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SOCIAL SECURITY FINANCING AND EXTERNAL SHOCKS

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ABSTRACT: The study considers different financing arrangements of social security in an open economy susceptible to external shocks. We consider social security as a broad concept, including most transfers from the public sector to households but excluding earnings-related pensions and other earnings-related benefits. There are two main financing alternatives: firstly, labour income and payroll taxes, and secondly, value-added taxes. A complementary third alternative is capital income taxation. We use a dynamic computable general equilibrium model (FOG) with an overlapping generations structure. There are two household types, one with low labour incomes and a high share of transfers in total income, and one with higher labour incomes which receives less in transfers. We compare the different financing systems and analyse transition paths from one system to another. We also analyse the effects of foreign shocks under all financing regimes, especially from the point of view of intergenerational and intragenerational redistribution. The shocks come in the form of a temporary rise in the international interest rate or a temporary reduction in export demand.

KEY WORDS: social security, taxes, export and interest rate shocks, intergenerational welfare

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TIIVISTELMÄ: Tutkimuksessa tarkastellaan sosiaalietuuksien rahoitusta kansantaloudessa, joka kohtaa kansainvälisestä taloudesta peräisin olevia shokkeja. Etuuksien rahoituksessa on kaksi päävaihtoehtoa, joko palkkasummaan sidotut maksut tai arvonlisäverotus. Näiden lisäksi tarkastellaan pääomatuloverotukseen perustuvaa rahoitusta. Tutkimusvälineenä käytetään ETLA:ssa rakennettua dynaamista yleisen tasapainon mallia (FOG), jossa kotitaloudet on mallitettu yhtä aikaa elävinä eri-ikäisinä sukupolvina. Kotitalouksia on kahta tyyppiä. Pienituloisilla ansiotulot ovat vähäiset ja tulonsiirtojen osuus käytettävissä olevista tuloista suuri. Normaalituloisilla ansiotulot ovat vastaavasti suuremmat ja saadut tulonsiirrot pienemmät. Tutkimuksessa verrataan sosiaalietuuksien rahoitusvaihtoehtoja ja esitetään sopeutumisurat siirryttäessä työtuloihin perustuvasta maksusta osittain vaihtoehtoisiin rahoitustapoihin. Lisäksi tutkitaan sitä, miten väliaikainen koronnnousu ja vientikysynnän väheneminen vaikututtavat eri rahoitusvaihtoehdoissa sukupolvien sisäiseen ja väliseen tulonjakoon.

ASIASANAT: sosiaaliturvaetuudet, verotus, vienti- ja korkoshokit, sukupolvien välinen tulonjako

SUMMARY

The study considers different financing arrangements of social security in an open economy susceptible to external shocks. We consider social security as a broad concept, including most transfers from the public sector to households but excluding earnings-related pensions and other earnings-related benefits. There are two main financing alternatives: firstly, labour income and payroll taxes, and secondly, value-added taxes. A complementary third alternative is capital income taxation. We use a dynamic computable general equilibrium model (FOG) with an overlapping generations structure. There are two household types, one with low labour incomes and a high share of transfers in total income, and one with higher labour incomes which receives less in transfers. We compare the different financing systems and analyse transition paths from one system to another. We also analyse the effects of foreign shocks under all financing regimes, especially from the point of view of intergenerational and intragenerational redistribution. The shocks come in the form of a temporary rise in the international interest rate or a temporary reduction in export demand.

Reducing payroll taxes and increasing VAT correspondingly would increase both the efficiency and welfare of future generations. Without specific compensation, current pensioners and some of those in working-age would, however, suffer a welfare loss. The reduction in the payroll tax would increase wages, and the rise in VAT would increase consumer prices. Real wages would still rise. The VAT rise would also constitute a one-time tax on existing wealth. The measures would increase household saving and lead to a lower net foreign debt.

The effects of a shift from a payroll tax to a capital income tax depends on the details of the capital income tax system and financial strategy of the firms, but the long-run effects are likely to be negative. The return on savings, and thus saving, diminishes. Foreign indebtedness increases. If investment declines - which is likely to happen - then welfare also decreases in the long run. The measures would increase real wages. A majority of current working-age households would benefit. The net return on wealth, on the other hand, would decline, and most of the current pensioners would suffer a welfare loss. If investments were not affected by the increase in capital-income taxes, the welfare of future generations could increase. This would be largely at the expense of current generations, because the overall efficiency of an open economy is not likely to change much due to divergent efficiency effects of a reduction in a payroll tax rate and a rise in a savings tax rate.

The welfare effects of export demand and interest rate shocks are larger for the normal-income households than the low-income households. The effects do not differ much between different financing forms of transfers. If wages are temporarily sticky, however, payroll taxes seem to be the worst alternative. One reason why the effects do not differ very much between the financing regimes is that all households pay all the taxes considered here during their lifecycles, although in different amounts. Larger differences would be observed with more extreme households, e.g. relying only on one income source. Another thing is that both shocks have effects that are independent of the transfer financing system. For example, shocks would lead to public sector deficits, which are here prevented by adjusting the VAT rate. This creates similar effects under all regimes.

YHTEENVETO:

Tässä tutkimuksessa tarkastellaan sosiaalietuuksien rahoitusta kansantaloudessa, joka kohtaa kansainvälisestä taloudesta peräisin olevia shokkeja. Etuuksien rahoituksessa on kaksi päävaihtoehtoa, joko palkkasummaan sidotut maksut tai arvonlisäverotus. Näiden lisäksi tarkastellaan pääomatuloverotukseen perustuvaa rahoitusta. Tutkimusvälineenä käytetään ETLA:ssa rakennettua dynaamista yleisen tasapainon mallia (FOG), jossa kotitaloudet on mallitettu yhtä aikaa elävinä eri-ikäisinä sukupolvina. Kotitalouksia on kahta tyyppiä. Pienituloisilla ansiotulot ovat vähäiset ja tulonsiirtojen osuus käytettävissä olevista tuloista suuri. Normaalituloisilla ansiotulot ovat vastaavasti suuremmat ja saadut tulonsiirrot pienemmät. Tutkimuksessa verrataan sosiaalietuuksien rahoitusvaihtoehtoja ja esitetään sopeutumisurat siirryttäessä työtuloihin perustuvasta maksusta osittain vaihtoehtoisiin rahoitustapoihin. Lisäksi tutkitaan sitä, miten väliaikainen koronnnousu ja vientikysynnän väheneminen vaikututtavat eri rahoitusvaihtoehdoissa sukupolvien sisäiseen ja väliseen tulonjakoon.

Palkkasummaperusteisten työnantajamaksujen alennus ja vastaavansuuruinen arvonlisäverotuksen korotus lisäävät sekä talouden tehokkuutta että tulevien sukupolvien hyvinvointia. Nykyiset eläkeläiset ja jotkut työssäolevat sukupolvet kärsivät kuitenkin hyvinvointitappion, jos toimenpidettä ei kompensoida. Työnantajamaksun alennus nostaa palkkatasoa ja arvonlisäveron korotus nostaa hintoja, mutta reaalipalkat silti nousevat. Arvonlisäverotuksen pysyvä kiristyminen aiheuttaa samalla myös kertaluonteisen veron olemassaolevalle varallisuudelle. Verotuksen siirtyminen myöhemmälle iälle lisää kotitalouksien säästämistä ja vähentää kansantalouden ulkomaista velkaa.

Työnantajamaksun alennuksen rahoitus pääomatuloihin kohdistetulla verolla vaikuttaa eri tavoin investointeihin riippuen siitä, millaiset ovat pääomatuloverotuksen yksityiskohdat ja miten yritysten rahoitusstrategia reagoi. Toimenpide heikentää kuitenkin todennäköisesti hyvinvointia. Verotuksen kiristyminen vähentää säästämisen tuottoa ja säästämistä. Jos se lisäksi nostaa investointien tuottovaatimusta, maksun alentumisesta johtuva palkkojen nousu jää väliaikaiseksi. Suurin osa nykyisistä kotitalouksista hyötyy, mutta tulevat häviävät. Jos investointien määrä ei muutu, palkkatason nousu jää pysyväksi ja tulevat sukupolvet hyötyvät muutoksesta. Hyöty perustuu kuitenkin suurelta osin tulonsiirtoon nykyisiltä sukupolvilta, sillä työnantajamaksun alenemisesta johtuva verokiilan pieneneminen työmarkkinoilla kompensoituu säästämiseen liittyvän verokiilan kasvulla pääomamarkkinoilla, jolloin yhteenlaskettu kansantalouden tehokkuuden muutos on vähäinen.

Vaihtoehtoiset sosiaaliturvan rahoitustavat eivät vaikuta olennaisesti talouden tapaan reagoida ulkoisiin shokkeihin, jos markkinat toimivat hyvin. Palkkajäykillä työmarkkinoilla kuitenkin palkkasummaperusteinen rahoitustapa on kaikkein epäedullisin. Rahoitustapojen erojen vaikutusta lieventää se, että kaikilla kotitalouksilla on työtuloja (tai niihin perustuvia eläkkeitä) ja pääomatuloja ja että ne saavat tulonsiirtoja, vaikkakin eri suhteessa. Shokeilla on lisäksi rahoitusjärjestelmistä riippumattomia vaikutuksia, esimerkiksi valtiontalouden kautta.

Tutkimus on tehty Kansaneläkelaitoksen rahoituksella. Laajempi suomenkielinen raportti on Lassila ja Valkonen (1998).

1. INTRODUCTION[1]

Transfers are a large expenditure and income item in all industrial countries. In Finland, social security benefits and social assistance grants were about 23 % of GDP in 1995. They formed over 30 per cent of households' before-tax incomes in 1995. They are financed mostly by various distortive taxes. Furthermore, the problem of high tax rates puts pressure on the size of the transfers in many countries. Here we study whether the financing structure of transfers could be changed so that the burden becomes smaller and the need to cut transfers diminishes. There are two main financing alternatives: firstly, labour income and payroll taxes, and secondly, value-added taxes. A complementary third alternative is capital income taxation.

The financing regimes of social transfers are compared and transition paths analysed in a fashion similar to what Forss et al. (1998) did in connection with earnings-related pensions. The effects of an export demand shock and an interest rate shock are also studied under different financing regimes. We consider social security as a broad concept, including most transfers from the public sector to households but excluding earnings-related pensions and other earnings-related benefits. These non-earnings-related transfers amounted to 18 % of households' incomes in Finland in 1995. We also consider two types of households, to distinguish those who are heavily dependent on transfers and those who are not.

The households determine their consumption, saving, and leisure by maximising lifetime utility. The share of low-income households in the model is calibrated to 1/5 of the total number of households. The remaining 4/5 represent more "average" households, who also receive some transfers but mostly experience social security in their tax burden. The household types have been calibrated so that they roughly conform to the income type differences observable in the Finnish Income Distribution Statistics. The main difference between the two household types is assumed to be in work efficiency, which is visible in wage rates. The maximum working time that can be supplied is also smaller for the low-income households.

As in Forss et al, we find that financing regimes must be defined in two ways. First, it can be defined by the structure of financing: which taxes are used and how much. Different structures imply e.g. different incentives to work and save. The second definition is the budget-balancing rule: which tax(es) adjust when shocks hit the economy, and whether public debt is allowed to change. Different rules have different implications for e.g. inter- and intragenerational redistribution.

The role of international capital movements is studied in a way similar to Lassila et al. (1997): The difference between domestic and international interest rates is modelled to depend on a varying degree on the development of net foreign assets. The model used in this study is an enlargement of the model described in Lassila et al. (1997), Valkonen (1997) and Forss et al. (1998). The model structure and calibration is presented in Section 2. The financing regimes of social transfers are compared and transition paths analysed in Section 3. The effects of the export demand shock and the interest rate shock under different financing regimes are studied in Section 4. Section 5 concludes.

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[1] The study is reported in Finnish in Lassila and Valkonen (1998).

2. THE MODEL

The model is an Auerbach-Kotlikoff-type perfect foresight numerical overlapping generations model. It has five sectors: households, enterprises, a government, a pension fund and a foreign sector. The goods and capital markets are competitive and prices balance the demand and supply period-by-period. The labour market is either competitive or has temporary stickiness; there is also a bargaining version with a centralized trade union.

Households

There are two types of households in the model. They are both lifetime utility maximisers. Utility is acquired from consumption, leisure, and in one household type also from giving a bequest. Their maximisation problems can be presented as follows:

$$(1)\qquad \max_{c,l,B} \quad \sum_{t=1}^{T} \frac{1}{1-\frac{1}{\gamma}} \frac{n_t}{(1+\delta)^{t-1}} U_t^{1-\frac{1}{\gamma}} + \frac{1}{1-\frac{1}{\gamma}} \mu \frac{n_T}{(1+\delta)^{T-1}} [B(1-\tau^B)]^{1-\frac{1}{\gamma}}$$

subject to the budget constraint which equals discounted wage income, pensions, transfers and bequests to discounted consumption expenditure:

$$(2)\qquad \begin{aligned} &\sum_{t=1}^{T_w}(1-l_t)e_t w_t(1-\tau_t^w-\tau_t^e-\tau_t^s)R_t + \sum_{t=T_w+1}^{T} Z_t(1-\tau_t^w-\tau_t^p)R_t \\ &+R_2 B_2(1-\tau_t^B) + \sum_{t=1}^{T} S_t R_t = \sum_{t=1}^{T} c_t p_t^C (1+\tau_t^C) R_t - R_T B_T \end{aligned}$$

and subject to the determination of earnings-related pensions Z. The periodic utility U_t depends on consumption and leisure:

$$(3)\qquad U_t = (c_t^{1-\frac{1}{\rho}} + \alpha l_t^{1-\frac{1}{\rho}})^{\frac{1}{1-\frac{1}{\rho}}}$$

R_t is the discount factor:

$$(4)\qquad R_t = n_t \Pi_{s=0}^{t-1} \frac{1}{1+r_s^d(1-\tau_{s+1}^r)} \qquad\qquad t = 1, \dots T$$

where c_t is consumption, p_t^C denotes consumer prices, and l_t is leisure. Of the constant parameters, γ is the elasticity of intertemporal substitution, δ is the rate of time preference and ρ is the elasticity of substitution between consumption and leisure. Low-income households leave no bequests and receive none. Households with normal incomes receive a net bequest $B(1-\tau^B)$ at the age of 25 (period 2) and plan to leave a bequest B_T at death. Parameter μ scales the joy of giving a bequest. The household type and age specific transfers S_t are fully indexed to consumer prices. Transfers contain all social benefits, also pensions other than earnings-related pensions Z.

