WORKING PAPER No. 49
January, 1996

GENERATIONAL ACCOUNTING IN A SMALL OPEN ECONOMY

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Svensk resumé på sid 47.

GENERATIONAL ACCOUNTING

IN A SMALL OPEN ECONOMY

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Abstract:

The general government in Sweden runs an enormous current budget deficit and the public debt is increasing rapidly The paper investigates the effects of a stabilization of the economy for different generations. The results for Sweden show that it is feasible to pay back the public debt and still have an increasing disposable lifetime income in the future. The main reason why future generations are going to be better off than the current ones is that the increase in wages, due to growth in productivity, completely dominates over the reallocation between generations through the public sector. However, for most sustainable stabilization policies, individuals born before 1925 have to pay less in taxes than they get back in transfers, pensions and public goods, while individuals born after 1925 have to pay more than they get in return.

1. Introduction

The general government[2] in Sweden runs an enormous current budget deficit and the public debt is increasing rapidly. Politicians and economists declare that something has to be done very soon or future generations will have to pay an enormous bill. Some of them even declare that this is the end of the welfare state, because the enormous budget deficit is a sign that the welfare state is not sustainable. The objective of the paper is to provide a framework for thinking on inter-generational redistribution in a small open economy and to look at a few sustainable public policies for Sweden and the implications for the disposable income of different generations.

[1] I am grateful to Jose-Victor Rios-Rull, Tomas Nordström, Lars-Erik Öller, and the seminar participants at University of Pennsylvania, National Institute of Economic Research, and Economic Council of Sweden for helpful comments.

[2] Local and central government and social security funds.

Generational accounting is not a new concept. It was introduced by Auerbach, Gokhale, and Kotlikoff (1991),(1994) to analyze a country's long-term fiscal position. Specifically, they investigate whether the country's current fiscal policies can be sustained without requiring future generations to pay higher net taxes than current generations do. However, redistribution through the public sector is not the only way to reallocate resources between generations. Bequests given by parents to their children and productivity growth, that increases future wages are two other important mechanisms. Hence, future generations may have higher disposable income than current generations even though they have to pay for a public debt generated by their parents.

The framework used in this paper is an exogenous growth model with overlapping generations and very elaborate demographics that is able to accurately describe the actual age distribution each year. First, individuals are students acquiring human capital, then workers supplying labor, and finally retired not working at all. Total disposable income is either consumed by the individuals themselves or left as bequest to their children. There exists a public sector, that collects taxes, provides transfers, and distributes a public good for free. Both individuals and the public sector have access to an international credit market with a constant real interest rate. The model is calibrated for Sweden. Since individuals live for 80 years and demographics evolve slowly, we need a very long time horizon for some simulations: The longest does not end until 2450.

The results for Sweden show that it is feasible to pay back the public debt and still have an increasing disposable lifetime income in the future. The main reason why future generations are going to be better off than the current ones is that the increase in wages, due to growth in productivity, completely dominates over the other inter-generational redistribution mechanisms. For most sustainable policies, individuals born before 1925 have to pay less in taxes than they get back in transfers, pensions and public goods, while individuals born after

1925 have to pay more in taxes than they get in return. Lifetime net transfers for generations born in 1925 and later are negative since Sweden introduced a welfare system based on the pay-as-you-go principle without accumulating any public funds. In other words, the first generations collected welfare benefits without paying the corresponding taxes when they were young. Consequently, later generations have to pay for the first generation's benefits and therefore make positive net contributions to the public sector.

The model is described in section 2, calibrated in section 3, and simulations with public expenditure cuts, tax increases, and increased education are made in section 4. Finally, some concluding remarks are made in section 5.

2. The Model

A neo-classical growth model with perfect foresight and overlapping generations is constructed. Every generation consists of a large number of individuals. Each individual is first educated, then working and finally retired before she dies and leaves bequests to her children. Both education and working experience affect the skill. Output is produced by competitive firms and can either be consumed, invested or exported. The public sector redistributes income and produces services. It is financed by taxes on consumption, wages, interest payments, some of the transfers, and on bequests. Individuals, firms and the public sector all have access to an international credit market with a constant real interest rate.

There is infinite number of identical firms (a continuum of measure unity) with constant returns to scale technologies. The parameterization is given by the following Cobb-Douglas production function

(1) $f\left(k_t, z_t h_t\right) = k_t^{\theta}\left(z_t h_{at}\right)^{1-\theta}$,

where in period t: k_t is the capital stock, h_{at} the aggregate effective labor used by firms, and z_t is an exogenous productivity factor equal to all firms. All investment has quadratic installation costs which in equilibrium smooth out investment over time.

Individuals and the public sector can freely decide whether to invest in the international credit market with the constant interest rate r^* or in the stock market. Since there is no uncertainty in the model, the two alternatives must give exactly the same return. If V_t is the value of a firm in period t, the following arbitrage condition must hold:

(2) $\quad r^* V_t = D_t + \left(V_{t+1} - V_t\right),$

The return from the international credit market is on the left hand side. It has to equal period t dividends D_t plus capital gains on the right hand side. The tax rate is the same for interest payments, dividends and capital gains and therefore does not affect the arbitrage condition. Dividends equal the value of output net of investments and wages. Thus,

(3) $\quad D_t = f\left(k_t, h_{at}\right) - i_t\left(1 + \mu \dfrac{i_t}{k_t}\right) - w_t h_{at},$

where i_t is investments net of installation costs and w_t the wage rate for effective labor, and μ is a coefficient determining the installation cost. The law of motion for the capital stock is given by

(4) $\quad k_{t+1} = i_t + (1-\delta)k_t,$

where δ is the depreciation rate. Due to the arbitrage condition (2), firms exposed to competition maximize

(5) $\quad V_t = \displaystyle\sum_{j=0}^{\infty}\left(\frac{1}{1+r^*}\right)^j D_{t+j},$

subject to (3) and (4), and with respect to the sequences of k_t and h_{at}.

All individuals live for n years, independently of when they are born. The generation born in period t consists of a continuum of individuals of measure q_t (the size of the generation). The individuals are indexed by $i \in [0, q_t]$. All individuals generate offspring. The number of children an individual gets per year depends on his age and on the year considered in the following way. Let $\eta = (\eta_1, \eta_2, \ldots \eta_n)'$ be a constant vector and ϕ_t a time dependent exogenous variable. Then, an individual born in period t delivers $\phi_t \eta_1, \phi_{t+1}\eta_2, \ldots, \phi_{t+n-1}\eta_n$ children in periods t, t+1, ..., t+n-1 respectively. If the elements in η sum to unity, the time dependent part ϕ_t equals the net reproduction rate. Consequently, if the net reproduction rate is unity, everybody are just reproducing themselves. If it is larger everybody are getting more than one child, and if it is smaller everybody are getting less than one child. The model is approximately able to replicate actual demographic data through the choice of ϕ_t.[3]

The preferences are identical for all individuals. Each individual derives utility from private and public consumption, and disutility from supplying labor. In order to avoid a secular time trend in the labor supply, the disutility of labor increases over time at exactly the same rate as productivity changes in the private sector. The reason behind is that leisure is used for home production and that the productivity in home production increases by the same rate as productivity in the private sector. For individual i born in period t lifetime utility $u_t^{(i)}$ equals

$$(7) \quad u_t^{(i)} = (1-\alpha)\sum_{j=0}^{n-1} \beta^j \left\{ \ln\left(c_{t,t+j}^{(i)} - z_{t+j}\Lambda\left(l_{t,t+j}^{(i)}\right)\right) + v\left(c_{t+j}^{gov}\right)\right\} + \alpha\beta^n \ln b_{t,t+n}^{(i)},$$

where $c_{t,t+j}^{(i)}$ is private consumption, c_{t+j}^{gov} per capita consumption of the publicly provided good, and $l_{t,t+j}^{(i)}$ labor supply in period t+j. Further, $b_{t,t+n}^{(i)}$ is the bequest he leaves to his children when he dies. The function Λ determines the conditions for home production and is given by the relation

$$(8) \quad \Lambda\left(l_{t,t+j}^{(i)}\right) = \frac{\varepsilon}{1+\varepsilon}\left(l_{t,t+j}^{(i)}\right)^{1+\frac{1}{\varepsilon}},$$

[3] Note that the model does not allow any immigration, so all inhabitants have to be born into the economy.

where ε is the wage elasticity; and the function v, determining the utility of the publicly provided good, is concave and increasing in c_{t+j}^{gov}.

An individual cannot determine the length of his education by himself. The length is determined by the government and is the same for all individuals born at the same time. The number of effective labor units supplied in period $t+j$ by worker i born in period t equals his working skill $h_{t,t+j}$[4] times the hours he is working $l_{t,t+j}^{(i)}$. The working skill depends on his education and his working experience in the following way, Mincer (1974):

$$(6)\quad \ln h_{t,t+j} = a_s s_{t,t+j} + a_{ss}\left(s_{t,t+j}\right)^2 + a_{se} s_{t,t+j} e_{t,t+j} + a_e e_{t,t+j} + a_{ee}\left(e_{t,t+j}\right)^2,$$

where $s_{t,t+j}$ is the length of his education in period $t+j$, and $e_{t,t+j}$ the length of his working experience in the same period. The working experience is equal for all individuals born at the same time, since these individuals have spent the same time in school. The a's are all constants. During their education, individuals have a grant from the government. All students get the same amount gra_t each year.

Later, when they start to work, they receive wages and government transfers. There are two types of government transfers: tr_t^{ta} that is taxable and tr_t^{nt} that is nontaxable. Primarily, taxable transfers are income insurance remuneration consisting of sick and unemployment allowances and early retirement payments. Due to moral hazard and adverse selection, no private market exists where individuals can insure themselves against these risks. Consequently, if the government does not provide the insurance, individuals have to bear the risks themselves. Compared to taxable transfers, nontaxable transfers are to a much higher degree income redistribution directed to mellow poverty. It consists primarily of social allowances. Payroll tax is paid on the wage incomes at rate τ_t^p. It finances compulsory social

[4] There is no individual index i on the working skill since it is equal for all individuals born at the same time.

security and contractual pensions. Tax rates on wage income net of payroll taxes, taxable government transfers, and pensions are all the same τ_t^w.

An individual cannot determine his retirement age himself. It is determined by the government and is the same for all individuals born at the same time. There exists three types of pensions. Individual i born in period t receives in period $t+j$ a governmental basic pension pen_{t+j}^{b} which is the same for everyone, a governmental supplementary pension $pen_{t,t+j}^{s,(i)}$, and a compulsory contractual pension $pen_{t,t+j}^{c,(i)}$ from the former employer, where the latter two depend on the individual's former wage income.

In Sweden, a governmental supplementary pension was introduced in 1963. In order to get a full supplementary pension an individual must have been working for at least 30 years since 1955. If individual i born in period t has been working less than 30 years, he gets the share $\xi_t^{(i)}$ of the full pension, where $\xi_t^{(i)}$ is the number of years he has been working since 1955 divided by 30. (However, there was some extra regulations regarding old workers who did not have the opportunity of working 30 years after 1955, but they are of minor importance in this study.) The full supplementary pension is determined by the labor income up to 7.5 base amounts during the 15 years of highest income. Specifically, the full pension for individual i born in period t equals 60 percent of the pension points $pp_t^{(i)}$ times the base amount at the time for the payment, where the pension points are determined by the formula

$$(9) \quad pp_t^{(i)} = \text{mean}\left\{ 15 \text{ largest} \left\{ \min\left(6.5; \frac{1}{ba_{t+m}} \left(\left(1-\tau_{t+m}^{p}\right) w_{t+m} h_{t,t+m} l_{t,t+m}^{(i)} - ba_{t+m} \right) \right) \right\}_{m=\sigma_t}^{\gamma_t - 1} \right\}$$

Note that the highest possible pension point is 6.5 and the lowest is 0.

The private compulsory contractual pension is determined in the following actuarial way: When an individual works, a share of his total wagesum each year is paid as pension insurance fee. Retiring, he gets a in real values constant pension as long as he lives. The total sum of the pension payments equals the total sum of the fees with interest payments taken into account.

An individual has zero assets when he is born. When his parent dies, he receives a bequest. For individual i born in period t, the bequest in period $t+j$ equals $beq_{t,t+j}^{(i)}$. How much he receives depends on how wealthy his parent is and on how many brothers and sisters he has[5]. The rate of the special tax on bequests equals τ_t^b. In addition, sales tax is paid on all private consumption at rate τ_t^c. Every individual is able to smooth consumption over time, since he has access to a credit market. However, he has to pay tax at rate τ_t^r on capital income. Since there is no uncertainty in the economy and the tax rates on interest payments, dividends, and capital gains are the same, all assets are perfect substitutes. Consequently, it does not matter if the wealth is held in bonds or in equity.

The budget constraint for period $t+j$ and individual i born in period t when he is a student is given by

$$(10)\quad \left(1+\tau_{t+j}^c\right)c_{t,t+j}^{(i)} + b_{t,t+j}^{(i)} = gra_{t+j} + \left(1-\tau_{t+j}^b\right)beq_{t,t+j}^{(i)} + \left(1+\left(1-\tau_{t+j}^r\right)r^*\right)b_{t,t+j}^{(i)},$$

where $b_{t,t+j}^{(i)}$ is the bond holdings[6]. Later, when he is working, the budget constraint becomes

$$(11)\quad \begin{aligned} \left(1+\tau_{t+j}^c\right)c_{t,t+j}^{(i)} + b_{t,t+j}^{(i)} &= \left(1-\tau_{t+j}^w\right)\left(\left(1-\tau_{t+j}^p\right)w_{t+j}h_{t,t+j}l_{t,t+j}^{(i)} + tr_{t+j}^{ta}\right) + tr_{t+j}^{nt} + \\ &+\left(1+\left(1-\tau_{t+j}^r\right)r^*\right)b_{t,t+j}^{(i)} + \left(1-\tau_{t+j}^b\right)beq_{t,t+j}^{(i)} \end{aligned}$$

and eventually when he has retired:

$$(12)\quad \begin{aligned} \left(1+\tau_{t+j}^c\right)c_{t,t+j}^{(i)} + b_{t,t+j}^{(i)} &= \left(1-\tau_{t+j}^w\right)\left(pen_{t+j}^b + pen_{t+j}^{s,(i)} + pen_{t+j}^{c,(i)}\right) + \\ &+\left(1+\left(1-\tau_{t+j}^r\right)r^*\right)b_{t,t+j}^{(i)} + \left(1-\tau_{t+j}^b\right)beq_{t,t+j}^{(i)} \end{aligned}$$

Each individual maximizes his utility (7) subject to his budget constraint (10), (11), and (12) with respect to his consumption, labor supply, and the bequest he wants to leave to his

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[5] All brothers and sisters share the bequest equally.

