



Turun yliopisto
University of Turku



ESSAYS ON SOCIAL
INSURANCE AND TAXATION
Why Incentives and Institutions Matter

Mauri Kotamäki



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Mauri Kotamäki

University of Turku

Turku School of Economics
Department of Economics
Subject - Economics
Doctoral Programme of Turku School of Economics

Supervised by

Professor Heikki Kauppi
University of Turku
Finland

Professor Matti Virén
University of Turku
Finland

Reviewed by

Docent, Research Director Essi Eerola
VATT Institute for Economic Research
Finland

Professor Markus Jäntti
University of Helsinki
Finland

Custos

Professor Matti Virén
University of Turku
Finland

Opponent

Professor Markus Jäntti
University of Helsinki
Finland

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Abstract

This dissertation starts with an introductory chapter which is followed by four essays. The introductory chapter discusses the theoretical and empirical backgrounds to taxation. There are two general points to this dissertation. First, taxation matters and the design of the tax scheme is to be taken seriously. Second, the point of view of all the papers is of applied science. When applying earlier results to practice, the partial equilibrium framework may not be sufficient, and, at least from time to time, a general equilibrium point of view is necessary.

The first essay considers the organization of the pension scheme in Finland. The optimal use and function of the pension funds is debated lively in Finland - at least in the popular media. In the first essay, a reform is modelled in which the economy moves from the current mixed pension scheme into either a pay-as-you-go scheme or into a fully funded scheme. It is shown that, given a set of simplifying assumptions, a gradual switch to a fully funded pension scheme might be a wise choice.

The second essay studies taxation in Finland with the aid of a general equilibrium model. It is shown how the tax revenue curves, the Laffer curves, are modified when a substitute for consumption, home production, is brought into the analysis. It is shown that the Laffer curves exhibit different form when a substitute for consumption is taken into account and, consequently, policy advices are significantly altered.

The third essay discusses incentives to work in Finland between 2011 and 2016. Participation tax rates are calculated and an extensive sensitivity analysis is conducted upon the various assumptions made. Furthermore, utilizing the participation tax rate estimates, an employment effect is calculated on a recent reform where the earned-income tax credit was increased considerably.

Finally, the fourth essay considers the Finnish unemployment insurance (UI) scheme. In Finland, all employees pay unemployment insurance fee, but approximately nine out of ten are in practice insured in the earnings-related scheme; approximately 10 % of the unemployed are not members of an unemployment insurance fund and therefore receive no earnings-related UI in the case of unemployment - even though they have contributed to the financing of the system. A switch to a universal earnings-related UI scheme is analyzed.

Tiivistelmä

Väitöskirja alkaa johdantoluvusta, jota seuraa neljä artikkelia. Johdanto käsittelee verotusta sekä teoreettisen että empiirisen tutkimuskirjallisuuden pohjalta. Käsillä olevalla väitöskirjalla on kaksi yleisempää viestiä. Ensinnäkin verotuksella on merkitystä ja verojärjestelmän suunnitteluun tulisi suhtautua riittävällä vakavuudella. Toiseksi väitöskirja lukeutuu soveltavan tieteen alaan ja sovellettaessa aikaisempia tutkimustuloksia osittaisen tasapainon analyysi ei välttämättä ole riittävää - joskus yleisen tasapainon näkökulma on välttämätön.

Ensimmäinen artikkeli käsittelee Suomalaista eläkejärjestelmää. Eläkerahastojen tehtävästä ja optimaalisesta käytöstä käydään melko vilkasta julkista keskustelua. Ensimmäisessä artikkelissa mallinnetaan uudistusta, jossa kansantalous siirtyy osittain rahastoivasta eläkejärjestelmästä joko jakojärjestelmään tai kokonaan rahastoivaan järjestelmään. Artikkelissa näytetään tiettyjen oletusten vallitessa kuinka vaiheittainen siirtymä osittain rahastoivasta järjestelmästä täysin rahastoivaan järjestelmään saattaisi olla viisasta eläkepolitiikkaa.

Toisessa artikkelissta tutkitaan Suomalaista verojärjestelmää yleisen tasapainon mallin avulla. Artikkelissa näytetään kuinka verotuotto- eli Lafferin käyrä muuntuu, kun analyysissä huomioidaan eräs kulutuksen substituutti; jos analyysissä huomioidaan kotitalouksissa tehtävä kotityö, muuntuu aikaisemmassa kirjallisuudessa havaittu aidosti kasvava Lafferin käyrä käänteisen U:n muotoiseksi.