A full life-cycle contains $T = 14$ five-year periods. The life-cycle plan is made at the age of 20, and retirement takes place at 60. Households start their adult lives with zero wealth, and are liquidity-constrained: wealth cannot be negative at any time. Lifetimes are uncertain but follow given constant probabilities. Households, in fact, maximise expected utility. The population is large enough so that every period a given fraction of each cohort dies with probability one, so there is no uncertainty at the aggregate level. Following Yaari (1965), we assume that insurance companies pay premiums to households on their assets and receive these assets if the household dies. With perfect competition in the insurance industry its profits are zero. The premiums that households receive vary with age. The survival probabilities n_t are included in the lifetime utility function and in the discount factor formula, and depend on dying probabilities s_j as follows:

(5)
$$n_t = 1 \qquad t = 1$$
$$n_t = \prod_{j=1}^{t-1}(1 - s_j) \qquad t = 2, ...T$$

The replacement rate of the earnings-related pension system is θ. It is the ratio of the pension in the first retirement period to the pension wage. θ depends in principle on the number of working years, but in the models households work during all working-age periods.

For the calculation of the pension wage, we need to define the normal working time. It is defined as follows:

(6)
$$1 - l^p = \frac{1}{T_w} \Sigma_{t=1}^{T_w}(1 - l_t)$$

and the pension wage:

(7)
$$w^p = \frac{\sum_{t=1}^{T_w} \Phi_t(1-l_t)e_t w_t^{\varphi}\left[p_t^C(1-\tau_t^C)\right]^{1-\varphi}}{1-l^p} w_{T_w+1}^{\varphi}[p_{T_w+1}^C(1+\tau_{T_w+1}^C)]^{\varphi-1}$$

where $\Sigma_{t=1}^{T_w} \Phi_t = 1$

Pension Z in period t, $(t = T_w + 1...T)$ is now:

(8)
$$Z_t = \theta(1 - l^p)w^p(\frac{w_t}{w_{T_w+1}})^{\psi}\left[\frac{p_t^C(1+\tau_t^C)}{p_{T_w+1}^C(1+\tau_{T_w+1}^C)}\right]^{1-\psi}$$

The weights Φ determine the pension rights averaging period. If the worker stays in one firm, the last ten years are crucial in the current Finnish system. In the simulations, due to moves between firms, all working periods have positive weights, but the last periods are the most important. The number of working periods T_w is 8. The parameter e_t describes age-dependent work efficiency. It makes the age-earnings profile hump-shaped.

There are two indexing systems. During the working years, the accrued pension rights are indexed to wages and consumer prices with equal weights (parameter φ = 0.5). During retirement, the pension wage is indexed less to wages than to consumer prices (parameter ψ = 0.2).

The parameters τ^w, τ^C and τ^r describe tax rates on wages, consumption and interest incomes. τ^e is employee's pension contribution rate. The parameter τ^s is the employee's and τ^p the pensioner's social security contribution rate.

The actual equations of the model are the first-order conditions derived from the optimisation problem. The household sector consists of fourteen households, of different age, in each period. Total consumption, labour supply, pensions and transfers received and taxes paid are aggregated from individual household decisions.

The two household types

Our aim is to study both those on the receiving side and those on the payers' side of social transfers. We label the former "low-income households" and the latter "normal-income households". The difference is a matter of degree: both groups receive transfers and pay them. Table 2.1 shows the relative roles of transfers, labour incomes and capital incomes in the two groups in the model.

Table 2.1 Household income structure in 1995, 1000 FIM

Item	Low-income households	Normal-income households	Total
Labour income	**29.2**	**127.2**	**107.6**
Property income	**3.4**	**17.9**	**15**
- without imputed rents	**0.7**	**8**	**6.5**
Transfers from the public sector	**51.1**	**57.5**	**56.2**
- earnings-related pensions	**6.9**	**28.2**	**23.9**
- national pensions	**8.9**	**7.1**	**7.5**
- unemployment pensions and benefits	**14.6**	**8.6**	**9.8**
Transfers to the public sector	**12.8**	**57.2**	**48.3**
Disposable income	**70.8**	**145.4**	**130.5**

Source: Income Distribution Statistics 1995, Statistics Finland, tables 2 and 19. Based on decile groups ordered according to households' disposable income per consumption unit. Figures for the low-income group are averages of the two lowest deciles and for the normal-income group averages of the remaining eight deciles.

The stylised facts we wish to model from Table 2.1 are: 1) Transfers received are much more important to low-income than to normal-income households, 2) Labour incomes are more important to normal-income households, 3) Capital incomes are more important to the normal-income group. In 1995 Finland was still climbing up from an extremely deep recession, which reduced labour incomes, and presumably so in the low-income group. An adjustment was made to the unemployment transfers and labour incomes, corresponding to an unemployment rate of 8 per cent instead of the actual 1995 rate of 16.9 per cent. After this adjustment, labour incomes, including earnings-related pensions, were the biggest income item also for the low-income households.

The next step was to calibrate the household types so that the stylised facts appear also in the model output. Transfers pose no problems; they are exogenous. Labour incomes needed three differences between the household types to create a sufficient outcome. Firstly, the efficiency parameters e for the low-income group were set at 0.6 on average, compared to 1.0 for the normal-income group. This relation was based on the assumption that low-income households received wages corresponding to the two lowest deciles in the Wage Statistics (Statistics Finland). Secondly, the maximum amount of disposable time was set at 0.88 in the low-income group and at 1 in the normal-income group. The difference reflects the average number of adults in the two groups, according to the Income Distribution Statistics. Thirdly, the consumption - leisure parameter α received a higher value in the low-income group than in the other group.

Capital income differences, and the corresponding wealth differences, were created by two adjustments. Firstly, the rate of time preference received a higher value in the low-income group. Secondly, the bequest motive was restricted to the normal-income households only. To get the wealth levels sufficiently high, more transfers were placed on the early phases of the life-cycle than on the latter periods.

The resulting outcome is displayed in Table 2.2. The figures are averages over the life-cycle.

Table 2.2 Household characteristics in the model

	Low-income households	Normal-income households	Total
Transfers, net / consumption	0.44	0.15	0.18
Net wages and earnings-related pensions / consumption	0.48	0.63	0.61
Capital incomes / consumption	0.08	0.23	0.21
Wealth / consumption	2.11	6.05	5.6
Consumption / average consumption	0.57	1.11	1

Other parameters are the same in both household types. The intertemporal elasticity of consumption determines the sensitivity of household saving to the net yield. The general opinion about the likely value of the parameter is that it is close to zero largely because of the contribution of Hall (1988). On the other hand, cross-sectional studies like Blundell et al. (1994) generate markedly higher values than time-series studies. Our choice was to use a value of 0.5. The intratemporal elasticity between consumption and leisure is chosen to be 0.75, which is close to the value used by Auerbach and Kotlikoff (1987), but somewhat lower than the unitary elasticity estimated for Finland by Törmä (1989).

Pension funds

Both the private sector and the public sector have pension funds for the earnings-related pensions. Pensions are financed by interest incomes and both the employee's and the employer's contributions. The latter balances the fund's budget. The financial wealth of the funds is fixed.

Government sector

The government collects taxes and uses the proceeds to pay interest on outstanding debt and to employ civil servants to produce public services. These services are provided free of charge and are not taken into account in individual utility considerations. There is a separate budget constraint for transfers: they are financed partly by employers' and employees' contributions and partly by VAT in the base case. Various financing rules, including the use of capital income taxes, are the subject of this study.

Firms

In this section we describe the firms' behaviour in the model. We show first that the way how corporate and personal capital income taxation affects the market value and investment decisions of the firms depends on the financial strategy they follow. Later we discuss the calibration of the firms.

Description of the firms' optimisation problem and reactions to taxation

A representative small firm produces the domestic good using capital inherited from the previous period, intermediate goods and labour. Infinite horizon decisions of investment and employment are made to maximise the firm's market value. The firm takes prices, demand for production and supply of factors at given prices, production technology and taxation as given. Intermediate and capital goods are costs minimising CES composites of domestic and imported goods.

Gross production is a combination of value added, net of investment adjustment costs, and the composite intermediate good in fixed proportions. The production function is a standard CES function of capital and labour. The end-of-period capital stock is the sum of investment during the period and the depreciated capital stock from the previous period. Capital depreciates at a constant annual rate d. In the process of installing new capital some of the production is lost as investment adjustment costs. These quadratic installation costs depend positively on the investments and negatively on the amount of capital.

Determination of the firm's market value is based on an arbitrage condition, which says that the expected after-tax yield on investment in firms' shares must be equal to the after-tax interest rate. Solving the arbitrage condition forward and ruling out bubbles gives the value of the firm as a discounted sum of tax-adjusted values of future dividends.

The firm's after-tax earnings, E_t^A include the value added of the firm net of investment adjustment costs, which are deductible in corporate taxation. Earnings are reduced by labour costs and the interest costs of the firm's debt.

The model includes two options for the financial strategy of the firms[2]. The base case strategy follows the "new view" of dividend taxation. In this strategy the means of financing the investment costs $p_t^K I_t$ are the after-tax earnings and increase in debt $B_t^F - B_{t-1}^F$. Dividends D_t are determined as a residual from the cash flow of the firms as follows:

(9) $$D_t = E_t^A + (B_t^F - B_{t-1}^F) - p_t^K I_t$$

The alternative financial strategy, named as the "old view" or "traditional view", finances the marginal investments with share issues and debt. According to the old view, the shareholders have a preference for dividends over capital gains generated by retained earnings. Here the dividend pay-out ratio a determines the amount of distributed dividends as a fixed ratio to the earnings net of depreciation costs[3]:

2 The strategy choices, the optimization problem induced, and the interpretation of the results are presented more closely in Valkonen (1997).

3 This is a simplified version of the formulation used by Goulder and Summers (1989).

(10) $D_t = a(E_t^A - dp_{t-1}^K K_{t-1})$

The needed amount of share issues V_t^N is solved from the firm's cash flow identity:

(11) $V_t^N = p_t^K I_t + D_t - E_t^A - (B_t^F - B_{t-1}^F)$

In both strategies the amount of debt corresponds to a fixed share of the replacement value of the firm's capital stock.

Firms choose the optimal amount of investment and use of labour to maximise the price of the their shares. The problem can be presented verbally as maximising in the beginning of the period the tax-adjusted dividends net of share issues plus the value of the firm at the end of the period, subject to the amount of the initial capital stock, production function, investment adjustment cost function, determination of the amount of debt, capital accumulation condition and the relevant conditions from (9)-(11).

The first order conditions for the maximum of the firm's value are as follows:
- The shadow value of one unit of capital equals the costs of purchasing and installing the capital unit.
- The value of the marginal product of capital equals the user cost of capital.
- The value of the marginal product of labour equals labour costs.
- The discounted value of the capital stock approaches zero when time goes to infinity (transversality condition).

Three of the conditions of the constrained optimisation are used as model equations.

Looking more closely at the first condition gives insight into the links between taxation and the valuation of the firms. In the new view case Tobin's marginal q (the ratio of shadow value of a capital unit to the purchasing price of that unit) is:

(12) Tobin’s marginal q = $\frac{1-\tau_t^D}{1-\tau_t^g} + \frac{1-\tau_t^D}{1-\tau_t^g}\frac{p_t^F}{p_t^K}(1-\tau^F)\xi\frac{I_t}{K_{t-1}}$

Here τ^D, τ^g and τ^F are the dividend tax rate, the capital gains tax rate and the corporate income tax rate. The price ratio includes the price of the value added p_t^F divided by the price of the capital good p_t^K. Assuming away the effects of adjustments costs (the second term on the right-hand side) gives an expression which is familiar to the new view analyses: the market valuation of the marginal unit of capital in the firm depends solely on the relative taxation of dividends and capital gains.

In the old view case the dividend preference parameter a complicates the corresponding marginal q equation somewhat:

(13) Tobin’s marginal q = $1 + (1 + \frac{1-\tau_t^D}{1-\tau_t^g}a - a)\frac{p_t^F}{p_t^K}(1-\tau^F)\xi\frac{I_t}{K_{t-1}}$

If there were no investment adjustment costs in the steady state, the equilibrium value for Tobin's marginal q would be one. This describes one of the main old view assumptions: retaining a unit of earnings raises the market value of the firm by the same amount irrespective of taxation.

