The Decline of the Welfare State: AGING, MIGRATION, AND THE WIDENING WAGE GAP

by

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[Based on a joint work with Phillip Swagel]

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2. 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:[1]

> "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 tax rates and the generosity of transfers. Using panel data on the United States and European countries in the 1970s-1990s, we provide supportive empirical evidence.

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, γ, which is not tax deductible.[2] 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, τ, 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. 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:

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

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.[3] Thus, for analytical tractability, we assume that the production function is effectively linear in labor, L, and capital, K :

$$Y = wL+(1 + r)K, \tag{2.2}$$

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 τ, so that the tax-transfer is distortive.[4] Note also that an increase in τ 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:

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

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 n period 0), and $l(e_t^*) = \int_0^{e_t^*}(1-e)dG + q[1-G(e_t^*)]$ 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:

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

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 (τ), 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 τ_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:

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

(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:

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

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 period, it follows

that the transfer in period $t+1$, $b(\tau_{t+1}, n, q)$, is independent of the tax rate τ_t in period t. In voting on the tax rate τ_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, τ_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 τ_t, we find that:

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

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, τ_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.

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 theeducation-cost parameter for the median voter:

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

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

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

For given n and q, the political-economy equilibrium τ is constant over time, so that the time subscript t is suppressed henceforth. As τ_{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:

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

and the second-order condition is:

$$\frac{\partial^2 W[e_M(n), \tau_0(n, q), n, q]}{\partial \tau^2} = B[\tau_0(n, q), n, q] \leq 0, \tag{2.10}$$

where the B_τ 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:

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

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 decompossed 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

$$\tau \frac{\partial I_A}{\partial \tau} = I_M - I_A, \tag{2.12}$$

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)].[5]

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:

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

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, τ_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:

$$B_n[\tau_o(n,q),n,q] = \begin{cases} w\frac{de_M}{dn} + wl\{e^*[\tau_0(n,q),q]\}\frac{1}{(2+n)^2} + \tau\frac{\gamma}{(1-\tau)}\frac{g\{e^*[\tau_0(n,q),q]\}}{(2+n)^2}\frac{\partial e^*}{\partial \tau} \\ \text{if } \; e_M < e^*[\tau_0(n,q),q] \\ \\ wl\{e^*[\tau_0(n,q),q]\}\frac{1}{(2+n)^2} + \tau\frac{\gamma}{(1-\tau)}\frac{g\{e^*[\tau_0(n,q),q]\}}{(2+n)^2}\frac{\partial e^*}{\partial \tau} \\ \text{if } \; 1 > e_M > e^*[\tau_0(n,q)], \end{cases} \tag{2.14}$$

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, τ_o, and consequently, the amount of the per-capita transfer, b.[7] On inspection of the right-hand side of equation (2.14), we can see that it contains one term - $wl\{e^*[\tau_0(n,q),q]\}/(2+n)^2$ - 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).[6] 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 poultion lowers the political-economy equilibrium tax rate and transfer.

If the median voter is an unskilled worker, $B_n[\tau_o(n,q),n,q]$ 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).[8] 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 $B_n[\tau_o(n,q),n,q]$ is positive.[91] It then follows that aging of the population lowers the political-economy equilibrium tax rate and the per capita transfer, τ and b.

We have so far assumed that $n > 0$, so that the median voter is a member of the

[1]To see this, let γ approach zero. Then, one can see from equation (14) that B_n approaches a positive limit of $wl\{e^*[\tau_0(n,q),q)]\}/(2+n)^2$, if τ does not approach one. From equation (??) it can be verified that τ does indeed not approach one if q is sufficiently large.

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 (τ) labor income. This term —either $(1-\tau)w(1-e_M)$ or $(1-\tau)wq$— is decreasing in τ. 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.

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:

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

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:

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

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

Because B_τ 5 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:

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

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:

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

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 γ, 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.

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.[10] 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.

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

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 (3.41)		9.098 (4.54)
Dependency rate	−0.466 (−4.61)	−0.159 (−1.19)	−8.409 (−10.73)	−5.290 (−5.18)
Government jobs/employment	0.838 (10.18)	0.816 (10.08)	3.519 (5.52)	3.294 (5.34)
Trade openness	0.225 (6.49)	0.210 (6.12)	0.533 (1.98)	0.378 (1.44)
Per capita GDP growth	−0.292 (−3.23)	−0.236 (−2.62)	−2.814 (−4.02)	−2.251 (−3.28)
Income skewedness	−0.006 (−0.33)	−0.015 (−0.87)	0.423 (3.06)	0.326 (2.42)
R^2	0.684	0.698	0.623	0.651

Note: All specifications include country fixed effects (coefficients not shown). The t statitics are in parentheses.

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, τ 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.

Table 2.2: Determinants of Tax Rate on Labor Income (dependent variable: labor tax rate, 146 observations)[a]

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

[a] All specifications include country fixed effects (coefficients not shown). The t statistics are in parentheses.

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. 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).

Table 2.3: Determinants of Per Capita Social Transfers

(dependent variable: social transfers per capita in real dollars, 146 observations)[a]

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

[a] All specifications include country fixed effects (coefficients not shown). The t statistics are in parentheses.

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 significant, 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 oppeness (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.

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.

Appendix

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.

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 explanory 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).

Table 6.1. Summary Statistics

(169 observations)

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

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

6.5. Appendix: Capital and Labor Tax Rates

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

4. 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.

5. 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.

6. 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.

7. 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.

8. 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%.

9. To see this, let γ 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 τ does not approach one. From equation (2.11) it can be verified that τ does indeed not approach one if q is sufficiently large.

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

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