$

As in the preceding section, the expression for  $B$  (which is the effect of a change in the tax rate on life-time income) consists of three terms: The first is the direct effect caused by the higher tax payments and it is negative; the second term reflects the change in the transfer had the tax base remained

constant and it is positive; and the last term measures the distortionary effect (the change in the tax base) and it is negative.

Differentiating equation (2.11') with respect to  $q_2$  yields:

$$B_{q_2} = \begin{cases} -w(1 - e_M) + \frac{w(1+n)}{2+n} \frac{\partial \ell}{\partial q_2} + \frac{\tau(1+n)\gamma^2}{(2+n)(1-\tau)^3 q_2^2} & \text{if } e_M < e^* \\ 0 + \frac{w(1+n)}{2+n} \frac{\partial \ell}{\partial q_2} + \frac{\tau(1+n)\gamma^2}{(2+n)(1-\tau)^3 q_2^2} & \text{if } e_M < e^*, \end{cases} \quad (2.16)$$

where  $\partial \ell / \partial q_2 > 0$  (that is, as expected, an increase in the productivity of the high-skill individuals increases the effective labor supply). The difference between the case of a skilled median voter and unskilled median voter is that  $B_{q_2}$  contains a term,  $-w(1 - e_M) < 0$  in the first case. This term reflects the fact that an increase in the tax rate is more painful to a skilled median voter when her productivity rises. The other two terms are positive because an increase in the tax rate generates a higher increase in the transfer when  $q_2$  rises. This follows because the distortionary effect (the third term) becomes less important when  $q_2$  rises: The non-deductibility of the pecuniary cost of education  $\gamma$ , which is the source of the distortion, becomes less relevant when the return to education rises following the increase in  $q_2$ . Thus, we conclude that  $\partial \tau_0 / \partial q_2$  is positive (that is, the equilibrium tax rate rises as the wage

gap widens) when the median voter is unskilled. On the other hand,  $\partial\tau_0/\partial q_2$  could well be negative or negligible (that is, the equilibrium tax rate falls as the wage gap widens), when the median voter is skilled.

## 2.5. Some Empirical Evidence

We next use data for the United States and ten European countries over the period 1965 to 1996 to examine the relationship between tax rates and benefits on the one hand, and the dependency ratio and the wage gap on the other.<sup>12</sup> We estimate regressions in which the dependent variables of the labor tax rate and real per capita transfers are functions of the return to education (a proxy for the wage gap), the share of the population with high education (a proxy for the skill of the median voter), the dependency ratio (which is positively related to the aging of the population), along with additional control variables. These include a measure of income distribution suggested by previous theories that seek to explain the size of the welfare state [e.g., Meltzer and Richard (1981), Persson and Tabellini (2002)], government employment as a share of total employment to indicate the breadth of government involvement in the economy, real GDP growth to control for business cycle effects, and a measure of openness to trade to capture exposure to external shocks against which the welfare state might provide social insurance [as

in Rodrik (1998)].

Data on the labor tax rate from 1965 to 1992 are from Enrique Mendoza et al. (1994), as extended by Mendoza et al. (1997), and Francesco Daveri and Tabellini (2000); these are derived by using revenue statistics to calculate an average tax rate on labor income. A brief description on how these tax rates are calculated is provided in the appendix to Chapter 6. The measure of income distribution is derived from Klaus Deininger and Lyn Squire (1996), which provides measures of income shares by quintile over time, with missing observations obtained through linear interpolation. The regressions use the ratio of the income share of the top quintile to the combined share of the middle three quintiles; this is the “skewedness” of income distribution in the terminology of Meltzer and Richard (1981).

The measures of the return to higher education are from OECD (1998) and are for women completing the upper level of secondary school in 1995 (results for men are similar). This is the internal rate of return, which equates the present value of higher lifetime income as a result of more education to the present value of the opportunity cost of attaining it. The share of the population by educational attainment is from Robert J. Barro and Jong-Wha Lee (2000), with values between five-year benchmarks obtained through linear

interpolation. Note that our theory indicates that the effect of the wage gap on the equilibrium tax rate depends on the interaction between the return to education and the share of individuals with high education. The interaction of these variables is thus used in the regressions. This is useful in the empirical specification since our measure of the return to education does not vary over time, but only across countries.

The OECD Analytical Database is used to calculate measures of real per capita GDP growth, per capita transfers received by households, government employment as a share of total employment, and openness to trade defined as the sum of the imports plus exports as a share of GDP. The dependency rate is defined as 1 minus the labor force as a share of the population. Per capita transfers include both social security and other transfers such as unemployment and disability compensation, though social security is by far the largest component of transfers in all countries. Transfers are deflated by each country's CPI to provide real transfers in 1990 terms and then translated into the common currency of U.S. dollars.

Table 2.1 provides results from ordinary least-squares regressions for the determinant of the labor tax rate and (log) real transfers per capita. All specifications include a complete set of country fixed effects. Columns (i) and

(ii) show results for the labor tax rate, and columns (iii) and (iv) those for per capita real transfers. In both cases, the interaction of the return to education and the share of the highly educated in the population has a positive and strongly significant coefficient. This is consistent with our theoretical model: The less educated are the majority in all countries and would thus be expected to favor higher taxes and transfers as either the share of the education rises (but remains still a minority) or the return to education increases. The positive coefficient of the interaction term is driven by the share of the educated in the population. This variable by itself is positive and statistically significant, and the interaction with the return to education is not significant when both are included in the regression (this is not surprising since we only have one observation per country for the return to education). In Table 2.1 the influence of the return to education by itself is captured by the country fixed effects. The dependency rate has a statistically significant negative effect on the labor tax rate and transfers. The young are the majority of the populations and thus would naturally vote for lower taxes and transfers as the number of dependents goes up in order to limit the “fiscal leakage” from the welfare state.<sup>13</sup>

The results for the other variables are sensible and are qualitatively unchanged in adding the interacted education variable. A larger share of gov-

ernment employment is associated with a higher tax rate and more transfers, while countries more open to trade have larger welfare states as predicted by Rodrik (1998). However, the effect of the trade openness (globalization) variable is hard to assess. In a slightly different sample and with another explanatory variable (migration), the coefficient of this variable loses its significance and even changes its sign; see table 2.2 below. The significant negative coefficient for per capita real GDP growth is in line with the use of automatic stabilizers providing countercyclical fiscal policy. The coefficient on the income skewedness variable is not statistically significant for tax rates but is positive and significant for transfers. This matches the prediction of previous theories that inequality leads to pressure for redistribution.

## 2.6. Low-Skill Migration: Theory and Evidence

We found that aging of the population may induce counter-intuitively a lower tax rate and benefit. A key explanation for such a result is a sort of fiscal leakage from the median voter to the elderly who are net beneficiaries of the welfare state (because they pay no labor taxes and receive the benefit). A similar mechanism is at work in the case of low-skill immigration. We find that a higher share of unskilled migrants in the population may actually reduce the size of the welfare state (that is,  $\tau$  and  $b$ ), if they are instated in the welfare system, namely, if they pay the taxes and qualify for the transfer. This result holds even when these unskilled migrants are allowed to participate in the voting process.

The formal derivation of this result is in Razin, Sadka and Swagel (2002). Here we will only explain the rationale for this result. There are two conflicting effects of migration on taxation and redistribution. On the one hand, low-income migrants who are net beneficiaries from the tax-transfer system join forces with the native-born, low-income voters in favor of higher taxes and transfers. Put differently, low-skill migration induces a shift in the median voter toward the bottom end of the skill distribution (higher  $e_M$ ). On the other hand, redistribution becomes more costly to the native-born

population as the migrants share some of the benefits at their expense. This is the fiscal leakage (from the median voter to the migrants) effect. As the number of migrants grows, a larger proportion of the tax revenues actually ends up in the hands of low-skill migrants. Therefore, the native-born taxpayers, including the median voter, will opt now for lower taxes. This shift in the general attitude of the native-born taxpayers against high taxes may be larger than the effect of the shift in the median voter. Therefore, a larger share of low-skill migrants may actually lower rather than raise the political-economy equilibrium tax rate and benefit. This result is evidently reinforced by the low voting participation rate among low-skill migrants.

The following empirical evidence shed some light on these theoretical considerations. We use data for eleven European countries (the ten countries included in the data set of the preceding section and Austria) over the period 1974-1992. We used identical regressors in regressions for the determinants of the labor tax rate and the log of social transfers per capita in real dollars. The baseline specification includes the share of government jobs, the dependency ratio, trade openness, per capita GDP growth, the measure of income skewedness suggested by the standard theory (rich/middle), and the share of income for the poor relative to the middle. All regressions include country

fixed effects.

Table 2.2 contains results for the determinants of the tax rate on labor income. Column (1) shows results without any variable for immigration. The tax rate on labor income is positively and significantly related to the involvement of the government in the economy as measured by the share of government jobs. In contrast, the measures of income distribution are both far from significant, and there is likewise little support for the hypothesis that the welfare state exists to provide social insurance against external shocks. The coefficient on the dependency ratio is negative and highly significant as suggested in the preceding sections.

The remaining columns of Table 2.2 add data on the stock of immigrants as a share of the population to the base specification, first for the share of all immigrants and then for immigrants by education level. In column (2), the share of immigrants out of the population has a negative sign (suggesting that the fiscal leakage effects dominates the effect of the shift in the median voter), though this coefficient is significant at only the 23% confidence level. One percentage point increase in the share of immigrants in the population (a roughly 20% increase in the total stock of immigrants of all 11 countries) leads to a 0.4-percentage point decline in the labor tax rate. The other results are

essentially unchanged with the immigrant share added to the regression.

There is a positive relationship between the unemployment rate and the labor tax rate. As suggested by Daveri and Tabellini (2000), this possibly reflects the effects in the other direction of high labor taxes leading to high unemployment in Europe. With the unemployment rate added, the coefficient on the share of immigrants becomes more negative and significant at the 5 percent confidence level.

Column (4) shows the baseline specification with immigrants separated by education level. The results are consistent with our theory: Low education immigrants have a statistically significant negative effect on the tax rate, while the combined category of medium and high education immigrants have a significant and positive effect. The results are unchanged in column (5), where the unemployment rate is again added. The composition of immigrants thus matters for the tax rate in the way consistent with the model: Low education immigrants lead to lower taxes, whereas an increased share of medium and high education immigrants, who would likely not be net recipients of government benefits, leads to higher tax rates.<sup>14</sup> Immigration might also increase income inequality and thus lead to higher taxes, as predicted by the standard theory (although our empirical results are inconclusive on this point because

the coefficient on the variable suggested by the standard theory, while negative, is not statistically significant), but our results show that immigration has an independent effect on tax rates, and this independent effect works to reduce taxes, as is consistent with our theory.

Table 2.3 shows results for the determinants of social transfers per person (in the common currency of real dollars). As with the labor tax rate, the share of government jobs has a significant positive effect on social transfers, whereas the dependency ratio has a significant negative effect. In contrast to the result for the tax rate, the coefficients on both measures of income distribution are significant. However, the variable for income skewedness suggested by the standard theory has the wrong sign, with greater inequality leading to lower rather than higher redistribution. On the other hand, the negative coefficient on the poor/middle variable indicates that greater inequality leads to more generous transfers. The coefficient on GDP growth is also significant in contrast to the results for the labor tax rate, suggesting a counter-cyclical role for social transfers (however, this coefficient is not statistically significant in the other specifications for transfers).

Adding the stock of immigrants out of the population in column (2) gives a strong positive effect of immigrants on transfers - the opposite as was

found for the tax rate. To put this in perspective, average social transfers rose from \$2,300 in 1984 to \$4,500 in 1991 (in real 1990 dollars), a change of 0.8 in logs. Over this period, the share of immigrants in the population rose from just over 3.5% to not quite 4.4%. Multiplying this 0.8-percentage point change by the coefficient of 21.6 for the share of immigrants in column (2) indicates that the rising share of immigrants accounts for more than 20% of rising benefits (0.18 of the 0.8 log change in benefits). The results for the other variables are qualitatively unchanged, though the coefficient on GDP growth is no longer significant and the magnitudes of coefficients on the dependency ratio and the income distribution variables change somewhat. It is interesting as well that the fit of the transfers regression (the within-country  $R^2$ ) improves markedly with the addition of the stock of immigrants, from 0.5 to better than 0.6, in contrast to the tax regression, where this hardly mattered. The results are essentially unchanged with the inclusion of the unemployment rate in column (3).

Separating immigrants by education in columns (4) and (5) of Table 2.3 provide results more in line with those for the labor tax rate in Table 2.2. As before, rising social transfers are related to medium- and high-education immigrants for which the coefficients in both columns are statistically sig-

nificant, while there are negative but not as strongly significant coefficients on the overall share of immigrants in the population (thus on the low-skilled immigrants).

It is worth mentioning the negative and significant coefficient of the trade openness (globalization) explanatory variable in all of the five regressions for the per-capita social transfer (see table 2.3). This is in contrast to the safety-net hypothesis of Rodrik. Note that this explanatory variable has an insignificant role for the labor tax rate (see table 2.2). We conjecture here that because trade openness goes hand-in-hand with capital account openness, then the trade openness coefficient may actually capture the effect of capital account openness. Globalization which stimulates tax competition among governments with respect to capital income leads to low capital income tax rates and revenues, thereby forcing a decline in the per capita transfers. We shall return to this issue in the next part.

Finally, there is a potential problem of reverse causality from the tax rate and benefits to the immigrant share. First, if taxes affect migration this would likely *strengthen* our results. This is because higher taxes or benefits would be expected to lead to more immigration of low-skilled workers (with higher-education immigrants moving for reasons other than benefits). But

this means that in our regressions, this positive effect of taxes or benefits on immigration is partially offsetting the negative effect we find of migration on taxes (or covering up a negative effect of migration on benefits). However, it is also possible that countries with more elaborate welfare systems will choose to tighten their migration quotas, especially with respect to unskilled migrants. This can offer an alternative explanation for the negative correlation between the tax rate and migration share that we find in the data.

## 2.7. Conclusion

We explored in this chapter how the demand for redistribution by the decisive voter is affected by the growing demands on the welfare state's public finances implied by aging population, low-skill migration and widening wage gaps. We uncovered similar effects of both aging population and low-skill migration on the political-economy equilibrium tax rates and transfers.

On the one hand, an aging population or a higher share of low-skill migrants mean a larger pro-tax coalition, because the retired and low-skill migrants are net beneficiaries of transfers from those who are employed. On the other hand, an aging population or a higher share of low-skill migrants put a higher tax burden on the people around the median voter, because it is necessary to finance transfers to a larger share of the population (a fiscal

leakage effect). People for whom the costs of higher taxes outweigh benefits shift to the anti-tax coalition. Hence, it may well be the case that the second factor dominates and the political-economy equilibrium tax rate declines when the dependency ratio or the share of low-skill migrants rise. The effect of a widening wage gap on the political-economy equilibrium tax and benefit depends on whether the median voter is skilled or not: When she is skilled, the tax rate and the benefit decline; the opposite is true when she is not skilled. These hypotheses are supported by our empirical analysis.

## Notes

1. The U.S. has experienced a similar trend until recently, but then the fertility rate started to rise sharply.
2. This is typically the case in practice where the out-of-pocket cost of investment in human capital is no tax-deductible. In contrast, investment in physical capital is tax-deductible, albeit imperfectly, through annual depreciation allowances (rather than full dispensing).
3. Strictly speaking, the transfer is defined per family, so that the number of children in the family does not affect the attitude of the family toward the transfer. Therefore, the number of children does not affect the voting decision of the family. Also, each family (whether young or old and irrespective of the

number of children) consists of the same number of eligible voters.

4. Razin and Sadka (2000) considers a similar model with variable factor returns, but the solution requires numerical simulations.

5. A further distortion is caused in practice by the progression of the labor income tax, as the opportunity cost of investment in human capital (in the form of foregone income) is typically taxed at a lower rate than the return to investment in human capital.

6. Our tax-transfer system redistributes income both within generations (from the rich to the poor) and between generations (from the young to the old). In a social security system which redistributes mainly between generations, the median (decisive) voter is naturally determined by age; see Sinn and Ubelmesser (2001) for an application to pension reform in Germany.

7. Anat Zand (2003) shows, however, that when the economy collectively decides whether to be more open, then the link between income inequality and redistribution is severely weakened.

8. Notice also that a lower  $n$  reduces lifetime welfare of everyone in our pay-as-you-go, tax-transfer system (for given tax rates) in an overlapping generations framework [see Razin and Sadka (1999)]; this is because a decline in  $n$  reduces the share of the (working) young in the population and their ability to finance

a given transfer, thereby forcing a decline in the transfer.

9. The efficiency cost of taxation arises because taxation distorts economic decisions. In our model, the payroll tax distorts the decision on whether or not to acquire skills (that is, the cutoff  $e^*$ ) and reduces output.

10. Because of the distortion caused by the tax, the unskilled median voter will not generally push the tax rate all the way up to 100%.

11. To see this, let  $\gamma$  approach zero. Then, one can see from equation (2.14) that  $B_n$  approaches a positive limit of  $wl\{e^*[\tau_0(n, q), q]\}/(2 + n)^2$ , if  $\tau$  does not approach one. From equation (2.11) it can be verified that  $\tau$  does indeed not approach one if  $q$  is sufficiently large.

12. The countries included are Denmark, Finland, France, Germany, Italy, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States.

13. The dependency ratio in our regressions grouped together both the elderly and children. Similarly, social transfers are all-inclusive. Recall that in our voting model it is the family that casts its vote (children do not vote). Thus, our model's predictions are consistent with the negative coefficient of the overall dependency ratio in the regressions. A follow-up study by Bryant (2003) distinguishes between the elderly and children both in the dependency ratios

and in the social expenditures.

14. One may argue that the positive coefficient of the share of medium and high educated immigrants may merely reflect the progression of the wage tax rather than causation between this share and the tax rate. However, the progression is controlled by the per-capita GDP growth rate variable.

### 3. MIGRATION AND THE WELFARE STATE

#### 3.1. Introduction

The preceding chapter analyzes *inter alia* the effect of migration on the welfare state. We show, theoretically, that low-skill migration may downscale the welfare state because of a fiscal-leakage effect. Empirical evidence that we brought in the chapter supports this hypothesis. It further suggests that high-skill migration may boost the welfare state, because of a fiscal-injection effect, the opposite of the fiscal-leakage effect. In this chapter we examine the theory behind a converse hypothesis, namely whether the welfare state attracts low-skill migrants, but distracts high-skill migrants.