[6] Note that we use the same symbol for bond holdings and bequests, since the bequest given by an individual is identical to his bond holdings the period after he has died.

children. Because of the specific parameterization of the utility, the labor supply depends only on the wage rate after tax. Since the skills and experiences are equal for all individuals born at the same time, the labor supplies are also equal for these individuals. For individuals born in period t, the labor supply in period $t+j$ is given by the relation

$$(13)\quad l_{t,t+j} = \left(\left(1-\tau_{t+j}^{w}\right)\left(1-\tau_{t+j}^{p}\right) \frac{w_{t+j} h_{t,t+j}}{z_{t+j}} \right)^{\varepsilon},$$

where we have dropped the individual index i. However, even if the wage income and transfers are equal for all individuals born at the same time, the bequest they receive from their parents are not. This is because their parents have different birth years and that the parent's lifetime income and therefore also the bequest he will give to his children depend on the year he is born.

Since we are only interested in the average consumption, income and wealth for each generation, there is no need to keep track of each individual in the generation. Fortunately, aggregation is easy, since the specific parameterization of the utility makes the decision rules for consumption $c_{t,t+j}^{i}$ and bequest $b_{t,t+n}^{i}$ linear in the individuals total discounted wealth. The aggregate consolidated budget constraint for the whole generation born at time t is given by the relation

$$(14)\quad \begin{aligned} &\sum_{j=0}^{n-1} \rho_{t,t+j}\left(1+\tau_{t+j}^{c}\right)c_{t,t+j} + \rho_{t,t+j} b_{t,t+n} = q_t \sum_{j=0}^{\sigma_t-1} \rho_{t,t+j}\, gra_{t+j} + \\ &\quad + q_t \sum_{j=\sigma_t}^{\gamma_t-1} \rho_{t,t+j}\left(\left(1-\tau_{t+j}^{w}\right)\left(\left(1-\tau_{t+j}^{p}\right) w_{t+j} h_{t,t+j} l_{t,t+j} + tr_{t+j}^{ta}\right) + tr_{t+j}^{nt}\right) + \\ &\quad + q_t \sum_{j=\gamma_t}^{n-1} \rho_{t,t+j}\left(1-\tau_{t+j}^{w}\right)\left(pe_{t+j}^{b} + pe_{t,t+j}^{s} + pe_{t,t+j}^{c}\right) + \\ &\quad + \sum_{j=1}^{n-1} \rho_{t,t+j} \frac{\phi_t \eta_{n-j}}{\phi_{t-n+j}\eta_1 + \phi_{t-n+1+j}\eta_2 \ldots + \phi_{t-1+j}\eta_n} b_{t-n+j,t+j} \end{aligned}$$

where we have dropped the super script i for contractual and supplementary pensions since these are identical for every individual in the generation. Further, $c_{t,t+j}$ is the generation's total consumption in period $t+j$, and $b_{t-n+j,t+j}$ is total bequests given by the generation born at t-n+j. The discount factor $\rho_{t,t+j}$ equals

$$(15)\quad \rho_{t,t+m} = \begin{cases} 1 & ,\text{for } j = 0 \\ \prod_{j=1}^{m} \dfrac{1}{1+\left(1-\tau_{t+j}^{r}\right)r^{*}} & ,\text{for } j = 1,2,\ldots m \end{cases}$$

The public sector is a consolidation of local and central government and of social security funds. The public sector produces goods (services) that are distributed free of charge. A fraction λ_t of all efficient labor available in the economy is exogenously allocated to the public production, and the rest (the fraction $1-\lambda_t$) is allocated to the private sector. However, no capital is used for public production for the following reason. It is important to get conformity between the model and the national accounts and in the national accounts, the value of public production is measured by labor costs plus depreciation[7]. Instead of letting the public sector use capital freely, capital is completely omitted from the public production. The income of the public sector consists of sales taxes on all private consumption, payroll taxes net of the contractual pension fee on all wages, and direct income taxes on wages net of payroll taxes, taxable transfers, and on all pensions. The expenditures consist of student grants, taxable and nontaxable transfer payments, basic and supplementary pensions, and public consumption[8].

The solutions to individuals' and firms' optimization problems are obtained sequentially. First, the total effective labor supply for firms can easily be derived by using individual labor supplies (13), individual skills (6), population data of the working force by age, and the fraction of the total working force that is employed by the private sector and aggregate them together. However, the total effective labor supply depends on the wage rate because the individual labor supply depends on the wage rate, but the wage rate is in turn a function of the

[7] Depreciation is negligible compared to labor costs.

[8] Public consumption in the model also includes public investments, since no capital is used in the public sector.

total effective labor supply for firms and the capital stock[9]. It is possible to eliminate the wage rate from the relation and make total effective labor supply for firms depend on the capital stock as only endogenous variable. By plugging this result into the first order condition determining the capital stock, we get a second order difference equation for the capital stock. This difference equation is solved with a multiple shooting method, and since the rest of the endogenous variables are easily determined once we know the evolution of the capital stock, we are done.

3. Calibration

The model is calibrated for Sweden and with calibration we mean that the model's parameters and exogenous variables are picked either from reliable independent sources or to make the model replicate data as closely as possible during the sample period 1925-92.

Population data and data on production, consumption, private investment, income taxes, and consumption sales taxes exist for the entire sample period, while pensions, transfers, public investment, payroll taxes, and subsidies exist only for the period 1950-92.[10] [11], and reliable data on aggregate bequests does not exist at all. Consequently, it will be necessary to generate some data belonging to the sample period. The following procedures are used: We assume that per capita transfers and basic pensions increased by the same rate as the average wage income net of payroll taxes during the period 1925-1950, and that public consumption was determined residually so that public budget deficits were zero during the period 1925-1950. Payroll taxes consist of social security contributions and contractual pension insurance fees. We assume that social security contributions increased by the same rate as the wagesum during the period 1925-46, and that contractual pension insurance fees during the entire sample period

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[9] The wage rate equals the marginal product of labor.

[10] However, social security contributions, that are part of payroll taxes, are available for the period 1947-92, and subsidies for 1946-92.

[11] Data sources are reported in the appendix.

1925-92 equals 2 percent of the wagesum. The size on the contractual pension insurance fee is determined so that contractual pension payments generated by the model approximately equal the actual payments during the period 1950-92.

The capital income tax rate τ_t^r and the bequest tax rate τ_t^b are set to zero throughout the entire sample period because both capital income and bequest taxes are small in the national accounts. The major reason for this is that in reality, the tax bases for both the capital income tax and the bequest tax are much smaller than in the model. Also, deduction rules are generous for capital income taxes. The payroll tax rate τ_t^p is set to equal social security contributions plus contractual pension insurance fees divided by the total wagesum[12]; the direct income tax rate τ_t^w is set to equal direct taxes divided by the total wagesum less social security contributions less contractual pension insurance fees plus all pension payments plus taxable governmental transfer payments[13]; and the consumption sale tax rate τ_t^c is set to equal indirect taxes less subsidies divided by private consumption, where we have used the consumption generated by the model. This is done to guarantee that the tax revenue from the sales tax always equals the actual revenue.

Taxable and nontaxable governmental transfers per worker, and basic pensions per retired are set to equal the actual values. The factor ξ_t that determines the number of year individuals have been working since 1955 divided by 30 is zero until 1963. Then, it starts to increase linearly through 1998 where it becomes unity, not to change after that. This choice makes the supplementary pension payments approximately equal to the actual payments in Sweden. The length of education is estimated from Levnadsnivåundersökningen (LNU) panel

[12] The wage sum consists of compensations to employees plus households' net operating surplus. A motivation is given in footnote 14.

[13]

$$\tau_t^w = \frac{\text{direct taxes}}{\text{tot. wagesum - soc. sec. contrib.-contr. pension insurance fees + pension payments + gov. transfer payments}}$$

data set from the years 1968, 1974, 1981, 1991 and equals the mean of the actual length. The initial public debt is set in such a way that it in 1990 equals zero, since Sweden this year according to the financial statistics has no public debt.

The parameter θ in the production function is set to 0.26, which is the mean of the actual capital's share of income[14] 1950-92 in Sweden. The exogenous productivity factor z_t is chosen so that the GDP generated by the model exactly coincides with actual GDP for the period 1925-92. Subsequently, the productivity factor grows at a constant annual rate of 1.5 percent for all simulations. The depreciation rate is 0.04. It makes depreciation of the private capital stock in the model approximately equal to the actual depreciation during the period 1950-92. The international interest rate r^* is 3.5 percent for all simulations. The value of the installation cost parameter $\mu = 0.528$ is chosen so that private investment's share of GDP approximately equals the actual share during the period 1950-1992.

In the model, individuals are "born" when they become independent from their parents and form their own households. In the real world this happens approximately when they reach the age of 16[15]. In order to avoid confusion, from now on individuals are indexed by their actual year of birth and not by the year they become an independent household. The lifetime for all individuals is 80 years. Consequently a household lives for $n = 64$ years. (Every individuals form an independent households at the age of 16 and live until they are 80.) The demographics are determined by η and ϕ_t: The vector η, shown in figure 1a, is set to equal births by age of mother in 1992, normalized so that the total number of children born that year is unity. The time series ϕ_t, shown in figure 1b, is determined so that the actual age distribution of the population is approximately replicated during the entire sample period. The retirement age was 67 in Sweden until 1975, when it was lowered to 65. The wage elasticity

[14] The net operating surplus of households is included in labor's share of income, since almost all of the surplus comes from self-employed such as small shop keepers, farmers etc.

[15] Consequently, there does not exist any individuals younger than 16 years in the model, since these individuals are concealed in their parents household.

ε in the utility function is set to 0.1, which is considered to be a standard value for Sweden, see for instance Blomquist and Hansson-Brusewitz (1990). The subjective discount factor β is 0.994, which is the estimate for the US, Hurd (1989), for individuals with known finite lifetime[16]. Unfortunately, we have no reliable value on the parameter α determining the bequest an individual leaves to his children, relative his own consumption. The subjective choice is $\alpha = 0.65$. This value approximately makes GDP equal to GNP, which occurs when net factor payments from abroad are zero. The parameters in the skill equation (6) are estimated from LNU panel data set for 1991:

$$a_s = 0.048288\,(4.82), \quad a_{ss} = -0.000270\,(-0.90), \quad a_{se} = 0.000016\,(-0.10),$$

$$a_e = 0.018660\,(6.93), \quad a_{ee} = -0.000250\,(-7.84),$$

where the figures in the parenthesis are t-values.

The Swedish economy is considered to be in steady-state in 1925 when all simulations start, because the capital stock always adjusts relatively quickly and the age distribution of the population in 1925, shown in figure 2a, is very close to a steady-state distribution. Consequently, all initial values such as initial capital stock and initial bequests are set equal to their 1925 steady-state values[17]. However, after 1925, it is not possible to accurately approximate the age distribution by a steady-state distribution. See figure 2b and c.

4. Simulations

The simulations should be regarded as hypothetical exercises, that show the development of the Swedish economy under the given presumptions, and not as predictions about the future.

[16] However, it is possible that the increase in consumption over the lifetime does not reflect individual preferences. Instead, the increase may be the consequence of a restricted credit market, where consumption has to follow income more closely.

[17] All tax rates are assumed to be constant before 1925 and transfers, public consumption etc. are assumed to grow by the same rate as the Solow residual.

As an obvious starting point, in section 4.1, we investigate the consequences if Sweden does not stabilize the public budget. What happens is that the public debt explodes. Therefore, it is necessary for Sweden to put the public budget on a sound basis either by increasing taxes or by decreasing expenditure. Consequently, we construct a baseline case in section 4.2, where public expenditure is decreased so the public debt disappears in 2015. In section 4.3, we use tax increases instead to achieve the same objective. Further, we discuss the size of public funds and the redistribution between generations in section 4.4, and education and growth in section 4.5. Finally, we check the robustness of our results with respect to a future change in the population growth in section 4.6, an extension of the stabilization period in section 4.7, and the wage elasticity of labor supply in section 4.8.

4.1 The Unchanged-Policy Case

In the unchanged-policy case, the variables determining demographics, production and fiscal policy evolve in the following way after 1992: The net reproduction rate, public employment, length of education, and all tax rates are constant after 1992 and equal to their 1992's values.[18] The Solow residual grows by a constant annual rate of 1.5 percent. Transfers and basic pensions per recipient increase by the same rate as the average wage income less payroll taxes. Finally, public consumption increases by the same rate as GDP. All the variables are plotted in figures 3a-j.

Discounted net lifetime transfers increase dramatically: from zero for individuals born around 1960 to about 180,000 real 1985 SEK for individuals born in 2020, see figure 3k. However, as shown in figure 3l, the policy is not sustainable: public debt explodes: from 0 in 1990 to 2.5 times GDP in 2020. Consequently, the policy is not regarded as a feasible

[18] As before 1992, contractual pension insurance fees equals 2 percent of the wagesum.

alternative. The objective of the unchanged-policy exercise is to show that it is necessary to stabilize the public budget. From now on we only deal with sustainable fiscal policies.