The effects of taxation on the optimal amount of capital stock can be studied by analysing the optimality conditions of capital in the steady state. In the new view case, the condition can be written as:

$$(14) \quad p^F(F_K - G_K) = p^K\left[d + br^d + (1-b)r^d \frac{1-\tau^r}{(1-\tau^g)(1-\tau^F)}\right] + p^F \xi d(r^d \frac{1-\tau^r}{1-\tau^g} + d)$$

The left-hand side describes the value of the marginal product of capital (taking into account that an additional unit of capital reduces future investment adjustment costs). The right-hand side includes the finance costs. The important parameters are inside the brackets, where the first term is the depreciation rate d, followed by the interest cost of debt financed share of capital br^d and the cost of the share $(1-b)$ of the capital stock unit financed by retained earnings. The last term is again related to investment adjustment costs.

The corresponding steady state equation for the old view is:

$$(15) \quad \begin{aligned} p^F(F_K - G_K) = p^K\left[d + br^d + (1-b)r^d \frac{1-\tau^r}{a(1-\tau^D)(1-\tau^F)+(1-a)(1-\tau^g)(1-\tau^F)}\right] + \\ p^F \xi d(r^d \frac{1-\tau^r}{1-\tau^g} + d) \end{aligned}$$

The dividend distribution decision now influences the cost of the equity-financed portion of capital. When $a = 1$, the dividend tax rate has replaced the capital gains tax rate. If $a = 0$, no dividends are distributed and the dividend tax is neutral. In that case the earnings are distributed via share repurchases and the cost of capital is exactly the same as in the new view model. In what follows, we will set $a = 1$, implying that in the current Finnish tax system shareholders prefer dividends to capital gains, because the former are taxed less.

We use these equations to anticipate some of the partial equilibrium results of a general capital income tax hike in the Finnish tax system. The Finnish corporate and capital income taxation is part of our dual tax system in which taxation of earned income has been separated from taxation of capital income. The tax rate is now a flat 28 per cent regardless of whether the tax base is interest income, dividend income, capital gains or corporate income (distributed or retained). Because of the full imputation system, the effective personal level tax rate for dividends distributed by a listed company to a domestic private individual is zero.

Let's look first at the valuation and capital stock effects in the new view case. Equation (12) says that the equal tax hike of the capital gains tax τ^g and corporate income tax rate τ^F (the effective tax rate of dividends τ^D still being zero because of imputation) cancel each other out in the latter part of the equation. The remaining effect is a strong appreciation of the firm's shares. The intuitive explanation for the surprising result is that the existing capital stock benefits from the higher required marginal productivity of new capital.

This harder requirement can be inferred from the Equation (14). It says that the hike in the capital gains tax rate and the interest income tax rate τ^r cancel each other out and the remaining effect is a higher cost of capital of retained earnings due to the higher corporate tax rate. Therefore, the marginal productivity has to be higher and the optimal amount of capital lower.

In the old view case the results are more straightforward, assuming that the firms distribute the maximum amount of dividends. According to Equation (13), the general tax hike does not have any direct effects on the valuation of the firms. The same result applies to the steady state condition of the optimal capital stock: the interest income tax and the corporate income tax hikes cancel each other out in the formula describing the cost of capital financed by share issues. The intuitive explanation for the neutrality results is that the additive earnings due to an investment financed with equity issues are distributed as dividends, and they are not taxed at the personal level in the imputation system.

The interest costs of the debt financed share of capital are not affected by taxation either, because interest expenditures can be deducted in the corporate taxation and the depreciation allowance in the model corresponds to the real depreciation. The latter simplification is no longer very harmful because the possibilities of using accelerated tax depreciation rates have been reduced and the interest rate is much lower than it used to be in Finland.

There is one further point that should be mentioned. In the calibration of the model the interest income tax rate has been reduced to be initially 14 per cent because a large share of the interest bearing assets are tax-free deposits. This does change slightly the neutrality results described above. Another point is that in the model domestic households own the firms. If a majority of the owners are foreigners and residence principle is applied in taxation, a general hike in capital income taxes affects their after-tax revenues solely via a higher coporate tax rate. They will require, however, the same after-tax rate of return, which means that the share values and the amount of capital must fall.

Lastly, this discussion was directed towards the partial equilibrium effects of taxation. As an example of the general equilibrium effects, tax hikes will generate changes in the terms of trade, which affect the cost of capital through the price of value added p^F and the price of the capital unit p^K, being a composite of the domestic and the imported good. A rise in the relative price of the domestic good raises incomes from a unit of capital more than costs because part of the unit is imported.

Calibration of firms behaviour

The important parameters in the firms' CES production function are the substitution elasticity of labour and capital and the share parameter. The substitution elasticity seems to be difficult to estimate credibly. The Finnish studies (e.g. Törmä 1989 and Tarkka et al.1990) yield somewhat higher values for the elasticity than the median value of 0.58 found by Rowthorn (1996), who surveys 33 studies. We chose the value of 0.7. The share parameter is used to determine the value-added shares of capital and labour incomes. The model has just one type of capital, which is assumed to depreciate yearly by 9 per cent. The value of the investment adjustment cost parameter is set to be 2, which corresponds to the lower end of the available estimates (see e.g. Lichtenberg 1988 and Whited 1994).

3. SHIFTING THE FINANCING STRUCTURE OF THE TRANSFERS

This section describes the macroeconomic and intergenerational welfare effects of a partial shift from payroll-tax financing to either consumption financing or to capital income financing of the transfers. The impacts of these permanent changes are contrasted to the incidence effects of a temporary income transfer financed with various taxes. The method used is the FOG-model described above.

3.1 A shift from payroll-tax financing to VAT

In the base case scenario transfers are financed by proceeds of a value added tax and a payroll tax. The value added tax returns used for this purpose are fixed and the payroll tax balances the revenues and expenditures of the transfer system.

The first measure studied is to fix the payroll tax paid by the employers at a level that is 3 percentage points lower than the current level, to compensate the revenue loss by raising the value added tax rate and to balance thereafter the transfer system with the VAT rate. This measure could be justified e.g. by a need to broaden the base of financing and to reduce the labour market distortions of taxation.

The initial reaction in the well-operating labour markets to the decline of the payroll tax rate is a rise in wages by almost as much as the fall in the tax rate, because the marginal product of labour has not changed. Real wages climb, however, markedly less due to the increase in the value-added tax rate.

The permanently higher consumption tax also reduces the real value of the existing wealth and gives an incentive to the households to save more for their old age because part of the tax burden has shifted to the latter part of their life cycle. More intensive saving reduces consumption of goods. Since the amount of production of the domestic good has not markedly changed, there will be a pressure to increase exports. This requires, however, that the price of the good fall.

Table 3.1 Macroeconomic effects due to a shift from payroll tax financing to VAT

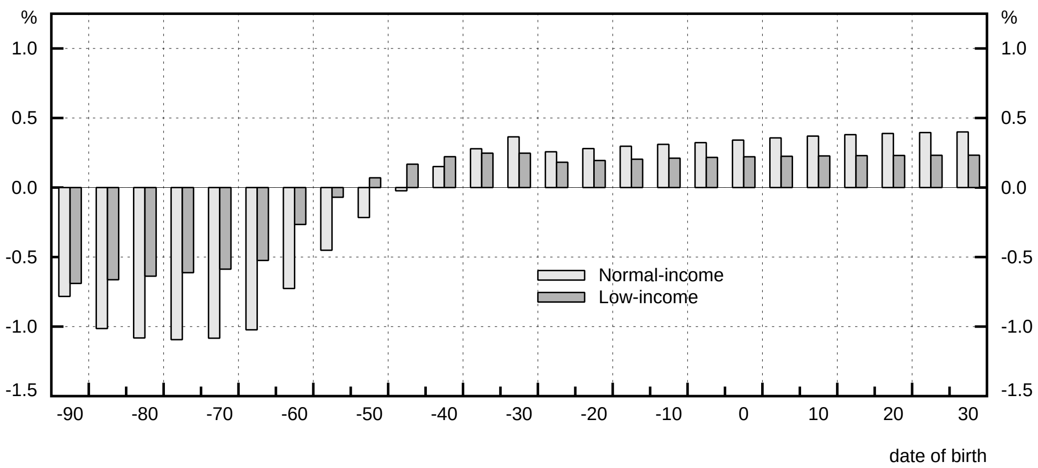
	5 years	10 years	50 years
Production	0.1	0.1	0.1
Imports	-0.3	-0.2	0.4
Exports	0.5	0.4	-0.4
Consumption	-0.4	-0.3	0.5
Investments	0.1	0.1	0.1
Consumer prices	1.8	1.8	1.8
Wages	2.3	2.4	2.7
Employment	0.1	0.1	0
Current account surplus/GDP	0.2	0.2	0
Terms of trade	-0.1	-0.1	0.1
Household wealth	0	0.3	2

In the table, the current account surplus/GDP describe the relative deviation from the original equilibrium in percentage points, while the other variables decribe per cent deviations. This applies to all tables in this chapter.

In the long term consumption revives due to the larger labour and capital incomes. The supply of the domestic good for export falls to less than the original level. The economy ends up at a new equilibrium in which households have more wealth, the economy has less foreign debt, and the domestic demand is larger. Table 3.1 above shows that the overall macroeconomic effects are limited, which is in line with the small scale of the measure.

The generation-specific welfare effects are presented in Figure 3.1 below. It shows that the lower real value of the existing wealth hurts the old generations most even though the purchasing power of their pensions rise because of the indexation in consumer prices and wages. This welfare loss is, as expected, smaller for the poor households. Current young and future generations gain more from the shift the higher the share of labour incomes.

Figure 3.1 Changes in welfare in value-added tax alternative



Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

The horizontal axes illustrates the date of birth of a generation in relation to the moment the measure is implemented. Therefore, the oldest generation living during the measure, the age group 85-90, is denoted by the number -90. The youngest generation is 20-25 years old and is denoted by -25. All observations on the right-hand side of this one describe the welfare of future generations.

The simulation was carried out assuming that in perfectly functioning global financial markets the interest rate of a small open economy cannot deviate from the foreign interest rate. We tested the sensitivity of the results to this feature of the model. It appeared that if the domestic interest rate falls due to higher saving, the capital stock and labour incomes are larger, but capital incomes will be lower. Therefore, the intergenerational welfare effects are rather similar even though the macroeconomic effects are more pronounced (for more details see Appendix A Table A1 on page 34). On the other hand, assuming that the price of the domestic good is determined by international markets did not change the results considerably and the simulations are not reported here (this applies to all presented simulations).

These outcomes can be contrasted to the ones by Auerbach-Kotlikoff (1987). They produced qualitatively similar welfare and macroeconomic results with a shift from income taxation to consumption taxation. Most of the long-term welfare gains turned out to be due to the shift of the tax burden to the current wealth. The overall efficiency gains generated by the reduced tax distortion in labour markets were small. This result was confirmed by Fehr and Kotlikoff (1995), who decomposed the generational welfare effects and found out that the efficiency gains are at least for the current generations small compared to the overall utility changes.

We also carried out some steady-state sensitivity analyses concerning the central behavioral elasticities (see Appendix A, Tables A2 - A4 on page 35). The results show that a higher intertemporal substitution of consumption allows households to save more for the old age. Increased savings gives larger consumption and improves the terms of trade by reducing exports. On the other hand, a higher elasticity between consumption and leisure does not seem to affect the results markedly. The same seems to apply to the substitution elasticity between labour and capital in production.

3.2 A shift from payroll tax financing to capital income taxes

The studies of capital income taxation have increasingly taken into account the difference between taxing saving and investments in an open economy. Some other studies aim to clarify the effects of taxing various types of capital incomes with different tax rates. But studies which combine the two aspects in one framework are more scarce. We showed in Chapter 2 that the partial equilibrium effects of raising the corporate and capital income tax rates depend on the details of the tax system and the firms' financial strategy.

In this chapter we broaden the scope of the analysis by studying the general equilibrium effects of shifting the tax burden from payroll taxes to capital income taxes. We allow firms to follow either the new view or traditional view in their investment financing and profit distribution decisions.

3.2.1 Effects of the tax shift when firms follow the new view

The measure is to reduce the employers' payroll tax rate by 3 percentage points and to increase the tax rates of personal interest incomes, dividends, capital gains and the corporate incomes to compensate for the revenue loss. As in the earlier case, the proceeds of the new taxes balance the budget of the transfer system after the reform. Firms are assumed to finance their investments with debt and retained earnings. Dividends are determined as a residual from the cash flow of the firms.

The reform initially raises the wage rate by nearly as much as it lowers the contribution rate, just as in the previous case. The main differences are the incentive effects of the capital income taxes to save and invest and the capitalisation of the taxes to the value of the firms.

The cost of capital rises due to the higher tax rate on corporate profits. On impact, the capital stock has to fall, but this is realised smoothly due to the investment adjustment costs. As noted in Chapter 2, the measure favours the old capital compared to the new investments, raising the stock market value of the firms and wealth of current households.

The higher interest income tax rate diminishes the after-tax returns on saving and reduces the optimal amount of wealth. The actual wealth has, however, increased and especially the oldest normal-income households react to this by increasing strongly consumption. The lower-income households do not own firms' shares but have invested their small savings on bonds.