#### 3.2. Low-Skill Migration

We continue to employ the human-capital formation model of the preceding chapter, except that we simplify a bit by deleting features which are inessential to the study of what determines the flow of migration. Because aging is no longer the focus in this chapter we also reduce the dynamic overlapping-generations model into a static one-period model. Also, because we merely wish to study whether the welfare state is attractive to migration, rather than the determination of tax rates and benefits of the welfare state, we can further simplify by assuming away the distortions caused by taxation on

the formation of human capital. Recall that in the presence of taxes the pecuniary cost,  $\gamma$ , of acquiring skill was the element through which the distortion manifested itself. We therefore eliminate now  $\gamma$ .

In this setup the tax has no effect on the decision to acquire skill. The cutoff ability level ( $e^*$ ) between acquiring and not acquiring skill is given by the following equation:

$$e^* = 1 - q \quad (3.1)$$

Denote the disposable income of an  $e$ -individual by  $w(e)$ . This is equal to:

$$W(e) = \begin{cases} (1 - \tau)w(1 - e) + [1 + (1 - \tau)r]K + b & \text{for } e < e^* \\ (1 - \tau)qw + [1 + (1 - \tau)r]K + b & \text{for } e = e^* \end{cases}, \quad (3.2)$$

as we assume that each individual is born with  $K$  units of capital. The tax rate  $\tau$  applies also to capital income, as it is this source of income which distinguishes the native-born individuals from the migrants, who are assumed to possess no capital.

As in the preceding chapter, the disposable income distribution curve

is piece-wise linear in the cost-of-education parameter  $e$ . This refers to the native-born population. For individuals who do not acquire skill (i.e. those with a cost-of-education parameter  $e$  above the cutoff parameter  $e^*$ ), the cost-of-education parameter is irrelevant and they have the same income. Naturally, within the group of individuals who do decide to become skilled (that is, for  $e \leq e^*$ ), the more able is the individual (that is, the lower is  $e$ ), then the higher is her disposable income. As can be seen from equation (3.2), this relationship is linear. The income distribution curve is depicted in Figure 3.1. Note that the slope of the downward sloping segment is  $-(1 - \tau)w$ . Also, notice that  $e^*$  is unaffected by the income distribution policy (namely,  $\tau$  and  $b$ ). We assume that the migrants (whose number is  $m$ ) are all unskilled and possess no physical capital. Their disposable income is only  $(1 - \tau)qw + b$  which is below that of the unskilled native-born individuals.

We assume a standard (concave, constant-returns-to-scale) production function<sup>1</sup>:

$$Y = F(K, L), \quad (3.3)$$

where  $Y$  is gross output;  $K$  is the total stock of capital (recall that each individual possesses  $K$  units of capital and the number of individuals is normalized to one), and  $L$  is the supply of labor which is given by:

$$L = \int_0^{e^*} (1 - e) dG + q[1 - G(e^*)] + qm, \quad (3.4)$$

The wage rate and the gross rental price of capital are given in a competitive equilibrium by the marginal productivity conditions:

$$w = F_L(K, L) \quad (3.5)$$

and

$$1 + r = F_K(K, L), \quad (3.6)$$

where  $F_i$  is the partial derivative of  $F$  with respect to  $i = K, L$ , and we continue to assume 100 percent depreciation.

The income tax parameters  $\tau$  and  $b$  are related to each other by the government budget constraint:

$$b(1 + m) = \tau(Y - K). \quad (3.7)$$

Note that the base for the flat income tax rate is net-of-depreciation domestic product  $(Y - K)$ , including labor income of migrants which is subject

to the income tax. (Recall that capital fully depreciates at the end of the production process.) Also, migrants qualify to the uniform demogrant,  $b$ .

Finally, there are no barriers to migration so that  $m$  is determined endogeneously by:

$$(1 - \tau)qw + b = w^*, \quad (3.8)$$

where  $w^*$  is the opportunity income (reservation wage) of the migrants in the source countries.

Consider now the issue of what is the mechanism through which the welfare state indeed attracts migrants. More generally, is it true that more taxes and more transfers attract more migrants in the context of our stylized model? Specifically, we study the sign of  $dm/d\tau$ .

To simplify the exposition further, we assume a uniform distribution of the ability parameter  $e$  over the interval  $[0, 1]$ , so that  $G(e) = e$ . This assumption yields a simple effective-labor supply function as follows:

$$L = \frac{1}{2}(1 - q)^2 + q(1 + m), \quad (3.4')$$

where use is made of equation (3.1).

Substituting equations (3.3), (3.4'), (3.5), (3.6), and (3.8) into equation (3.7) and rearranging terms yields:

$$\begin{aligned} & \left\{ w^* - (1 - \tau)qF_L \left[ K, \frac{1}{2}(1 - q)^2 + q(1 + m) \right] \right\} (1 + m) \\ &= \tau \left\{ F \left[ K, \frac{1}{2}(1 - q)^2 + q(1 + m) \right] - K \right\}. \end{aligned} \quad (3.9)$$

Total differentiation of equation (3.9) with respect to  $\tau$  yields:

$$\left[ w^* - qF_L - (1 + m)(1 - \tau)q^2F_{LL} \right] \frac{dm}{d\tau} = F - K - (1 + m)qF_L, \quad (3.10)$$

where  $F_{LL}$  is the second-order derivative of  $F$  with respect to  $L$ .

By substituting equations (3.4'), (3.5), (3.8), and the Euler's equation,

$F(K, L) = (1 + r)K + wL$  into equation (3.10) we conclude that:

$$\left[ b - q\tau w - (1 + m)(1 - \tau)q^2F_{LL} \right] \frac{dm}{d\tau} = rK + \frac{1}{2}(1 - q)^2w. \quad (3.11)$$

It is straightforward to see from the government budget constraint

[namely, equation (3.7)] that the tax on labor income paid by an unskilled individual (namely,  $\tau qw$ ) must fall short of her transfer (namely,  $b$ ), that is  $b > \tau qw$ . Because  $F_{LL} < 0$ , it finally follows from equation (3.11) that:

$$\frac{dm}{d\tau} > 0. \quad (3.12)$$

Thus, as expected, more taxes and transfers must attract more unskilled migrants. Inspection of equation (3.11) reveals also some of the undefined parameters that determine the magnitude of this effect.

### 3.3. The Welfare State and the Skill Mix of Migration

The unambiguous conclusion that the more intensive is the welfare state, the more attractive it becomes to migrants is restricted, naturally, to the case of low-skill migration. If we allow for high-skill migrants as well, we can examine whether the welfare state attracts more low-skill migrants, but fewer high-skill migrants.

Denote the number of low-skill migrants and high-skill migrants by  $m_\ell$  and  $m_h$ , respectively. Suppose that their opportunity incomes (reservation wages) in their home countries are  $w_\ell^*$  and  $w_h^*$ , respectively. Then the migration equation (3.8) is replaced by two equations, one for each skill type:

$$(1 - \tau)qw + b = w_\ell^* \quad (3.8a)$$

and

$$(1 - \tau)w + b = w_h^*. \quad (3.8b)$$

The effective labor supply equation (3.4') becomes now

$$L = \frac{1}{2}(1 - q)^2 + q(1 + m_\ell) + m_h = \frac{1}{2}(1 - q)^2 + q + m_1, \quad (3.4'')$$

where  $m_1 \equiv qm_\ell + m_h$  is the labor supply of the migrants in efficiency units.

The government's budget constraint [(namely, equation (3.7)] now becomes:

$$b(1 + m_2) = \tau(Y - K), \quad (3.7')$$

where  $m_2 \equiv m_\ell + m_h$  is the total number of low and high skill migrants.

Finally, the other equations of the model, namely equations (3.1), (3.3), (3.5)

and (3.6), remain intact.

We can solve equations (3.8a) and (3.8b) for  $b$  and  $w$  :<sup>2</sup>

$$b = \frac{w_\ell^* - qw_h^*}{1 - q}, \quad (3.13)$$

and

$$w = \frac{w_h^* - w_\ell^*}{(1 - \tau)(1 - q)}. \quad (3.14)$$

Substituting equations (3.1), (3.4') and (3.13) into equations (3.7') we get:

$$\begin{aligned} & \left( \frac{w_\ell^* - qw_h^*}{1 - q} \right) (1 + m_2) \\ &= \tau \left\{ F \left[ K, \frac{1}{2}(1 - q)^2 + q + m_1 \right] - K \right\} \equiv R(\tau, m_1), \end{aligned} \quad (3.15)$$

where  $R(\tau, m_1)$  is tax revenues. Substituting equations (3.14) and (3.4'') into equation (3.5) yields:

$$w_h^* - w_\ell^* = (1 - \tau)(1 - q)F_L \left[ K, \frac{1}{2}(1 - q)^2 + q + m_1 \right]. \quad (3.16)$$

The latter two equations [namely, equations (3.15) and (3.16)] can now be solved for the effective labor supply ( $m_1$ ) and the number ( $m_2$ ) of the

migrants as functions of the tax rate ( $\tau$ ). Total differentiation of equation (3.16) with respect to  $\tau$  yields:

$$\frac{dm_1}{d\tau} = F_L [(1 - \tau)F_{LL}]^{-1} < 0,$$

because we assume that the marginal product of labor is diminishing (that is,  $F$  is concave). Upon inspection of equation (3.15) we can see that:

$$\text{sign} \left( \frac{dm_2}{d\tau} \right) = \text{sign} \left( \frac{dR}{d\tau} \right),$$

where  $dR/d\tau = \partial R/\partial \tau + (\partial R/\partial m_1)(dm_1/d\tau)$ . Suppose that “supply-side economics” does not prevail, that is  $dR/d\tau > 0$ , so that an increase in the tax rate must raise tax revenues. (The no Laffer Curve property is always true for small  $\tau$ 's.) Then,  $dm_2/d\tau > 0$ .

Thus, we have established that the labor supply of migrants ( $m_1$ ) falls whereas the number of migrants ( $m_2$ ) rises, when the tax rate ( $\tau$ ) is raised.

That is:

$$\frac{dm_1}{d\tau} \equiv q \frac{dm_\ell}{d\tau} + \frac{dm_h}{d\tau} < 0,$$

whereas

$$\frac{dm_2}{d\tau} \equiv \frac{dm_\ell}{d\tau} + \frac{dm_h}{d\tau} > 0.$$

This can happen, if, and only if,  $dm_\ell/d\tau > 0$  and  $dm_h/d\tau < 0$ . Therefore, as expected, more taxes and transfers attract more low-skill migrants but fewer high-skill migrants.

### 3.4. Conclusion

We show in the preceding chapter that low-skill migration may plausibly downscale the welfare state. For similar reasons, high-skill migration may boost the welfare state. In this chapter we demonstrate the converse effect, that is a downscaled welfare state attracts fewer low-skill migrants but more high-skill ones. The two mechanisms may lead to a sort of joint **stable equilibrium** of migration and the size of the welfare state. If the welfare state grows out of this equilibrium, it will attract more low-skill migrants and fewer high-skill migrants. This, in turn, generates a political-economy response which downscales the welfare state, going back to the original joint equilibrium. Similarly, if the welfare state is downscaled out of the equilibrium, then it will attract fewer low-skill migrants and more high-skill migrants. This, in turn generates political forces that boost the size of the welfare, bringing it back to the original joint equilibrium.

### Notes

1. A linear production function would attract an infinite number of migrants.
2. Note from equations (3.7') and (3.13) that positive  $b$  and  $\tau$  are possible only when the wage differential at the source country (that is,  $w_h^*/w_\ell^*$ ) is lower than the wage differential at the destination country which is  $1/q$ .

## 4: BALANCED-BUDGET RULES AND THE DOWNSCALING OF THE WELFARE STATE

### 4.1. Introduction

We show in chapter 2 how aging can tilt the political power balance toward downscaling the welfare state. One of the well-publicized proposals on how to reduce the size of the welfare state is to shift from national pensions to individual retirement accounts. In this chapter we examine how rigid balanced-budget rules that do not make exceptions for fundamental structural changes in social security can impede such shifts.

### 4.2. Social Security versus Individual Retirement Accounts: An Overview

The economic viability of national old-age security systems has been increasingly deteriorating. Though the recent 2000 population census in the United States reveals some encouraging signs that the aging process is checked through increasing fertility rates and migration of young people, the demographic picture for Europe is cloudy. As vividly put by **The Economist** (3rd August, 2002, p. 23):

“As its people grow fewer, Europe’s state pensions systems will go deeper into the red. Germany and Italy are trying to push the

private-sector alternative. It is not easy...”.

More concretely, for Germany:

“Seven-tenths of German pensions come from a state scheme with roots in Bismarck’s day. It is financed mainly by a levy on wages, 19.1% this year, half paid by workers and half by employers. But, as all over Europe, the demographics are grim. Today, there are 2.8 Germans aged 20 – 59 to support each pensioner. By 2030 there could be half as many. And the state can’t just fork out money to fill the gap”.

And similarly, in Italy (op. cit):

“The government’s strategy is to get private pension schemes and funds, now embryonic, working properly first. Then, it hopes, it will be politically able to tackle the financing of the pay-as-you-go state system. But Italy cannot afford to wait. Its state’s spending on pensions is more than 14% of GDP, almost double the European Union average. Every year, payouts far exceed contributions by workers and employers”.

Indeed, the aging of the population raises the burden of financing the existing pay-as-you-go, national pension (old-age security) systems, because there is a relatively falling number of workers, that have to bear the cost of paying pensions to a relatively rising number of retirees. Against this backdrop, there arose proposals to privatize social security, as a solution to the economic sustainability of the existing systems. This, by and large, means a shift from the current pay-as-you-go systems to individual retirement accounts (or fully-funded systems). A supposedly added benefit to such a shift is the better return on the contributions to individual accounts than to a pay-as-you-go national pension systems. If privatized pensions can offer better rates of return than national pensions, transition from the latter to the former may be smooth. However, a careful scrutiny of the pensions' rate-of-return argument reveals that it is flawed, as neatly demonstrated by Paul Krugman (2002).

We imagine an overlapping-generations model with just one young (working) person and one old (retired) person in each period - each individual lives for two periods. Suppose there is a pay-as-you-go, national pension system by which the worker contributes one euro to finance the pension benefit of one euro paid to the retiree. Each young person contributes one euro when young and working and receives one euro upon retirement. Evidently,

the young person earns zero return on her contribution to the national pay-as-you-go, old-age security system. If, instead, the young person were to invest her one euro in an individual account, she would have earned the real market rate of return of, say, 100%, allowing her a pension of two euros at retirement. (Recall that the average length of time between the first period of her life, in which she works, and the second period of her life, in which she is a pensioner, could be something like 30 years; so that a real rate of return of 100% between these two periods is not exorbitant.) Is the young person better off with this transition from pay-as-you-go systems to individual retirement accounts? Not if the government still wishes to honor the existing "social contract" (or political norm) to pay a pension benefit of one euro to the old at the time of the transition. In order to meet this liability, the government can issue a debt of one euro. The interest to be paid by the government on this debt at the market rate of 100% will be one euro in each period, starting from the next period **ad infinitum**. Hence the young person will be levied a tax of one euro in the next period when old, to finance the interest payment. Thus, her net-of-tax balance in the individual account will only be one euro, implying a zero net-of-tax return in the individual account; the same return as in the national, pay-as-you-go system. And what if the individual invests the one euro in the

equity market and gets a better return than the 100% which the government pays on its debt? If the capital markets are efficient, the higher equity return (relative to the government bond rate) reflects nothing else but a risk premium. That is, the equity premium is equal to the risk premium through arbitrage. Therefore, equity investment offers no gain in risk-adjusted return over government bonds<sup>1.2.3</sup>. And if markets are inefficient, then the government can, as a general policy, issue debt in order to invest in the equity market, irrespective of the issue of replacing social security by individual retirement accounts.<sup>4</sup>

Nevertheless, the increased fragility of national pay-as-you-go pension systems, caused by the aging of the population, raises doubts among the young about whether the next generations will continue to honor the implicit inter-generational social contract, or the political norm, according to which, “I pay now for the pension benefits of the old, and the next young generation pays for my pension benefits, when I get old”. These doubts are not unfounded, for after all there will indeed be more pensioners per each young worker of the next generation, and hence each one of the young workers will have to pay more in order to honor the implicit social contract. With such doubts, the political power balance may indeed shift towards scaling down the pay-as-you-go system, encouraging the establishment of supplemental individual retirement

accounts.<sup>5</sup> Such accounts are, by their very nature, fully funded, so that they are not directly affected by the aging of the population.<sup>6</sup> Naturally, the existing old generation opposes any scaling down of the pay-as-you-go system, because it stands to lose pension benefits (without enjoying the reduction in the social security contributions). This opposition can, however, be softened, or altogether removed, if the government creates a budget deficit in order to support the social security system and allow it not to scale down the pension benefits to the current old, so as to fully offset the reduction in social security contributions, or even allow it to maintain these benefits intact. (Of course, this deficit will be carried over to the future, with its debt service smoothed over the next several generations.) However, here may stand in the way some self-imposed restrictions such as those imposed by the Stability and Growth Pact in the EU, which put a ceiling on the current fiscal deficit.<sup>7</sup> As put by Guido Tabellini (2003):

“... The current formulation of the Stability and Growth Pact is problematic... the Pact now emphasizes the budget deficit, but neglects the longer term generational imbalances. For instance, consider a pension reform that gradually but permanently reduces pension outlays in the future, but immediately cuts social secu-

... rity contributions so as to relax political constraints. A transition from a pay-as-you-go towards a fully-funded private pension system could have this effect. Such a reform could run against the Stability Pact as currently formulated, no matter how desirable from an economic point of view."

In any event the current systems are by and large insolvent because of the aging of the population. So either social security taxes are increased exorbitantly, or else, as we point out in the overview, government debt could, according to some projections, reach 150 percent of national income in the EU at large by 2050 and 250 percent in Germany and France. Recall that the debt target ceiling in the Pact is only 60 percent!

In this chapter we develop an analytical model in which a pay-as-you-go, old-age security system is designed as a political-economy equilibrium. We then investigate how the aging of the population can shift the equilibrium towards scaling down this fiscal system (thereby encouraging the emergence of individual retirement accounts). We further examine how lifting the ceiling on fiscal deficits can politically facilitate such a scaling down of pay-as-you-go systems, and whether such a constitutional reform could come about through the political process.