4.2 Expenditure Cuts - The Baseline Case with zero Public Debt in 2015

The baseline case is identical to the unchanged-policy case, except that per capita transfers, public consumption, basic and supplementary[19] pensions are decreased from 1997 onwards. The decrease in percent is equal for all the variables and the magnitude such that the public debt becomes zero in 2015. We discuss the choice of the long-run debt level in section 4.4. The necessary decrease in expenditure leading to zero debt is initially around 16 percent annually but shrinks eventually, see figure 4a. The resulting transfers, pensions, and public consumption are shown in figure 4b-f. The hump shape of supplementary pensions as a share of GDP in figure 4f is caused by an upper ceiling for the pensions: Supplementary pensions were introduced in 1963 and as more and more individuals received full pension, pension payments' share of GDP increased. However, since incomes constantly keeps on growing (due to technological growth), more and more individuals hit the ceiling and supplementary pensions' share of GDP decreases.

Discounted net lifetime transfers per capita, shown in figure 4g, are positive for all individuals born before 1925 and negative for those born after 1925. Individuals born in 2020 contribute 325,000 real 1985 SEK to the public sector. However, we should not feel sorry for them since their discounted disposal lifetime income per capita is 4.7 million real 1985 SEK, which should be compared to an income of 1.2 million for individuals born in 1925, see figure 4j. Hence, due mainly to technological progress, the later an individual is born, the higher is his lifetime income going to be. The fact that the net contribution in real SEK to the public sector also increases over time does not change this result. The reason is that the net

[19] The base amount used for determining the pensions is decreased, while the base amount used to determined the pension points from the wage income is unchanged.

contribution in percent of the lifetime income does not increase over time, see figure 4i. The relative importance of the contribution achieves its maximum (approximately 8 percent) for individuals born in 1942 and in 1997.

4.3 Tax Increases Versus Expenditure Cuts

Instead of cutting expenditures until the public debt disappears, as in the baseline case, we investigate two other alternatives to achieve the target of zero debt in 2015. In the first alternative, the income tax rate, the dashed line in figure 5a, is increased to 38 percent in 1997. However, in the long run, as the same line shows, a 33 percent tax rate is sufficient to keep the target of zero debt. The decrease is primarily due to the adjustment towards the demographic steady-state, where the burden of supporting the old is smaller. In the second alternative, the payroll tax rate, the dashed line in figure 5b, is increased to 36 percent in 1997. For the same reason as in the income tax case, a 31 percent payroll tax rate is sufficient to keep the target of zero debt in the long run. The solid lines in figure 5a and b show the baseline case.

For both alternatives, Gross Domestic Product (GDP), shown in figure 5h, decreases initially by 1.5 percent relative the baseline case. The dashed line in figure 4c is the income tax case and the solid line the payroll tax case. The reason why GDP falls is that the increased income and payroll tax rates decrease the after tax wage rate and therefore also labor supply. Eventually, because the tax rates decreases, GDP recovers about one percentage point.

Transfers, pensions, and public consumption increase in the income tax case by approximately 18 percent relative to the baseline case, see the solid line in figures 5c-g. The reason is that transfers, pensions and public consumption now are unchanged while they in the baseline case decreased by 16 percent.

In the payroll tax case, transfers and basic pensions do not change relative the baseline case, because they decrease by approximately the same amount as in the baseline case, due to the decrease in wage incomes net of payroll taxes[20], see the dashed line in figure 5c-e. The supplementary pension, the dashed line in figure 5g, decreases because wage income less payroll taxes decreases[21]. However, the decrease in wage income does not matter any longer for the supplementary pensions when all wage incomes less payroll taxes are larger than the ceiling for the supplementary pension system. This happens in 2060 and supplementary pensions in the income and payroll tax cases coincide therefore thereafter. Public consumption, the dashed line in figure 5f, is relatively unchanged since GDP only decreases by one percent[22].

In both the income and payroll tax cases, the following holds: Discounted net lifetime per capita transfers, in figure 5i, are smaller than in the baseline case for all individuals born after 1960. Discounted disposable lifetime income per capita, in figure 5j, falls to 90 percent of the baseline case for individuals born in 1980 and grows slowly for individuals born later and becomes eventually around 95 percent of the baseline case. There are two major sources for the fall in lifetime income relative the baseline case: The first source is that GDP falls and the second source is that public consumption is larger, which redistributes income towards the public sector.

Summing up this section: A policy that stabilizes the public budget through expenditure cuts gives a larger production than the policies that stabilize through income and payroll tax increases.

4.4 Changing the Size of Public Funds

Even though the public deficits are zero after the year 2015, individuals still make a positive net contribution to the public sector. Look for instance at figure 4h or 4i. But should

[20] Future transfers and basic pensions are determined by the evolution of the wage income net of payroll taxes.
[21] Supplementary pensions are determined by the wage income below 7.5 base amounts.
[22] Future public consumption is determined by the evolution of GDP.

not an individual's net contribution to the public sector be zero when the public deficit is zero? The answer is no except for in a few very special cases. Let us for transparency discuss the issue in a two periods overlapping generations model with neither technological nor population growth. Each generation works and pays 1 SEK in taxes in the first period and receives pensions in the second period. We consider two different steady-states: In the first one, public funds are zero, so pension payments equal the tax revenues (1 SEK) in each period. Hence, the discounted value of each generation's discounted lifetime net transfers from the public sector is negative. In the second steady-state, public funds are 1 SEK, so pension payments equal tax revenues (1 SEK) plus interest payments on the public funds (r SEK) in every period. Hence, each generation's net lifetime transfer from the public sector is zero. The economy evolves into the first steady-state if the first generation participating in the pension system starts directly to collect pensions without paying any taxes when it is young. Because later generations have to pay for the first generation's pensions, they must contribute more to the public sector than they get back. The economy evolves into the second steady-state if the first generation participating in the pension system starts by paying taxes when it is young before it collects pensions when it is old. The taxes (1 SEK) constitutes the public funds that are necessary for the economy to end up in the second steady-state. Of course, it is possible to transit from the first to the second type of steady-state if some generations are willing to pay "extra" taxes to accumulate public funds of 1 SEK.

Sweden introduced a welfare system without accumulating any public funds at all. In other words the first generations collected welfare benefits without paying the corresponding taxes when they were young.[23] Be as it may, this is history, and whether we want to change it or not, we cannot. So where should Sweden go from now, how large should the public funds

[23] We do not take a stand whether it is fair or unfair that the first generation did not accumulated any public funds, mainly because we do not make any welfare comparisons at all between generations. In addition, remember that public funds is only one out of several ways to redistribute resources between generations.

be in the future? There are two extremes: The first one is to let tax payers accumulate public funds during the next 20 years, so that net lifetime transfers in the future eventually become zero. The size of the public funds needed for that is approximately 72 percent of GDP. The other extreme is to balance the public debt in percent of GDP at the current debt level, implying relatively large negative net lifetime transfers for future generations. The baseline case, where public funds are zero in 2015 is in between these extremes. Why have we picked a zero long-run debt condition? First, we regard it to be a natural focal point, frequently mentioned in the policy debate, and second, it is a reasonable compromise between letting the first generations pay for their welfare benefits while they still are alive, and letting future generations pay for them.

We investigate two alternative long-run levels of public funds, and the implications for the lifetime income of different generations. The alternatives considered are the baseline case, with zero public funds, and the case where public funds are 72 percent of GDP after 2015, in which case discounted net lifetime transfers eventually becomes zero. The transition to these steady-states are financed by expenditure cuts of the same type as in the baseline case (transfers, pensions and public consumption are decreased equally in percent until the funding target in question is obtained). Figure 6a shows the evolution of public funds, and figure 6d shows the corresponding necessary percentage decrease in public expenditure relative the unchanged-policy case. Lifetime net transfers in real SEK, in figure 6b, vary a lot between the alternatives: For individuals born in year 2150, net lifetime contributions per capita to the public sector equal 200 and 900 thousand real 1985 SEK, when long-run public funds are 0 and 72 percent of GDP, respectively. The slow adjustment to the steady-states comes from the slow demographic adjustment. However, the effects on lifetime income net of taxes are small. Figure 6c shows that the differences between the cases are less than one percent.

4.5 Increasing the Duration of Education

We increase education by one year from 1997 onwards. Further, we assume that the prolongment in education does not increase total public consumption since all additional costs for the extra year of education are financed by cuts in public consumption in other sectors. The effects of the extension of the education compared to the baseline case are shown in figure 7a-e. More individuals attend schools when an extra year of education is introduced. Consequently, the total number of effective labor units in the economy immediately falls about 1 percent, and stays low for about 10 years before it starts to rise because of the increase in human capital. The rise continues for the next 40 years until the number of effective labor units reaches a new steady-state around 2045, which is 2 percent above the baseline case, see figure 7b. It takes 45 years for the increase in education to reach full effect, since one more generation with higher education is added every year until the education of the entire labor force is increased. Due to the relative quick adjustment of the capital stock, we see in figure 7c that GDP closely follows the development of the total number of efficient labor units in the economy, and that the new steady-state for GDP also becomes approximately 2 percent larger than in the baseline case.

What happens to discounted net lifetime transfers per capita? When individuals spend an extra year in school, they do not receive any public grants at all. Transfers and pensions increase because the wage income increases. Public consumption falls immediately because GDP falls. However, later on when GDP increases, public consumption also increases. The total effect on the discounted net lifetime transfers per capita is shown in figure 7d: It falls immediately after the introduction of the extra year of education and increases thereafter.

Lifetime disposable income per capita, in figure 7e, increases starting with the first generation of better educated individuals. It increases further as the net lifetime transfers that fell immediately after the introduction of the extra year increases. Eventually (for generations born later than 2030) lifetime income reaches its new steady-state that is about 1 percent larger than in the baseline case.

4.6 Changing the Population Growth

Recall from section 4.2 that the population in the future approximately was assumed to reproduce itself in the baseline case. In this section we consider two alternative future growth paths for the population after 1992. Eventually, the annual population growth rates for these new paths will become plus 0.5 percent and minus 0.5 percent compared to zero percent in the baseline case. The change in the net reproduction rates starts with a smooth transition period of 15 years and becomes thereafter 1.137, 1.000 (the baseline case), and 0.857 for the three cases, respectively, see figure 8a. The change in demographics affects disposable lifetime income through two major channels. The first one is that due to capital installation costs[24], the capital stock per worker depends on the growth rate of the labor force. Figure 8b shows that GDP per worker is about 1 percent smaller than in the baseline case when the population increases, and about 1 percent larger than in the baseline case when the population decreases. The second channel is that different growth rates generate different age profiles for the population, and consequently different numbers of retired individuals per active worker. Figure 8c shows the number of retired as share of the labor force: In the year 2100, the number of old individuals is 28 percent of the labor force when the population is growing, 33 percent when the population is constant, and 38 percent when the population decreases. Discounted net lifetime transfers per capita increases of course with the number of old individuals that each worker has to support. Hence, as figure 8d shows, net lifetime transfers are the largest in the population growth case, smaller in the constant population case, and even smaller when the population is shrinking. The net effect on lifetime incomes is shown in figure

[24] The increase (decrease) in the capital stock will lag the increase (decrease) in the population because of installation costs that are symmetric with respect to increases and decreases of the capital stock.

8e.. A population growth of 0.5 percent per year decreases the lifetime disposal income by about 1 percent relative to the baseline case, while a negative population growth of 0.5 percent increases it by about 1 percent. Thus, the size of the per capita capital stock is quantitatively more important than the number of retired individuals per worker.

4.7 Extending the Stabilization Period

How much less do we have to cut public expenditure if we extend the stabilization period so that the public debt is zero in 2025 instead of zero in 2015 (the baseline case)? The situation for individuals that die before the start of the stabilization program in 1997 or are born after the completion of the new program in 2025 are not affected at all since they meet approximately the same situation as in the baseline case[25]. The overall effect is extremely small on lifetime disposable income of the individuals that are affected (individuals born between 1918 and 1925). Figure 9c shows that the difference from the baseline case is less than 0.1 percent.

4.8 Changing the Wage Elasticity of Labor Supply

The wage elasticity of labor supply is calibrated to 0.1 in the baseline case. In this section, we make a calibration with another value on the wage elasticity. The new value 0.2 makes individuals more willing to substitute between labor and leisure.

The experiment is to increase the income tax rate from 1997 so that the public debt becomes zero in 2015. The increase in the income tax rates necessary to achieve this is approximately the same for the case with wage elasticity 0.2 and for the baseline case. Figure 10a shows the income tax rates in both cases. However, the decrease in GDP caused by the tax increase is larger because the wage elasticity is larger. The effects on GDP are shown in

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[25] Bequests given to individuals born after 2025 differ, since the wealth of their parents are affected through the length of stabilization period.

figure 10b. Lifetime net transfers and incomes, shown in figure 10c-d, are also smaller. However, it is important to remember that the comparison is between two versions of the model that are calibrated differently.

5. Concluding Comments

The general conclusion is that technological growth is the most important factor determining the disposable income of future generation and that other inter-generational redistribution schemes have only relatively marginal effects. This holds of course only under the assumption that the other redistribution schemes do not affect the growth rate. However, we have not investigated the effect of different growth rates on the economy for the following two reasons. First, the effect on lifetime incomes is obvious: the larger the growth rate, the larger the future incomes. Second, by assumption in the model, public expenditure and taxes grow essentially by the same rate. Consequently, the public budget balance in percent of GDP is not affected by the growth rate. In order to make the public budget balance depend on the growth rate, we have to divide public expenditure into an autonomous part and an induced part[26]. Unfortunately, reality is more complicated than that, so it is impossible to get robust estimates of autonomous and induced public expenditures that do not change over time. Because of the lack of robustness, we simply do not deal at all with how different growth rates affect the public budget.

The general conclusion in Auerbach, Gokhale, and Kotlikoff (1991),(1994), and in OECD Economic Outlook (1995) that presents generational accounting for a number of countries is that future generations have to make a larger contribution to the public sector than the already existing.[27] The result is in accordance with ours. However, their recommendation

[26] Another way is to make taxes depend on the growth rate, for instance through progressive tax rates.
[27] The measure of lifetime net transfers used in these papers is very different from the measure used here. Their measure of future generations' lifetime net transfers does not directly correspond to the actual payments made, since they do not take into consideration that a change in the welfare system also changes the conditions for the already existing generations and not only for the not yet born.

to use lifetime net transfers to the public sector for different generations to evaluate fiscal policy is not a good idea, since these lifetime transfers only marginally affect the disposable income of future generations relative to technological growth.