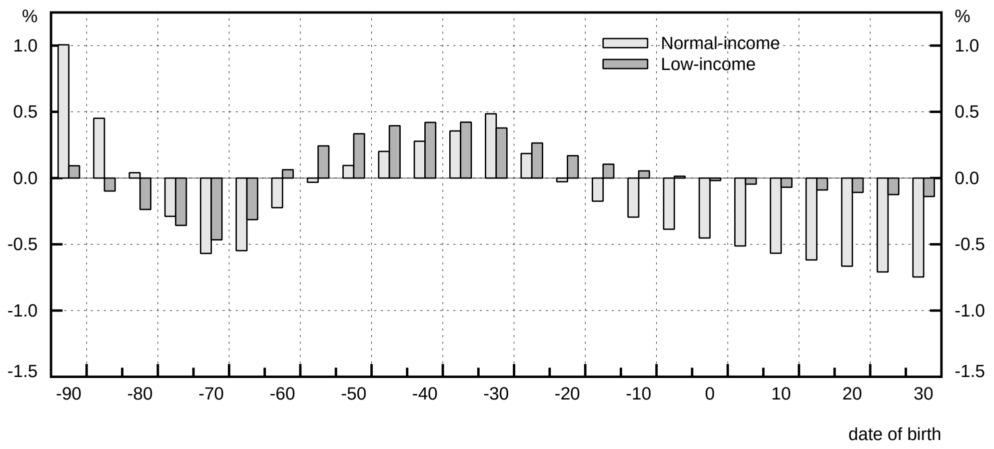
Table 3.2 The macroeconomic effects of the tax shift when firms follow the new view

	5 years	10 years	50 years
Production	0.1	-0.2	-1.2
Imports	0.7	0.1	-1.4
Exports	-0.4	-0.2	-0.5
Consumption	1.5	0.9	-1.1
Investments	-0.9	-1.5	-2.4
Consumer prices	-0.5	0	0
Wages	2.8	2.3	0.4
Employment	0.2	0.1	0.2
Current account surplus/GDP	-0.3	-0.1	-0.2
Terms of trade	0.1	0	0.1
Household wealth	1.7	1.1	-2.6

While the capital stock adjusts to its lower equilibrium level, the productivity of labour and wage rate fall. Households supply, however, more labour than before to earn enough to be able to save for old age. Also the age-profile of labour supply changes, concentrating work effort closer to the retirement age. In the long term the lower return on saving reduces old age consumption.

Household wealth has declined, but the portfolio composition has also changed. The higher stock market value of the firms leaves less room for bonds in the portfolios. This also means that the receipts from interest income are smaller, and it turns out that the hike in personal capital income tax rates actually reduces tax revenues.

Figure 3.2   Changes in welfare in capital income tax alternative, new view



Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

The generational welfare effects follows closely the differences in lifetime income sources. The jump in stock market prices has been distributed evenly to all currently living normal-income households. Therefore the welfare loss due to the drop in the after-tax interest rate hits middle-aged generations the most, who are on the top of their life-cycle wealth and have a lot of bonds. The youngest currently living generations have the longest time to benefit from the temporarily high wages. Future generations meet falling wages and have to work more, which reduces particularly the welfare of the normal-income households.

The initial decline in saving is larger than the drop in investments, so that if the domestic interest rate is allowed to react, it rises. The capital stock, production and wages fall more than in the fixed interest rate case (see Appendix A Table A1). The negative effects of the reduced output are mitigated somewhat by the improved terms of trade. The generational welfare effects are again surprisingly robust to the endogenisation of the interest rate and still mostly due to the compensating changes in capital and labour incomes.

The scale of the effects seems to be sensitive to the intertemporal elasticity of substitution (see Appendix A Table A2). With a higher elasticity, the domestic saving and capital income tax base is much larger**,** and the necessary tax hike to balance the budget of the transfer system is smaller. Therefore the capital stock and household wealth falls less. The intratemporal substitution elasticity does not seem to have a significant impact on the results. On the other hand, a lower substitution between capital and labour accelerates the drop in production and wages generated by the reduction in the capital stock (see Appendix A Table A3).

3.2.2 Effects of the tax shift when firms follow the old view

Since the prevailing financial strategy of Finnish firms is uncertain, we performed a sensitivity analysis assuming that they follow the old view. Firms fund in that case their marginal investments with share issues and debt and distribute profits according to a given rule. As explained in Chapter 2.2, if this rule is to maximise dividends and the dominating investor is a domestic household, in the Finnish tax system with one flat capital income tax rate and complete imputation, a tax hike has no effect on the cost of capital for investments financed with equity issues.

Table 3.3 The macroeconomic effects of the tax shift when firms follow the old view

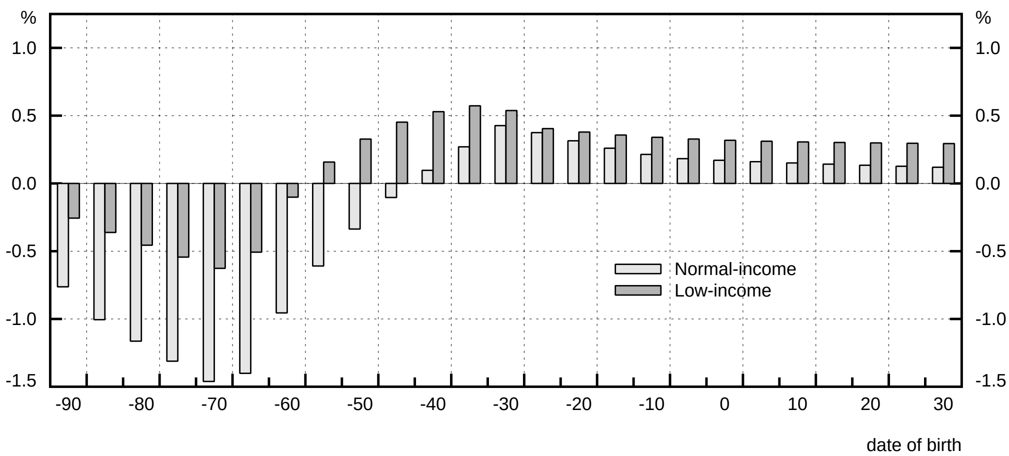
	5 years	10 years	50 years
Production	0.1	0	0
Imports	0.4	0.3	-0.3
Exports	-0.2	-0.2	0.4
Consumption	0.7	0.5	-0.3
Investments	-0.2	-0.3	-0.3
Consumer prices	0.1	0	0
Wages	2.7	2.5	1.8
Employment	0.2	0.2	0.2
Current account surplus/GDP	-0.2	-0.2	-0.1
Terms of trade	0.1	0.1	-0.1
Household wealth	-0.1	-0.4	-2.4

The extreme tax neutrality means that the appreciation and capital stock effects of a universal capital income tax hike described in the previous section drop off. The implications of the higher interest income tax rate and the reduction in the payroll tax remain. On impact, the need to adjust household wealth is not so large and consumption will jump less.

The capital stock stays almost at the initial level allowing the wage rate to be higher. With higher wages households can afford to save more for old age and their life cycle wealth does not fall as much due to the reduced yield on saving.

The welfare effects are now quite different. The loss of the currently living normal-income households due to the fall in bond yield hits them more heavily, since there is no share price appreciation to compensate it. But the future generations in both income groups gain from the tax shift due to higher wages. It seems that most of the welfare changes are due to the lump-sum capital income tax effect. When the tax shift is neutral from the point of view of investments, the possible efficiency improvement depends on the relative impacts of the higher interest income tax on saving and the lower payroll tax on labour supply.

Figure 3.3 Changes in welfare in capital income tax alternative, old view

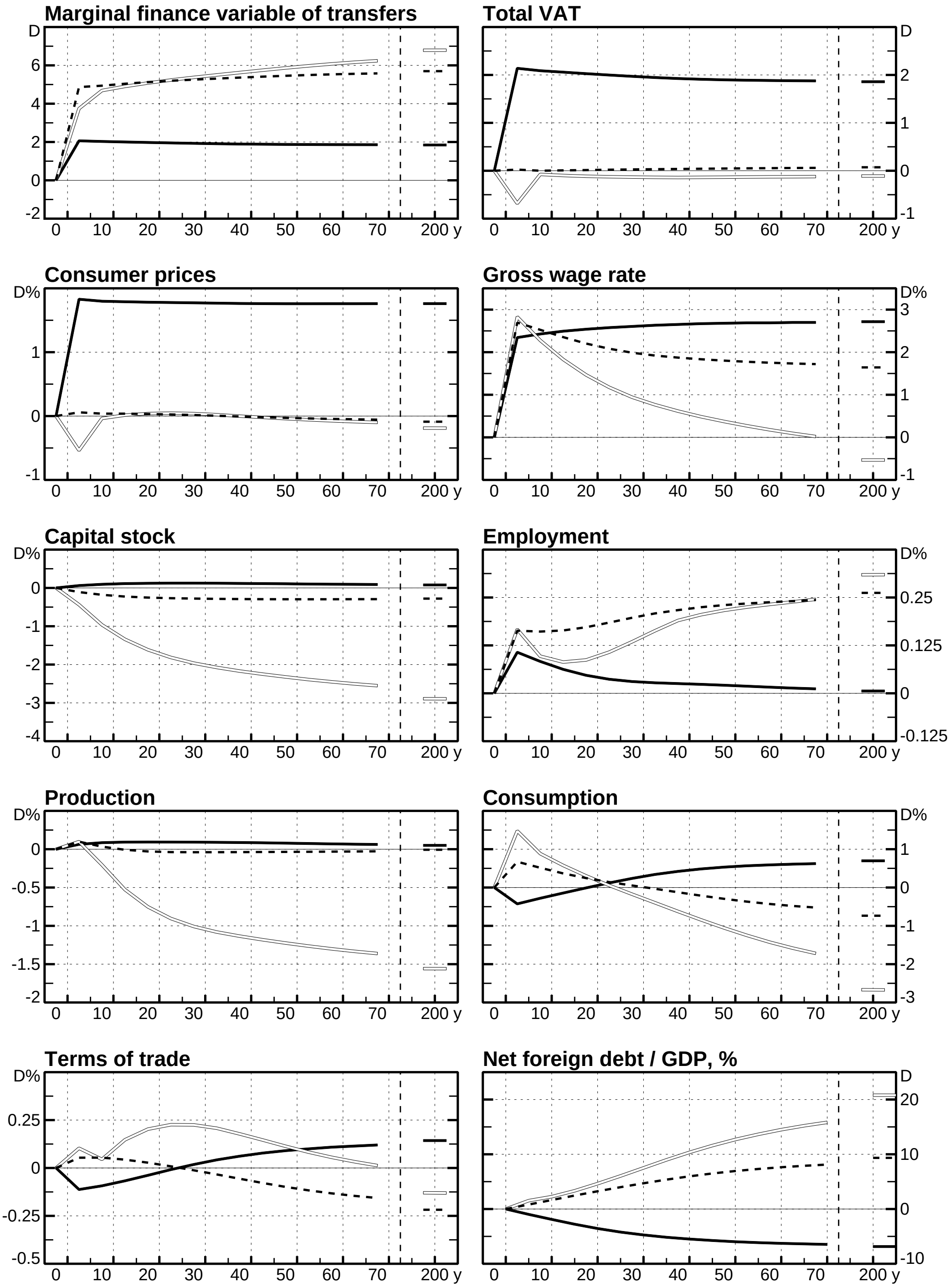


Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

The above results point out that the effects of the tax shift depend largely on the firms' financial strategy, at least when we consider the extreme alternatives as in this study. It is interesting that changes in taxation might themselves create incentives to follow either view. In the Finnish case one of the justifications to shift to an imputation system was to reduce the lock-in effect of the previous tax system leading to retaining of profits. The incentive to finance investments with share issues is in the current Finnish tax system larger the higher is the overall capital income tax rate. Therefore the studied tax shift makes the old view strategy more likely. On the other hand, empirical observations do not unanimously support the shift in behaviour and, additionally, the incentives might reverse if the share owners are foreign investors who do not benefit from the imputation system and whose capital gains are not taxed.

The figures on the next page compare the macroeconomic results from shifting to various transfer financing regimes. The figures denote that the effects are fairly small, as well as the studied welfare effects. This is partly due to the small scale of the measure. The variation in the gains and losses of the two income groups shows, however, that the recognition of the composition of the lifetime incomes is important for tax policy.

Figure 3.4 Summary of the macroeconomic effects



Deviation of simulation run from base run
D = absolute deviation
D% = per cent deviation

Transfers financed on the margin by:
VAT
Capital income tax, new view
Capital income tax, old view

ETLA

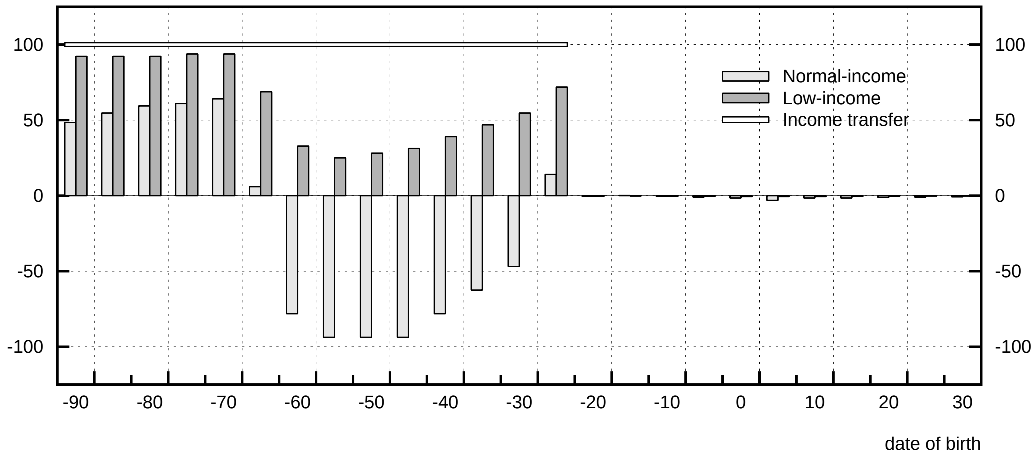
3.3 On the incidence of taxation

A tax on a production factor or consumption affects mostly the markets where it is set, but a complete analysis of tax incidence necessitates the use of a general equilibrium framework. Another justification for the use of a CGE model is that it compels the modeller explicitly to take a stance on the institutions and tax-transfer system of the economy, thereby creating an incentive system which causes the economy to deviate from the pure market equilibrium. One deficiency of the usual CGE analysis is, however, that there is just one representative type of consumers. In what follows, we illustrate some results of the generational tax incidence for the two household types in the model. The idea is to point out that there are large differences in tax burdens due to the disparity of income transfers, factor incomes, credit constraints and phase of life of the households.