### 4.3. Political-Economy Design of Social Security

We continue to employ a standard overlapping-generations model in which each generation lives for two periods: a working period and a retirement period. As before, we assume a stylized economy in which there are two types of workers: skilled workers who have high productivity and provide one efficiency unit of labor per unit of labor time, and unskilled workers who provide only  $q < 1$  efficiency units of labor per unit of labor time. Workers have one unit of labor time during their first period of life, but are born without skills and thus with low productivity. Each worker chooses whether to acquire an education and become a skilled worker, or else remain unskilled. After the working period, individuals retire, with their consumption funded by private savings and social security pension, discussed below. As before, there is a continuum of individuals, characterized by an innate ability parameter,  $e$ , which is the time needed to acquire an education.

The transfer  $b$  is now paid only to the retirees (see below), so that the cutoff level of the education-cost parameter is given by:

$$(1 - \tau)w(1 - e^*) - \gamma = (1 - \tau)qw,$$

which yields the same formula as before:

$$e^* = 1 - q - \frac{\gamma}{(1 - \tau)w}. \quad (4.1)$$

To obtain analytical results, we continue to employ a specification in which factor prices are exogenously determined. Thus, we assume a linear production function in which output ( $Y$ ) is produced using labor ( $L$ ) and capital ( $K$ ):

$$Y = wL + (1 + r)K, \quad (4.2)$$

with capital fully depreciating at the end of the production process.

As before, the population grows at a rate of  $n$ . Each individual's labor supply is assumed to be fixed, so that the income tax does not distort individual labor supply decisions at the margin. But the total labor supply does again depend on the income tax rate, as this affects the cut-off ability,  $e^*$ , and thus the mix of skilled and unskilled individuals in the economy. At present, the total labor supply is given by:

$$L = \left\{ \int_0^{e^*} (1 - e) dG + q[1 - G(e^*)] \right\} N_o(1 + n) \equiv \ell(e^*)N_o(1 + n), \quad (4.3)$$

where  $N_o(1 + n)$  is the size of the working-age population at present ( $N_o$  is the number of young individuals born in the preceding period), and  $\ell(e^*) = \int_0^{e^*} (1 - e) dG + q[1 - G(e^*)]$  is the average (per worker) labor supply at present. As before,  $G$  is the cumulative distribution function of  $e$ , with  $G(0) = 0$  and  $G(1) = 1$ .

There is a pay-as-you-go, old-age social security system by which the taxes collected from the young (working) population are earmarked to finance a pension-benefit to the old (retired) population. Thus, the benefit ( $b$ ), paid to each individual at present, must satisfy the following pay-as-you-go budget constraint:

$$bN_0 = \tau wL = \tau w\ell(e^*)N_o(1 + n),$$

where  $\tau$  is the social security tax at present. Dividing through by  $N_o$  yields an explicit formula for the pension benefit:

$$b = \tau w\ell(e^*)(1 + n). \quad (4.4)$$

In each period, the benefit of the social-security system accrues only to the old, whereas the burden (the social-security taxes) are borne by the young. Then, one may wonder why would not the young, who outnumber

the old with a growing population, drive the tax and the benefit down to zero in a political-economy equilibrium. We appeal to a sort of an implicit intergenerational social contract which goes like this:<sup>8</sup>

“I, the young, pay now for the pension benefits of the old; and you, the young of the next generation, will pay for my pension benefit, when I grow old and retire”.

With such a contract in place, the young at present are willing to politically support a social security tax,  $\tau$ , which is earmarked to pay the current old a pension benefit of  $b$ , because they expect the young generation in the next period to honor the implicit social contract and pay them a benefit  $\alpha b$ . The parameter  $\alpha$  is assumed to depend negatively on the share of the old in the population. If the current young will each continue to bring  $n$  children, then the share of the old will not change in the next period and  $\alpha$  is expected to be one. But if fertility falls, the share of the old in the next period will rise relative to the present and  $\alpha$  is expected to fall below one.

Because factor prices are constant over time, current saving decisions will not affect the rate of return on capital that the current young will earn on their savings. Hence, the dynamics in this model are redundant. For any social security tax rate,  $\tau$ , equations (4.1) and (4.2) determine the functions

$e^* = e^*(\tau)$  and  $b = b(\tau)$ . Denote by  $W(e, \tau, \alpha)$  the lifetime income of a young e-individual:

$$W(e, \tau, \alpha) = \begin{cases} (1 - \tau)w(1 - e) - \gamma + \alpha b(\tau)/(1 + r) & \text{for } e \leq e^*(\tau) \\ (1 - \tau)wq + \alpha b(\tau)/(1 + r) & \text{for } e \geq e^*(\tau). \end{cases} \quad (4.5)$$

In each period, the political-economy equilibrium for the social security tax,  $\tau$  (and the associated pension benefit,  $b$ ), is determined by majority voting among the young and old individuals who are alive in this period. The objective of the old is quite clear: so long as raising the social security tax rate,  $\tau$ , generates more revenues, and consequently, a higher pension benefit,  $b$ , they will vote for it. However, voting of the young is less clear-cut. Because a young individual pays a tax bill of  $\tau w(1 - e)$  or  $\tau wq$ , depending on her skill level, and receives a benefit of  $\alpha b/(1 + r)$ , in present value terms, she must weigh her tax bill against her benefit. She votes for raising the tax rate, if  $\partial W/\partial \tau > 0$ , and for lowering it, if  $\partial W/\partial \tau < 0$ . Note that:

$$\partial^2 W(e, \tau, \alpha)/\partial e \partial \tau = \begin{cases} w & \text{for } e < e^*(\tau) \\ 0 & \text{for } e > e^*(\tau). \end{cases} \quad (4.6)$$

As before, if  $\partial W/\partial \tau > 0$  for some  $e_o$ , then  $\partial W/\partial \tau > 0$  for all  $e > e_o$ ; and, similarly, if  $\partial W/\partial \tau < 0$  for some  $e_o$ , then  $\partial W/\partial \tau < 0$  for all  $e < e_o$ . This implies that if an increase in the social security tax rate benefits a particular young (working) individual (because the increased pension benefit outweighs the increase in the tax bill), then all young individuals who are less able than her (that is, those who have a higher cost-of-education parameter,  $e$ ), must also gain from this tax increase. Similarly, if a social security tax increase hurts a certain young individual (because the increased pension benefit does not fully compensate for the tax hike), then it must also hurt all young individuals who are more able than her.

As was already pointed out, the old always opt for a higher social security tax. But as long as  $n > 0$ , the old are outnumbered by the young. To reach an equilibrium, the bottom end of the skill distribution of the young population joins forces with the old to form a pro-tax coalition of 50% of the population, whereas the top end of the skill distribution of the young population forms a counter anti-tax coalition of equal size. The pivot in determining the outcome of majority voting is a young individual with an education-cost index denoted by  $e_M$ , such that the young who have an education-cost index below  $e_M$  (namely, the anti-tax coalition) form 50% of the total population.

The political-economy equilibrium tax rate maximizes the lifetime income of this median voter.

Formally,  $e_M$  is defined as follows. At present, there are  $N_o(1+n)G(e_M)$  young individuals with cost-of-education parameter  $e \leq e_M$  (more able than the median voter), and  $N_o(1+n)[1 - G(e_M)]$  young individuals with cost-of-education parameter  $e \geq e_M$  (less able than the median voter). There are also  $N_o$  retired individuals at present who always join the pro-tax coalition. Hence,  $e_M$  is defined implicitly by:

$$N_o(1+n)G(e_M) = N_o(1+n)[1 - G(e_M)] + N_o$$

Dividing this equation by  $N_o$  and rearranging terms yield the cost-of-education parameter for the median voter:

$$e_M = G^{-1} \left[ \frac{2+n}{2(1+n)} \right]. \quad (4.7)$$

As before, the political equilibrium tax rate,  $\tau$ , denoted by  $\tau_o(e_M, \alpha)$ , maximizes the lifetime income of the median voter:

$$\tau_o(e_M, \alpha) = \arg \max_{\tau} W(e_M, \tau, \alpha). \quad (4.8)$$

This equilibrium tax rate is implicitly defined by the first-order condition:

$$\frac{\partial W[e_M, \tau_0(e_M, \alpha), \alpha]}{\partial \tau} \equiv B[e_M, \tau_0(e_M, \alpha), \alpha] = 0, \quad (4.9)$$

and the second-order condition is:

$$\frac{\partial^2 W[e_M, \tau_0(e_M, \alpha), \alpha]}{\partial \tau^2} \equiv B_\tau[e_M, \tau_0(e_M, \alpha), \alpha] < 0, \quad (4.10)$$

where  $B_\tau$  is the partial derivative of  $B$  with respect to its second argument.

#### 4.4. Social Security under Strain: Aging Population

The aging population puts the pay-as-you-go, old-age social security systems under strain. The burden of financing the pension benefits to the old falls on fewer young shoulders, when population ages, as we have already pointed out. Thus, if the fertility of the current young falls below the fertility rate ( $n$ ) of their parents, then the share of the old in the next period will rise and  $\alpha$  will fall.

In order to find the effect of aging on social security, we investigate the effect of a decline in  $\alpha$  on the equilibrium social security tax rate,  $\tau_0(e_M, \alpha)$ .

Differentiate equation (4.9) totally with respect to  $\alpha$  to conclude that

$$\frac{\partial \tau_o(e_M, \alpha)}{\partial \alpha} = -\frac{B_\alpha[e_M, \tau_o(e_M, \alpha), \alpha]}{B_\tau[e_M, \tau_o(e_M, \alpha), \alpha]}, \quad (4.11)$$

where  $B_\alpha$  is the partial derivative of  $B$  with respect to its third argument. Because  $-B_\tau$  is nonnegative [see the second-order condition (4.10)], it follows that the sign of  $\partial \tau_o / \partial \alpha$  is the same as the sign of  $B_\alpha$ . It also follows from equation (4.9) that  $B_\alpha = \partial^2 W / \partial \alpha \partial \tau$ . Employing equation (4.5) we find that:

$$B_\alpha[e_M, \tau_o(e_M, \alpha), \alpha] = \frac{\partial^2 W[e_M, \tau_o(e_M, \alpha), \alpha]}{\partial \alpha \partial \tau} = \frac{1}{1+r} \frac{db[\tau_o(e_M, \alpha)]}{d\tau}. \quad (4.12)$$

Naturally, no one will vote for raising the social security tax if  $db/dt < 0$ , because in such a case, the pension-benefit falls when the social security tax is raised. Put differently, a political-economy equilibrium will never be located on the “wrong” side of the Laffer curve, where a tax rate hike lowers revenue. This can also be seen formally. From equation (4.5),

$$B(e, \tau, \alpha) = \frac{\partial W(e, \tau, \alpha)}{\partial \tau} = \begin{cases} -w(1-e) + \frac{\alpha}{1+r} \frac{db(\tau)}{d\tau} & \text{for } e \neq e^*(\tau) \\ -wq + \frac{\alpha}{1+r} \frac{db(\tau)}{d\tau} & \text{for } e = e^*(\tau) \end{cases}, \quad (4.13)$$

so that, when the lifetime income of the median voter is maximized that is, when  $B = 0$  [see equation (4.9)], we have

$$\frac{db[\tau_0(e_M, \alpha)]}{d\tau} = \left\{ \begin{array}{ll} w(1 - e_M)(1 + r)/\alpha & \text{if } e_M < e^*(\tau) \\ wq(1 + r)/\alpha & \text{if } e_M \geq e^*(\tau) \end{array} \right\} \geq 0. \quad (4.14)$$

Thus, it follows from equations (4.12) and (4.14), that  $B_\alpha[e_M, \tau_0(e_M, \alpha), \alpha] \geq 0$ , and hence, from equation (4.11), that

$$\frac{\partial \tau_0(e_M, \alpha)}{\partial \alpha} > 0. \quad (4.15)$$

We conclude that when the young population expects reduced social security benefits because of the aging of the populations (that is, when  $\alpha$  falls), the public indeed votes for scaling down the social security system already at present (that is, for lowering  $\tau$  and  $b$ ). As a result, the young resort to supplemental old-age savings, such as individual retirement accounts. Naturally, the old are worse-off as a result of reducing  $b$ . But, they are outvoted by the young, whose attitude for lowering  $\tau$  has turned stronger, following the reduction in the social security benefits that they will get.

#### 4.5. Relaxing the Ceiling on Fiscal Deficits

The old, naturally, continue to oppose the (partial) transition from a pay-as-you-go, old age social security system to individual retirement accounts, because they lose some of their pension benefits. They also have a strong moral claim that they contributed their fair share to the social security system, when they were young, but they receive at retirement less than what they paid when they were young. Their opposition, strengthened perhaps by being morally justified, can be accommodated, in part or in full, if the government is allowed to make a **debt-financed** transfer to the social security system, so as to allow the system to pay pension benefits in excess of the social security tax revenues. This deficit is carried forward to the future, and its debt-service is smoothed over the next few generations, so that its future tax implications for the current young generation is not significant. This, of course, requires relaxation of some restrictions of the sorts imposed by the Stabilization and Growth Pact in the EU during the transition from social security to individual retirement accounts.<sup>9</sup>

For simplicity, suppose that the government makes a transfer at the exact amount that is required to keep the pension benefits of the current old intact, despite the reduction in the social security tax rate. Specifically, when  $\tau$  falls, then the term  $b$  in equation (4.4), that is financed by this  $\tau$ , falls as

well. But we assume that the government compensates the old generation, so as to maintain the total pension benefits intact. Therefore, despite the fall in  $b$ , the old are indifferent to the reduction in  $\tau$  (and, consequently, the reduction in  $b$ ). Thus, the outcome of the majority voting is now effectively determined by the young only. The median voter is now a median among the young population only. This median voter has a lower cost-of-education index than before; that is,  $e_M$  will fall.

In order to find the effect of the fall in  $e_M$  on the political-economy equilibrium social security tax rate,  $\tau_0(e_M, \alpha)$ , we follow the same procedure as in the preceding section, and conclude that:

$$\frac{\partial \tau_0}{\partial e_M} = -\frac{B_{e_M}[e_M, \tau_0(e_M, \alpha), \alpha]}{B_\tau[e_M, \tau_0(e_M, \alpha), \alpha]}. \quad (4.16)$$

As before, the sign of  $\partial \tau / \partial e_M$  is the same as the sign of  $B_{e_M}$ , because  $B_\tau \leq 0$ . Note that  $B_{e_M} = \partial^2 W / \partial e_M \partial \tau$  [see equation (4.9)], so that it follows from equation (4.5) that:

$$B_{e_M}[e_M, \tau_0(e_M, \alpha), \alpha] = \begin{cases} w & \text{for } e_M < e^*(\tau) \\ 0 & \text{for } e_M > e^*(\tau) \end{cases}. \quad (4.17)$$

Thus, we conclude that  $\partial\tau/\partial e_M$  is nonnegative: it is positive when the median voter is a skilled individual (that is, when  $e_M < e^*$ ), and zero when the median voter is an unskilled individual (that is, when  $e_M > e^*$ ). Hence, a decline in  $e_M$  decreases (or leaves intact) the social security tax  $\tau_o(e_M, \alpha)$  and the associated benefit  $b$ .

The rationale for this result is straightforward. All unskilled people have the same lifetime income, regardless of their cost-of-education parameter,  $e$ . Therefore, the attitude towards the  $(\tau, b)$ -pair is the same for all of them. Hence, the change in the median voter has no consequence on the outcome of the majority voting, when this median voter is an unskilled individual. For skilled individuals, lifetime income increases when the education-cost parameter,  $e$ , declines. Because the social security system is progressive with respect to the cost-of-education parameter, the net benefit from it (that is, the present value of the expected pension benefit minus the social security tax) declines, as lifetime income increases (that is, as  $e$  falls). Therefore, a decline in the cost-of-education parameter of the median voter,  $e_M$ , lowers the political-economy equilibrium social security tax and pension benefit.

Thus, making the fiscal constraints of the sorts imposed by the Stability and Growth Pact in the European Union, more flexible may facilitate

the political-economy transition from a national pay-as-you-go, old-age social security system to a fully funded private pension system. Such a transition improves the viability of the national system but at a cost of a lesser degree of redistribution (which is an inherent feature of a national system).<sup>10</sup>

#### **4.6. Conclusion**

The idea of the Stability and Growth Pact is to prevent governments from running loose fiscal policies at the expense of other euro-area countries. This spillover effect could happen through higher interest rates, if the ECB offset the fiscal laxity with tight monetary policy, or through higher risk premium on euro-area government bonds. But the Pact, as it is rigidly constructed, neglects long-term fiscal considerations and creates political-economy impediments to social-security reforms which, if implemented, can improve the fiscal balance in the future.

We emphasize in this chapter that the aging population shakes the public finances of pay-as-you-go, old-age social security systems. We demonstrate how in a political-economy framework these deteriorated balances lead to the down-sizing of the social system, and the emergence of supplemental individual retirement accounts. Indeed, in chapter two we demonstrate the existence of a negative correlation between the dependency ratio (which increases with

the aging of the population) and labor tax rates, in a 1970s-1990s sample that includes twelve Western European countries and the United States. Similarly, a negative correlation is found between the dependency ratio and per capita social transfers (of which old-age social security captures the lion's share). These findings are consistent with the hypothesis of this chapter that aging puts political-economic pressure so as to downsize pay-as-you-go, old-age national systems.

## Notes

1. Greg Mankiw (*Fortune Magazine*, March 15, 1999) puts this argument as follows:

“Having trouble saving for your retirement? Try this simple solution: Borrow some money at 7%, buy stocks that return 10%, and pocket the 3% difference. Still running short? Don't worry - just do it again.

This is, of course, ridiculous advice. Buying equities with borrowed money is a risky strategy and no one should do it without understanding those risks.

So let's consider the downside. Suppose the federal government put some of the Social Security trust fund in equities. Now suppose that the next decade turns out less like the early 1990s and more like the early 1930s, when

the Dow Jones Industrial Average fell from 381 to 41 - or like Japan today, where the stock market is still at less than half the level it reached a decade ago. What would happen?

Clearly, Social Security would be in big trouble. Not only would baby-boomers be starting to retire, automatically boosting government spending on retirement programs, but the market collapse would likely coincide with a recession, reducing tax revenue. With the trust fund drained by low stock prices, Social Security benefits would almost certainly be cut a lot.