Finally, would the results change if uncertainty were introduced in the model? We claim that the answer is no for business cycle fluctuations, because these even out over a lifetime of 64 years. However, very long term swings in the growth rate may affect the lifetime income of different generations, but they will not affect the public budget since it by assumption is robust with respect to variations in the growth rates. (Future taxes, transfers, and pensions are essentially proportional to the production outcome of the economy.)

References

Auerbach, A.J., J. Gokhale, and L.J. Kotlikoff (1991), "Generational Accounts: A Meaningful Alternative to Deficit Accounting", In Bradford, D., ed., *Tax Policy and the Economy*, vol. 5 Cambridge: MIT Press, 55-110.

Auerbach, A.J., J. Gokhale, and L.J. Kotlikoff (1994), "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy", *Journal of Economic Perspective*, 8:1, 73-94.

Blomquist, S. and U. Hansson-Brusewits (1990), "The Effect of Taxes on Male and Female Labor Supply in Sweden", *Journal of Human Resources* 25,317-357.

Haveman, R. (1994), "Should Generational Accounts Replace Public Budgets and Deficits?", *Journal of Economic Perspective*, 8:1, 95-111.

Huggett, M. (1994), "Wealth Distribution in Life Cycle Economies", Mimeo, Department of Economics, University of Illinois.

Hurd, M. (1989), "Mortality Risk and Bequests", *Econometrica* 57, 779-813.

Krantz, O., and C.A. Nilsson (1975), *Swedish National Product 1861-1970*, Lund: Gleerup.

Kotlikoff, L.J. and L.H. Summers (1981), "The Role of Intergenerational Transfers in Aggregate Capital Accumulation", *Journal of Political Economy* 89:4, 706-732.

Mincer, J. (1974), *Schooling, Experience, and Earnings*, NY: Columbia University Press for the NBER.

Modigliano, F. (1988), "The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth", *Journal of Economic Perspective* 2:2, 15-40.

OECD (1995), January, "Effects of Ageing Populations on Government Budgets", *Economic Outlook* , January, 33-42.

Appendix: The Data

Nominal and real GDP, nominal private consumption, and nominal private investment:

1925-49 Krantz and Nilsson (1975)
1950-92 Statistics Sweden: N 14 SM 9301

Direct and indirect taxes:

1925-49 Statistical Yearbook, Sweden 1925-50
1950-62 Statistics Sweden: 1974:51 (Supplement to N 1974:89)
1963-69 Statistics Sweden: N 1975:98
1970-79 Statistics Sweden: N 1982:2.5
1980-92 Statistics Sweden: N 14 SM 9301

Basic and supplementary[28] pensions:

1925-49 generated
1950-92 Statistical Yearbook, Sweden 1950-93

Public consumption, public investment, basic, contractual pensions, social security benefits (taxable transfers) including supplementary and basic pensions, other current transfer from general government (nontaxable transfers), and employee welfare contributions:

1925-49 generated
1950-62 Statistics Sweden: 1974:51 (Supplement to N 1974:89)
1963-69 Statistics Sweden: N 1975:98
1970-79 Statistics Sweden: N 1982:2.5
1980-92 Statistics Sweden: N 14 SM 9301

Social security contributions:

1925-46 generated
1947-49 Statistical Yearbook Sweden 1948-50
1950-62 Statistics Sweden: 1974:51 (Supplement to N 1974:89)
1963-69 Statistics Sweden: N 1975:98
1970-79 Statistics Sweden: N 1982:2.5
1980-92 Statistics Sweden: N 14 SM 9301

Subsidies:

1925-45 generated
1946-49 Statistical Yearbook, Sweden 1947-50
1950-92 Statistics Sweden: N 14 SM 9301

Public employment:

1925, 1940 Statistical Yearbook, Sweden 1926, 1941
1960, 1968-92 OECD Historical Statistics 1960-93
(the rest of the values are linearly interpolated)

[28] Supplementary pensions are zero 1925-62, since they were not introduced until 1963.

FIGURE 1: VARIABLES DETERMINING THE DEMOGRAPHICS

1a: BIRTH BY AGE (eta)

1b: NET REPRODUCTION RATES (FI)

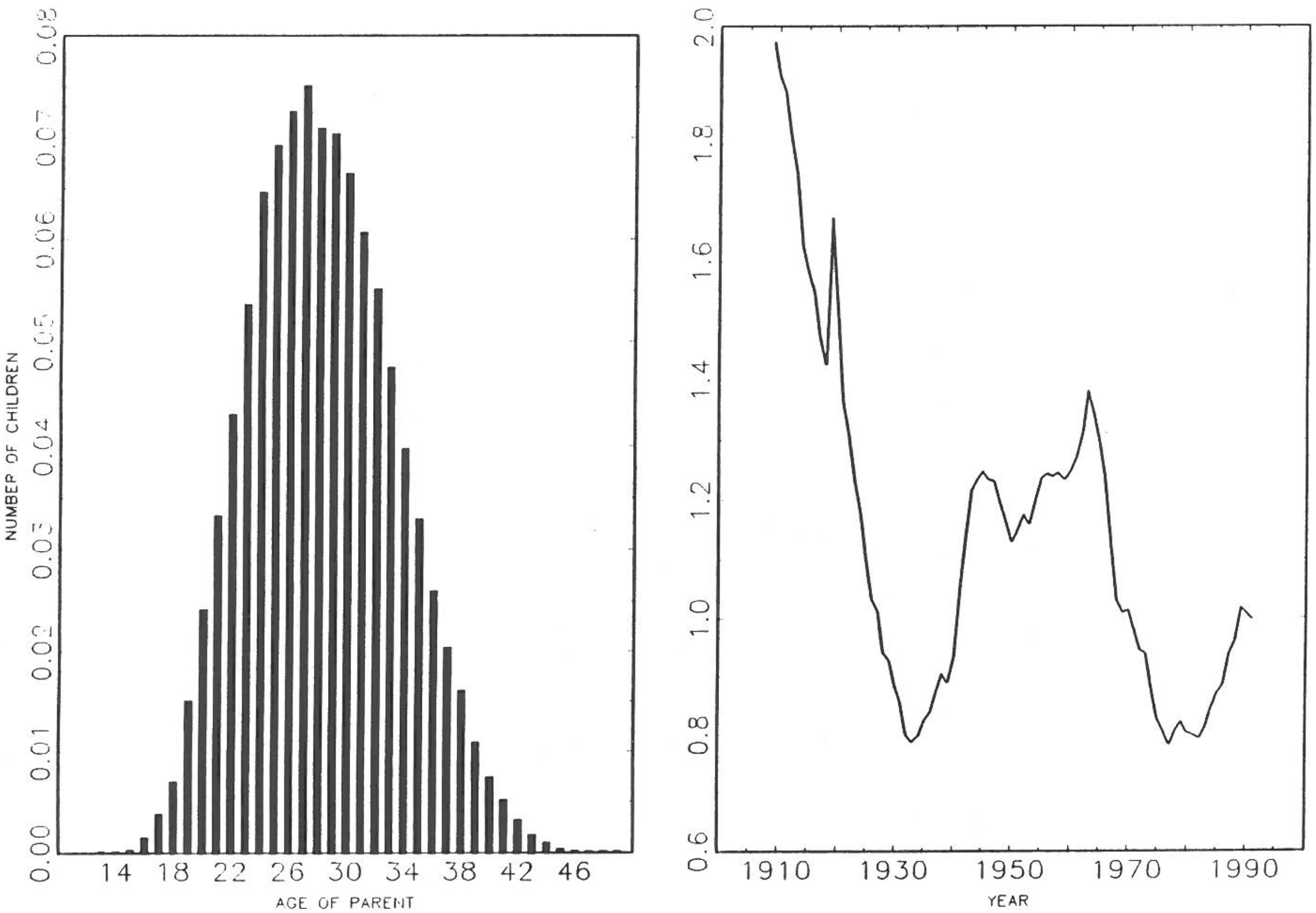
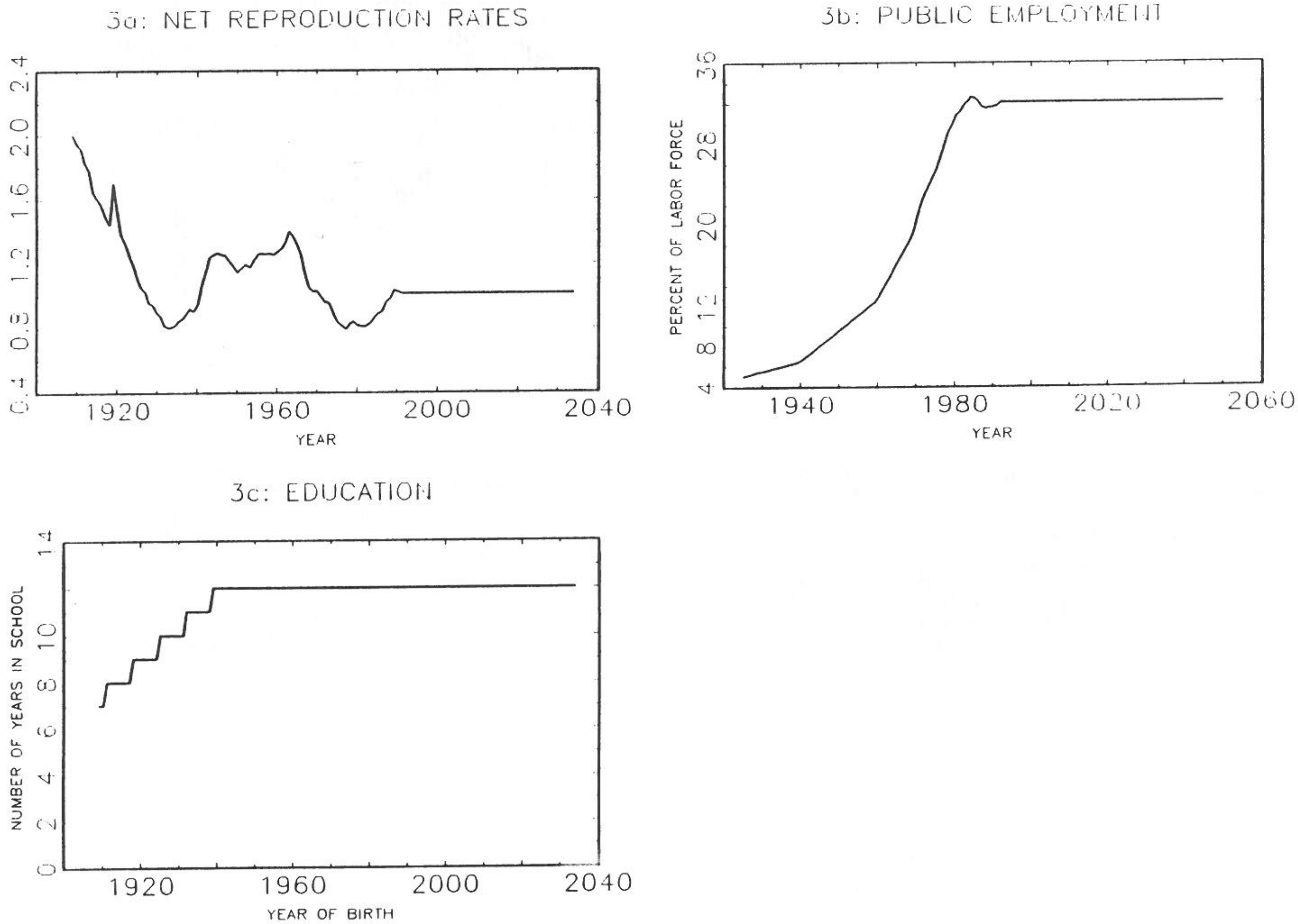
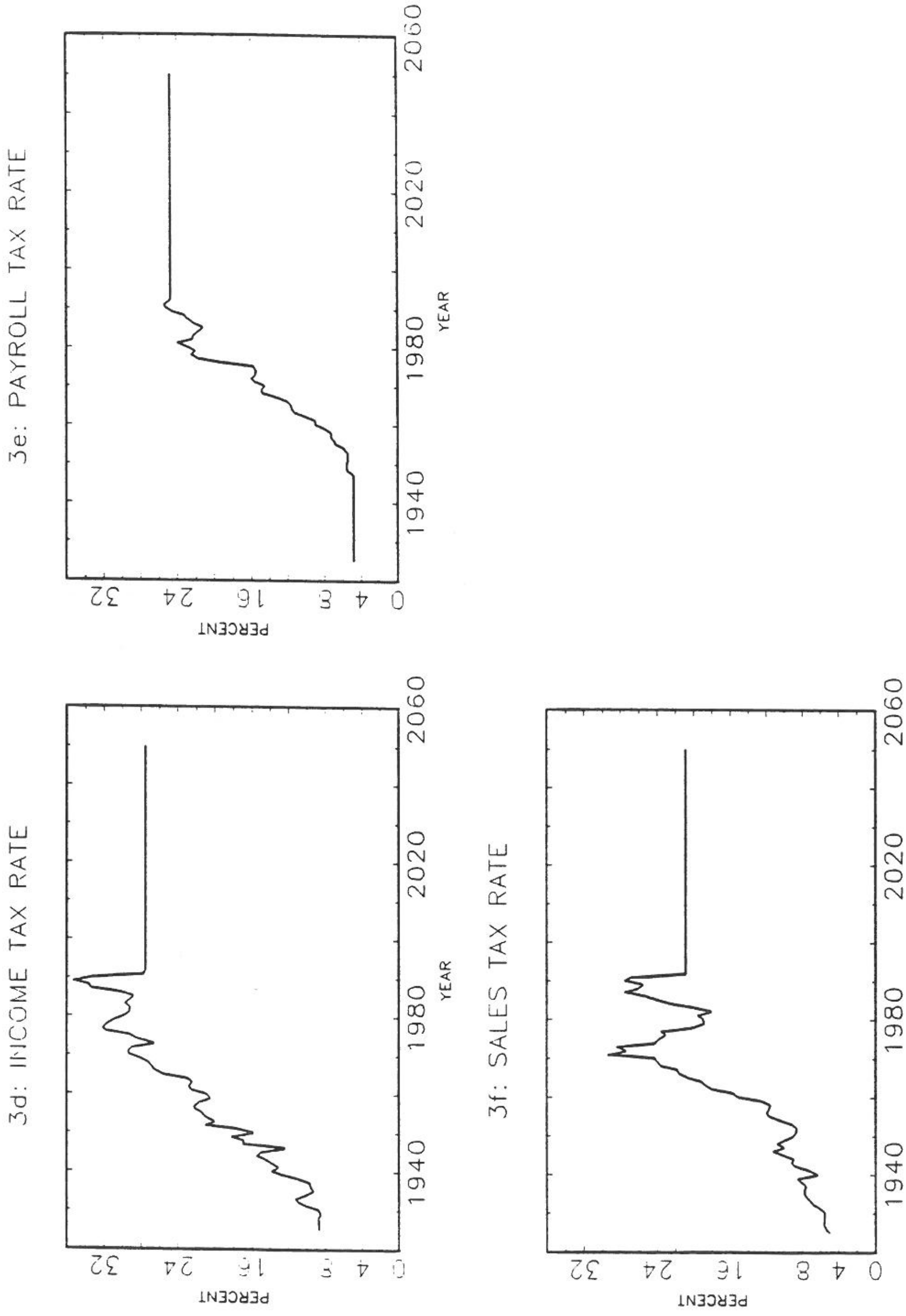
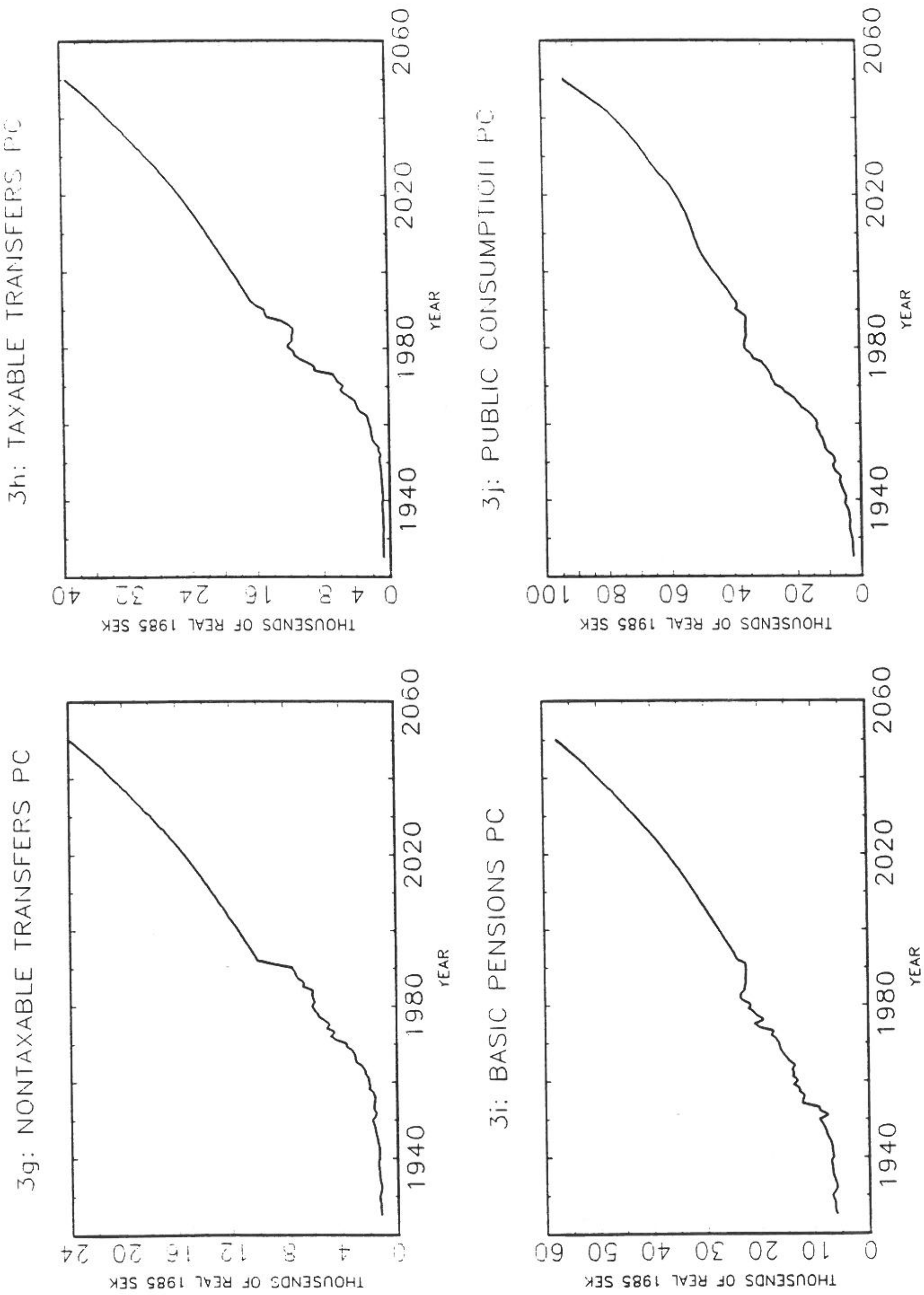