Kolmas artikkeli käsittelee työn tekemisen kannustimia vuosien 2011 ja 2016 välisenä aikana. Artikkelissa lasketaan työllistymisveroasteet ja niiden herkkyyttä eri oletusten suhteen testataan. Tämän lisäksi tuloksia sovelletaan taannoin voimaan tulleen uudistuksen vaikutusarviossa, jossa työtulovähennystä kasvatettiin merkittävästi.

Neljäs essee käsittelee Suomalaista työttömyysvakuutusjärjestelmää. Suomessa kaikki työntekijät maksavat työttömyysvakuutusmaksuja, mutta vain noin yhdeksän kummenestä ovat käytännössä vakuutettuja; noin 10 % työttömistä eivät ole työttömyyskassojen jäseniä eivätkä siksi oikeutettuja ansiosidonnaiseen työttömyyspäivärahaan työttömyyden sattuessa kohdalle. Tilanne on tämä huolimatta siitä, että nämä henkilöt ovat kuitenkin osallistuneet järjestelmän rahoitukseen. Artikkelissa pohditaan siirtymää nykyjärjestelmästä universaaliin ansiosidonnaiseen työttömyysturvajärjestelmään.

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In the beginning of the 2000s, I wasn't quite sure what I should do when I grow up. As it happens, in 2004, I came across a book in my bookshelf that I had acquired some years back. The book was *Kansantaloustiede* written by Jukka Pekkarinen and Pekka Sutela. In about five minutes my life had a direction and a clear objective - to study economics in the University of Turku. For this reason, I thank Jukka Pekkarinen and Pekka Sutela for writing this fantastic introduction on economics. Without this fortunate moment with this splendid book, I would probably be doing something rather different this spring than defending my doctoral dissertation.

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The making of this dissertation led me to work at the Labour Institute for Economic Research. In PT, I had time to dwell into various research questions, which is, of course, a necessary condition to making research. The environment also challenged one to think. Especially the many debates at the PT's legendary coffee table were exhilarating. I would like to thank all the people at the PT - the period of my life I spent there was a good time and I really learned a lot.

After PT, I worked about four years at the Ministry of Finance where I more or less finalized my dissertation. I would like to thank Tuulia Hakola for pushing me towards

microsimulation, which, in the end, constituted a significant part of my dissertation. I also thank Tuulia for all the other, important support and faith she gave me during my time at the MoF. It was a joy to work in a unit that truly appreciates scientific research, but first and foremost, it's great to work with friendly and talented people. Thank you Sami, Laura, Sanna, Allan, Riikka, Outi, Sari, Tuomo, Matti, Ulla and Jenni. Special thanks to Jukka Mattila for many interesting theories and thank you for co-authoring one of the essays in this dissertation. I am also grateful to Mika Kuismanen with whom I had many interesting debates during my time at the MoF. Mika's help and encouragement with papers handling Laffer curves was invaluable.

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For the last 34 years, I have been repeatedly told that education pays off. And I don't refer to a couple of talks in the comprehensive school and high school. I mean repeatedly in the very true sense of the word. Well mom, I guess you get what you bargain for. That said, I am enormously grateful to my mom Eeva who has more than encouraged me in my studies. I would most definitely not be writing this if it wasn't for your support.

Finally, I would like to thank Tiina for supporting me in this project. I promise to support you in your professional endeavours. You mean the world to me.

I dedicate this book to my daughter Emma, who has brought immense joy and laughter into our lives. Always stay happy.

Helsinki, April 2017

Mauri Kotamäki

Introduction to the Dissertation

Mauri Kotamäki

1 Introduction

Economic thinking stems from the notion that individuals have demands, but resources are scarce. The question is, how does the society allocate these scarce resources? Given the scarcity of resources, choices must be made. An individual choice gives rise to markets, that is, co-operation of people.

This dissertation is all about the public choice and the functioning of the public sector in a world where decision makers have scarce resources. The notion of scarcity forces a society to think about efficiency issues as, by and large, higher efficiency means less scarcity and better standard of living. Efficient use of resources is not, of course, an unproblematic statement. What is efficiency and for whom? And how is the central trade-off between equity and efficiency to be interpreted in this context?