Incidence of a transfer financed by a payroll tax

Financing the transfer by higher employers' contributions raises labour costs. In well-functioning labour markets the incidence shifts almost totally to wages. The effects on profitability and share values of the firms come through the reduction in labour supply and consumption, but are quite small. Therefore, the spillover effects on markets other than the labour market remain subdued.

Figure 3.5 Changes in household welfare from a payroll tax financed income transfer



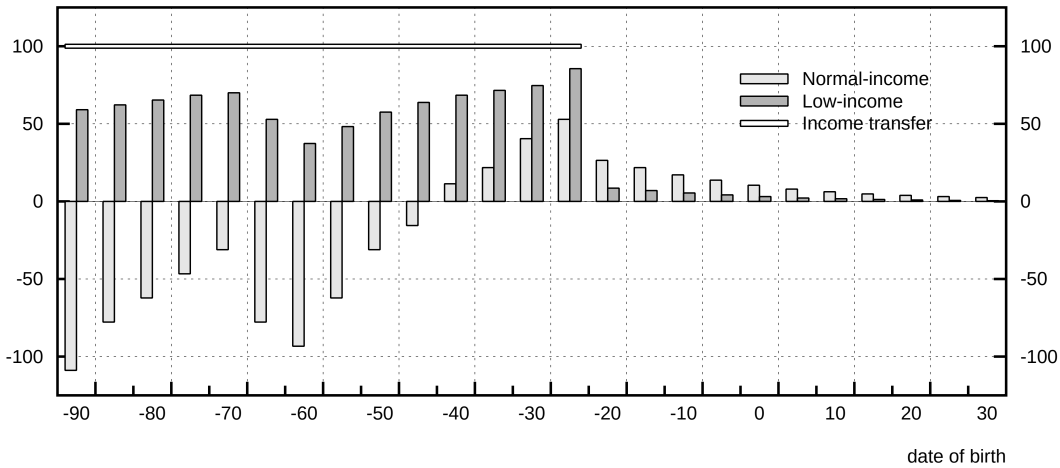
The figure above depicts the welfare effects of the transfer. It has been generated by calculating the size of the monetary value each household gives to a universal 100 unit transfer, taking into account all the effects that the transfer and its financing causes to prices, incomes and other variables.

The incidence of the tax due to the fall in wages for the working-age households depends, as expected, on the amount of current wage income, which depends on age and income-group- specific working efficiency. Therefore, the burden is heaviest for the middle-age normal-income households. All pensioners benefit from the transfer because in the pension index the weight of consumer prices is markedly bigger than the weight of wages. The low-income group benefits from their lower income tax rate. The youngest generation in both income groups have extra gains from the transfer because it alleviates the credit constraint they meet. The measure has no significance for the future generations.

Incidence of a transfer financed by a value-added tax

Financing the corresponding transfer with a value-added tax raises consumer prices temporarily. This variation in prices creates an incentive to postpone consumption. The already existing transfers increase due to the indexation in consumer prices, thereby magnifying the need to raise the tax. Real wages fall for one period nearly as much as in the case of the payroll tax.

Figure 3.6 Changes in household welfare from a VAT-financed income transfer



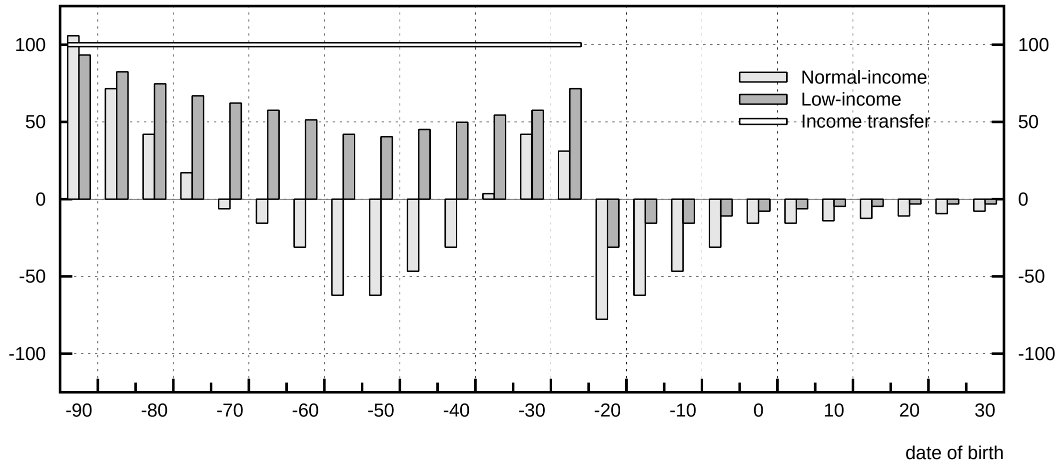
The generated welfare outcomes are fairly similar to all the currently living low-income households due to their flat life-time consumption profile and because every household participates in financing the transfer via higher consumer prices. The normal-income households have a rising life-time consumption profile (rate of time preference is much lower that the interest rate), which concentrates the tax burden to the old age. Retirement causes a fall in incomes and the consumption profile. This life-time distribution of consumption explains a major part of the generational incidence.

The welfare gain is again large for the youngest credit-constrained households. Their consumption increases and labour supply decreases, since the transfers allows for a more efficient life-cycle planning. The future generations born just after the implementation of the measure gain due to higher real wages. Wages rise marginally because of the temporary fall in labour supply of the young generations.

Incidence of a transfer financed by a capital income tax

A capital income tax reduces the yield on saving and raises the required productivity of new capital and the value of the old capital (if financed with retained earnings, see Chapter 2). Households react to the temporary tax rate hike by increasing consumption and firms by reducing investments. The lower capital stock leads to lower productivity of labour and wages.

Figure 3.7 Changes in household welfare from a capital income tax financed income transfer



The currently living low-income group gains as their share of capital incomes is low. The future poor suffer, however, due to the lower real wage.

For the normal-income households the outcome depends on the generations' distribution of bonds and shares in portfolios. We have assumed that they own an equal amount of shares and the rest of the wealth is bonds. Therefore, the jump in stock prices benefits everyone equally, but the welfare loss due to the fall in the after-tax interest rate hits hardest on the middle-aged generations with highest wealth.

The largest welfare losses are directed, however, to the normal-income generations born just after the implementation of the transfer. The steep fall in wages reduces their lifetime income nearly by the amount of the transfer.

These three incidence calculations are naturally sensitive inter alia on household preferences, the details of the tax-transfer system and price determination in various markets.

4. FINANCING STRUCTURE AND EXTERNAL SHOCKS

4.1 Introduction

An external shock induces an endogenous change in tax bases and creates a need to change some tax variable in order to finance the transfers. The shocks may also change the amount of transfers. We, however, keep the real value of transfers fixed and concentrate on the tax base changes and the corresponding tax changes.

How does this analysis differ from the previous section's analysis? There the question was how the economy adjusts to different financing regimes and changes in the regimes. Here the question is how the financing regimes adjusts to shocks. In both cases the economy and the transfer system, financing included, are fully intertwined.

Another reason for the shock analysis is that it allows us to study the importance of labour market imperfections. These imperfections could be modelled as in Jensen et al (1996) or Lassila (1998), but especially the latter makes dynamic analysis very tedious. Here we use a crude but much simpler formulation. Wages are assumed either to be flexible every period and keep the labour market in balance, or be inflexible for one period after the shock, during which employment is determined by the demand for labour. The results indicate that the welfare effects may vary much less between the financing regimes than they vary between the labour market regimes.

4.2 Export demand shock

Finland is a small open economy where the export share of total demand is large. The amount exported depends on the price elasticity σ^E of foreign demand:

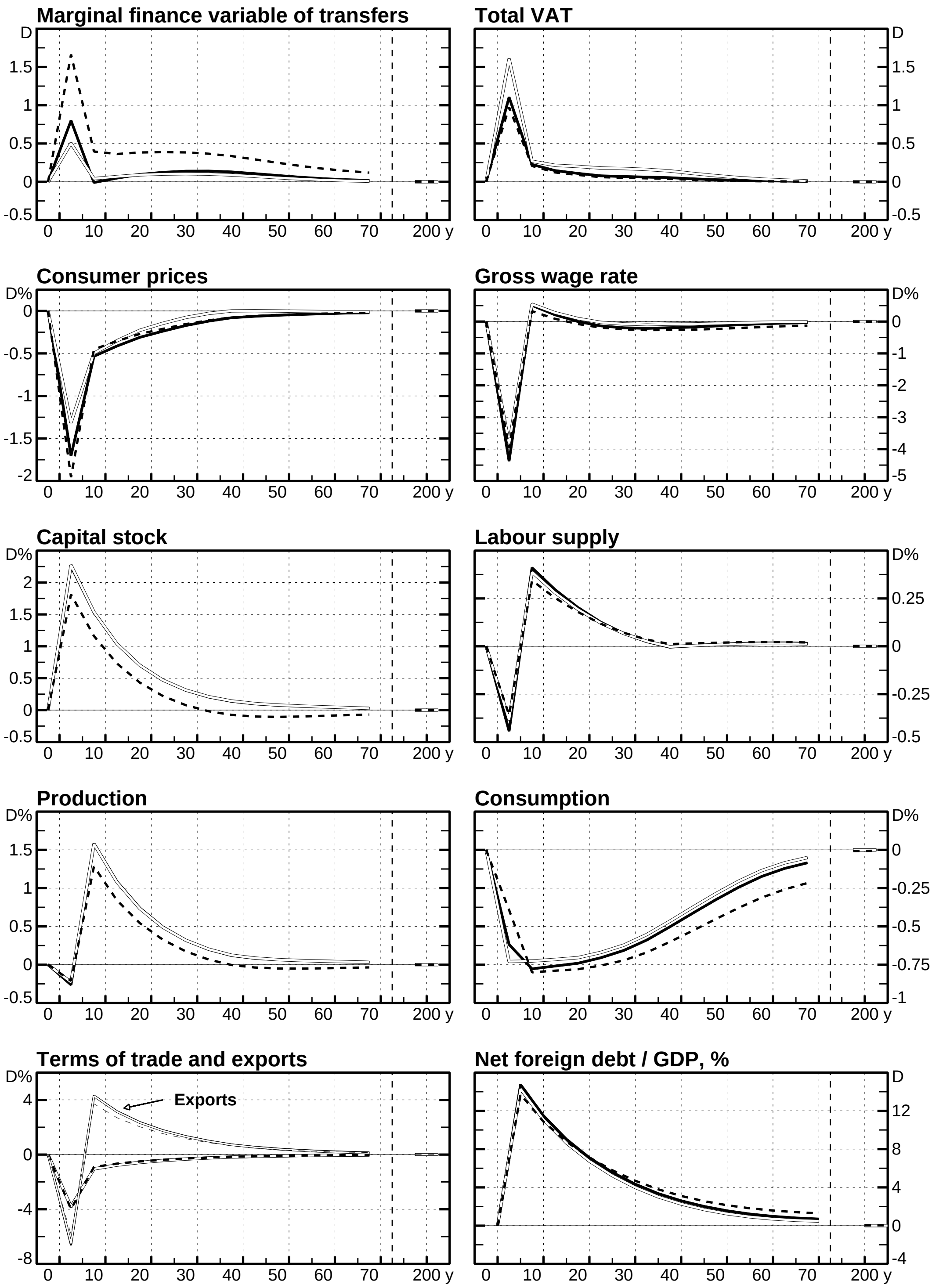
$$(16) \quad X_t = x\left(\frac{p_t^d}{p_t^M}\right)^{\sigma^E}$$

The export demand shock is modelled as a 20 per cent drop in x for one period, after which it returns to the original value. It is assumed that immediately after the unexpected decline has taken place, every household and firm knows with certainty that export demand will return to its previous level, and reoptimises accordingly.

The price of exports is endogenous, and its fall partly compensates the demand effect. The resulting path of the export quantity is shown in the lower left section of Figure 4.1. The price of the exported domestic good falls, because its supply is rigid. Productive capital cannot be adjusted immediately, and in the model it is always advantagous to use the capital stock fully. The fall in the domestic good's price reduces imports also.

The shock leads, somewhat surprisingly, to higher investments during the first period. The price of the investment good is low, compared with the return from investment that is received in the second period. It pays to increase the capital stock when its price is low, as it is known that a larger capital stock is needed when the exports rebound. From the second period onwards, up untill the new equilibrium, the investments are not sufficient to offset depreciation.

Figure 4.1 Effects of export demand shock



Deviation of simulation run from base run
D = absolute deviation
D% = per cent deviation

Transfers financed on the margin by:
Employer's contributions
VAT
Capital-income tax

ETLA

If the export demand shock would last more than one period, the capital stock would first decline and then reach its peak just before export demand would return to the normal level.