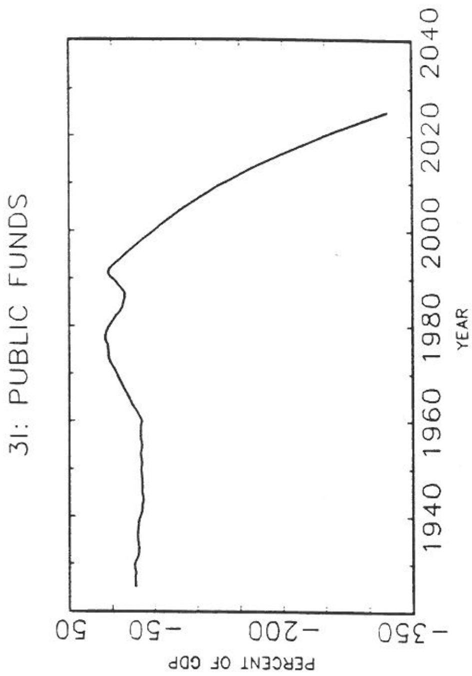
FIGURE 2: POPULATION BY AGE

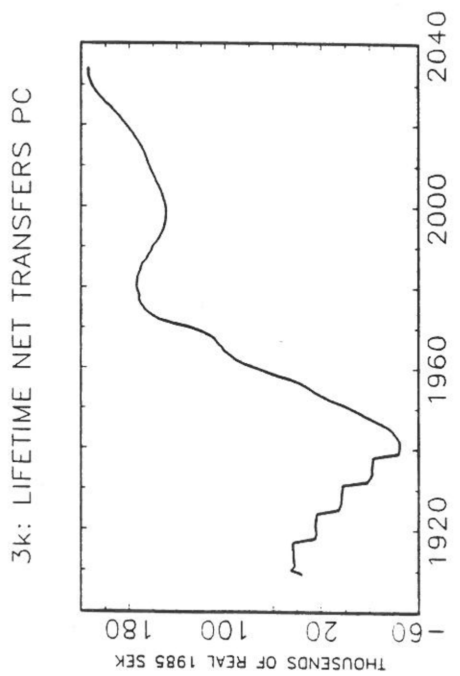
FIGURE 3: THE UNCHANGED–POLICY CASE




3d: INCOME TAX RATE
3e: PAYROLL TAX RATE
3f: SALES TAX RATE
PERCENT
0 4 8 16 24 32
YEAR
1940 1980 2020 2060


3h: TAXABLE TRANSFERS PC
THOUSENDS OF REAL 1985 SEK
0 4 8 16 24 32 40
1940 1980 2020 2060
YEAR
3j: PUBLIC CONSUMPTION PC
THOUSENDS OF REAL 1985 SEK
0 20 40 60 80 100
1940 1980 2020 2060
YEAR
3g: NONTAXABLE TRANSFERS PC
THOUSENDS OF REAL 1985 SEK
0 4 8 12 16 20 24
1940 1980 2020 2060
YEAR
3i: BASIC PENSIONS PC
THOUSENDS OF REAL 1985 SEK
0 10 20 30 40 50 60
1940 1980 2020 2060
YEAR


3l: PUBLIC FUNDS
PERCENT OF GDP
50
-50
-200
-350
1940
1960
1980
2000
2020
2040
YEAR


3k: LIFETIME NET TRANSFERS PC
THOUSENDS OF REAL 1985 SEK
180
100
20
-60
1920
1960
2000
2040
YEAR OF BIRTH

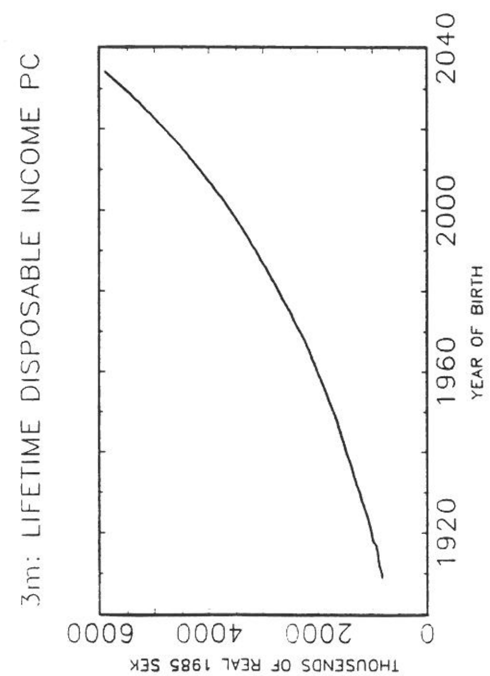
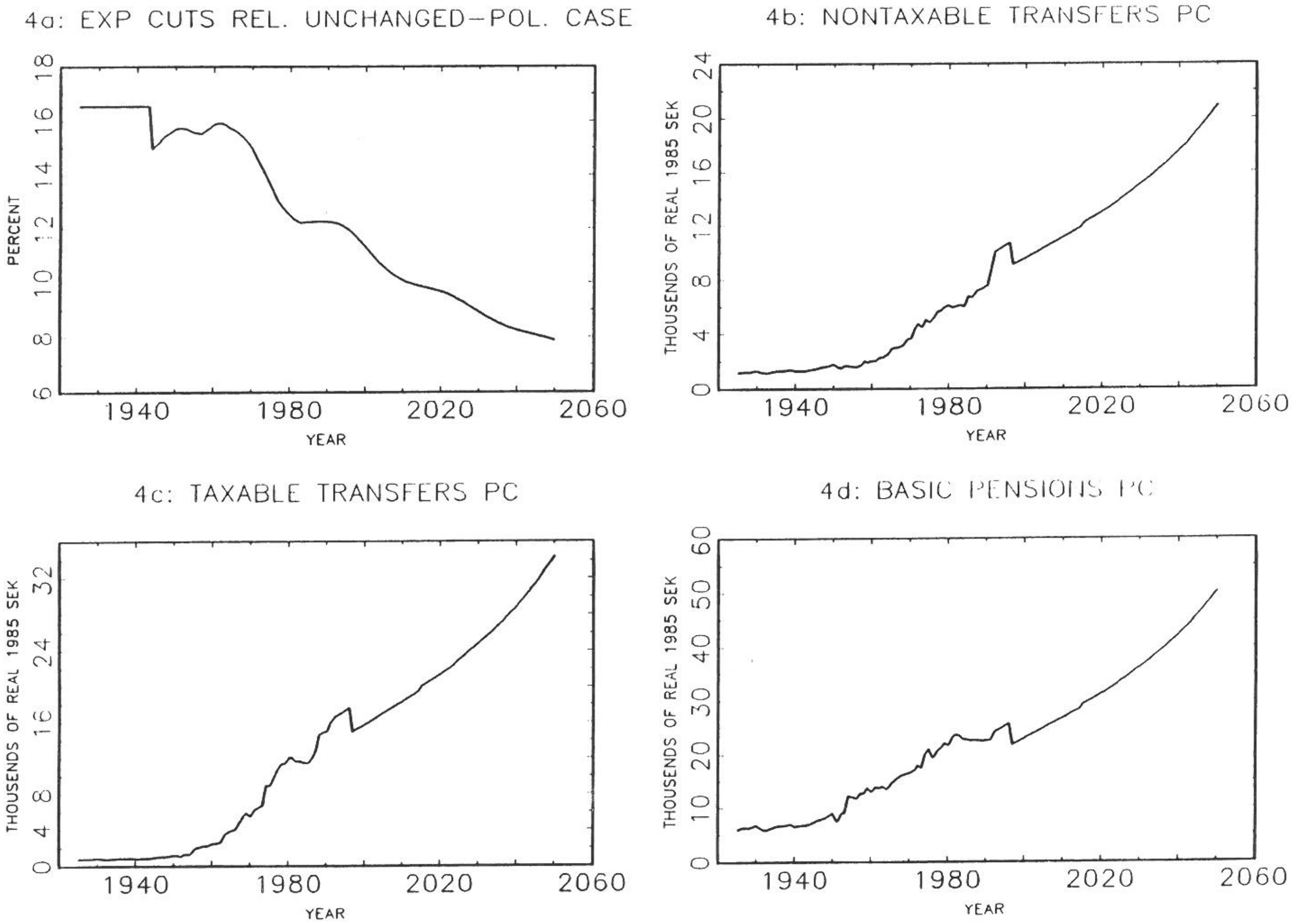
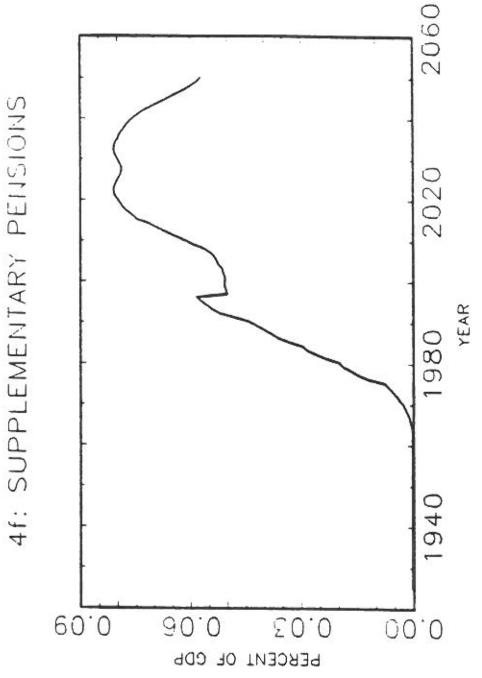
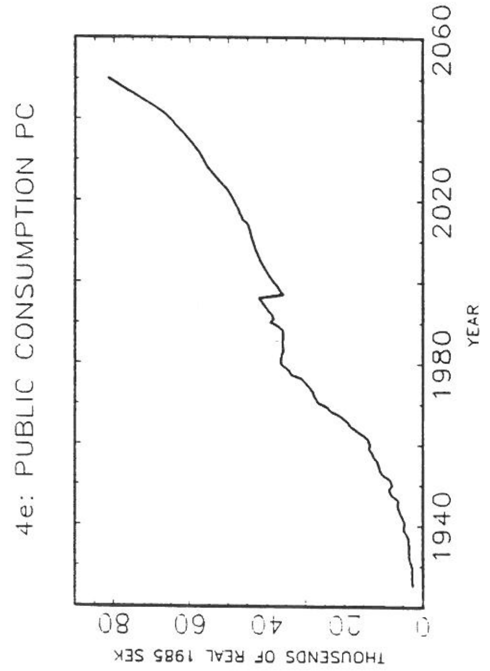