This dissertation is, thus, closely connected to taxation and, whenever taxation is considered, the equity-efficiency trade-off becomes relevant. A redistribution of resources with taxation might be desirable, but it becomes at the cost of efficiency - individual decision making is distorted by taxes, thus, changing relative prices and usually creating inefficiency. On the other hand, equity, relating tax rate to tax payers ability to pay, is an intrinsic value and therefore a certain level of redistribution is usually seen to be for the good of the society. How much efficiency are we, the society, willing to sacrifice in the name of equity? Would the society be better off maximizing the Rawlsian utility function, or would an equal utility weight for all individuals with the assumption of diminishing marginal utility be sufficient? This impossibly hard question is not explored in depth here, because the models used in this dissertation are models of representative agent, and, consequently, the focus is on efficiency issues.

At first glance, the four essays presented in this dissertation may seem disconnected. They all, however, do have a common, important point. A simplified summarization would be: "Taxation matters". The first essay studies the pension scheme. In that essay, depending on how resources, collected by the pension contributions¹, are used, has implications on how the pension scheme should be organized. The second essay considers the efficient organization of a linear tax system and how are the aggregate tax revenue curves (Laffer curves) affected when home production is introduced into the model. It turns out that home production, as a substitute for market consumption, matters with respect to tax policies. The third essay is

¹Pension contribution rate is a tax-like fee

about incentives to work, but also, about the ex-ante evaluation of the Earned-income Tax Credit (EITC). The augmentation of the Finnish EITC is predicted to have considerable employment effects, although, there are considerable costs as well. The fourth essay focuses on the funding of the Finnish UI scheme in the case of a system reform. It is shown that the funding scheme matters greatly in terms of income distribution.

2 Taxation From the Past to the Present

The modern tax systems and the general knowledge of taxation has evolved in the course of time. Since the Egyptian times, taxes in their many forms have been collected. For a long time, however, taxation was mostly excises and custom duties. The earliest taxes were paid in kind, because currency was developed only later. Needless to say that the tax collection in those days required a significant effort from the “government”, and was rather inefficient compared to today’s standards.

One of the most important cornerstones in the development of the modern tax system was the Magna Carta in England, which, in a rudimentary way, ensured that no tax could be increased without the consent of the government, or, the Great Council at that time. The Magna Carta built the foundation to the phrase “no taxation without representation”, thus, creating a foundation for the American revolution. Also, when Finland became an autonomous part of the Russian empire in 1809, the notion of “no taxation without representation” was realized - the state taxes collected in Finland were to be used in Finland.

Income taxation was first introduced as late as during the Napoleonic wars in Europe in the beginning of the 19th century. The measure was only temporary, however, as the motivation was to collect resources to fund the war. The income tax scheme in England was re-established some three decades later, followed quickly by other countries. The US was a late mover in this aspect as the first income tax law was introduced only in 1913.

Two world wars and the emergence of the welfare state largely explain the significant increases in tax rates in the 20th century. A compulsory health insurance and pension scheme were introduced already in the 19th century in Prussia. Unemployment benefits were first introduced in the first half of the 20th century. The Finnish (voluntary) unemployment insurance was founded in 1917 (Pekkarinen (2015)). The welfare state in its many shades was born and it necessitated a more comprehensive and efficient tax collection than before. The earlier tax scheme consisting of mostly duties and excises has, over the years and through a

number of innovations, evolved into a modern but complex system, although, it is still finding its shape as societies evolve and knowledge accumulates.

Today, it is commonly viewed that there are a number of features that a well-functioning tax system should have. A preferred system is one that is efficient, but doesn't put too much burden on any particular group. In other words, a good tax system is fair. Furthermore, more concrete objectives can be given to taxation: i) collection of funds, ii) promotion of more "fair" distribution of income and iii) correction of negative externalities or giving support to positive ones. To an economist, taxation is means to an end which is the greater wellbeing of the society. The objective is never taxation because of taxation, but instead, something else in order to organize something that is seen to be desirable for the society as a whole.

Jean-Baptiste Colbert is claimed to have said to have suggested that²

"The art of taxation is the art of plucking the goose so as to get the largest possible amount of feathers with the least possible squealing"

What he refers to is that taxation distorts economic decisions and creates excess burden - taxation is often associated with welfare loss, and therefore a good tax system attempts to minimize the welfare losses due to taxation. A formalization of this is called the Ramsey problem.