From the households' point of view, the export shock reduces the value of financial wealth through the stock market, reduces labour incomes, and causes consumer prices to drop initially and then gradually regain the old level. The wealth and income effects are spread over the lifecycles, except by those (mainly young) households where the liquidity constraints are binding. An increase in saving is needed to restore the wealth situation, but on the other hand buying consumption goods is cheap especially in the first period, so saving increases only after the first period. Wages fall initially more than consumer prices, as the decline in the price of the domestic good reduces the value of the marginal product of labour more than it reduces the consumption good price. The increase in the quantity of labour supplied is slightly postponed, as the future increase in wages is anticipated.

Comparison of transfer financing regimes

In all three regimes the export shock leads to decline in the tax bases. The marginal financing variable has to adjust to compensate this effect. If the *employer's contribution rate* is endogenous, the new equilibrium in the labour market has a lower wage level. The contribution rate increases but the total labour cost remains below the initial level. The burden falls mainly on the working-age generations, and to a lesser extent on the retired, through the fact that pensions are partly indexed to wages (and partly to consumer prices).

If the *value-added tax* is the marginal form of financing, VAT rises for two reasons: to cover the transfers, and to cover other public expenditures. The latter need follows from the decline in all tax receipts, e.g. in capital income taxes, which must be compensated for in some way and from our assumption that VAT be the general budget-balancing tax form. VAT affects consumer prices but does not change the form of their time path.

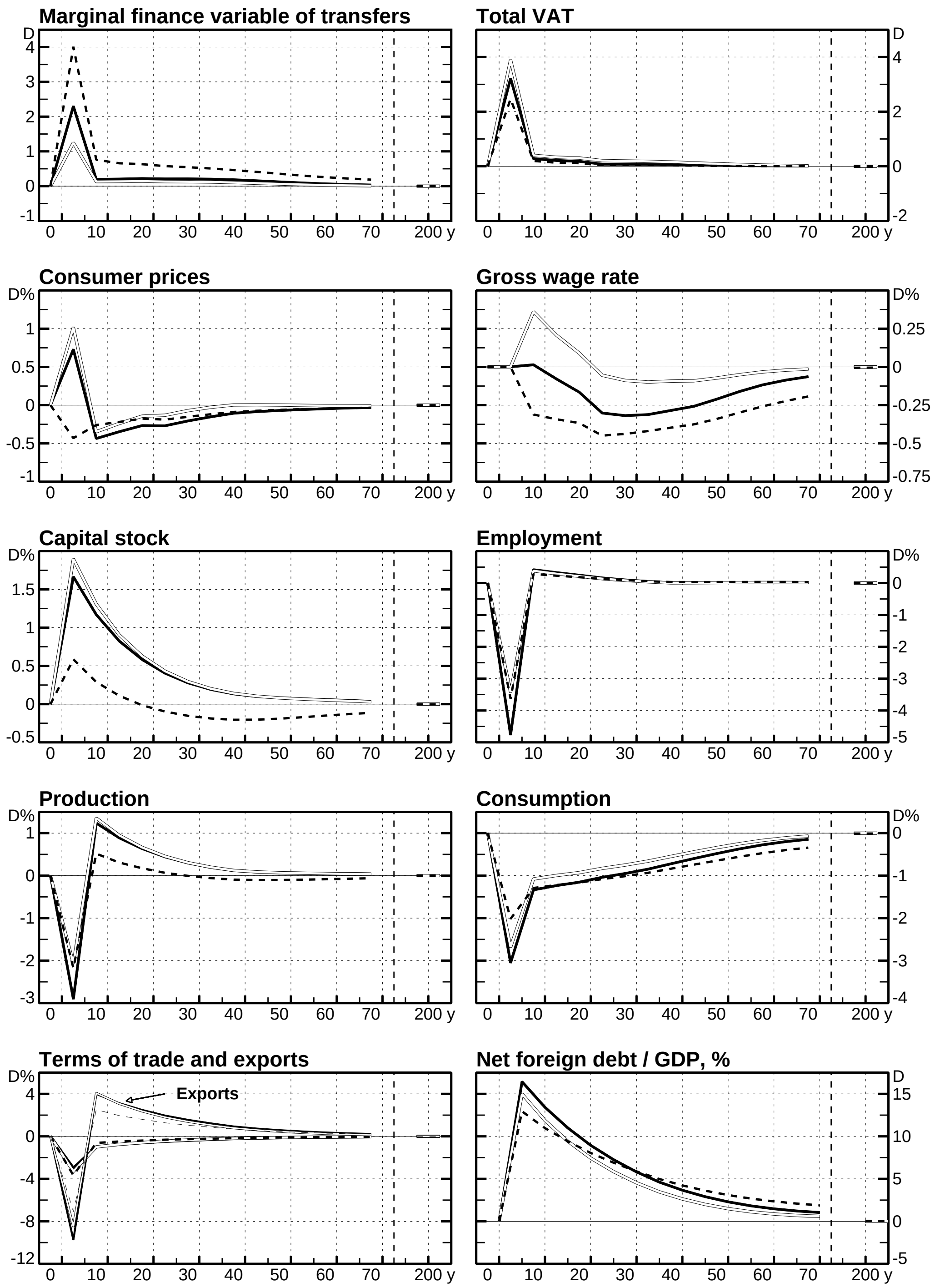
If *capital income taxes* are endogenous the effects come through both saving and investment. As saving initially becomes less attractive the biggest fall in consumption is postponed. The rise in the capital income tax rate also makes the initial increase in the capital stock smaller.

The role of labour markets

Figure 4.2 shows the macroeconomic effects of an export demand shock when wages fail to adjust to balance the demand for and the supply of labour. We assume that wages are completely sticky in the first period. After that, they become completely flexible again, which all agents correctly anticipate.

This attempt to mimic sluggishness in wage adjustment makes, in the case of a negative export shock, labour supply exceed demand. Employment is then determined by demand. Households are rationed in the labour markets. By household type, this rationing is assumed to hit low-income households harder: their employment falls twice as much in percentage terms as the employment of normal-income households. By age, employment falls in equal amounts within a household type, again in percentage terms.

Figure 4.2 Effects of export demand shock with sticky wages



Deviation of simulation run from base run
D = absolute deviation
D% = per cent deviation

Transfers financed on the margin by:
Employer's contributions
VAT
Capital-income tax

ETLA

When employment adjusts instead of wages, the fall in consumption is larger and lasts longer. Tax bases are reduced more, and thus there is a need for bigger adjustments in the marginal financing variables. Public employment is assumed fixed, and as the wage rate does not change there is not a similar reduction in the public wage bill as there would be if wages were flexible. This makes the necessary increases in VAT bigger.

Welfare effects

The welfare effects of the export demand shock are presented in Figures 4.3 and 4.4. Two general observations stand out: The effects are bigger in the normal-income group than in the low-income group (notice the different scaling), and the effects are usually larger in older age groups. The latter feature is mainly a result of the fact that the effects are expressed in relation to expected consumption during the remaining lifetime, and the shock takes a proportionately larger part of the remaining lifetime the older the household is. The former effect reflects the greater role labour and capital incomes have, compared to transfers, in normal-income households.

Welfare declines in all age groups in normal-income households. In older households the main factors are the decline in stock values and the reduced purchasing power of pensions. Pensions are indexed both to wages and to prices, and wages fall more than prices. In working-age households the effects come via stock values and labour incomes. We have assumed that all normal-income households have equal amounts of shares, except the cohort that has just entered the labour force, and has no wealth. An alternative assumption that shares are held in fixed ratio to total wealth would change the results: middle-aged households would be hurt more and other age groups less. There is also a positive temporary wealth effect: the decline in consumer prices increases the purchasing power of acquired wealth. This benefits especially households that have no shares in their portfolios.

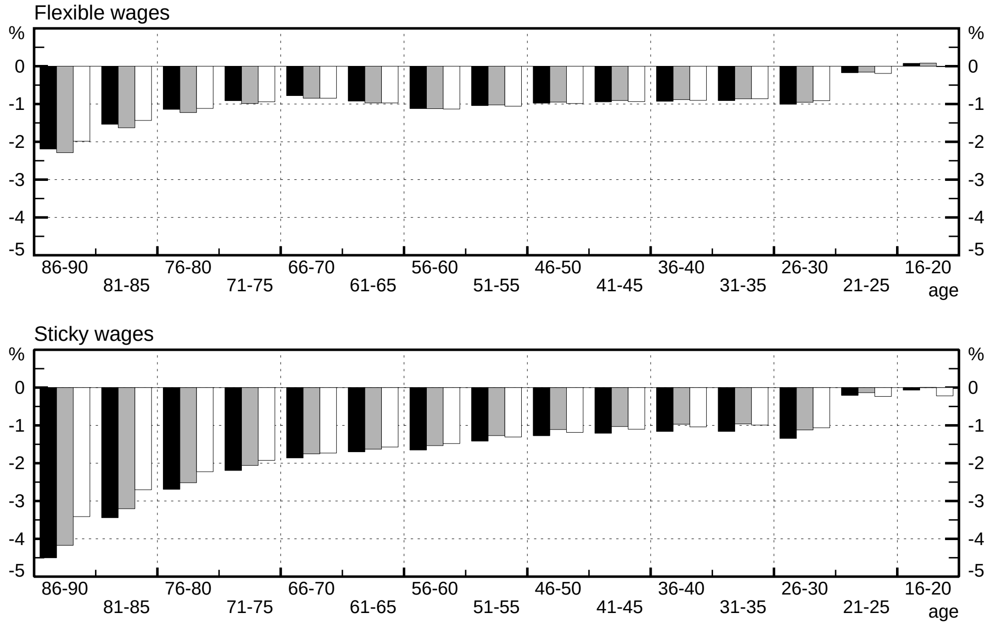
If wages are sticky, the negative welfare effects are larger. In this case the consumer prices do not fall but rise, and this reduces the purchasing power of all wealth.

These wealth effects are illustrated more pronouncedly in the case of low-income households. They are assumed not to hold shares. If wages adjust and consumer prices fall, retired low-income households actually gain from the shock. But if wages do not adjust and prices rise the elderly also lose. Low-income working households lose in both cases.

All financing regimes are quite similar for normal-income households, if wages adjust. Capital-income taxes seem to give the smallest welfare losses for the retired. We have assumed that capital-income taxation is symmetric, and the decline in share values leads to bigger tax reliefs the higher the rate is. If wages are temporarily inflexible, the employer's contribution is the worst form of transfer financing for the normal-income group. The differences are rather small, however, especially when compared to the differences between the two labour market regimes. In this model, choosing the "best" financing regime can do very little, compared to what can be accomplished if labour markets can be made flexible.

For the low-income households, no systematic pattern seems to emerge concerning the welfare effects in different financing regimes.

Figure 4.3 Welfare effects of export demand shock in normal-income households, by age

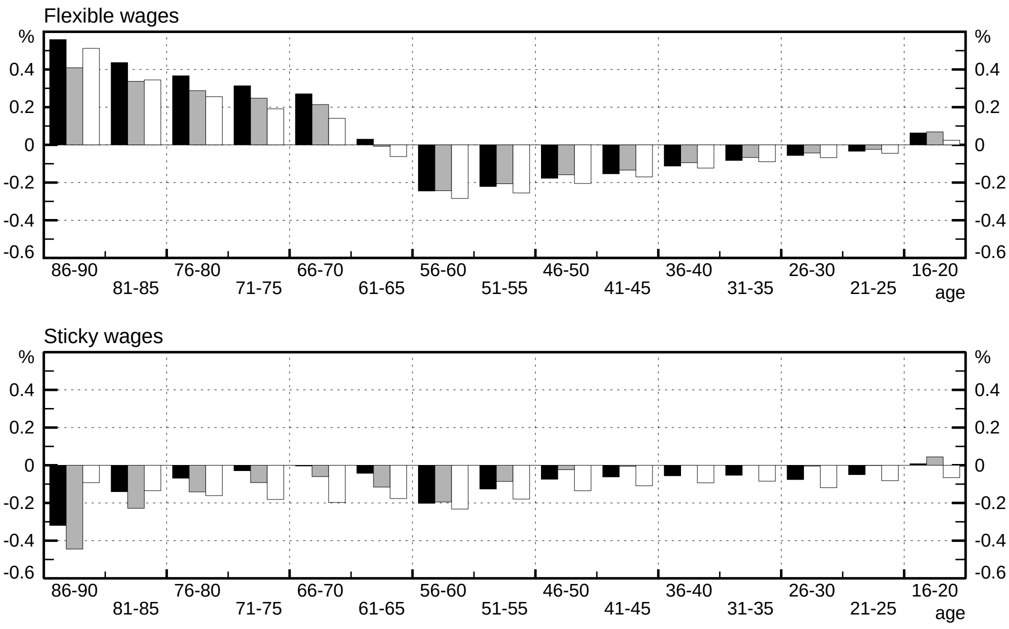


Transfers financed on the margin by:

Employer's contributions VAT Capital-income tax ETLA

Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

Figure 4.4 Welfare effects of export demand shock in low-income households, by age



Transfers financed on the margin by:

Employer's contributions VAT Capital-income tax ETLA

Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

A sensitivity analysis was made with respect to the behavioural parameter values of the low-income households. When they were given the parameters of the normal-income households, concerning leisure - consumption trade-off, time preference and bequest motive, the welfare effects became slightly larger. This probably reflects the fact that they now value consumption more in relation to leisure, and the income effects of the shock are felt more. Still the effects were small compared to those of the normal-income households. The effect-age profile was not changed markedly. So the results seem to be rather insensitive to the assumed preference differences.