3m: LIFETIME DISPOSABLE INCOME PC
THOUSENDS OF REAL 1985 SEK
6000
4000
2000
0
1920
1960
2000
2040
YEAR OF BIRTH

FIGURE 4: EXPENDITURE CUTS – THE BASELINE CASE




4f: SUPPLEMENTARY PENSIONS
PERCENT OF GDP
0.00
0.03
0.06
0.09
YEAR
1940
1980
2020
2060


4e: PUBLIC CONSUMPTION PC
THOUSENDS OF REAL 1985 SEK
0
20
40
60
80
YEAR
1940
1980
2020
2060

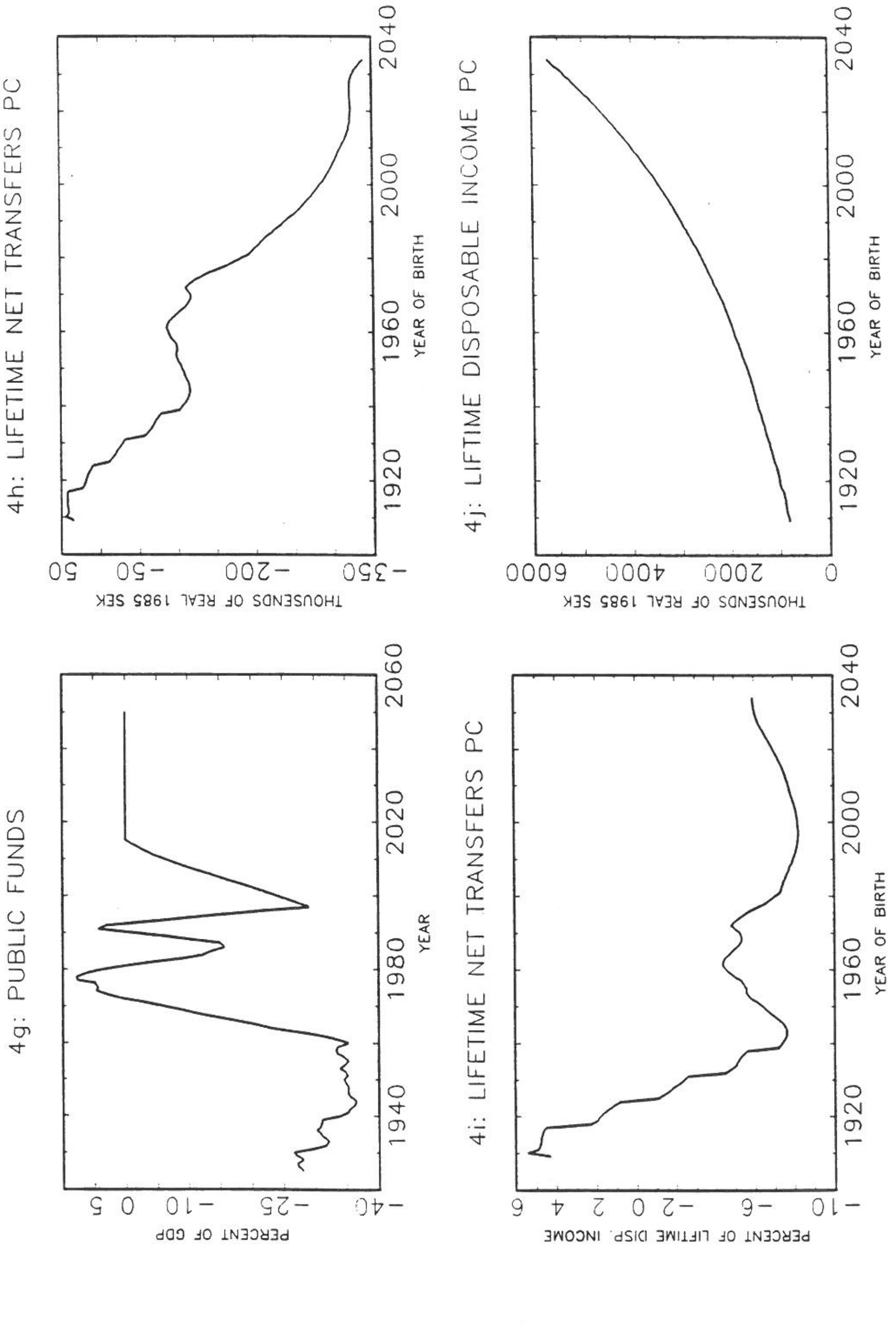
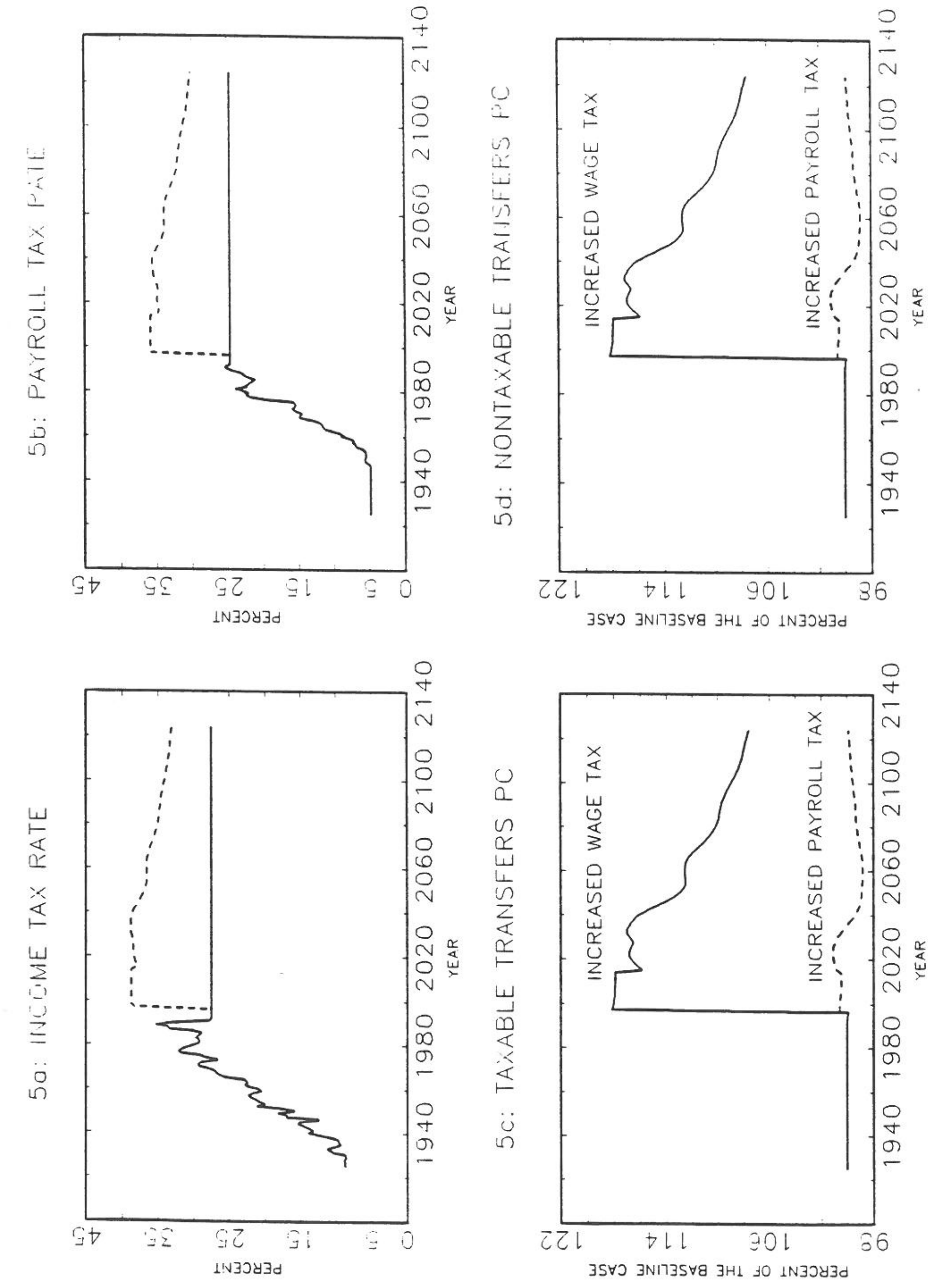
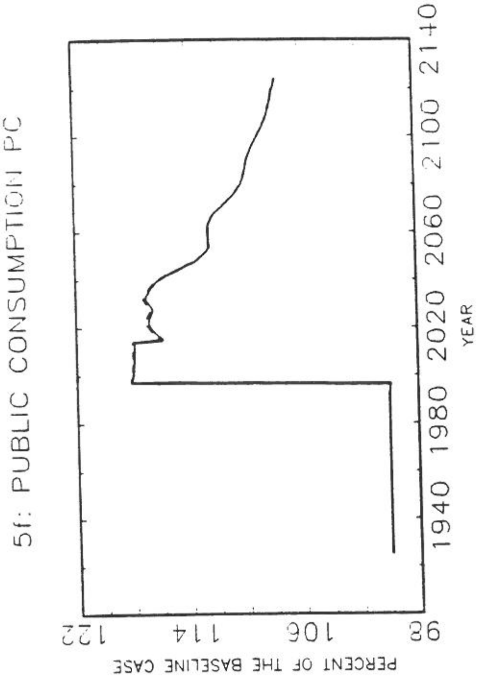
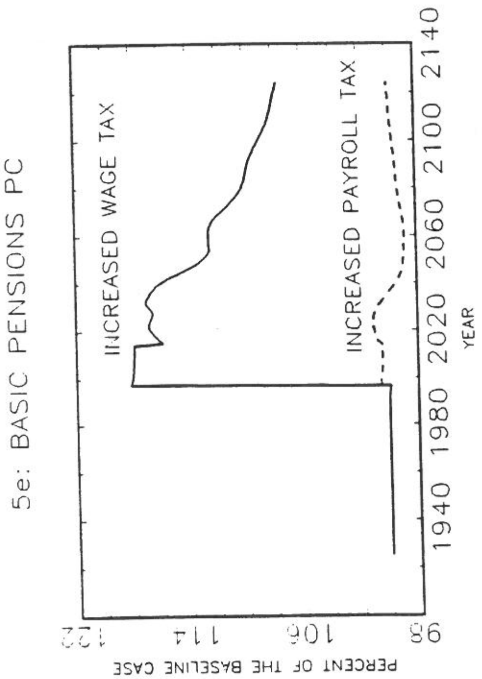
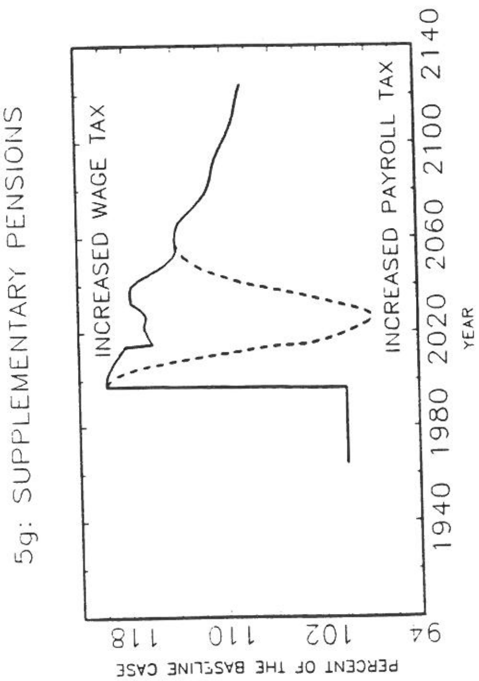

4g: PUBLIC FUNDS
PERCENT OF GDP
YEAR
4h: LIFETIME NET TRANSFERS PC
THOUSENDS OF REAL 1985 SEK
YEAR OF BIRTH
4i: LIFETIME NET TRANSFERS PC
PERCENT OF LIFETIME DISP. INCOME
YEAR OF BIRTH
4j: LIFETIME DISPOSABLE INCOME PC
THOUSENDS OF REAL 1985 SEK
YEAR OF BIRTH