Although the downside risk is far from negligible, it could still be a risk worth taking. Buying stocks rather than bonds does work out, on average, and we would be irrational to avoid risk at all costs. But there are several reasons to think its a bad bet.

First, it seems an unlikely coincidence that the proposal (to go long on equities and short on government bonds) comes on the heels of several years (the 1990s) of truly exceptional stock returns. If we take a look at history, however, the stock market isn't nearly as impressive: In the 19th century, the average premium for investing in stocks over bonds was less than 3%.

Second, the stock market's historical performance reflects a large amount of good luck. We live in the world's richest country, at the end of the most

prosperous century ever; it should come as no surprise that the market has done so well. The future may give us a similarly lucky draw, but let's not count on it.

Third, some economists see the large historical equity premium as an anomaly that has already been corrected. Most measures of stock market valuation are now at historical extremes. Perhaps this is because investors, realizing stocks were undervalued in the past, have corrected the problem. If so, stocks are unlikely to keep outperforming bonds by the same margin."

2. Galasso (2001) indeed calculated the returns on her PAYG social-security "investment" for the U.S. median voter in the 1964 to the 1996 presidential elections. He found that they overperformed the Dow Jones Industrial Average (DJIA) in the early part of this period, but underperformed the DJIA in the latter part of this period; see also Geanakoplos, Mitchell and Zeldes (1998).

3. See, however, Diamond and Geanakoplos (1999) for a useful analysis of the portfolio diversification advantages from investing retirement savings in the equity market in certain circumstances; see also Bohn (2001).

4. See also Fehr, Jokisch and Kotlikoff (forthcoming), Attansio and Violante (2000) and Brooks (2003) for an inter-generational, world-wide analysis of the general-equilibrium effects of demographic transitions on rates of return and

capital flows.

5. The welfare state may also come under attack because of international tax competition brought about by globalization; see, for instance, Sinn (1990), Lassen and Sorensen (2002), and Wilson and Wildasin (forthcoming). On the other hand, Rodrik (1998) advances an opposite hypothesis that exposure to foreign trade, another facet of globalization, generates greater income uncertainties; consequently, the public demand for social insurance rises. We return to these issues in subsequent chapters.

6. Naturally, the aging of the population has some bearing on individual retirement accounts too through the general-equilibrium effects on the return to capital (stemming from the induced change in the capital-labor ratio).

7. See, however, endnote number 3 of chapter 1.

8. Recent models [see Cooley and Soares (1995) and Bohn (1999)] have used an explicit game-theoretic reasoning to address the issue of the survivability of the pay-as-you-go social security system. This literature demonstrates the existence of an equilibrium in an overlapping-generations model with social security as a sequential equilibrium in an infinitely repeated voting game. The critical support mechanism is provided by trigger strategies. As put by Bohn:

“The failure of any cohort to adhere to the proposed equilib-

rium triggers a negative change in voters' expectations about future benefits that destroys social security. Since survival and collapse are discrete alternatives, trigger strategy models provide a natural definition of what is meant by social security being viable."

To support social security as a sequential equilibrium, there is a very simple condition that must be fulfilled. For the median voter, the present value of future benefits exceeds the value of social security contributions until retirement. This condition is easily satisfied in our overlapping generations model.

9. In view of the decision taken by the EU ministers of finance in November 2003 not to enforce the stability and growth Pact in its present form, there will presumably be some major changes in the Pact. One such change could accommodate some privatization of social security systems.

10. There is a majority of the voters who may benefit from the budget deficit cum social security reform. The majority consists of the entire group of the old and those skilled working young who contribute to the pay-as-you-go social security system more than the benefit (in present value) they expect to get when they retire. The minority of the voters are those who are less skilled and thereby contribute to the pay-as-you-go social-security system less than the benefit they expect to get upon retirement. Thus, we may envisage a two-stage

voting process. In the first stage, the vote is cast on whether to allow budget deficit so as to be able to implement the social-security reform. The majority will vote yes. In the second stage, the vote is on the tax-benefit rates of the post reform pay-as-you-go social security system. The transition from the existing large pay-as-you-go social security system to the individual retirement accounts becomes smoother in this two-stage political economy process.

## 5: CAPITAL-TAX FINANCED WELFARE STATE

### 5.1. Introduction

In the preceding chapter we develop the hypothesis that contemporary phenomena such as aging and low-skill migration generate political processes that must eventually downscale the welfare state<sup>1</sup>. Our model welfare state is financed primarily by labor income taxes, as is typically the case in reality. In this chapter we turn to examine whether capital income taxation can come to the rescue of the welfare state, as an alternative to labor tax.

In every life-cycle saving framework (for instance, the overlapping-generations model) the burden of a tax on capital income falls most heavily on the shoulders of the elderly, whose income is primarily derived from capital. The current young become capital-income taxpayers only later, when they grow older and accumulate savings. A change in the age composition of the population therefore has potentially strong implications for the political economy of capital income taxation.

In this chapter we first develop a simple model of a political-economy determination of capital income taxation in the framework of overlapping generations. The capital-income tax revenues now replace (or add to) the previous labor tax revenues in financing a uniform lump-sum transfer (demogrant), so

that the combined tax-transfer system is progressive, as in the modern welfare state.

Conventional wisdom suggests that a rising share of the elderly in the population should tilt the political-power balance against taxes on capital income, because the old are the primary owners of capital. This hypothesis is first examined theoretically in the present chapter. In chapter 6 we confront the theoretical conclusions with data from the ten Western European countries over the period 1970 to 1996. We show that the implications of the model are largely consistent with the data.

## **5.2. Exogenous Capital Income Tax**

The heart of any political-economy equilibrium must be some underlying distribution of income. For concreteness, our model generates, as before, an income distribution based on human-capital formation framework, with an exogenously given heterogeneity in innate ability. We continue to work with a standard overlapping-generations model in which each generation lives two periods: a working period, and a retirement period. However, we focus now on capital income taxation, where the labor income tax is exogenously determined. For simplicity, we set the labor tax rate equal to zero.

Evidently, a capital income tax distorts saving-consumption decisions.

To abstract from the distortion associated with human capital investment, we assume for simplicity that  $\gamma = 0$ . In this case, the cutoff level,  $e^*$ , such that individuals with education cost parameter below  $e^*$  will invest in education and become skilled, whereas everyone else remains unskilled, is given by:

$$w(1 - e^*) = qw,$$

Rearranging terms yields:

$$e^* = 1 - q. \quad (5.1)$$

Thus, essentially, the cutoff level  $e^*$  is exogenous, that is, it is not distorted by the tax.

Suppose that the government levies a flat capital income tax denoted by  $\tau$ , to finance a uniform transfer, denoted by  $b$ . It is assumed that the tax revenues in each period are used fully to finance the transfer in the same period - essentially, a pay-as-you-go system. Because an individual is born with no capital, only the old have any capital income in each period, . On the other hand, the young, who own no capital yet, constitute a majority of the population, as long as the population growth rate ( $n$ ) is positive. Thus, in any majority-voting system the young majority will attempt to institute a 100% tax on the income from capital (held only by the old minority) and, if feasible, will even confiscate the capital principal in addition to the income

generated from it. To eliminate such an implausible outcome from the model, we assume that any capital-income tax change must last for at least two periods and that this provision is deemed credible. In this case, the young will realize that raising the capital income tax rate will increase their tax burden as well because the tax hike applies to their capital income in the next period when they grow old.

The tax rate and the generosity of the grant are linked through the government's budget constraint. In a multi-period setting, this simple specification captures the spirit of a pay-as-you-go, tax-benefit (transfer) system.

We continue to assume a small open economy with free capital mobility. In this case, the domestic interest rate ( $r$ ) must be equal to the (assumed fixed) world rate of interest. With a constant-returns-to-scale production technology, this means that the wage rate per efficiency unit of labor ( $w$ ) is fixed too. We assume also that the residence principle of taxation is adopted by our small open economy.<sup>2</sup> That is, income of residents is taxed irrespective of its origin, whether at home or abroad; income of non-residents is fully exempted from tax. This means that the capital income tax base is equal to the interest from domestic savings, because only these savings are taxed; no matter whether they are invested domestically or abroad.

In the current period (period  $t$ ), the savings of the old are already pre-determined, so that the capital-income tax base is also given. Thus, there is no efficiency cost to taxing the income from these savings. As noted, the government's budget is balanced period-by-period. Thus, the transfer ( $b_t^A$ ) that is paid to both the young (the workers) and the old (the retirees) in period  $t$ , the first period of the two-period political cycle, is given by:

$$b_t^A N_0[(1+n)^{t-1} + (1+n)^t] = \tau r s_{t-1}^A N_0(1+n)^{t-1},$$

where  $s_{t-1}^A$  is the average saving of the old in period  $t$  (which was pre-determined in period  $t-1$ ). Re-arranging terms yields:

$$b_t^A = \frac{\tau r s_{t-1}^A}{2+n}. \quad (5.2)$$

We emphasize that  $s_{t-1}^A$  is exogenously given in period  $t$ , since it is determined by the choices made by the now-old in the previous period.

Similarly, the transfer ( $b_{t+1}^B$ ) paid in period  $t+1$  (the second period of the two-period cycle) is given by:

$$b_{t+1}^B = \frac{\tau r s_t^B}{2+n}, \quad (5.3)$$

but now  $s_t^B$  is the *average* (over the young population) saving made by the young in period  $t$ , that is:

$$s_t^B = \int_0^1 s_t^B(e) dG. \quad (5.4)$$

where  $s_t^B(e)$  is the saving made by a young individual with an education-cost parameter  $e$ . Unlike  $s_{t-1}^A$ ,  $s_t^B$  is not given in period  $t$ ; it will be determined by utility-maximizing young individuals in period  $t$ . It is thus endogenously determined by the tax ( $\tau$ ) and transfer ( $b_t^A, b_{t+1}^B$ ) parameters.

We denote by  $W(e, \tau, b_t^A, b_{t+1}^B)$  the life-time income (wealth) of a young individual with an ability parameter  $e$  who is born in period  $t$ :

$$W(e, \tau, b_t^A, b_{t+1}^B) = \begin{cases} w(1 - e) + b_t^A + \frac{b_{t+1}^B}{1 + (1 - \tau)r} & \text{for } e \leq e^* \\ wq + b_t^A + \frac{b_{t+1}^B}{1 + (1 - \tau)r} & \text{for } e = e^*. \end{cases} \quad (5.5)$$

Note that due to the capital income tax, the discount rate is the net-of-tax interest rate, that is  $(1 - \tau)r$ .

A standard utility function,  $u(c_{1t}, c_{2t})$ , is maximized over first-period consumption ( $c_{1t}$ ) and second-period consumption ( $c_{2t}$ ), subject to the life-

time budget constraint:

$$c_{1t} + \frac{c_{2t}}{1 + (1 - \tau)r} = W(e, \tau, b_t^A, b_{t+1}^B), \quad (5.6)$$

The maximized value of  $u$ , known as the indirect utility function, is a function of the life-time income and the net-of-tax discount factor, and is denoted by:

$$V\{W(e, \tau, b_t^A, b_{t+1}^B), [1 + (1 - \tau)r]^{-1}\}. \quad (5.7)$$

The saving of a young individual in period  $t$ ,  $S\{W(e, \tau, b_t^A, b_{t+1}^B), [1 + (1 - \tau)r]^{-1}\}$ , equals the present value of second-period consumption:

$$S(\cdot) = C_2(\cdot)[1 + (1 - \tau)r]^{-1}, \quad (5.8)$$

where  $C_2(\cdot)$  is the demand function of second-period consumption. Substituting equation (5.4) into equation (5.3) yields:

$$b_{t+1}^B = \frac{\tau r}{2 + n} \int_0^1 S\{W(e, \tau, b_t^A, b_{t+1}^B), [1 + (1 - \tau)r]^{-1}\} dG. \quad (5.9)$$

One can see from equation (5.5) that all individuals with an ability

parameter  $e$  above  $e^*$  (the unskilled individuals) have the same wealth, and, consequently the same saving (and utility). Using equation (5.5), we can therefore rewrite equation (5.9) as follows:

$$\begin{aligned}
 b^B = & \frac{\tau r}{2+n} \int_0^{e^*} S\{w(1-e) + b^A + b^B[1 + (1-\tau)r]^{-1}, \\
 & [1 + (1-\tau)r]^{-1}\} dG + \frac{\tau r}{2+n} S\{wq + b^A + b^B[1 + (1-\tau)r]^{-1}, \\
 & [1 + (1-\tau)r]^{-1}\} [1 - G(e^*)].
 \end{aligned} \tag{5.10}$$

Because  $w$  and  $r$  are fixed, the economy reaches the steady-state cycle at once. We therefore drop the time subscripts  $t$  and  $t+1$  in equation (5.10) and henceforth. Note also that there is a proportion of  $1 - G(e^*)$  of unskilled individual among the working-age population.

Given the capital income tax rate  $\tau$ , we now have a complete description of the equilibrium. Equation (5.2) determines  $b^A$  as a function of  $\tau$  and  $n$  (note that  $s^A$  is exogenous, thus independent of  $\tau$ ), whereas equation (5.10) determines  $b^B$  as a function of the same variables:

$$b^A = B^A(\tau, n) \tag{5.2'}$$

$$b^B = B^B(\tau, n). \quad (5.10')$$

### 5.3. Endogenous Capital Income Tax

We now return to describe how the capital income tax is determined in a political-economy setting. As before, we assume that the political process is of a direct democracy. That is, people vote directly for the tax rate, taking into account the budget-balancing benefits,  $b^A$  and  $b^B$ , as determined in equations (5.2') and (5.10'), respectively.

Consider first an old individual with an ability parameter  $e$ . Her saving, denoted by  $s^A(e)$ , has already been pre-determined. Note that  $s^A$  in equation (5.2) or (5.2') is the average of the saving of the old. Her **net** gain from the tax-transfer system (denoted by  $\beta$ ) is given by:

$$\beta(\tau, n, e) = B^A(\tau, n) - \tau r s^A(e). \quad (5.11)$$

Note that  $s^A(e)$  is strictly declining in  $e$  for all  $e \leq e^*$  (assuming, of course, normality), and then becomes flat. Thus, if a certain tax hike benefits an old person with ability parameter  $e_0$ , it must also benefit all old people with ability parameter above  $e_0$  (that is, all less able individuals). Conversely, if

an  $e_0$ -person favors a certain tax cut, then all persons with a lower  $e$  (the more able) will also favor such a tax cut. To see this formally, note from equation (5.11) that  $\partial(\partial\beta/\partial\tau)/\partial e = \partial^2\beta/\partial\tau\partial e = -rds^A/de \neq 0$ .

Consider next a young individual of type  $e$ . Expressing the transfers  $b^A$  and  $b^B$  as functions of  $\tau$  and  $n$ , as in equations (5.2') and (5.10'), respectively, we can rewrite her indirect utility function as:

$$\hat{V}(\tau, n, e) = \begin{cases} V\{w(1-e) + B^A(\tau, n) + B^B(\tau, n)[1 + (1-\tau)r]^{-1}, [1 + (1-\tau)r]^{-1}\} & \text{for } e < e^* \\ V\{wq + B^A(\tau, n) + B^B(\tau, n)[1 + (1-\tau)r]^{-1}, [1 + (1-\tau)r]^{-1}\} & \text{for } e = e^* \end{cases} \quad (5.12)$$

As with the old, we can calculate how the **net** gain from a tax change varies with  $e$ :

$$\frac{\partial^2 \hat{V}}{\partial\tau\partial e}(\tau, n, e) = \begin{cases} -w_1(V_{11}(\cdot)\{\frac{\partial B^A}{\partial\tau}(\cdot) + \frac{\partial B^B}{\partial\tau}(\cdot)[1 + (1-\tau)r]^{-1} \\ + rB^B(\cdot)[1 + (1-\tau)r]^{-2}\} + rV_{12}(\cdot)[1 + (1-\tau)r]^{-2}) & \text{for } e < e^* \\ 0 & \text{for } e > e^* \end{cases} \quad (5.13)$$

where subscripts stand for partial derivatives. At this point, we plausibly assume that  $\partial^2 \hat{V}/\partial\tau\partial e = 0$ . For instance, with a log-linear utility function,

$V_{11} < 0$ ;  $V_{12} = 0$ ; and because raising the tax rate must raise revenue at the equilibrium range of tax rates (that is,  $\partial W/\partial\tau = \partial B^A/\partial\tau + \partial B^B/\partial\tau[1 + (1 - \tau)r]^{-1} + rB^B[1 + (1 - \tau)r]^{-2} > 0$ ), it follows that  $\partial^2 \hat{V}/\partial\tau\partial e$  is indeed non-negative. In this case, if a certain tax hike benefits a young individual of type  $e_1$ , it must benefit all individuals with  $e > e_1$ ; conversely, if a tax cut is beneficial for an  $e_1$ -individual, it must also be beneficial for all individuals with  $e < e_1$ .

A political-economy equilibrium can be now specified compactly. There is a triplet  $(\tau^*, e_O, e_Y)$  such that:

$$\tau^* = \operatorname{argmax}_{\tau} \beta(\tau, n, e_O); \quad (5.14)$$

$$\tau^* = \operatorname{argmax}_{\tau} \hat{V}(\tau, n, e_Y); \quad (5.15)$$

and

$$G(e_O) + G(e_Y)(1 + n) = (2 + n)/2. \quad (5.16)$$

This implies that there is a pair of individuals, one old (with an ability parameter  $e_O$ ) and one young (with an ability parameter  $e_Y$ ), who each plays the role of a “pivot” for her respective generation. Note that these pivots’ pre-

ferred choice in equilibrium is the **same** tax rate  $\tau^*$ ; see equations (5.14) and (5.15). Together, these pivots divide the total population (of the old and the young) evenly, so that the preferred tax rate  $\tau^*$  is consistent with the outcome of democratic voting. All old individuals with ability parameters above  $e_O$  and all young individuals with ability parameters above  $e_Y$  would prefer a higher tax rate than (or, at least, the same tax rate as)  $\tau^*$ . All old individuals with ability parameters below  $e_O$  and all young individuals with ability parameters below  $e_Y$  would prefer a lower tax rate than (or the same tax rate as)  $\tau^*$ . To see that these pivots divide the total population (of the old and the young) evenly, note that the number of old people with ability parameters below  $e_O$  is  $G(e_O)N_0(1+n)^{t-1}$ . Similarly, the number of young individuals with ability parameters below  $e_Y$  is  $G(e_Y)N_0(1+n)^t$ . The rest of the population (who favor a higher tax rate than  $\tau^*$ ) is  $[(1 - G(e_O))N_0(1+n)^{t-1} + [1 - G(e_Y)]N_0(1+n)^t]$ . Equating the latter expression with  $G(e_O)N_0(1+n)^{t-1} + G(e_Y)N_0(1+n)^t$  yields equation (5.16).