A more extreme labour market version was also used, where the decline in labour demand, caused by a shock and wage stickiness, fell entirely on the low-income households. Their incomes fell drastically, which was then partly compensated by increased transfers. If these transfers were financed by payroll taxes, this lead to situation where the low-income working-age households would have been better off without the extra transfers. The reason is that extra transfers increased the payroll tax, which increased the labour costs and reduced the demand for labour further. With other transfer finance forms the extra transfers did increase the welfare of the low-income households. The detailed results following from this extreme labour market specification can be obtained from the authors.

4.3 Interest rate shock

The domestic interest rate depends on the international exogenous interest rate. Developments in net foreign debt may cause differences between these rates, as discussed in section 3. Here we use the regime where the domestic rate is the same as the international rate. The interest rate shock is then a one percentage point rise in the rate for a one five-year period (period 1). The interest incomes and outlays corresponding to this higher rate are received and paid in period 2. As in the export shock case, we assume that as soon as this surprising rate increase takes place, every agent knows with certainty that the rate will fall to the initial level the next period.

The interest rate increase raises the required return on capital temporarily, and leads to decline in the capital stock. Saving becomes temporarily more profitable, and consumption declines. The decline is strengthened by both intertemporal substitution, as consumer prices increase, and liquidity constraints, as labour incomes decline in the first period.

Wages reflect the need to adjust labour input when the capital stock varies, and to a lesser extent also small changes in the supply of labour. The rise in consumer prices is due to the increase in VAT.

The paths of the financing variables are shown in Figure 4.5. Employer's contribution rate rise initially but returns to the initial level quickly. VAT falls slightly below the initial level after the first period increase. This fall is due to the increase in consumption in the second period. The second-period fall in the capital income tax rate is more marked. It is caused by the increase in taxable interest incomes, which are higher as they now reflect the shock level of the interest rate and also higher savings.

Figure 4.5 Effects of interest rate shock

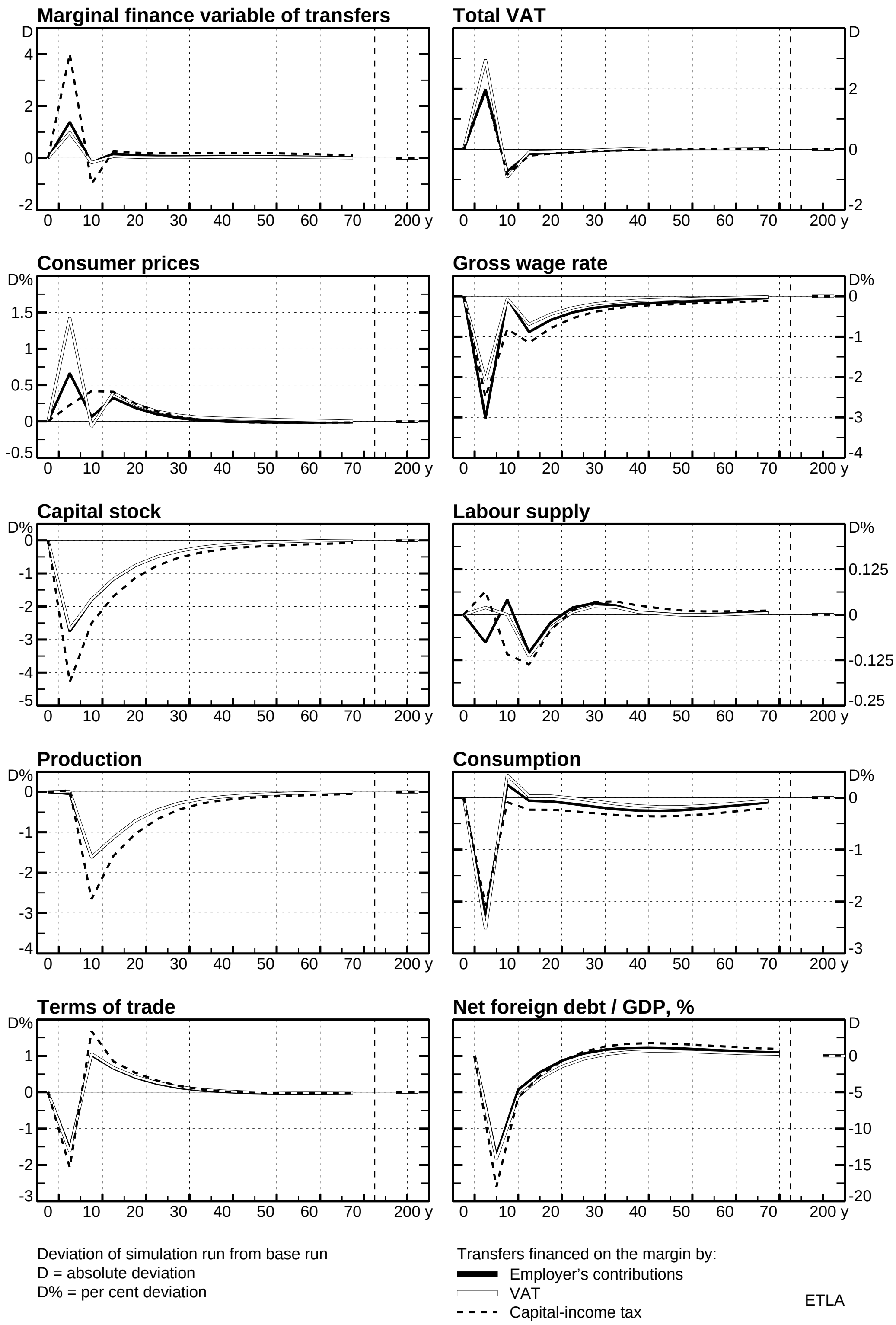
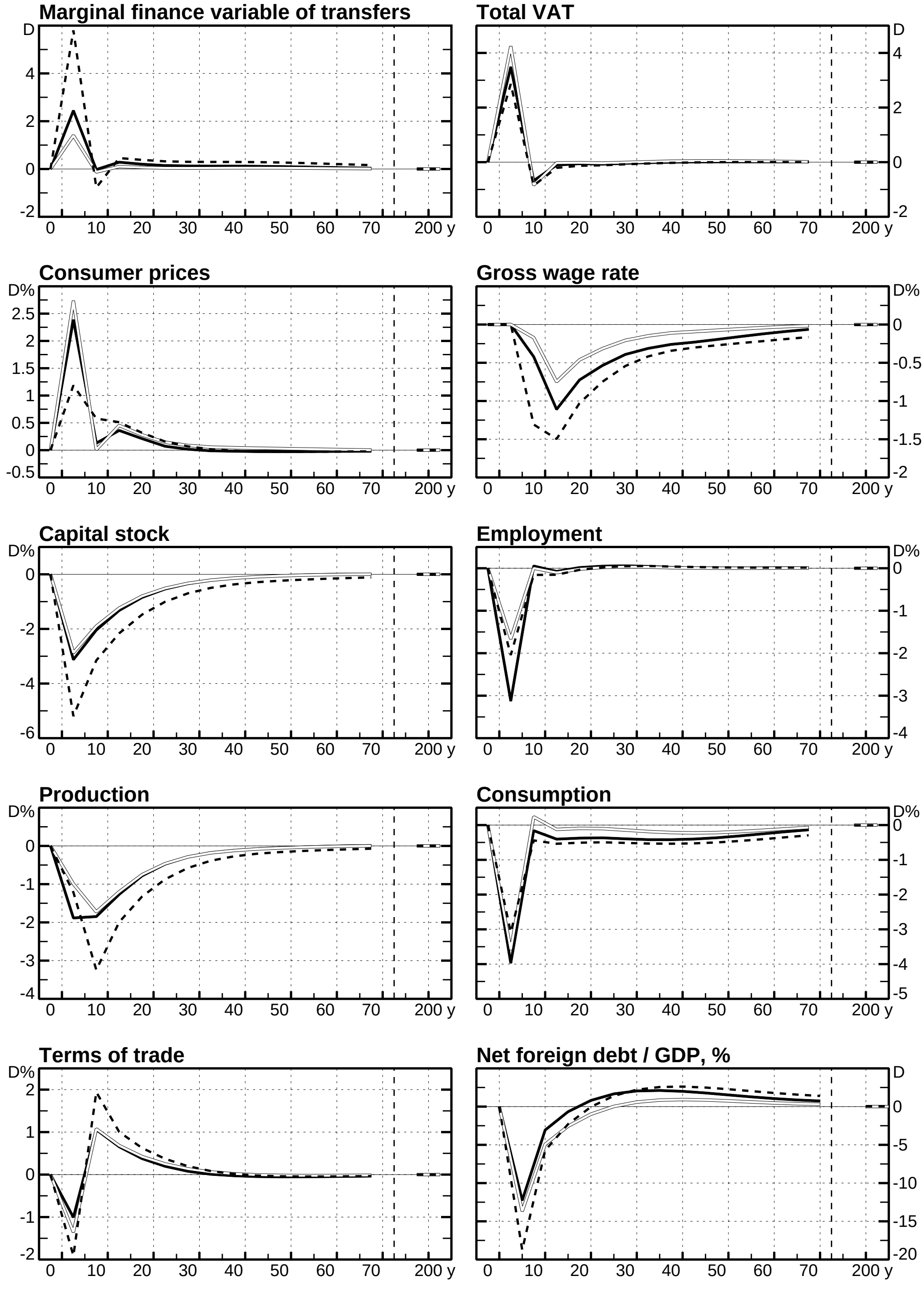


Figure 4.6 Effects of interest rate shock with sticky wages



Deviation of simulation run from base run
D = absolute deviation
D% = per cent deviation

Transfers financed on the margin by:
Employer's contributions
VAT
Capital-income tax

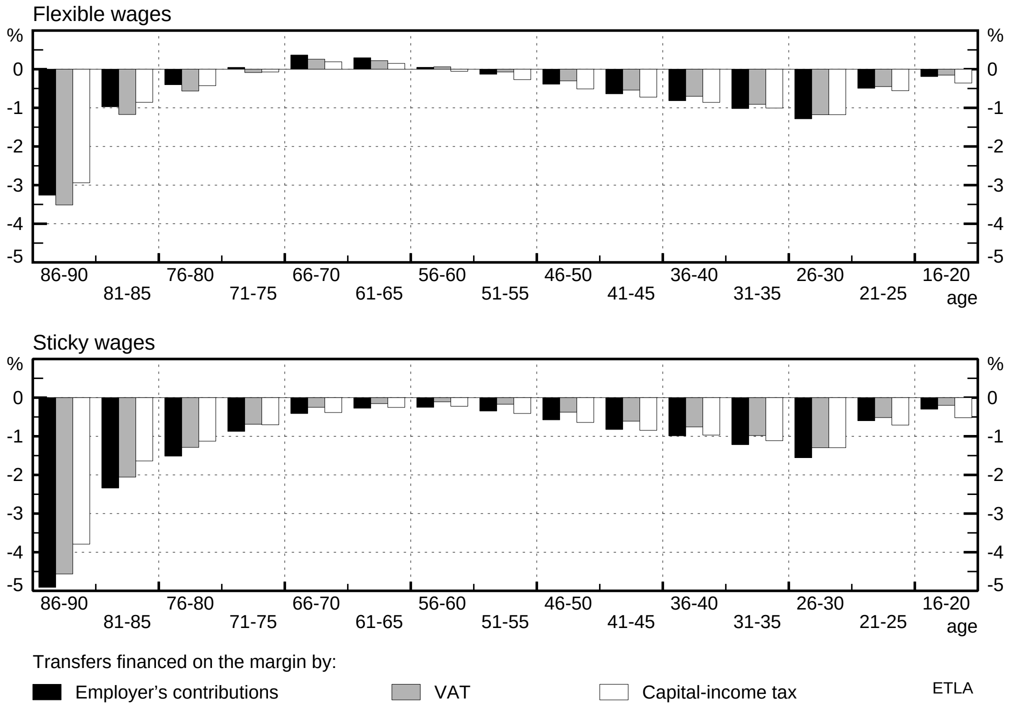
ETLA

If wages are sticky in the first period, most quantitative effects of the shocks are larger. Again, one reason is that the public wage bill does not fall at all, and a higher VAT is needed to finance that. Employment effects can now be measured with full percentage points, with the largest drop corresponding to the employer contribution regime.

The welfare effects in Figures 4.7 and 4.8 are similar than those with the export shock: the effects are larger for the normal-income households and for the older age groups.