FIGURE 5: TAX INCREASES VERSUS EXPENDITURE CUTS

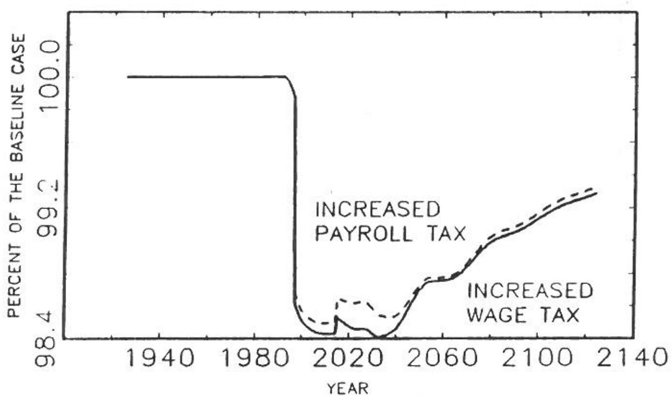



5f: PUBLIC CONSUMPTION PC
PERCENT OF THE BASELINE CASE
98
106
114
122
1940
1980
2020
2060
2100
2140
YEAR

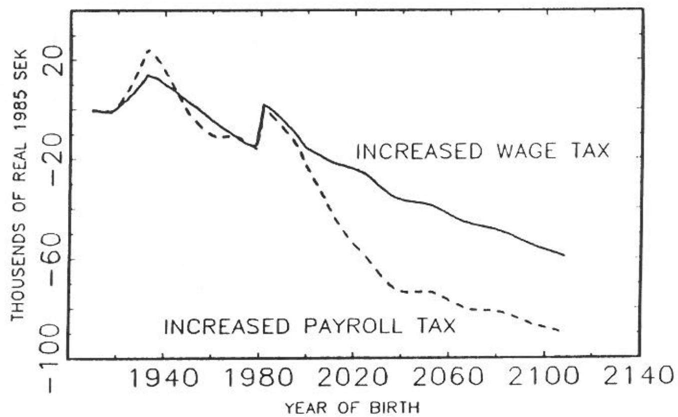

5e: BASIC PENSIONS PC
INCREASED WAGE TAX
INCREASED PAYROLL TAX
PERCENT OF THE BASELINE CASE
98
106
114
122
1940
1980
2020
2060
2100
2140
YEAR


5g: SUPPLEMENTARY PENSIONS
INCREASED WAGE TAX
INCREASED PAYROLL TAX
PERCENT OF THE BASELINE CASE
94
102
110
118
1940
1980
2020
2060
2100
2140
YEAR

5h: GROSS DOMESTIC PRODUCT



5i: DIFF. IN LIFETIME NET TRANSFERS PC



5j: LIFETIME DISPOSABLE INCOME PC

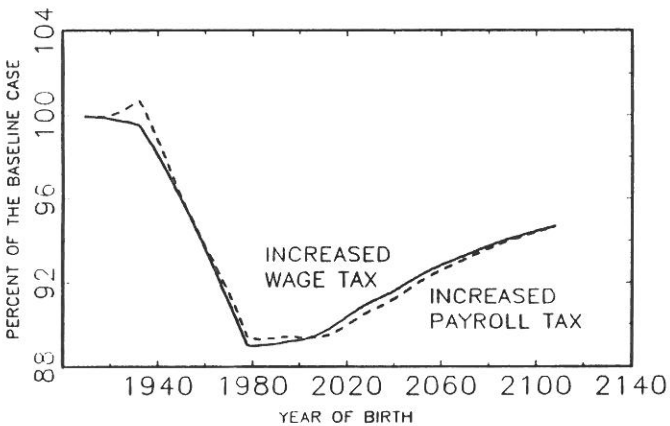


FIGURE 6: CHANGING THE SIZE OF PUBLIC FUNDS

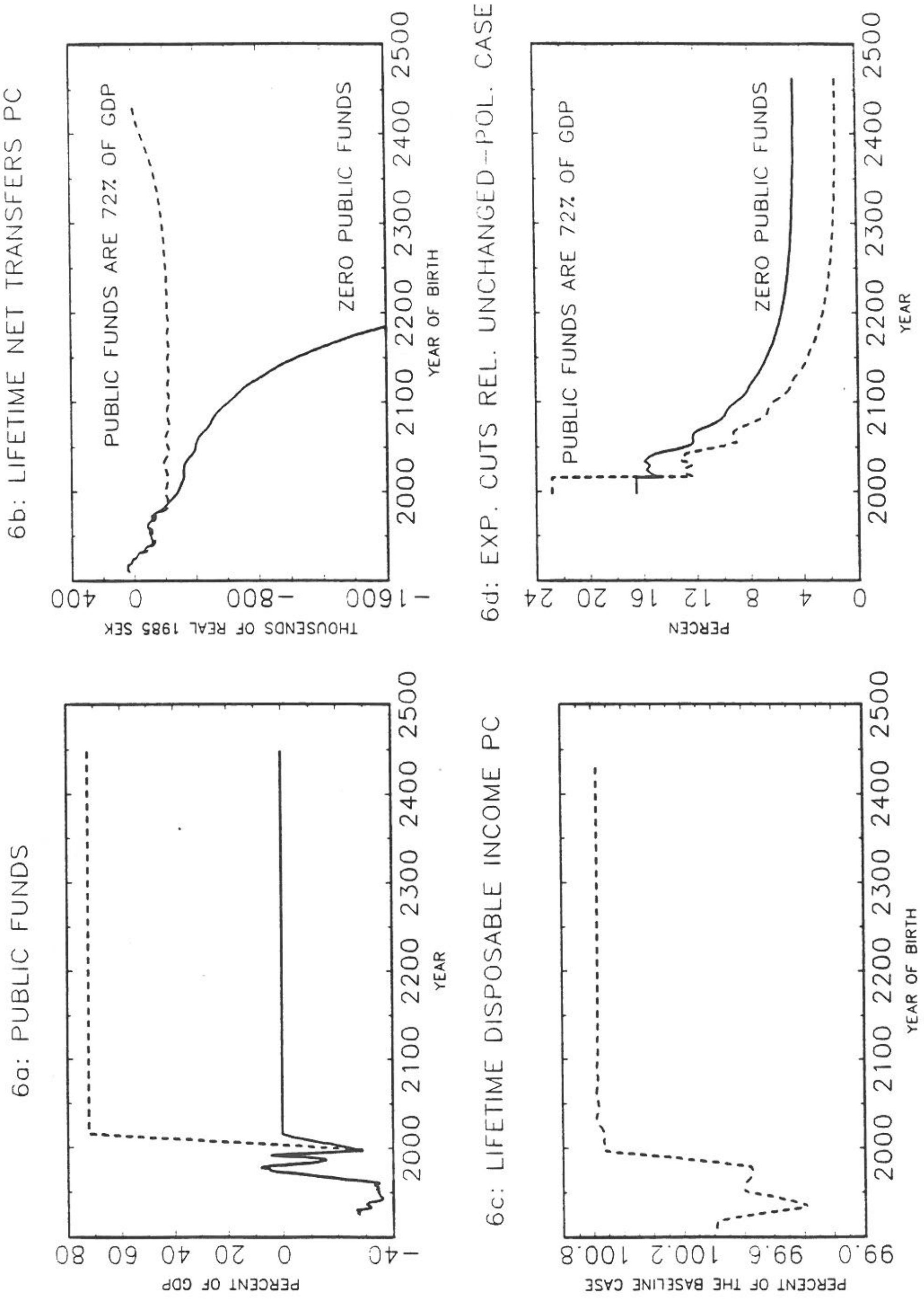
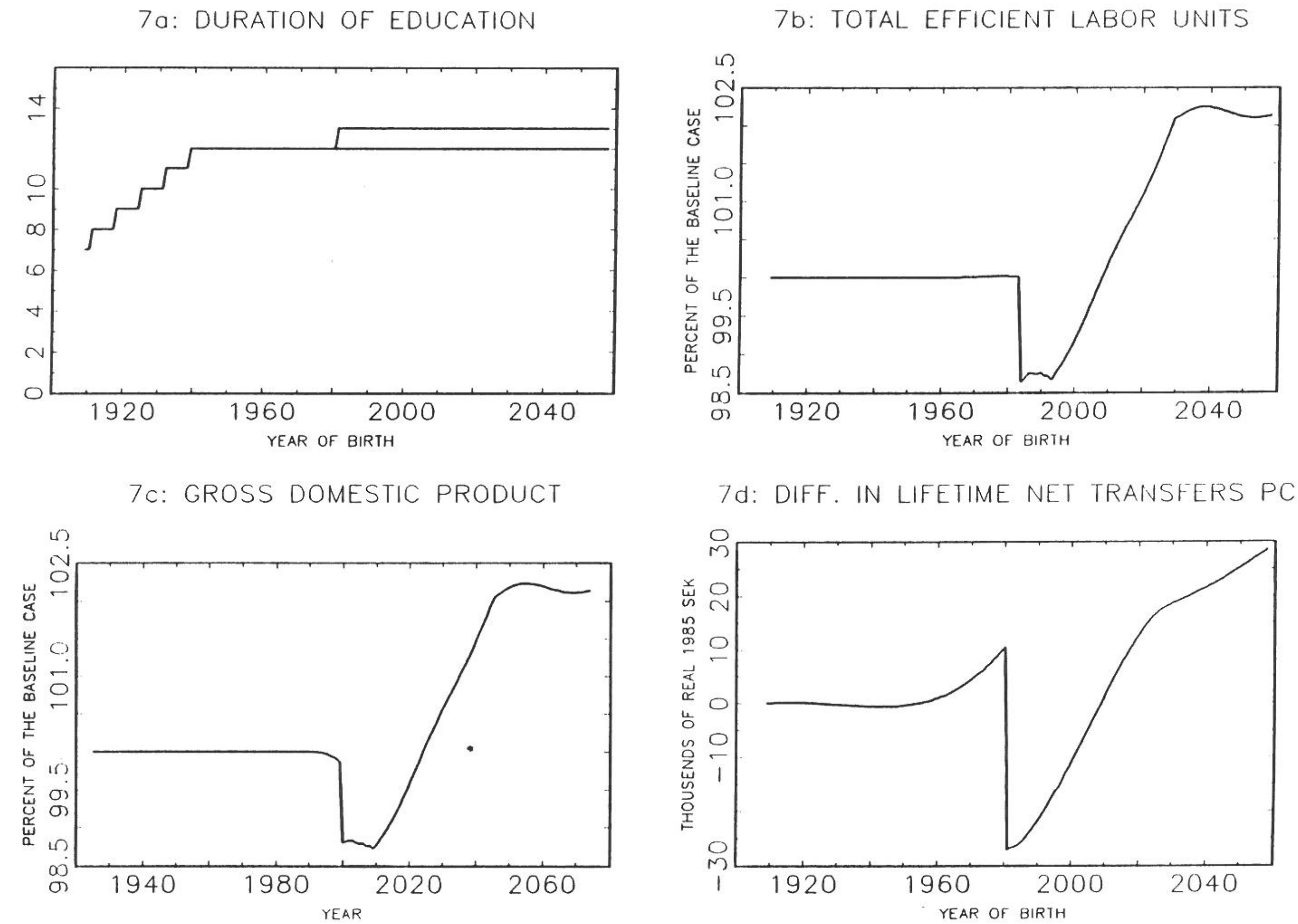


FIGURE 7: INCREASING THE DURATION OF EDUCATION



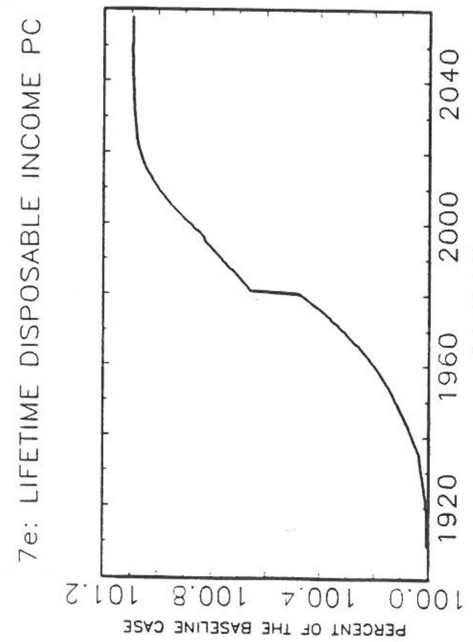
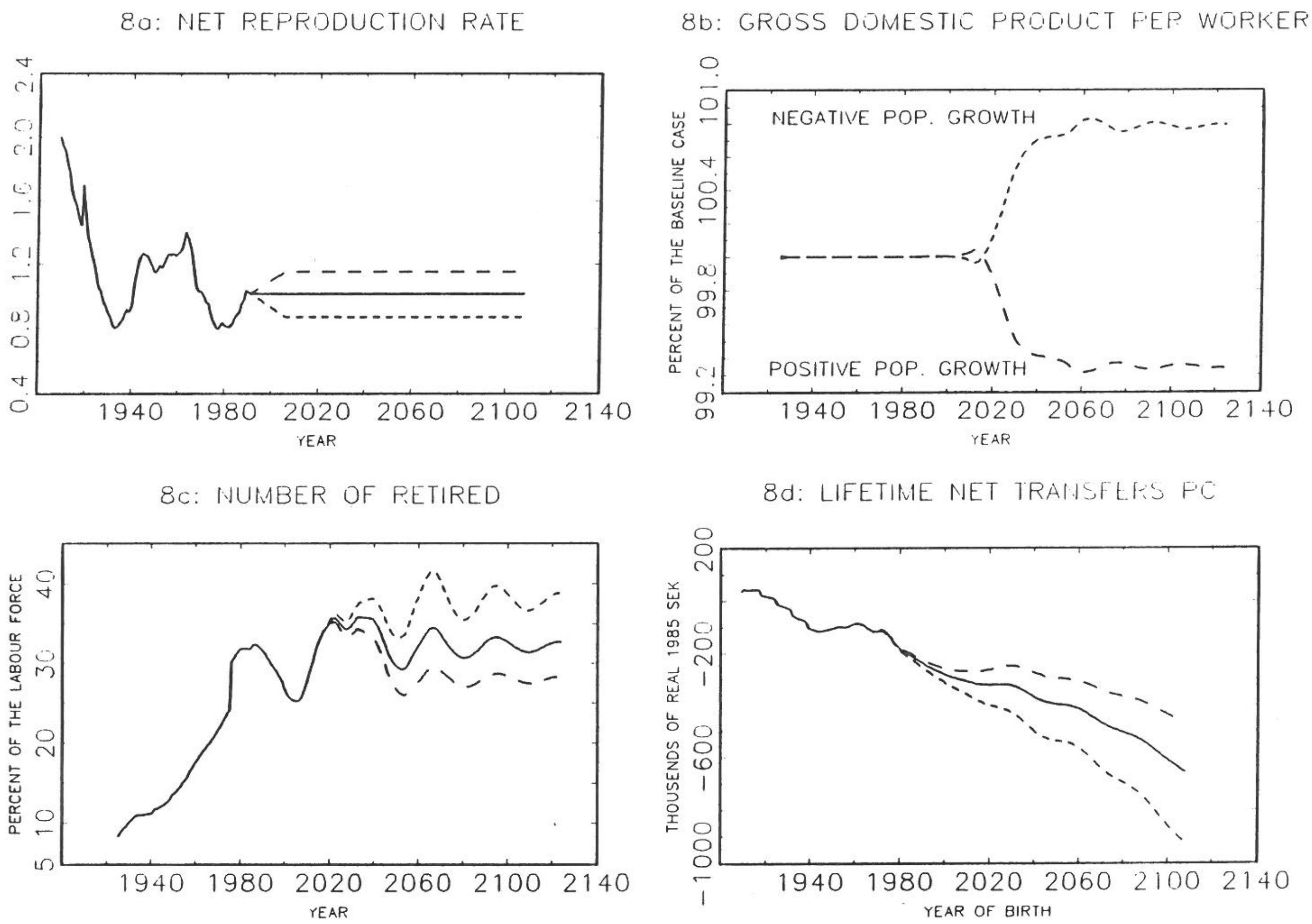