Given the structure of the model, the determination of the political-economy equilibrium can be simplified a great deal. To see this, differentiate

$\beta$  with respect to  $\tau$  to get:

$$\frac{d\beta}{d\tau}(\tau, n, e) = \frac{\partial B^A}{\partial \tau}(\tau, n) - r s^A(e) = \frac{r s^A}{2 + n} - r s^A(e), \quad (5.17)$$

where use is made of equation (5.2). Note that this derivative is independent of  $\tau$ , so that each individual either gains from raising the tax all the way to 100 percent (when this derivative is positive for her), or lowering it all the way down to zero (when this derivative is negative for her) or is indifferent to the tax (when this derivative is zero for her). Recall that  $s^A$  is the average (over the **old** population only) saving of the old, whereas  $s^A(e)$  is the saving of just an old individual of type  $e$ . Because  $s^A(e)$  is declining in  $e$ , then the ability parameter of the old pivot is determined by:

$$\frac{s^A}{2 + n} = s^A(e_O). \quad (5.18)$$

This  $e_O$  depends on the population growth rate,  $n$ ; denote it by  $E_O(n)$ . All old individuals with an ability parameter above  $E_O(n)$  [and hence individual saving,  $s^A(e)$ , below the total saving of the old per the **total** population,  $s^A/(2 + n)$ ] would (weakly) benefit from a tax hike up to a maximum of 100%, whereas all the rest would (weakly) benefit from a tax cut all the way down

to zero. The pivot among the old, however, is indifferent to any level of the tax rate, and therefore will not play an effective role in setting the tax rate. Note that it may be possible that  $s^A/(2+n) < s^A(e)$  for all  $e$ , in which case the old pivot is  $E_O(n) = 1$ . In this case, all old individuals object to any tax on capital income.<sup>3</sup>

Thus the equilibrium condition in equation (5.14) becomes redundant as the old pivot is determined by (5.18), and she is indifferent among all tax rates. Substituting  $E_O(n)$  into equation (5.16) determines the ability parameter of the young pivot; denote this by  $e_Y = E_Y(n)$ . The political-economy equilibrium tax rate is then finally derived by substituting  $E_Y(n)$  for  $e_Y$  into equation (5.12) and setting the derivative of  $\hat{V}$  with respect to  $\tau$  equal to zero. That is, the political-economy equilibrium is effectively determined by the young pivot according to:

$$\hat{V}_1[\tau, n, E_Y(n)] = 0. \quad (5.19)$$

The solution to this equation constitutes the political-economy equilibrium tax rate, denoted by  $\tau^*(n)$ .

#### 5.4. Aging and Capital Income Taxation

In a life-cycle saving framework such as the overlapping generations model employed here, a tax on capital applies immediately to the current old, whose income is derived primarily from capital. Only one period later, when the current young grow older, do they bear the tax burden as well. Therefore, at any point in time, one would expect the anti-tax coalition to draw heavily on the current old generation. Thus, one would also expect that as the population ages and the share of the elderly in the population rises, the anti-tax coalition increases its influence and the ensuing political-economy equilibrium will involve lower taxes on capital.

We turn to address this issue. In our setting, the share of the elderly in the population is  $No(1+n)^{t-1}/[No(1+n)^{t-1} + No(1+n)^t] = 1/(2+n)$ . Thus, when the population growth rate ( $n$ ) falls, the share of the elderly in the population rises. We therefore focus on the question of whether  $d\tau^*/dn$  is indeed positive, so that when  $n$  declines (and the share of the elderly in the population rises), the political-economy capital income tax rate falls.

For this purpose we totally differentiate equation (5.19), the single equation which effectively determines the political-economy equilibrium tax rate on

capital income, with respect to  $n$  to get:

$$\frac{d\tau^*}{dn} = \frac{\hat{V}_{12} + \hat{V}_{13}dE_Y/dn}{-\hat{V}_{11}}. \quad (5.20)$$

As previously, subscripts denote partial derivatives, and the arguments of the functions were dropped for ease of notation. Because  $\tau^*$  maximizes  $\hat{V}$ , it follows, as before, from the second-order condition for maximization that  $\hat{V}_{11} < 0$ , so that:

$$\text{Sign} \left( \frac{d\tau^*}{dn} \right) = \text{Sign} (\hat{V}_{12} + \hat{V}_{13}dE_Y/dn). \quad (5.21)$$

Thus, the effect of  $n$  on  $\tau^*$  is decomposed into two components. First,  $\hat{V}_{12}$  represents the effect of a change in  $n$  on the preferred tax by the existing young pivot. Second, a change in  $n$  changes the identity of the young pivot and, correspondingly, the equilibrium tax rate; this is represented by  $\hat{V}_{13}dE_Y/dn$ . (As was already mentioned, the old pivot does not play an active role in the determination of the tax rate.)

We are now well equipped to address the question of whether a rise in the elderly share in the population (namely, a decline in  $n$ ) does indeed lower the capital income tax rate in a political-economy equilibrium. Formally put, is  $d\tau^*/dn$  indeed positive? We show, however, contrary to the aforementioned

common wisdom, that the latter derivative may plausibly be negative rather than positive.

To see this, we first investigate the sign of  $\hat{V}_{12}$ , which represents the attitude toward the capital income tax of the existing young pivot. Note from equation (5.12) that

$$\hat{V}_1 = V_1 \frac{\partial W}{\partial \tau} + V_2 \frac{\partial R}{\partial \tau}, \quad (5.22)$$

where  $R$  is the discount factor, that is  $R = [1 + (1 - \tau)r]^{-1}$ .

The net gain to the young pivot from raising the tax rate consists of two components: an income effect [the first term on the right-hand side of equation (5.22)]; and a price (interest rate) effect [the second term on the right-hand side of equation (5.22)], which is related to the efficiency cost of taxation. To see how the incentive to raise the tax (that is,  $\hat{V}_1$ , which is zero at the existing  $n$ ) changes when  $n$  rises, differentiate the expression in (5.22) with respect to  $n$ , to get:

$$\hat{V}_{12} = \frac{\partial}{\partial n} \left( V_1 \frac{\partial W}{\partial \tau} \right) + \frac{\partial}{\partial n} \left( V_2 \frac{\partial R}{\partial \tau} \right). \quad (5.23)$$

The first term on the right-hand side of equation (5.23) is plausibly negative,

on two mutually enforcing grounds. First, when  $n$  rises, taxes collected from the old in the current period is shared (via the transfer  $b^A$ ) by more young people, thereby reducing the transfer  $b^A$  to everyone, including the young pivot, who is decisive. This reduces the net gain to the young pivot from raising the tax rate. Second, when  $n$  rises, the taxes collected in the second period, when the current young become old, is now shared by more newly born young individuals. Therefore the transfer  $b^B$  that the current young pivot will receive in the second period of her life, when she turns old, is also reduced. Put differently, when  $n$  rises and the share of the elderly in the population declines, the first term on the right-hand side of equation (5.23) may be negative because of a “fiscal leakage” from the young pivot to others (namely, the other current-period young and all of the next-period young). The second term on the right-hand side of equation (5.23) has to do with how an increase in  $n$  changes the price (and efficiency cost) component of  $\hat{V}_1$ , the net gain to the young pivot from raising the tax on capital. We cannot, however, a priori sign this term. If the distortion is small this term is also small. Nevertheless, because of the first term (the “fiscal leakage” effect),  $\hat{V}_{12}$  may be negative, so that the net gain to the existing young from raising the tax diminishes.

In order to complete the analysis of the sign of  $d\tau^*/dn$ , we must also examine the sign of  $\hat{V}_{13}dE_Y/dn$ , which represents the effect of a change in the identify of the young pivot on the equilibrium tax rate. This term tends to be rather small and may even altogether vanish. For instance, it does indeed vanish when the young pivot is an unskilled individual, because  $\hat{V}_{13} = 0$  in this case; see equation (5.13). That is, the new and the existing young pivot, being both unskilled, have identical attitudes towards taxation.

To sum up, we have demonstrated how  $d\tau^*/dn$  may plausibly be negative. That is, as the population ages and the share of the elderly in the population rises (namely, as  $n$  declines), the capital income tax rate and the transfers in the political-equilibrium may plausibly rise. The main driving force for this result is the fiscal leakage effect.

## 5.5. Conclusion

Aging may boost the size of the welfare state when capital income taxation are employed to finance the benefits provided by the welfare state. Note that aging has an opposite effect in the size of the welfare state when the benefits granted by it are financed by labor taxes (as demonstrated in chapters 2 and 4). Can capital income taxation indeed rescue a welfare state with an aging population, as may be concluded from this chapter? We cannot give

a positive answer at this stage, because we do not know yet whether capital tax can generate sufficient revenue in a globalized world economy. In the next part of the book we examine whether strong international tax competition in the era of globalization imposes severe constraints on capital income taxation, and thereby put into question its standing in the public finance of the welfare state.

## Notes

1. Here is a recent alarm (**Financial Times**, March 11, 2003):

“Because of emerging pension funding gap German economic reform efforts will face a further setback. The VDR association of statutory pension funds warns that increasing contributions to the state-run pay-as-you-go pension system from 19.5 to 19.9 percent of gross wages may be unavoidable.”

2. See Frenkel, Razin and Sadka (1991) for a comprehensive analysis of principles of international taxation.
3. The opposite case of  $s^A/(2+n) > s^A(e)$  for all  $e$  is not possible, because  $s^A$  is the average of  $s^A(e)$  over all  $e$ , and  $s^A/(2+n) < s^A$ .

## **6. AGING AND THE WELFARE STATE: EMPIRICAL EVIDENCE**

### **6.1. Introduction**

Our model may suggest opposing effects of aging on labor taxation and capital taxation. We may conclude that aging generates political processes that downscale the welfare state, in case the benefits provided by it are financed by labor taxes. These processes may upscale the welfare state, in case the benefits are financed through capital income taxes. In this chapter we provide integrative empirical evidence of the effects of aging on labor and capital taxes and the benefits provided by the welfare state. We examine whether patterns in the data for ten European countries over the period 1970 to 1996 are consistent with the predictions of the theory regarding the relationship between the aging of the population and the tax rate on labor income, capital income, and social transfers.<sup>1</sup> Capital tax rates are set in conjunction with taxes on labor income, the largest source of revenue in the advanced economies. We present results for specifications in which the regression equations for the capital tax rate are estimated jointly with those for labor taxes, allowing for an interaction between the two. Among other things, we use the differing prediction of our theories on the implications of aging for the political-economy equilibrium concerning different sources of public finances in order to identify the two tax rates. As

noted in the preceding chapters, the capital income tax depends on the balance of interests between the old and the young, whereas the equilibrium for labor income tax depends on the balance between the working individuals and the dependents - these are overlapping but not identical populations. In addition, we make use of the notion that capital crosses borders relatively more easily than labor, so that capital tax rates in open economies are more likely to be subject to international tax competition than is the case for labor tax rates (see an extensive analysis in the next part).

Control variables for capital tax rates can be thought of as comprising several groups. First, we include two measures of exposure to the international flows of capital, to take into account the impact of capital mobility on governments' setting of tax rates through international tax competition. These measures are: The ratio of the stock of international portfolio investment to GDP, and the ratio of the stock of international direct investment to GDP. Both are measured as the total stock of international investment, not the flow in a single year. By gross stock, we mean the sum of inflows and outflows, in absolute value. This set of variables captures a country's overall integration with international capital, both inward and outward investment, though of course domestic capital can be potentially (but not necessarily in realiza-

tion) mobile, and thus affected by international tax competition in ways not captured by our data.

The next set of variables is meant to control for factors that affect the size of the welfare state, both the government's need for revenue and residents' demands for social services. The control variables are the share of government employment out of total employment, to indicate the breadth of government involvement in the economy, and a measure of openness to trade, to capture exposure to external real sector shocks. As before, openness is included to address the hypothesis made by Rodrik (1998) that an important function of the welfare state is to provide social insurance against the adverse effects of external shocks. Thus, large governments would be expected to be found in open economies. Alternately, Alesina and Wacziarg (1998) suggest that the empirical connection between openness and the size of government comes about indirectly through a size effect. Small countries are both more open than large countries and have larger government spending, as a share of national income (and thus higher taxes than large economies). We further include a measure of income inequality, the ratio of the income share of the top quintile to the combined share of the middle three quintiles ("rich versus middle"). As we have already pointed out, this variable - denoted as the "skewness of

income distribution” - is suggested by previous political-economy theories that seek to explain the size of the welfare state [e.g., Meltzer and Richard (1981), Persson and Tabellini (2002)]. Finally, as before, to control for business cycle effects which might affect revenue requirements, we also include the real GDP growth .

The specification for the labor tax rate regressions is as in chapter 2. The explanatory variables include the total dependency ratio (or the old dependency ratio), along with openness to trade flows, the share of government jobs in total employment, GDP growth, and the income distribution variable.

## **6.2. Data: Sources and Description**

Data on capital and labor tax rates are based on Mendoza, Razin, and Tesar (1994)[as extended by Mendoza, Milesi-Ferretti, and Asea (1997)], and Daveri and Tabellini (2000). The effective average rates of taxation are derived by using revenue statistics. A brief description on how these tax rates are calculated appears in the appendix. Data on the share of the old in the population are from the World Development Indicators (World Bank, various years). Regressions reported use the share of those aged 64 and older out of the total population, though the results are not affected by taking the share of the old out of only the population of individuals 14 years and older, which

might correspond to the working-age population.

Data on the stock (not flows) of international capital investment are from Lane and Milesi-Ferretti (2001). These are the estimated stock of inward and outward direct investment assets adjusted for relative stock market price variations, and the stock of portfolio equity assets and liabilities adjusted for stock market price variations.

The OECD Analytical Database is used to calculate measures of per capita GDP, government employment as a share of total employment, and openness to trade, defined as the sum of the imports plus exports as a share of GDP. The total dependency ratio is defined as one minus the labor force as a share of the population (rather than as the number of dependent per **working** individual). The measures of income skewedness are derived from the updated inequality database of Deininger and Squire (1996), which provides measures of income shares by quintile over time, though data are not available for every year. Only the high quality measures in the database are used, and the missing observations are then obtained through linear interpolation (these shares do not vary all that much over time, though in most countries there is a general trend toward increased inequality).

As shown in Table 6.1, the data encompass slightly different periods for

some of the countries, so that an unbalanced panel is used in the regressions. Tax rates on capital income vary across countries, from a low of under 14 percent in Spain to over 50 percent in Sweden and the United Kingdom (the latter having the lowest tax rate on labor income on average over the sample period). The importance of international investment varies substantially across countries, with a great deal of inward and outward investment in the Netherlands and United Kingdom and relatively little in others. This is even more true of portfolio investment, though of course the data end for many countries before important steps forward in European capital market integration were taken in 1992 following the single market act.

### **6.3. Estimation Results**

Table 6.2 provides results from a set of regressions for the determinants of the capital and labor tax rates. All specifications include a complete set of country fixed effects (not shown in the tables); the regressions thus take into account the fact that richer countries tend to have higher tax rates and provide more generous welfare benefits than poor ones.

The first two columns show single-equation results estimated by using OLS (this is a panel-fixed effect specification). We then provide results in which the two taxes depend on one another; first estimating regressions for

each variable separately using two-stage least squares, and then with the two estimated jointly by three-stage least squares. Both estimators allow for the endogeneity of the two tax rates with respect to each other, with the latter estimates further allowing for common shocks to both regressions. We now discuss the estimates for each technique in turn, focusing first on the equations for the influences of the capital tax rates.

The coefficient of the share of the old in the population is positive and statistically significant in the capital tax equations, with all three estimation techniques. The results indicate that the tax rate on capital income goes up by 2 to 3 percentage points for each one percentage point increase in the share of the old in the population. This seemingly counter-intuitive result is quite consistent with the implication of the theory. The old are less than a majority of voters in all countries in our sample, so that the young will naturally want to levy taxes on capital and thus shift the burden of taxation to older individuals who tend to be owners of capital. Further, the young will be more inclined to do so when there are more old people to pay the capital income tax, and fewer young people to share the tax revenues that finance the transfers. The coefficient becomes larger in magnitude with the system estimates but the results are qualitatively the same.

The coefficients on the other explanatory variables in the capital-tax rate regression, likewise, provide sensible results with all three estimation techniques. We discuss the coefficient of the openness variables in detail in chapter 8.

The coefficient of the share of government workers out of total employment has a significant positive effect in the OLS regression but a negative, though not statistically significant, coefficient in the two-stage least squares and three-stage least squares results. The difference arises from labor taxes which are included in the latter two equations. Because the government jobs variable has a strongly positive coefficient in the labor tax equations, this variable by itself in the Ordinary-Least-Squares (OLS) capital-tax regressions appears to be picking up some of the effect of the omitted labor tax variable.

The coefficients on GDP growth and income distribution are again consistent across the three estimators. Stronger growth is associated with lower tax rates—a feature shared with labor taxes as well. This is likely due to the larger tax base with lower tax rates. In addition, there may be at play a reversed causality effect from the tax rates to growth: lower tax rates (and fewer distortions) may promote growth. A distribution of income more skewed to the richest quintile is associated with a statistically significant lower tax rate,

on capital, but with higher tax rate on labor. This is a somewhat puzzling result; one possibility is that it stems from a different lobbying intensity on the part of the two groups, something that we do not capture in our model.

The labor tax rate has a positive coefficient in the latter two capital-tax regressions, though this is significant at only the 10 percent confidence level. While not conclusive, this suggests that the capital-tax rate is effectively set as complement to the labor tax rather than a substitute (in addition to the other influences). In contrast, the coefficient of the capital-tax rate is far from statistically significant in the two specifications where this variable appears as an influence on the labor tax.