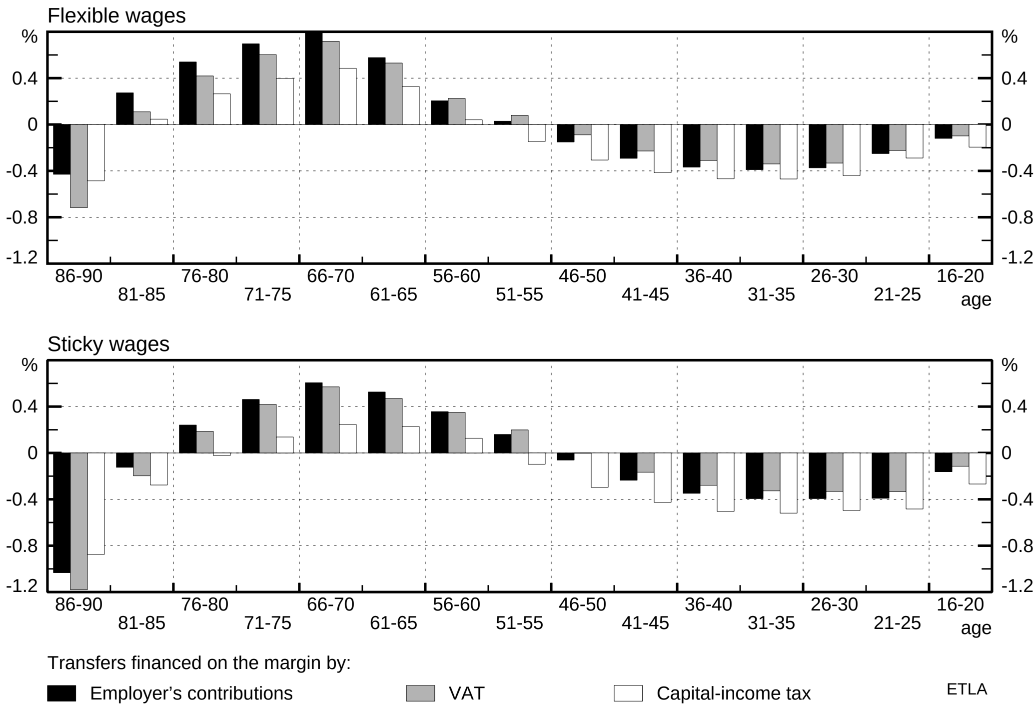
If wages are inflexible, the employer's contribution seems to be the worst endogenous financing variable for the normal-income households. If wages are flexible, no clear pattern is visible. Except in the oldest age group, the capital income tax regime results in smallest gains or largest losses in welfare. For the retired low-income households the employer contribution system seems best, whereas for those in the working-age the VAT system results in least losses.

Figure 4.7 Effects of interest rate shock in normal-income households, by age



Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

Figure 4.8 Effects of interest rate shock in low-income households, by age



Welfare effects are measured by compensated variation, expressed as a percentage of discounted consumption expenditure during remaining lifetime (negative sign implies a welfare loss).

4.4 Conclusions

The three main conclusions are: Firstly, the choice of the financing system is more important for the normal-income households than the low-income households. Secondly, welfare effects of the two shocks considered do not vary much between the different forms of financing. Thirdly, the functioning of the labour market seems to be important when comparing the financing arrangements. If wages are sticky the wage-based contribution financing becomes worse than other alternatives.

There are reasons why the effects do not differ very much between the financing regimes. One is that all households pay all the taxes considered here during their lifecycles, although in different amounts. Larger differences would be observed with more extreme households, e.g. relying only on one income source. Another thing is that both shocks have effects that are independent of the transfer financing system. For example, shocks would lead to public sector deficits, which are here prevented by adjusting the VAT rate. This creates similar effects under all regimes.

5. CONCLUSIONS

This paper provides a large variety of results, which we do not repeat here. Rather, we try to look at the implications of the analysis from a broader view.

The main lesson from the section describing the financing structure shift is that even though the current system is not optimal, it is hard to make any major shifts without large welfare losses to some group. Shifting the tax burden from employers' contribution to consumption hits the owners of capital the most due to the wealth tax feature of VAT. The real value of current pensions is, however, sheltered from the consumption price hike by indexation.

The effects of a shift from a payroll tax to a capital income tax depends on the details of the capital income tax system and financial strategy of the firms. If firms rely on retained earnings in investment financing, the tax hike raises the required marginal productivity of new capital and revalues the old capital stock. On the other hand, the higher the dividend pay-out ratio and the share of investments financed by share issues, the more neutral for investments is the current Finnish tax system with complete imputation of corporate taxes. In both cases there are additional effects due to the reduced payroll tax and lower after-tax yield on saving. The welfare results depend in a complicated way on the firms' financial strategy and the amount and composition of the wealth of the households.

The sensitivity analysis on the openness of the economy shows that even though the macroeconomic effects are magnified by an endogenous interest rate, the intergenerational welfare effects are not. This is due to the divergent effects interest rate have on capital and labour incomes.

The analysis of the welfare effects of a temporary universal income transfer denoted that there are large inter- and intragenerational differences in the incidence of various taxes. It appeared that the current low-income households gain and working-age normal-income households suffer independently of the financing method. The scale of the losses as well as the welfare of the future household generations depends, however, heavily on the applied tax.

Reducing payroll taxes and increasing VAT correspondingly would increase both efficiency and welfare in the long run. Without specific compensation, current pensioners and part of those in working-age would, however, suffer a welfare loss. The reduction in the payroll tax would increase wages, and the rise in VAT would increase consumer prices. Real wages would still rise. The VAT rise would also constitute a one-time tax on existing wealth. The measures would increase household saving and lead to a lower net foreign debt.

If the reduction in payroll taxes were financed by increasing capital-income tax rates, the long-run effects are likely to be negative. The return on savings, and thus saving, diminishes. Foreign indebtedness increases. If investments decline - a likely thing to happen - also welfare decreases in the long run. The measures would increase real wages. A majority of current working-age households would benefit. The net return on wealth, on the other hand, would decline, and most of the current pensioners would suffer a welfare loss. If the investments were not affected by the increase in capital-income taxes, the welfare of future generations could increase. This would be largely at the expense of current generations, because the overall efficiency of an open economy is not likely to change much due to divergent efficiency effects of a reduction in a payroll tax rate and a rise in a savings tax rate.

Welfare effects of export demand and interest rate shocks are larger for the normal-income households than the low-income households. The effects do not differ much between different financing forms of transfers. If wages are temporarily sticky, however, payroll taxes seem to be the worst alternative.

The study has not taken into account that evasion of capital income taxation, international tax competition and tax harmonization might reduce markedly the feasibility of taxation alternatives.

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Appendix A. Sensitivity analyses

Determination of the domestic interest rate

The table below describes the effects of a shift in the financing regimes when the domestic interest rate r_t^d is allowed to react to the deviation of net foreign assets from the initial level A_0^f. The exact formula is as follows:

$$r_t^d = r_t^f - \frac{A_t^f - A_0^f}{\varpi}$$

where r_t^f is the exogenously given foreign interest rate and the parameter ϖ controls the scale of the reaction in the domestic interest rate. The parameter value used in calibration was 3, which corresponds approximately to a 1 percentage point difference in interest rates, when the amount of assets vary by 10 per cent.

Table A 1. Fixed and endogenous domestic interest rate

	VAT		CAPITAL INCOME TAX new view		CAPITAL INCOME TAX old view	
	fixed	endogenous	fixed	endogenous	fixed	endogenous
Production	0.1	0.5	-1.5	-3	0	-0.6
Imports	0.5	0.7	-2.5	-3.1	-0.6	-0.8
Exports	-0.6	0.1	0.4	-1.5	0.9	-0.1
Consumption	0.7	0.7	-2.6	-2.6	-0.7	-0.6
Investments	0.1	0.8	-2.9	-5.1	-0.3	-1.3
Consumer prices	1.8	1.7	-0.2	0.1	-0.1	0
Wages	2.7	3	-0.5	-1.6	1.6	1.2
Employment	0	0.1	0.3	0.2	0.3	0.2
Terms of trade	0.1	0	-0.1	0.4	-0.2	0
Household wealth	2.3	1.5	-5.6	-4.3	-3.3	-2.5

In the table, the variables describe the relative deviation from the original equilibrium in per cent.

Parameter specification

Table A 2   Intertemporal elasticity of substitution

	VAT			Capital income tax (new view)		
	0.3	0.5	0.7	0.3	0.5	0.7
Production	0	0	0	-1.6	-1	-0.6
Imports	0.3	0.5	0.8	-2.2	-1.8	-1.7
Exports	-0.4	-0.7	-1.2	-0.2	0.6	1.4
Consumption	0.5	0.7	1	-2	-1.9	-1.8
Investments	0	0	0.1	-3	-2	-1.3
Consumer prices	2.1	1.9	1.8	-0.2	-0.2	-0.2
Wages	2.7	2.8	3	-0.4	0.2	0.5
Employment	0	0	-0.1	0.3	0.3	0.4
Terms of trade	0.1	0.2	0.3	0.1	-0.1	-0.4
Household wealth	2.4	2.5	2.7	-4.3	-4.3	-3.9

Table A 3 Intratemporal elasticity of substitution

	VAT			Capital income tax (new view)		
	0.65	0.75	0.85	0.65	0.75	0.85
Production	0	0	0	-1.1	-1	-1
Imports	0.5	0.5	0.5	-1.8	-1.8	-1.9
Exports	-0.7	-0.7	-0.6	0.4	0.6	0.7
Consumption	0.7	0.7	0.7	-1.8	-1.9	-2
Investments	0	0	0	-2	-2	-2
Consumer prices	1.9	1.9	2	-0.2	-0.2	-0.2
Wages	2.8	2.8	2.7	0.3	0.2	0
Employment	0	0	0	0.3	0.3	0.4
Terms of trade	0.2	0.2	0.2	-0.1	-0.1	-0.2
Household wealth	2.5	2.5	2.6	-3.9	-4.3	-4.9

Table A 4 Elasticity of substitution between capital and labour

	VAT			Capital income tax (new view)		
	0.5	0.7	0.9	0.5	0.7	0.9
Production	0	0	0	-2.2	-1	-0.5
Imports	0.2	0.5	0.7	-2.5	-1.8	-1.6
Exports	-0.2	-0.7	-1.2	-1.3	0.6	1.7
Consumption	0.7	0.7	0.8	-3.3	-1.9	-1.4
Investments	0	0	0.1	-2.6	-2	-2
Consumer prices	1.9	1.9	2	-0.1	-0.2	-0.3
Wages	2.6	2.8	2.9	-1.9	0.2	0.8

Employment	0	0	0	0.3	0.3	0.4
Terms of trade	0.1	0.2	0.3	0.3	-0.1	-0.4
Household wealth	2.4	2.5	2.7	-5	-4.3	-4.1

Appendix B. List of model variables and parameters

Endogenous variables

	FIRMS
K	capital stock of the firms
Y	gross production of the domestic good
G	installation costs
F	value added
p^F	price of the value added
V	value of the firms
D	dividends
B^F	firms' debt
V^N	value of the new shares of the firm
I	investments
E^A	earnings
λ	shadow value of the capital
	PRODUCT MARKETS
i^d	demand of the domestic good in investment use
i^m	demand of the imported good in investment use
p^K	price of the composite investment good
c^d	demand of the domestic good in consumption use
c^m	demand of the imported good in consumption use
p^C	price of the composite consumption good
v^d	demand of the domestic good in intermediate use
v^m	demand of the imported good in intermediate use
p^v	price of the composite intermediate good
p^d	price of the domestic good
p^m	price of the imported good
	FOREIGN TRADE AND INTEREST RATE
X	exports
m	imports
A^f	net foreign assets
r^d	domestic interest rate (yearly)
C^f	current account surplus

	LABOUR MARKETS
L^F	private employment
L^G	public employment
L	aggregate labour supply
w	wage rate
	HOUSEHOLDS
c	consumption of one household
C	aggregate consumption
l	leisure of one household
U	utility of one household
S	transfer received by one household
B	bequest of one household
W	aggregate household wealth
	PENSION SYSTEMS
τ^l	private sector employer's pension contribution
τ^y	private sector employer's social security contribution
l^p	average leisure
w^p	pension wage
Z	pension
H^F	value of the private sector pension fund's assets
H^G	value of the public sector pension fund's assets
	GOVERNMENT
B^g	public debt
τ^C	value added tax rate
	OTHERS
Q	value of gross domestic product

Eksogenous variables and parameters

personal income tax, normal-income households	τ^{wn}	0.27
personal income tax, low-income households	τ^{wp}	0.16
dividend income tax	τ^D	0
interest income tax	τ^r	0.14

capital gains tax	τ^g	0.28
corporate income tax	τ^F	0.28
bequest tax	τ^B	0.1
employee's pension contribution	τ^e	0.05
employee's social security contribution	τ^s	0.03
depreciation rate (yearly)	d	0.09
installation cost parameter	ξ	2
share of the value of firms' capital financed by debt	b	0.6
dividend distribution parameter	a	1
input-output coefficient for the composite intermediate good input	ζ	0.1
labour share parameter of the value added production fuction	ε	0.35
elasticity of substitution between labour and capital	β	0.7
growth rate of labour productivity (yearly)	ν	0.0
scale parameter for value added	A	1
share parameter of domestic good for consumption	υ^C	0.7
share parameter of domestic good for investment	υ^K	0.7
share parameter of domestic good for intermediate use	υ^v	0.7
elasticity of substitution between imported and domestic good in consumption	σ^C	0.99
elasticity of substitution between imported and domestic good in investment	σ^K	0.99
elasticity of substitution between imported and domestic good in intermediate use	σ^v	0.99
scale parameter of export demand	x	0.6
price elasticity of export demand	σ^X	-4
foreign interest rate (yearly)	r^f	0.04
sensitivity parameter of capital movements	ϖ	3
elasticity of intertemporal substitution of consumption	γ	0.5
elasticity of substitution between consumption and leisure	ρ	0.75
rate of time preference (yearly), normal-income households	δ^n	0.01
rate of time preference (yearly), low-income households	δ^p	0.025
leisure preference parameter, normal-income households	α^n	0.81
leisure preference parameter, low-income households	α^p	0.5
bequest preference parameter, normal-income households	μ	1.6
age-dependent working efficiency	e	0.5 - 1.3
share of full pension to pension wage (replacement rate)	θ	0.55
weights used to calculate the effect of periodic wages to the pension wage	Φ	0.02-0.5
pension indexing parameter for the pension periods	ψ	0.2
pension indexing parameter for the working periods	φ	0.5
survival rate	n	
mortality rate	s	