7e: LIFETIME DISPOSABLE INCOME PC
1920
1960
2000
2040
YEAR OF BIRTH
100.0
100.4
100.8
101.2
PERCENT OF THE BASELINE CASE

FIGURE 8: CHANGING THE POPULATION GROWTH



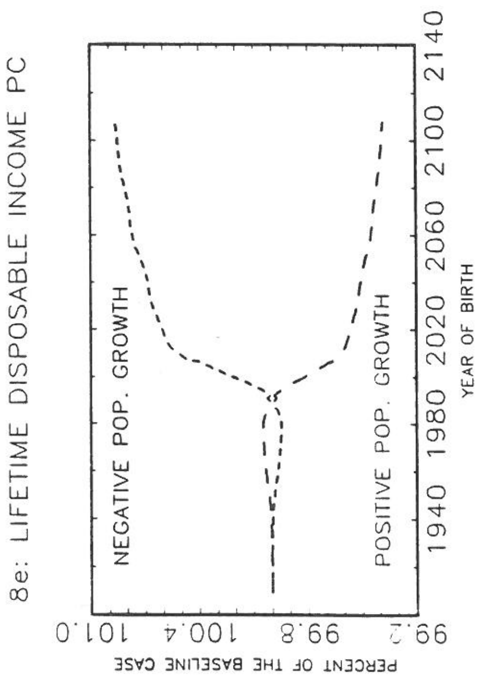

8e: LIFETIME DISPOSABLE INCOME PC
NEGATIVE POP. GROWTH
POSITIVE POP. GROWTH
PERCENT OF THE BASELINE CASE
101.0
100.4
99.8
99.2
1940
1980
2020
2060
2100
2140
YEAR OF BIRTH

FIGURE 9: EXTENDING THE STABILIZATION PERIOD

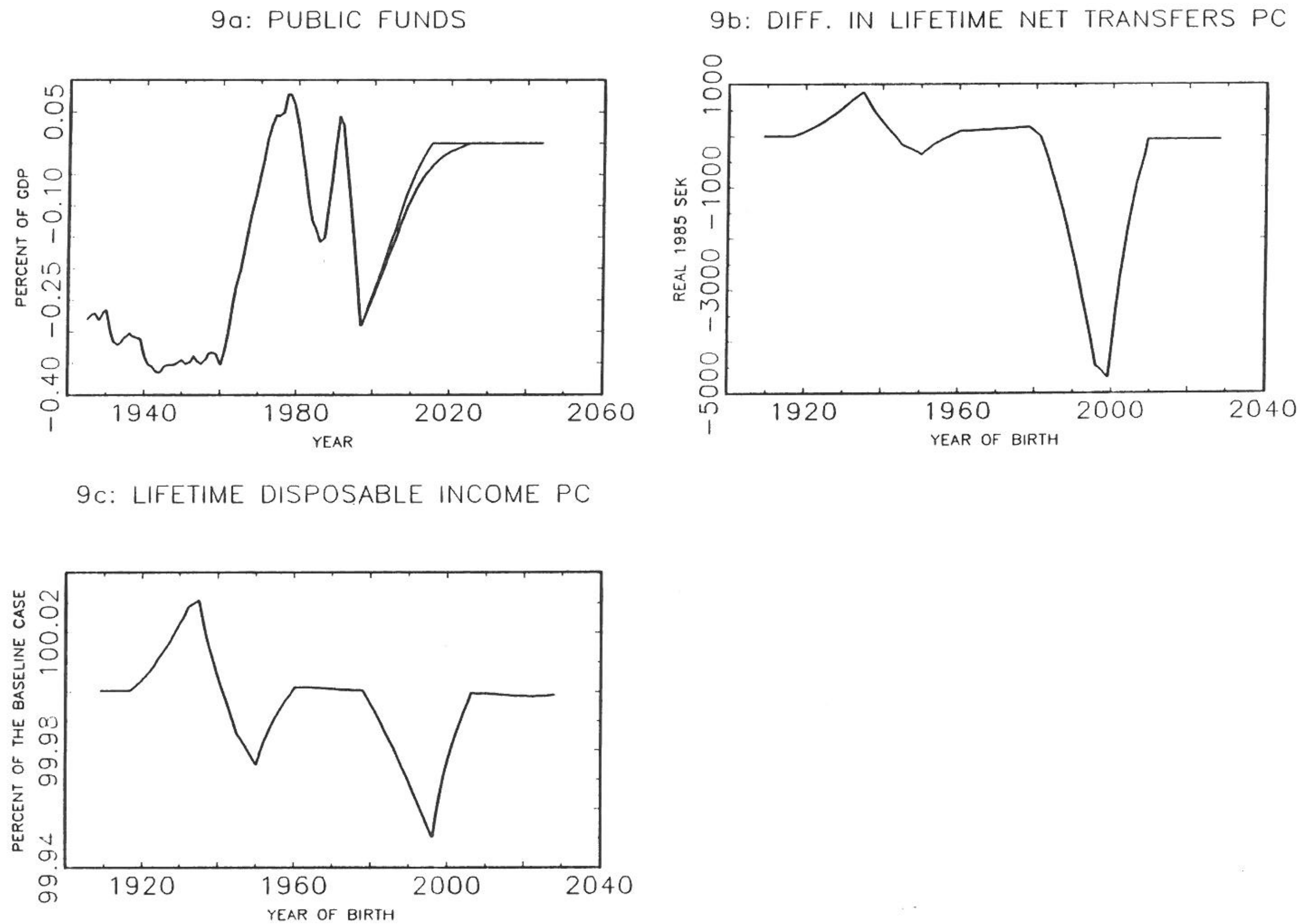
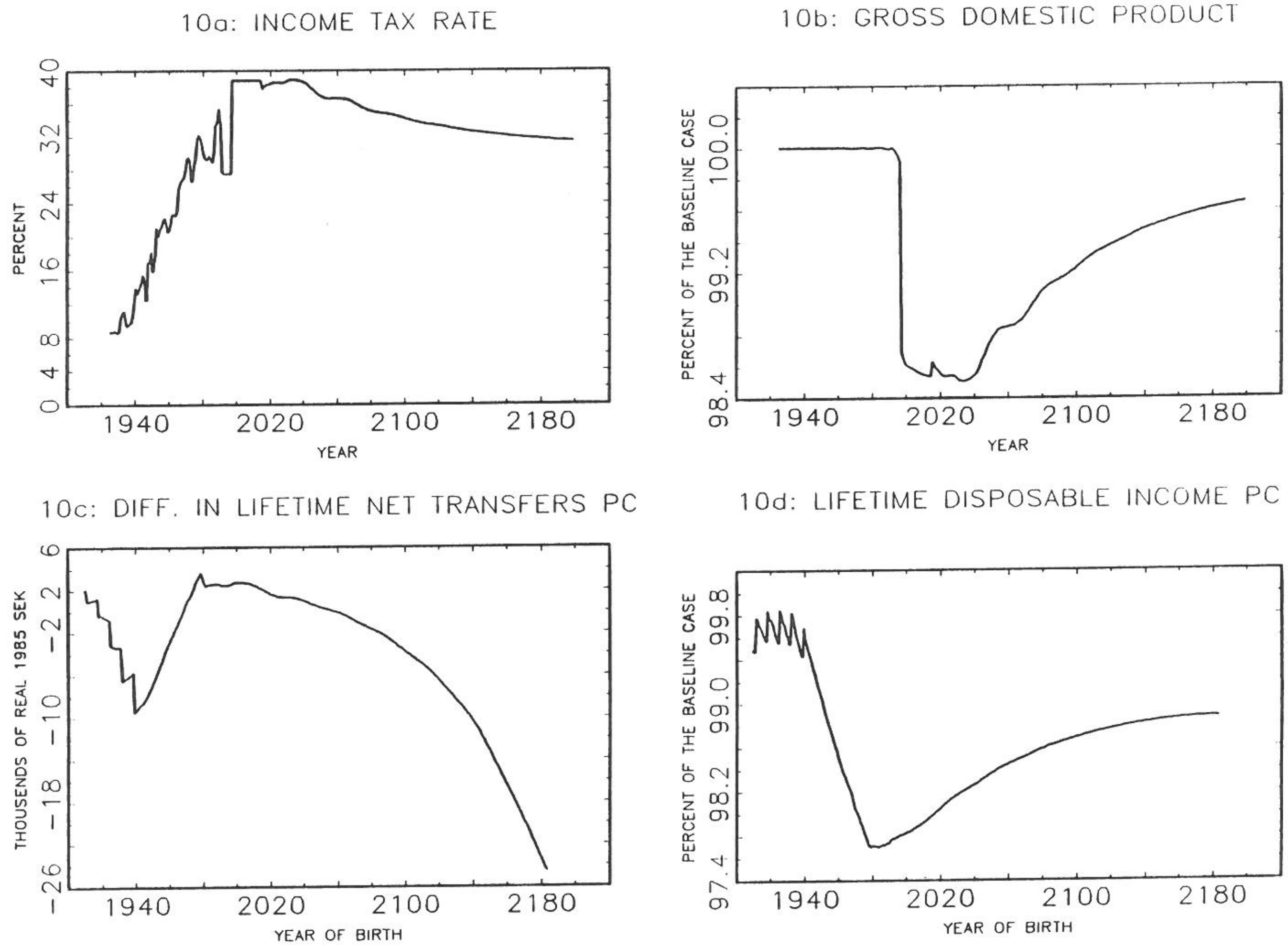


FIGURE 10: CHANGING THE WAGE ELASTICITY OF LABOR SUPPLY



Svensk sammanfattning

Den offentliga sektorn i Sverige har de senaste åren gått med stora underskott och skuldsättningen har därför ökat kraftigt. Denna studie undersöker hur en stabilisering av den offentliga budgeten påverkar samtida och framtida generationer. Undersökningen visar att det är möjligt att betala tillbaka den offentliga sektorns skuld utan att den disponibla livstidsinkomsten för framtida generationer behöver minska. Främsta skälet till detta är att lönerna på grund av teknisk utveckling växer samtidigt som andelen av inkomsten som en individ betalar till den offentliga sektorn är relativt konstant. För de flesta stabiliseringsprogram gäller att den disponibla inkomsten växer i ungefär samma takt som totalproduktiviteten, men att individer födda före 1925 kommer att få större bidrag och offentlig konsumtion än vad de betalar för i form av skatter, medan individer födda efter 1925 kommer att få bidra med mer än de får ut från den offentliga sektorn. Skälet är att Sverige införde ett välfärdssystem utan att fondera medel, (framför allt det offentliga pensionsystemet): De första generationerna betalade inte till systemet när de var yrkesverksamma. Istället började de med att lyfta förmåner. Efterföljande generationer delar på kostnaderna för de första generationernas förmåner och betalar därför netto ungefär fem procent av sin disponibla livstidsinkomst till den offentliga sektorn. Detta gäller även efter det att den offentliga skulden är helt återbetalad, eftersom de yrkesverksamma inte betalar för sina egna förmåner utan för tidigare generationers förmåner så länge inte välfärdssystemet är fullt fonderat. Full fondering innebär för Sveriges del offentliga fonder motsvarande ungefär 70 procent av BNP.

Beräkningsmodellen består av överlappande generationer som lever i 80 år, vinstmaximerande företag under perfekt konkurrens, och en skattefinansierad offentlig sektor. Alla individer går i skolan, yrkesarbetar med en lön som beror på utbildning och erfarenhet, och är slutligen pensionärer. Varje år föds det nya generationer som så småningom ärver sina föräldrars tillgångar. Antalet nyfödda i modellen väljs varje år så att det blir lika med det verkliga antalet i Sverige. På så sätt fås modellens åldersstruktur att överensstämma med den verkliga. I modellen finns tre olika kanaler för resursöverföring mellan olika generationer: Privata arv från föräldrarna, högre lön på grund av teknisk utveckling, och omfördelning genom den offentliga sektorns skuldsättning.

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