The results for the influences on the tax rate on labor income are in line with our previous evidence provided in chapter 2 (despite a slight difference in the sample of countries, owing to data limitations on the capital tax rates and international capital stocks). This is the case in both the single-equation and system estimators. The dependency ratio has a statistically negative coefficient. As noted above, this negative association is along the lines of the relationship between the capital tax and the share of the old in the population. Remember that the dependent are a minority of voters, so the majority of working individuals naturally favors lower taxes and transfers as the number

of dependents rises. Openness to goods trade flows is associated with a statistically significant higher tax rate, in accordance with the theory of Rodrick (1998) or the interpretation of Alesina and Wacziarg (1998), whereas more unequal income distribution leads to higher labor tax rates as in Meltzer and Richards (1981).

#### **6.4. Conclusion**

The empirical results for the relationship between capital-tax rates, labor-tax rates and the aging of the population (or the increase in the share of dependents in the population) are thus in close alignment with the predictions of the political-economy theory. The capital income tax rises and the labor tax falls when the share of the old in the population rises (due to a “fiscal leakage” effect). We also find that globalization may have opposing effects on labor and capital taxation. Greater trade openness raises the labor tax rates (and social transfers), but has an insignificant effect on capital tax rates. On the other hand, greater capital openness (as measured by the stock of foreign portfolio investments) has a statistically significant depressing effect on capital taxation. A possible explanation for the negative effect of capital openness on capital taxes is international tax competition, which we discuss in the next part.

## 6.5. Appendix: Capital and Labor Tax Rates

### 6.5.1. Labor Taxes

The effective tax rate on labor income is defined as the percentage difference between post- and pre-tax labor income. In practice, however, computing this tax rate is difficult because of the manner in which data on income taxes and other taxes based on labor income are reported. One common problem which also affects most calculations of aggregate labor income tax rates is that tax revenue sources typically do not provide a breakdown of individual income tax revenue in terms of labor and capital income. This is due to the fact that tax returns are generally filed to cover all of a tax-payer's income, regardless of its origin. This problem is addressed by assuming that all sources of the households' income are taxed at the same rate - an assumption which according to 1991 statutory tax rates in OECD member countries is a good approximation (OECD, 1991). Another issue of concern is the fact that, in addition to the individual income tax on wages, there are other important taxes on labor income such as social security contributions and payroll taxes that need to be taken into account [Barro and Sahasakul (1986)].

First, the households' average tax rate on total income ( $\tau_H$ ) is defined as:

$$\tau_H = \left( \frac{1100}{OSPUE + PEI + W} \right), \quad (A6.1)$$

where, from the OECD revenue statistics,

1100 - taxes on income, profits and capital gains of individuals

and where, from the National Accounts:

OSPUE - operating surplus of private unincorporated enterprises

PEI - households' property and entrepreneurial income, and

W - wages and salaries

Then, the effective tax rate on labor income ( $\tau_L$ ) is defined by:

$$\tau_L = \frac{\tau_H W + 2000 + 3000}{W + 2200}, \quad (A.62)$$

where

2000 - total contribution to social security

2200 - employers' contribution to social security

3000 - taxes on payroll and workforce

### 6.5.2. Capital Taxes

Similarly, the effective tax rate on capital income ( $\tau_K$ ) is defined by:

$$\tau_K = \frac{\tau_H(OSPUE + PEI) + 1200 + 4100 + 4400}{OS},$$

where

- 1200     -     taxes on income, profits and capital gains of individuals
- 4100     -     recurrent taxes on immovable property
- 4400     -     taxes on financial and capital transactions, and
- OS       -     total operating surplus of the economy.

### Notes

1. The countries included are Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, Spain, Sweden, and the United Kingdom.

**PART TWO: GLOBALIZATION**

## **7: CAPITAL TAXATION: THE SHADOW OF INTERNATIONAL TAX COMPETITION**

### **7.1. Introduction**

We see in the first part of the book that aging generates political forces that tend to curtail the size of the welfare state, in case the social transfers it provides are financed by labor taxes. We also point out that aging may generate political forces that tend to boost a capital-tax financed welfare state. We end the first part by posing the question whether capital tax can indeed replace labor tax and thereby come to the rescue of the aging welfare state. In this part we analyze how capital-market globalization exerts downward pressure on the size of the welfare state, through international tax competition. Therefore, in the end, the downsizing of an aging welfare state is unavoidable.

In this chapter we provide a simple analytical framework for the study of capital taxation in the presence of international capital mobility. In particular, we analyze the tax structure in the political-economy equilibrium.

### **7.2. International Capital Mobility: A Stylized Political-Economy Tax Model**

We present a stripped-down model of international capital mobility, which

enables us to explore key issues of international taxation, without being side-tracked by irrelevant complications. This is an extension of the model described in Chapter 2. We consider an economy that lives for two periods, indexed by  $t = 1, 2$ . There is one aggregate, all-purpose good in each period, serving for both consumption and investment.

### 7.2.1. Consumers

As in Chapter 2, there are two types of workers: Skilled workers, who have high productivity, and provide one efficiency unit of labor per unit of labor time, and unskilled workers, who provide  $q < 1$  efficiency units of labor per unit of time. Workers have one unit of labor time during each one of the two periods of their life. They are born without skills and thus with low productivity. In the first period, each worker chooses whether to get an education and become a skilled worker, or instead remain unskilled.

There is a continuum of individuals, characterized by an innate ability parameter,  $e$ , which is the time needed to acquire a skill. By investing  $e$  units of labor time in education, in the first period, a worker becomes skilled; after which the remaining  $(1 - e)$  units of labor time in the first period provide an equal amount of efficiency units of labor in the balance of the first period. We now assume that the individual also provides one efficiency unit of labor in

the second period. We assume a positive pecuniary cost of acquiring skills,  $\gamma$ , which is not tax deductible.

Given these assumptions, there exists, again, a cutoff level,  $e^*$ , such that those with education cost parameters below  $e^*$  will invest in education and become skilled, whereas everyone else remains unskilled. The cutoff level is determined by the equality between the present value of the payoff to education and the cost of education (including foregone income):

$$(1 - \tau_L)(1 - q) \left[ w_1 + \frac{w_2}{1 + (1 - \tau_D)r} \right] = (1 - \tau_L)w_1 e^* + \gamma, \quad (7.1)$$

where  $w_t$  is the wage rate per efficiency unit of labor in period  $t = 1, 2$ ;  $r$  is the domestic rate of interest;  $\tau_L$  is the tax rate on labor income (constant over time); and  $\tau_D$  is the tax rate on capital income of residents from domestic sources (see below). Note that unlike the model in Part One, we now have both taxes on labor and capital at the same time. Rearranging terms, equation (7.1) yields:

$$e^* = (1 - q) \left[ 1 + \frac{w_2/w_1}{1 + (1 - \tau_D)r} \right] - \frac{\gamma}{(1 - \tau_L)w_1}. \quad (7.2)$$

Note that the two taxes, the tax on labor income and the tax on capital income, have opposite effects on the decision to acquire skill. The tax on labor income reduces the foregone (net of tax) income component of the cost of education. It also reduces the payoff to education by the same proportion.<sup>1</sup> Were the pecuniary cost  $\gamma$  equal to zero (or else tax-deductable), the labor income tax would have no effect on the decision to acquire skill. However, with a positive pecuniary cost of education, the labor income tax has a negative effect on acquiring skills: It reduces  $e^*$  and, consequently, also the proportion of the population who becomes skilled [namely,  $G(e^*)$ ]. On the other hand, the tax on capital income has a positive effect on education, because it reduces the (net-of-tax) discount rate; thereby raising the present value of the future payoff to education.

We continue to assume for the sake of simplicity that the individual's leisure time is exogenously given. Nevertheless, total labor supply is distorted by the taxes, as can be seen from equation (7.2). Note that there are  $G(e^*)$  skilled individuals and  $1 - G(e^*)$  unskilled individuals in each period. The labor supply of each one of the unskilled individuals, in efficiency units, is  $q$ , in each period. Therefore, total labor supply in efficiency units of the unskilled individuals is  $q[1 - G(e^*)]$  in each period. However, a skilled individual devotes

$e$  units of her time in the first period to acquire education, and hence works only  $1 - e$  units of time in the first period. Thus, the individual labor supply in the first period varies over  $e$ . The labor supply of skilled individuals is equal to  $\int_0^{e^*} (1 - e) dG$ . Any skilled individual supplies as labor all of her unit time in the second period. Thus, total labor supply ( $L_t$ ) in efficiency units in period  $t = 1, 2$ , is given by:

$$L_1 = \int_0^{e^*} (1 - e) dG + q[1 - G(e^*)] \quad (7.3)$$

and

$$L_2 = G(e^*) + q[1 - G(e^*)]. \quad (7.4)$$

For the sake of simplicity, assume that all individuals have identical preferences over first and second-period consumption [ $c_1(e)$  and  $c_2(e)$ , respectively], represented by a common, concave utility function  $u[c_1(e), c_2(e)]$ .<sup>2</sup> Each individual has initial income (endowment) in the first period of  $I_1$  units of the consumption-capital good. The total amount of the initial endowment ( $I_1$ , because the size of the population is normalized to one) serves as the stock of capital employed in the first period. (This initial endowment is generated by

past savings or is inherited.) Because taxation of the fixed initial endowment is not distortionary, we may assume that the government could efficiently tax away the entire value of the initial endowments. Thus, an individual of type  $e$  faces the following budget constraints in periods one and two, respectively:

$$c_1(e) + s_D(e) + s_F(e) = E_1(e) + T_1, \quad (7.5)$$

and

$$\begin{aligned} c_2(e) = & T_2 + E_2(e) + s_D(e)[1 + (1 - \tau_D)r] \\ & + s_F(e)[1 + (1 - \tau_F - \tau_N^*)r^*], \end{aligned} \quad (7.6)$$

where  $E_t(e)$  is after-tax labor income, net of the cost of education,  $t = 1, 2$ , and where  $T_t$  is a uniform lump-sum transfer (demogrant) in period  $t = 1, 2$ . That is:

$$E_1(e) = \begin{cases} (1 - \tau_L)(1 - e)w_1 - \gamma & \text{for } e \neq e^* \\ (1 - \tau_L)qw_1 & \text{for } e = e^* \end{cases}, \quad (7.7)$$

and

$$E_2(e) = \begin{cases} (1 - \tau_L)w_2 & \text{for } e \neq e^* \\ (1 - \tau_L)qw_2 & \text{for } e = e^* \end{cases}. \quad (7.8)$$

An individual can channel savings to either the domestic or foreign capital market, because the economy is open to international capital flows. We denote by  $s_D(e)$  and  $s_F(e)$  savings channelled by an  $e$ -individual to the domestic and foreign capital market, respectively. We denote by  $r$  and  $r^*$  the real rate of return in these markets, respectively.<sup>4</sup> The government levies a tax at the rate  $\tau_D$  on capital (interest) income from domestic sources. Capital (interest) income from foreign sources is subject to a non-resident tax at the rate of  $\tau_N^*$ , levied by the foreign government. The domestic government may levy an **additional** tax on its domestic residents, on their foreign-source income at an **effective** rate of  $\tau_F$ . Note that  $\tau_F + \tau_N^*$  is the **effective** tax rate on foreign-source income of residents.

For the sake of brevity, we consider only the case of a capital-exporting country that is, its national savings exceed domestic investment, with the difference (defined as the current account surplus) invested abroad.<sup>5</sup> (The analogous case of a capital-importing country can be worked out similarly.) By arbitrage possibilities, the net-of-tax rate of interest, earned at home and abroad,

are equalized; that is:

$$(1 - \tau_D)r = (1 - \tau_F - \tau_N^*)r^*. \quad (7.9)$$

Employing (7.9), one can consolidate the two one-period budget constraints (7.5) and (7.6) into one life-time budget constraint:

$$c_1(e) + Rc_2(e) = E_1(e) + RE_2(e) + T, \quad (7.10)$$

where

$$R = [1 + (1 - \tau_D)r]^{-1}, \quad (7.11)$$

is the net-of-tax discount factor (which is also the relative after-tax price of second-price consumption), and

$$T \equiv T_1 + RT_2 \quad (7.12)$$

is the discounted sum of the two transfers ( $T_1$  and  $T_2$ ).<sup>6</sup>

As usual, the consumer maximizes her utility function, subject to her lifetime budget constraint. A familiar first-order condition for this optimiza-

tion is that the intertemporal marginal rate of substitution is equated to the tax-adjusted interest factor:

$$MRS(e) \equiv u_1[c_1(e), c_2(e)] / u_2[c_1(e), c_2(e)] = 1 + (1 - \tau_D)r = R^{-1}, \quad (7.13)$$

where  $u_i$  denotes the partial-derivative of  $u$  with respect to its  $i$ th argument,  $i = 1, 2$ . Equations (7.13) and (7.10) yield the consumption-demand functions  $\bar{c}_1[R, E_1(e) + RE_2(e) + T]$  and  $\bar{c}_2[R, E_1(e) + RE_2(e) + T]$  of an  $e$ -individual. The maximized value of the utility function of an  $e$ -individual,  $v[R, E_1(e) + RE_2(e) + T]$ , is the familiar indirect utility function.

Denote the aggregate consumption demand, in period  $t = 1, 2$ , by:

$$\begin{aligned} C_t[R, (1 - \tau_L)w_1, (1 - \tau_L)w_2, T] &\equiv \int_0^1 \bar{c}_t[R, E_1(e) + RE_2(e) + T] dG \\ &\int_0^{e^*} \bar{c}_t[R, (1 - \tau_L)(1 - e)w_1 + R(1 - \tau_L)w_2 + T - \gamma] dG + \\ &[1 - G(e^*)] \bar{c}_t[R, (1 - \tau_L)qw_1 + R(1 - \tau_L)qw_2 + T], \end{aligned} \quad (7.14)$$

where use is made of equations (7.7) and (7.8). Note that  $e^*$  is a function of

$(1-\tau_L)w_1$  and of  $Rw_2/w_1$  [see equation (7.2)].

### 7.2.2. Producers

All firms are identical and possess constant-returns-to-scale technologies, so that with no further loss of generality we assume that there is only one firm, which behaves competitively. Its objective, dictated by the firm's shareholders, is to maximize the discounted sum of the cash flows accruing to the firm. We assume that the firm finances its investment by issuing debt. In the first period, it has a cash flow of  $(1 - \tau_D)[F(K_1, L_1) - w_1 L_1] - [K_2 - (1 - \delta)K_1] + \tau_D \delta K_1$ , where  $F(\cdot)$  is a neo-classical, constant-returns-to-scale, production function. In the second period, the firm has an operating cash flow of  $(1 - \tau_D)[F(K_2, L_2) - w_L L_2] + (1 - \delta)K_2 + \tau_D \delta K_2$ . We denote by  $\delta$  both the physical and the economic rate of depreciation (assumed for the sake of simplicity to be equal to each other). This depreciation rate is also assumed to apply for tax purposes. We essentially assume that the corporate income tax is fully integrated into the individual income tax. With such integration of the individual income tax and the corporate tax, there is no difference between debt and equity finance. Specifically, we assume that the individual is assessed a tax (at the rate  $\tau_D$ ) on the profits of the firm, whether or not they are distributed, and that there is no tax at the firm level. The firm's discounted sum

of its after-tax cash flow is therefore:

$$\begin{aligned} \pi = & (1 - \tau_D)[F(K_1, L_1) - w_1 L_1] - [K_2 - (1 - \delta)K_1] + \tau_D \delta K_1 \\ & + \{(1 - \tau_D)[F(K_2, L_2) - w_2 L_2] + \tau_D \delta K_2 + (1 - \delta)K_2\} / [1 + (1 - \tau_D)r]. \end{aligned} \quad (7.15)$$

Note that  $K_1$  is the pre-existing stock of capital at the firm, carried over from period zero. Maximizing (7.15) with respect to  $K_2$ ,  $L_1$  and  $L_2$  yields the standard marginal productivity conditions:

$$F_L(K_1, L_1) = w_1, \quad (7.16)$$

$$F_L(K_2, L_2) = w_2, \quad (7.17)$$

and

$$F_K(K_2, L_2) - \delta = r. \quad (7.18)$$

Note that although taxes do not affect the investment rule of the firm, nevertheless, the taxes are distortionary. To see this distortion, consider the intertemporal **marginal rate of transformation** (*MRT*) of second-period

consumption (namely,  $c_2$ ) for first-period consumption (namely,  $c_1$ ). It is equal to  $(1 - \delta) + F_K(K_2, L_2)$ : When the economy gives up one unit of first-period consumption in order to invest it, then it receives in the second period the depreciated value of this unit (namely,  $1 - \delta$ ), plus the marginal product of capital (namely,  $F_K$ ). From equation (7.18), we can see that:

$$MRT = 1 + r.$$

However, from equation (7.13) we can see that the common intertemporal marginal rate of substitution of all individuals is equal to:

$$MRS = 1 + (1 - \tau_D)r.$$

Hence, the  $MRT$  need not equal the  $MRS$ ; in fact, the  $MRT$  is larger than the  $MRS$  when the tax rate on capital income from domestic sources ( $\tau_D$ ) is positive. This violates one of the Pareto-efficiency conditions.

Note that the firm has pure profits (or surpluses) stemming from the pre-existing stock of capital,  $K_1$ . We denote this surplus by  $\pi_1$ , which is equal

to:

$$\pi_1 = (1 - \tau_D)[F(K_1, L_1) - \delta K_1 - w_1 L_1] + K_1. \quad (7.19)$$

The surplus consists of the after-tax profit of the first period, plus the level of the pre-existing stock of capital. Given the constant-returns-to-scale technology, the firm's after-tax cash flow consists entirely of this surplus, that is  $\pi = \pi_1$ . This equality follows by substituting the Euler's equation,  $F(K_2, L_2) = F_K(K_2, L_2)K_2 + F_L(K_2, L_2)L_2$ , and the marginal productivity conditions, equations (7.17) and (7.18), into equation (7.15). Naturally, the government fully taxes away the surplus  $\pi_1$ , before resorting to distortionary taxation (via the various  $\tau's$ ).

### 7.2.3. Policy Tools: Taxes, Transfers and Debt

The government has a consumption demand of  $C_t^G$  in period  $t = 1, 2$ . We assume that the government can lend or borrow at market rates. With no loss of generality, we assume that the government operates only in the foreign capital market, that is, its first-period budget surplus is invested abroad; for concreteness, suppose that this is positive. Therefore, the government does not have to balance its budget period by period, but only over the two-period horizon:

$$C_1^G + R^*C_2^G + T_1 + R^*T_2 = \quad (7.20)$$

$$\begin{aligned} & \tau_L w_1 L_1 + \tau_L R^* w_2 L_2 + \tau_D R^* r S_D + \tau_F R^* r^* S_F \\ & + \pi_1 + \tau_D [F(K_1, L_1) - \delta K_1 - w_1 L_1], \end{aligned}$$

where:

$$S_D = \int_0^1 s_D(e) dG \quad (7.21)$$

is the aggregate private savings, channelled into the domestic capital market;

$$S_F = \int_0^1 s_F(e) dG \quad (7.22)$$

is the foreign aggregate private savings, channelled into the foreign capital market; and

$$R^* = [1 + (1 - \tau_N^*)r^*]^{-1} \quad (7.23)$$

is the foreign discount rate faced by the domestic economy. Note that the foreign government levies a tax at the rate  $\tau_N^*$  on interest income from the home government budget surplus invested abroad.

The left hand side of equation (7.20) represents the present value of the government expenditures on public consumption and transfers, discounted by the factor  $R^*$ , which is the interest factor at which the domestic economy can lend. The right-hand side of equation (7.20) represents the present value of the revenues from the labor income taxes, the interest income taxes, and the pure surplus of the firm.

Market clearance in the first period requires that:

$$CA + C_1 + C_1^G + K_2 - (1 - \delta)K_1 + G(e^*)\gamma = F(K_1, L_1), \quad (7.24)$$

where  $CA$  is the current account surplus.<sup>4</sup> Market clearance in the second period requires that:

$$C_2 + C_2^G = F(K_2, L_2) + (1 - \delta)K_2 + CA[1 + (1 - \tau_N^*)r^*]. \quad (7.25)$$

Note that the tax at the rate  $\tau_N^*$  is levied by the foreign country on the interest income of the residents of the home country, and must therefore be subtracted from the resources available to the home country.

In order to get one present-value resource constraint, we can substitute the current account surplus,  $CA$ , from equation (7.24) into equation (7.25)

$$C_1 + R^*C_2 + C_1^G + R^*C_2^G + K_2 - (1 - \delta)K_1 + \quad (7.26)$$

$$G(e^*)\gamma = F(K_1, L_1) + R^*F(K_2, L_2) + R^*(1 - \delta)K_2.$$

Note that we may ignore the government budget constraint (7.20), by Walras Law, because constraint (7.20) will be satisfied when equation (7.26), the economy-wide “budget” constraint, and equation (7.10), the individual budget constraints, both hold. This is demonstrated in the Appendix.

#### 7.2.4. Political-Economy Tax-Transfer Equilibrium

As before, the median voter can be shown to be the decisive voter. Therefore, the political-economy equilibrium tax rates maximize the (indirect) utility of the median voter. Denoting the indirect utility function of the median voter by  $V$ , it is given by:

$$V(e_M, R, w_1^N, w_2^N, T) = \begin{cases} v[R, (1 - e_M)w_1^N + Rw_2^N + T - \gamma] & \text{if } e_M < e^* \\ v[R, q(w_1^N + Rw_2^N) + T] & \text{if } e_M > e^*, \end{cases}$$

where  $w_t^N = (1 - \tau_L)w_t$  is the after-tax wage per efficiency unit of labor in period  $t = 1, 2$ .

Policy tools at the government's disposal are *inter alia* labor income taxes and capital income taxes. We therefore assume that the government can effectively choose the after-tax wage rates ( $w_1^N$  and  $w_2^N$ ) and the after-tax discount factor ( $R$ ). The government can choose also  $T$ , the discounted sum of the lump-sum transfers ( $T_1$  and  $T_2$ ). Once  $w_1^N$ ,  $w_2^N$ ,  $R$  and  $T$  are chosen, then private consumption demands [ $C_1(R, w_1^N, w_2^N, T)$  and  $C_2(R, w_1^N, w_2^N, T)$ ] are determined. The cutoff level,  $e^*$ , and labor supplies,  $L_1$  and  $L_2$ , are also determined as follows:

$$e^*(R, w_1^N, w_2^N) = (1 - q)[1 + Rw_2^N/w_1^N] - \gamma/w_1^N, \quad (7.2')$$

$$L_1(R, w_1^N, w_2^N) = \int_0^{e^*(R, w_1^N, w_2^N)} (1 - e) dG + q\{1 - G[e^*(q, w_1^N, w_2^N)]\}, \quad (7.3')$$

and

$$L_2(R, w_1^N, w_2^N) = G[e^*(R, w_1^N, w_2^N)] + q\{1 - G[e^*(R, w_1^N, w_2^N)]\}. \quad (7.4')$$

In choosing its policy tools  $(R, w_1^N, w_2^N, \text{ and } T)$  and its public-consumption demands  $(C_1^G \text{ and } C_2^G)$ , the government is constrained by the economy-wide "budget" constraint (7.26), where  $C_1$ ,  $C_2$ ,  $L_1$ ,  $L_2$  and  $e^*$  are replaced by the functions  $C_1(\cdot)$ ,  $C_2(\cdot)$ ,  $L_1(\cdot)$ ,  $L_2(\cdot)$  and  $e^*(\cdot)$ , given by equations (7.14) and (7.2') – (7.4'), respectively. Note that the capital stock in the first period ( $K_1$ ) is exogenously given. The capital stock in the second period ( $K_2$ ) must satisfy the investment rule of the firm [equation (7.18)]. Note that because the economy is financially open, the individuals, by the arbitrage condition [equation (7.9)], are indifferent between channelling their savings domestically or abroad. This means that the government can choose  $K_2$ , and then  $r$  and the pre-tax wages ( $w_1$  and  $w_2$ ) are determined so as to clear the capital market

and labor market in each period through equations (7.18), (7.16) and (7.17), respectively. This does not mean that the government actually chooses the stock of capital ( $K_2$ ) for the firm, or the pre-tax wage rates ( $w_1$  and  $w_2$ ), or the domestic interest rate ( $r$ ). Rather  $w_1$ ,  $w_2$  and  $r$  are determined by market clearance and the firm chooses  $K_2$  so as to maximize its value. What we did is to determine  $K_2$ ,  $w_1$ ,  $w_2$  and  $r$  at levels which are compatible with firm-value maximization and market clearance in the presence of taxes.

To sum up, the government in a political-economy equilibrium chooses  $C_1^G$ ,  $C_2^G$ ,  $R$ ,  $w_1^N$ ,  $w_2^N$ ,  $T$  and  $K_2$ , so as to maximize the utility of the median voter [as given by equation (7.27)], subject to the economy-wide “budget” constraint, equation (7.26). Note that  $C_1$ ,  $C_2$ ,  $L_1$ ,  $L_2$  and  $e^*$  in the latter constraint are replaced by the functions  $C_1(\cdot)$ ,  $C_2(\cdot)$ ,  $L_1(\cdot)$ ,  $L_2(\cdot)$  and  $e^*(\cdot)$ , respectively.

Note that in this maximization,  $K_2$  appears only in the economy-wide “budget” constraint, equation (7.26). Thus, the first-order condition for the political-economy equilibrium level of  $K_2$  is given by:

$$1 - R^* F_K(K_2, L_2) - R^*(1 - \delta) = 0. \quad (7.28)$$

Note that this choice does not depend on whether the median voter is skilled

or unskilled.

Substituting the firm's investment rule, equation (7.18), and rearranging terms yield:

$$1 - \delta + F_K(K_2, L_2) = 1 + (1 - \tau_N^*)r^*. \quad (7.29)$$

The political economy equilibrium stock of capital [implicitly determined from equation (7.29) ascertains the Diamond-Mirrlees (1971) aggregate production efficiency theorem: The intertemporal marginal rate of transformation [which is  $1 - \delta + F_K(K_2, L_2)$ ] must be equated to the world intertemporal marginal rate of transformation faced by the domestic economy [which is equal to  $1 + (1 - \tau_N^*)r^*$ ].

This rule can be seen in Figure 7.1, where first-period total (private and public) consumption ( $C_1 + C_1^G$ ) is plotted on the horizontal axis and second-period total consumption ( $C_2 + C_2^G$ ) on the vertical axis. Suppose that  $L_1$ ,  $L_2$  and  $e^*$  were already set at their political-economy equilibrium levels. The production possibility frontier is described by the curve  $ABD$  whose slope is equal (in absolute value) to  $(1 - \delta) + F_K(K_2, L_2)$ . The optimal-tax stock of  $K_2$  is  $HD$ , which gives rise to the consumption possibility frontier given by  $MBN$ . Any other level of  $K_2$ , say  $H'D$ , must generate a lower consumption

possibility frontier - the curve  $M'B'N'$ .

Employing the firm's investment rule [the marginal productivity condition (7.18)] and the arbitrage condition [equation (7.9)], we can conclude from equation (7.29) that:

$$r = (1 - \tau_N^*)r^*. \quad (7.30)$$

That is, the pre-tax domestic rate of interest ( $r$ ) must be equated to world rate of interest faced by the domestic economy, which is the world rate of interest, net of the source taxes. Equations (7.9) and (7.30) yield the political-economy equilibrium tax on foreign-source income:

$$\tau_F = \tau_D(1 - \tau_N^*). \quad (7.31)$$

Thus, in the political-economy equilibrium, the home country imposes the same tax rate ( $\tau_D$ ) on foreign-source income from capital as on domestic-source income from capital, except that a deduction is allowed for foreign taxes paid (and levied at source): One euro earned abroad is subject to a tax at source at the rate  $\tau_N^*$ ; the after-foreign-tax income, which is  $1 - \tau_N^*$ , is then taxed by the home country at the rate  $\tau_D$ . The total effective tax rate paid on

foreign-source income is therefore:

$$\tau_F + \tau_N^* = \tau_D + \tau_N^* - \tau_N^* \tau_D.$$

### 7.3. International Tax Competition and Capital Taxation

A critical issue of taxation, in the era of globalization of the capital markets, is the ability of national governments to tax their residents on foreign-source capital income. An editorial in the **New York Times** (May 26th, 2001) underscores the severity of this issue:

“From Antigua in the Caribbean to Nauru in the South Pacific, offshore tax havens leach billions of dollars every year in tax revenues from countries around the world... . The Internal Revenue Service estimates that Caribbean tax havens alone drain away at least \$70 billion per annum in personal income tax revenue. The OECD suspects the total worldwide to be in the hundreds of billions of dollars... the most notorious tax havens do not even extend their minimal tax rates to their own citizens or domestic enterprises. Their primary aim is to encourage and profit from individuals and businesses seeking to evade taxes in their own

countries."

It is fairly safe to argue that tax havens, and the inadequacy of cooperation among national tax authorities in the OECD in information exchanges, put binding ceilings on how much foreign-source capital income can be taxed. What then are the implications for the taxes on **domestic-source** capital income?

Consider the extreme situation where the home country cannot effectively enforce any tax on foreign-source capital income of its residents. That is, suppose that  $\tau_F = 0$ . Then we can see from the political-equilibrium tax rule applying to foreign-source capital income, equation (7.31), that the tax rate on **domestic-source** capital income,  $\tau_D$ , would be set to zero too. Thus, the capital income tax vanishes altogether. And even if some enforcement of taxation on foreign-source capital income is feasible so that  $\tau_F$  does not vanish altogether, it still follows from equation (7.31) that  $\tau_D = \tau_F / (1 - \tau_N^*)$ ; so that a low  $\tau_F$  generates a low  $\tau_D$ . Indeed a poor enforcement of international taxes would generate political processes that curtail any burden of capital income taxation.

The unwillingness of foreign tax authorities to cooperate with the home tax authority in helping to enforce capital taxation on the capital income of

residents of the home country originating abroad usually stems from their desire to lure capital to their countries. This is what is meant by tax competition. They further compete with the home country by lowering the source tax ( $\tau_N^*$ ) they levy on the capital income of the residents of the home country. We thus capture formally the effect of tax competition by assuming that  $\tau_N^*$  falls. Then we can see from equation (7.30) that  $r$ , the net (of depreciation  $\delta$ ) marginal product of domestic capital, must rise. With diminishing marginal product, this happens when the stock of domestic capital falls and more capital flows abroad. Hence, the tax base for the **domestic-source** capital income shrinks, thereby turning the enforcement of foreign-source capital income all the more acute. Thus, a welfare state that relies on capital taxes is akin to a house built on sand.

#### 7.4. Tax Coordination

Can tax coordination among countries salvage capital taxation as a powerful source of financing the welfare state? When countries coordinate their tax systems and enforcement efforts, it seems that they can escape the "race to the bottom" outcome of international tax competition.

Indeed some minimal degree of coordination is always necessary in order to stop unlimited capital flight due to rate-of-return arbitrage. To see this,

consider two countries (A and B). Denote their domestic interest rates by  $r^A$  and  $r^B$ . Then for capital not to fly completely to one country or another, net-of-tax rates of return must be equalized. That is, a resident in each country must earn the same net-of-tax rate of return when investing at home or when investing abroad:

$$(1 - \tau_D^A)r^A - (1 - \tau_F^A - \tau_N^B)r^B = 0 \quad (7.32)$$

$$(1 - \tau_F^B - \tau_N^A)r^A - (1 - \tau_D^B)r^B = 0 \quad (7.33)$$

where:

$\tau_D^i$  - tax levied by country  $i$  on domestic-source income of its residents;

$\tau_N^i$  - tax levied by country  $i$  on capital income of nonresidents;

$\tau_F^i$  - the additional **effective** tax levied by country  $i$  on foreign-source income of its residents;

$i = A, B$ .

Thus, an interior solution to  $r^A$  and  $r^B$  (without a complete capital flight from one country to another) requires that :

$$(1 - \tau_D^A)(1 - \tau_D^B) = (1 - \tau_F^A - \tau_N^B)(1 - \tau_F^B - \tau_N^A). \quad (7.34)$$

This condition which contains the tax rates of the two countries must indeed involve some coordination between the two countries. The level of this coordination may be very small, such as that they both agree on applying the **residence principle** [see Frenkel, Razin and Sadka (1991)]. According to this principle, each country levies a uniform tax on the world-wide income of its residents and exempts nonresidents, that is:

$$\tau_D^i = \tau_F^i \text{ and } \tau_N^i = 0 \quad i = A, B. \quad (7.35)$$

In this case, condition (7.34) holds. Similarly, if both countries agree to adopt the **source principle** of international taxation (that is,  $\tau_D^i = \tau_N^i$  and  $\tau_F^i = 0$ ,  $i = A, B$ ), then condition (7.34) holds.

Note also that it is the residence principle that leads to aggregate (world-wide) production efficiency which requires equalization of before-tax rates of return, that is:

$$r^A = r^B.$$

In this case where  $\tau_D^i = \tau_F^i$ , if the two countries would like to maintain non-negligible taxes on capital (that is  $\tau_D^i = \tau_F^i > 0$ ), then there is another level of coordination which is needed. They have to agree to help each other enforce the tax on foreign source income of residents (namely,  $\tau_F^i$ ).

Nevertheless, if there is a third country which is not a party to this coordination, then we are back to the "race to the bottom" outcome of international tax competition. It is thus doubtful whether the welfare state can rely on capital taxation for its survival.

### 7.5. Conclusion

We develop a stripped-down general-equilibrium model of a political-economy determination of capital taxation with a free mobility of capital internationally. We show how international tax competition severely curtails the scope of capital taxation as a means of finance for the welfare state benefits. Therefore, an aging welfare state, governed by political-economy forces, cannot avoid the tough task of downscaling its size by resorting to capital taxes, in order to finance the social transfers it provides.

### 7.5. Appendix: Walras' Law

In this appendix we demonstrate that the government budget constraint [equation (7.26)] is redundant, as it must be satisfied when equations (7.26) and (7.10) hold (Walras's Law).

Substituting the definitions of  $E_1(e)$  and  $E_2(e)$  in equations (7.7) and (7.8), respectively, into the individual budget constraint [equation (7.10)], aggregating over all individuals and dividing by  $R$  yields:

$$C_1/R + C_2 = T_1/R + T_2 + (1 - \tau)w_1L_1/R + (1 - \tau_L)w_2L_2 - G(e^*)\gamma/R, \quad (\text{A7.1})$$

where use is made of the definitions of  $L_1$  and  $L_2$  in equations (7.3) and (7.4), respectively. Now, divide the economy-wide "budget constraint", equation (7.26), by  $R^*$ , and subtract it from equation (A7.1) to get:

$$\begin{aligned}
& C_1 \left( \frac{1}{R} - \frac{1}{R^*} \right) - \frac{T_1}{R} - T_2 - \frac{(1 - \tau_L)w_1 L_1}{R} \\
& - (1 - \tau_L)w_2 L_2 + G(e^*)\gamma \left( \frac{1}{R} - \frac{1}{R^*} \right) - \\
& \frac{C_1^G}{R^*} - C_2^G - \frac{K_2 - (1 - \delta)K_1}{R^*} + \frac{F(K_1, L_1)}{R^*} + \\
& F(K_2, L_2) + (1 - \delta)K_2 = 0.
\end{aligned} \tag{A7.2}$$

Note that:

$$\frac{1}{R} - \frac{1}{R^*} = 1 + (1 - \tau_D)r - [1 + (1 - \tau_N^*)r^*] = -\tau_F r^*, \tag{A7.3}$$

by equation (7.9). Substituting equation (A7.3) into equation (A7.2) yields:

$$\begin{aligned}
& -\tau_F r^* C_1 - \frac{T_1}{R^*} + \tau_F r^* T_1 - T_2 \\
& - \frac{(1 - \tau_L) w_1 L_1}{R^*} + \tau_F r^* (1 - \tau_L) w_1 L_1 \\
& - (1 - \tau_L) w_2 L_2 - \tau_F r^* G(e^*) \gamma \\
& - \frac{C_1^G}{R^*} - C_2^G - \frac{K_2 - (1 - \delta) K_1}{R^*} + \\
& \frac{F(K_1, L_1)}{R^*} + F(K_2, L_2) + (1 - \delta) K_2 = 0.
\end{aligned} \tag{A7.4}$$

Substituting the definition of  $\pi_1$  from equation (7.19), and Euler's equation [namely,  $F(K_2, L_2) = F_K(K_2, L_2) K_2 + F_L(K_2, L_2) L_2 = (r + \delta) K_2 + w_2 L_2$ , by the marginal productivity conditions (7.17) and (7.18)], into equation (A7.4) yields:

$$\begin{aligned}
& \tau_F r^* [T_1 + (1 - \tau_L) w_1 L_1 - C_1 - G(e^*) \gamma] - \frac{T_1}{R^*} \\
& - T_2 + \frac{\pi_1}{R^*} + \frac{\tau_L w_1 L_1}{R^*} + \tau_L w_2 L_2 + r K_2 - \frac{K_2}{R^*} + \\
& K_2 - \frac{C_1^G}{R^*} - C_2^G + \frac{\tau_D [F(K_1, L_1) - \delta K_1 - w_1 L_1]}{R^*} = 0.
\end{aligned} \tag{A7.5}$$

Finally, substituting the arbitrage condition, equation (7.9), into equa-

tion (A7.5), and multiplying by  $R^*$ , yield:

$$\begin{aligned}
& R^* \tau_F r^* [T_1 + (1 - \tau_L)w_1 L_1 - C_1 - G(e^*)\gamma - K_2] \\
& + R^* \tau_D r K_2 + \tau_L w_1 L_1 + R^* \tau_L w_2 L_2 + \pi_1 + \tau_D [F(K_1 L_1) - \delta K_1 - w_1 L_1] \\
= & C_1^G + R^* C_2^G + T_1 + R q^* T_2.
\end{aligned} \tag{A5.6}$$

Note that the government has effectively appropriated the initial stock of capital,  $K_1$ , by fully taxing away the surplus stemming from it. Therefore, the households must finance through their savings, which is  $T_1 + (1 - \tau_L)w_L L_1 - C_1$ , all three forms of investment: The investment in human capital,  $G(e^*)\gamma$ , the entire new domestic stock of domestic capital,  $K_2$ , and the private financial investment abroad. Consequently,

$$S_D = K_2 \tag{A7.7}$$

and

$$S_F = T_1 + (1 - \tau_L)w_1 L_1 - C_1 - G(e^*)\gamma - K_2. \tag{A7.8}$$

Substituting equations (A7.7) and (A7.8) into equation (A7.6) yields the consolidated government budget constraint, equation (7.20); validating Walras's Law.

### Notes

1. Evidently, if the tax is progressive, the payoff would be reduced proportionally more than the foregone-income cost.
2. Because leisure time is exogenously given, it is dropped out from the utility function. Nevertheless, as before, a labor tax is still distortionary, because it affects the decision to acquire skill; see equation (7.2).
3. These rates ( $r$  and  $r^*$ ) hold in essence between periods one and two and we therefore assign no time subscript (one or two) to these rates.
4. Evidently in a non-stochastic set-up like ours, the country is either capital exporter or capital importer.
5. Note that even though  $T$  may seem at first glance to be dependent on  $\tau_D$  (through the discount factor  $R$ ), we may nevertheless assume that these are two independent policy tools because the government can always change either  $T_1$  and  $T_2$  in order to keep  $T$  constant when it changes  $\tau_D$ .
6. For notational simplicity, we assume that the net external assets are initially equal to zero, so that there is no initial external debt payment term in the

*CA.*

7.  $\tau_N^i$  could be positive provided tax credits are offered for foreign taxes.

## **8. DOWNWARD CONVERGENCE OF CAPITAL TAXATION ACROSS COUNTRIES: EVIDENCE FROM THE EU**

### **8.1. Introduction**

Our theory suggests that because of international tax competition, capital-market globalization generates political economy processes that curtail capital taxes. In this chapter we supplement this finding with some empirical evidence from the EU.

### **8.2. Capital Taxes: Panel Data**

In chapter 6 (table 6.2) we provide estimates of determinants of capital tax rates, *inter alia*, in a sample of ten EU countries over the period 1970 to 1996.<sup>1</sup> Among the determinants are three openness variables that we now elaborate on.

The first variable is the gross stock of international portfolio assets (that is, both the stock that foreigners invested in the country and the stock that residents of this country invested abroad).<sup>2</sup> Its coefficient is negative and

significant (at the one-percent level) in both the OLS regression and the two systems regressions. This result is in line with the notion that there is international tax competition for relatively mobile portfolio investments, so that a country with more mobility has lower capital tax rates. This hypothesis is further supported by Hines (1999), Sorensen (2000), Besley, Griffith and Klemm (2001), Devereux, Griffith and Klemm (2002), Devereux and Griffith (2002), and Lassen and Sorensen (2002).

The second variable is the **gross** stock of foreign direct investment assets. However, its coefficient is not statistically different from zero in the systems equations. The greater "fixity" of direct investment, compared to portfolio investment, likely lessens the importance of international tax competition, accounting for this finding of little effect of direct investment on the setting of capital tax rates. Also, foreign direct investments often qualify for a special tax treatment by the host country, so that its effective tax rate need not be related to the average tax rate on capital income. In addition, FDI stock may generate intra-firm trade, so that it may be correlated with the measure of trade openness (see below). Therefore, the coefficient turns out to be statistically insignificant.

The aforementioned two variables obviously relate to the globalization

of capital markets. The third variable is trade openness as measured by the volume of trade (imports plus exports of goods and services). Its coefficient is negative in all three equations, but not statistically different from zero. This might indicate that countries that are open along other dimensions, such as goods trade, face more tax competition on capital, and that capital openness and goods trade openness are correlated in the sample. We note also that trade openness has a positive and significant effect on the labor tax rate in all three regressions. One possible interpretation is that with the erosion of the base for capital taxation, resorting to labor taxation is inevitable.<sup>3</sup>

### 8.3. The Effects of the European Single Market

The event of the creation of a single market in Europe creates a rare natural experiment for the effects of capital market openness on capital income taxation. We highlight the effects of this event on the corporate sector in the EU.

The **statutory** tax rates have indeed declined since the 1970s by from 11 percentage points (Germany) to 26 percentage points (Ireland). However, the meaningful tax rates from an economic point of view are the **effective** tax rates which may substantially differ from the statutory rates. We therefore calculate effective tax rates on corporate income. These calculations are based

on the well-known work of Hall and Jorgenson (1967) who introduced the user-cost of capital approach.<sup>4</sup> We follow here the formula for the effective tax rate on corporate income ( $\tau_e$ ) refined by Auerbach (1983):<sup>5</sup>

$$\tau_e = \frac{(r + \delta)(1 - \tau_s z) - (r + \delta)(1 - \tau_s)}{(r + \delta)(1 - \tau_s z) - \delta(1 - \tau_s)},$$

where

$r$  — real rate of return the firm must earn after corporate taxes (by instruction of its shareholders)

$\delta$  — physical rate of depreciation (assumed exponential)

$\tau_s$  — statutory corporate tax rate

$z$  — present value of depreciation allowances.<sup>6</sup>

The calculations were carried out for fourteen EU countries for the period 1974-2000. The countries are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom. The results are depicted in Figure 8.1. One can clearly detect a downward breakpoint at the end of the 1980s in the wake of the single market event. Overall, the mean EU effective corporate tax rate went down from 42% in 1975 to 32% in 2000, and the standard deviation went down from 8% in 1975 to 5.8% in 2000.

Evidently, globalization seems to be a catalyst to a major cut in the taxes on corporate income.

#### 8.4. Conclusion

We present empirical evidence on the behavior of taxes on capital income in the EU in the last three decades of the 20th century. It points to the notion that international tax competition that follows globalization of capital markets put strong downward pressures on the taxation of capital income. The latter cannot come to the rescue of the aging welfare state.

#### Notes

1. These countries are Austria, Belgium, Finland, France, Germany, the Netherlands, Norway, Spain, Sweden and the United Kingdom.
2. We use the stocks rather than the flows of foreign portfolios, because the former, as explanatory variables, may be less prone to endogeneity problems when the dependent variable is the tax rate.
3. As put by **The Economist** (September 29th, 2001) in a survey on globalization (p. 16): "Since workers tend to stay put, governments can tax them at surprisingly high rates without provoking flight."
4. For a recent refinement of Hall and Jorgenson see Gordon, Kalambokidis and Slemrod (2003).

5. This formula assumes equity finance of investment.
6. The present value is obtained by discounting nominal statutory depreciation allowances at the rate  $r + \pi$ , where  $\pi$  is the expected inflation rate.

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**Table 2.1: Determinants of the Labor Tax Rate and Social Transfers (274 observations)**

|                                                | Labor Tax rate    |                   | Social Transfers   |                   |
|------------------------------------------------|-------------------|-------------------|--------------------|-------------------|
| Independent variable                           | (i)               | (ii)              | (iii)              | (iv)              |
| (Return to education) x (High-education share) |                   | 0.895<br>(3.41)   |                    | 9.098<br>(4.54)   |
| Dependency rate                                | −0.466<br>(−4.61) | −0.159<br>(−1.19) | −8.409<br>(−10.73) | −5.290<br>(−5.18) |
| Government jobs/employment                     | 0.838<br>(10.18)  | 0.816<br>(10.08)  | 3.519<br>(5.52)    | 3.294<br>(5.34)   |
| Trade openness                                 | 0.225<br>(6.49)   | 0.210<br>(6.12)   | 0.533<br>(1.98)    | 0.378<br>(1.44)   |
| Per capita GDP growth                          | −0.292<br>(−3.23) | −0.236<br>(−2.62) | −2.814<br>(−4.02)  | −2.251<br>(−3.28) |
| Income skewedness                              | −0.006<br>(−0.33) | −0.015<br>(−0.87) | 0.423<br>(3.06)    | 0.326<br>(2.42)   |
| R <sup>2</sup>                                 | 0.684             | 0.698             | 0.623              | 0.651             |

Note: All specifications include country fixed effects (coefficients not shown).

The  $t$  statistics are in parentheses.

**Table 2.2: Determinants of Tax Rate on Labor Income****(dependent variable: labor tax rate, 146 observations)<sup>a</sup>**

|                                                  | (1)                | (2)               | (3)               | (4)                | (5)               |
|--------------------------------------------------|--------------------|-------------------|-------------------|--------------------|-------------------|
| Government jobs/total employment                 | 0.879<br>(7.34)    | 0.877<br>(7.34)   | 0.620<br>(4.65)   | 0.901<br>(8.75)    | 0.699<br>(5.52)   |
| Dependency ratio                                 | -1.168<br>(-7.59)  | -1.287<br>(-7.05) | -1.358<br>(-7.76) | -1.185<br>(-6.96)  | -1.254<br>(-7.53) |
| Trade openness                                   | -0.003<br>(-0.10)  | -0.004<br>(-0.16) | -0.045<br>(-1.65) | 0.008<br>(0.34)    | -0.026<br>(-0.99) |
| Per capita GDP growth                            | -0.015<br>(-0.25)  | -0.035<br>(-0.55) | -0.006<br>(-0.10) | 0.027<br>(0.45)    | 0.042<br>(0.72)   |
| Rich/middle income share                         | -0.009<br>(-0.18)  | -0.033<br>(-0.62) | -0.019<br>(-0.37) | -0.033<br>(-0.68)  | -0.022<br>(-0.47) |
| Poor/middle income share                         | -0.065<br>(-0.040) | -0.101<br>(-0.61) | -0.059<br>(-0.38) | -0.017<br>(-0.11)  | 0.006<br>(0.04)   |
| Unemployment rate                                |                    |                   | 0.327<br>(3.73)   |                    | 0.259<br>(3.07)   |
| Immigrants/population                            |                    | -0.403<br>(-1.20) | -0.614<br>(-1.89) | -10.852<br>(-4.88) | -9.723<br>(-4.45) |
| Medium + high education<br>immigrants/population |                    |                   |                   | 19.043<br>(4.75)   | 16.679<br>(8.37)  |
| R <sup>2</sup>                                   | 0.652              | 0.656             | 0.690             | 0.708              | 0.728             |

<sup>a</sup> All specifications include country fixed effects (coefficients not shown).The *t* statistics are in parentheses.

**Table 2.3: Determinants of Per Capita Social Transfers**

(dependent variable: social transfers per capita in  
real dollars, 146 observations)<sup>a</sup>

|                                                  | (1)                | (2)               | (3)               | (4)                | (5)                |
|--------------------------------------------------|--------------------|-------------------|-------------------|--------------------|--------------------|
| Government jobs/total employment                 | 4.359<br>(3.13)    | 4.461<br>(3.65)   | 5.263<br>(3.69)   | 4.618<br>(3.84)    | 5.825<br>(4.14)    |
| Dependency ratio                                 | -10.247<br>(-5.72) | -3.908<br>(-2.09) | -3.685<br>(-1.96) | -3.346<br>(-1.81)  | -2.941<br>(-1.59)  |
| Trade openness                                   | -2.028<br>(-6.73)  | -1.946<br>(-7.35) | -1.819<br>(-6.29) | -1.879<br>(-7.19)  | -1.682<br>(-5.87)  |
| Per capita GDP growth                            | -1.388<br>(-1.95)  | -0.336<br>(-0.52) | -0.425<br>(-6.25) | 0.009<br>(0.01)    | -0.078<br>(-0.12)  |
| Rich/middle income share                         | -2.399<br>(-4.22)  | -1.115<br>(-2.07) | -1.159<br>(-2.15) | -1.117<br>(-2.11)  | -1.181<br>(-2.24)  |
| Poor/middle income share                         | -7.350<br>(-3.89)  | -5.424<br>(-3.21) | -5.554<br>(-3.29) | -4.959<br>(2.97)   | -5.090<br>(-3.07)  |
| Unemployment rate                                |                    |                   | -1.022<br>(-1.09) |                    | -.514<br>(-1.62)   |
| Immigrants/population                            |                    | 21.583<br>(6.30)  | 22.244<br>(6.39)  | -36.328<br>(-1.51) | -42.945<br>(-1.77) |
| Medium + high education<br>immigrants/population |                    |                   |                   | 105.532<br>(2.43)  | 119.375<br>(2.71)  |
| R <sup>2</sup>                                   | 0.497              | 0.616             | 0.620             | 0.633              | 0.641              |

<sup>a</sup> All specifications include country fixed effects (coefficients not shown).

The *t* statistics are in parentheses.

**Table 6.1. Summary Statistics**

(169 observations)

| Country     | Years | Old/<br>Pop | Labor<br>Tax | Capital<br>Tax | Govt Job<br>Share | Dependents/<br>Population |
|-------------|-------|-------------|--------------|----------------|-------------------|---------------------------|
| Spain       | 80-86 | 11.5        | 32.6         | 13.8           | 11.1              | 63.5                      |
| Austria     | 70-92 | 14.8        | 37.4         | 21.1           | 17.7              | 56.1                      |
| France      | 82-96 | 14.0        | 46.5         | 26.2           | 23.2              | 56.2                      |
| Germany     | 70-96 | 14.9        | 39.1         | 27.5           | 14.6              | 54.0                      |
| Netherlands | 85-92 | 12.6        | 52.0         | 30.5           | 13.7              | 60.4                      |
| Belgium     | 70-91 | 14.2        | 42.6         | 34.7           | 18.0              | 59.6                      |
| Norway      | 81-91 | 15.8        | 39.2         | 40.5           | 26.5              | 50.0                      |
| Finland     | 86-92 | 13.2        | 34.0         | 45.3           | 21.1              | 48.8                      |
| Sweden      | 71-92 | 16.5        | 46.5         | 52.0           | 29.7              | 48.6                      |
| UK          | 70-96 | 14.9        | 25.7         | 56.5           | 19.7              | 52.2                      |

| Country     | Years | Trade    | FDI/ | Intl Portfolio | GDP  |
|-------------|-------|----------|------|----------------|------|
|             |       | Openness | GDP  | Stock/GDP      | Grow |
| Spain       | 80-86 | 39.7     | 8.6  | 0.9            | 1.7  |
| Austria     | 70-92 | 69.7     | 6.6  | 1.8            | 3.0  |
| France      | 82-96 | 44.4     | 17.5 | 7.9            | 1.9  |
| Germany     | 70-96 | 50.1     | 9.6  | 5.2            | 2.7  |
| Netherlands | 85-92 | 103.2    | 65.7 | 32.7           | 2.8  |
| Belgium     | 70-91 | 121.8    | 19.6 | 3.5            | 2.7  |
| Norway      | 81-91 | 74.5     | 13.3 | 2.3            | 2.4  |
| Finland     | 86-92 | 49.8     | 10.8 | 0.6            | 0.8  |
| Sweden      | 71-92 | 59.6     | 13.8 | 1.9            | 1.7  |
| UK          | 70-96 | 52.1     | 41.1 | 23.1           | 2.1  |

**Table 6.2: Determinants of Capital and Labor Tax Rates**  
(169 observations)

|                  | OLS               |                   | 2SLS              |                   | 3SLS              |                   |
|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                  | Capital           | Labor             | Capital           | Labor             | Capital           | Labor             |
| Old/population   | 2.033<br>(2.23)   |                   | 3.532<br>(2.58)   |                   | 2.820<br>(2.27)   |                   |
| Dependency ratio |                   | -0.438<br>(-3.59) |                   | -0.443<br>(-3.43) |                   | -0.443<br>(-3.61) |
| Capital tax rate |                   |                   |                   | -0.054<br>(-0.68) |                   | 0.030<br>(0.41)   |
| Labor tax rate   |                   |                   | 2.493<br>(1.60)   |                   | 2.295<br>(1.63)   |                   |
| FDI stock        | 0.199<br>(1.90)   |                   | 0.001<br>(0.00)   |                   | 0.116<br>(0.77)   |                   |
| Portfolio stock  | -0.335<br>(-3.84) |                   | -0.418<br>(-3.83) |                   | -0.440<br>(-4.41) |                   |
| Trade openness   | -0.026<br>(-0.38) | 0.117<br>(5.19)   | -0.285<br>(-1.60) | 0.113<br>(4.63)   | -0.282<br>(-1.74) | 0.113<br>(4.87)   |
| Govt job share   | 0.876<br>(3.26)   | 0.827<br>(10.94)  | -1.805<br>(-1.06) | 0.907<br>(6.36)   | -1.512<br>(-0.98) | 0.907<br>(6.68)   |
| GDP growth       | -0.711<br>(-4.18) | -0.073<br>(-1.25) | -0.603<br>(-3.04) | -0.116<br>(-1.31) | -0.594<br>(-3.25) | -0.116<br>(-1.38) |
| Income skewness  | -0.152<br>(-3.04) | 0.077<br>(4.12)   | -0.313<br>(-2.73) | 0.069<br>(3.64)   | -0.309<br>(-2.95) | 0.070<br>(3.82)   |
| R <sup>2</sup>   | 0.432             | 0.204             | 0.178             | 0.241             | 0.897             | 0.960             |

All specifications include country fixed effects (coefficients not shown).