In this introduction, a brief discussion is offered which considers these matters in terms of capital income taxation, labor income taxation and consumption taxation. Selected models, that elaborate on these issues, are presented. The research literature in question is large, thus, only a small part of important results can be presented. Furthermore, issues on general equilibrium and financial incentives to work are discussed. Also selected empirical observations are presented. The introduction, however, starts with a short summary of the current economic picture of the public sector in Finland.

3 Public Sector in Finland

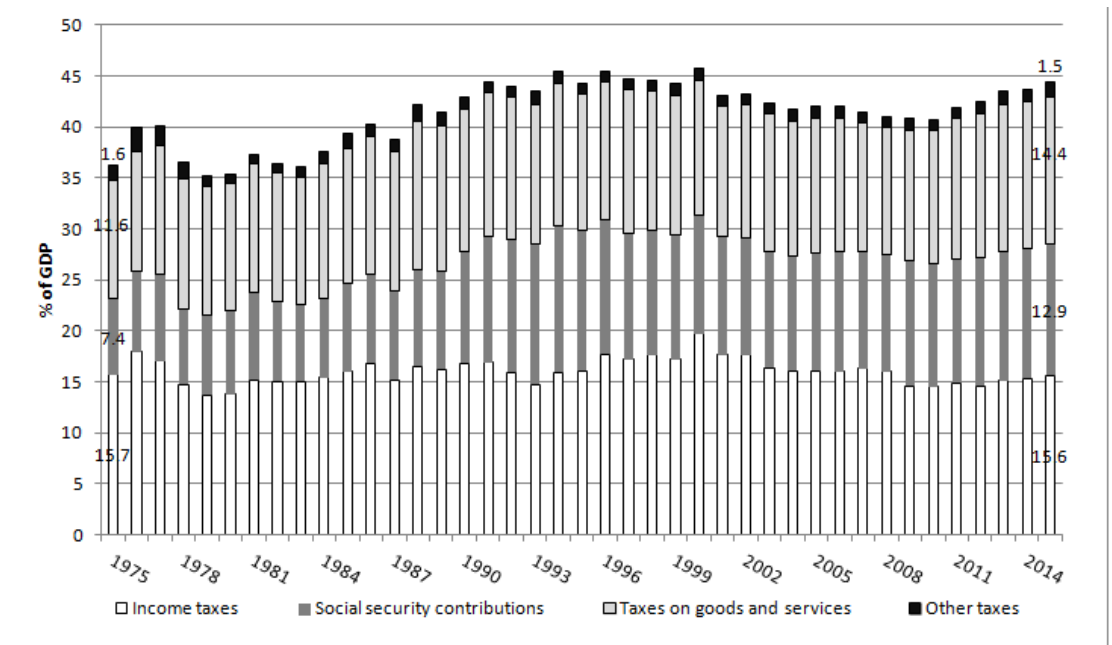
The fiscal position of the public sector has been a subject of considerable debate during the recent years. Is the Finnish taxation at the "correct" level? Is the ratio of public expenditures to GDP needlessly high? Are there unnecessary efficiency losses associated with taxation or

²Armitage-Smith (1907)

with public transfers? This dissertation, in a very broad manner, discusses these matters. In the umbrella of this dissertation, one can ask how a society should organize the public sector operations and funding? As the four essays all address the Finnish economy, a quick overview of the Finnish public sector revenues and expenditures is in order.

Figure 1 depicts the Finnish tax ratio³ from 1975 to 2015 decomposed into i) income taxes, ii) social security contributions, iii) taxes on goods and services and iv) other taxes⁴. Tax ratio is not a flawless indicator, as it hides many details of the system. It does, however, describe how the tax system has evolved over the years and also what are the relative weights of different tax categories.

Figure 1: Tax Ratio 1975-2015



Source: Statistics Finland, Taxes and tax-like payments

In 1975 the tax ratio was 36.3 % of GDP while it was 44.4 % in 2015. The ratio has, in other words, been in an increasing trend for a longer time period. Interestingly, the GDP share of labor income taxes has remained approximately the same - at a little less than 16 %. Social security contributions and taxes on goods and services, on the other hand, have

³Tax ratio describes the amount of compulsory taxes and other levies collected by general government as a percentage of GDP.

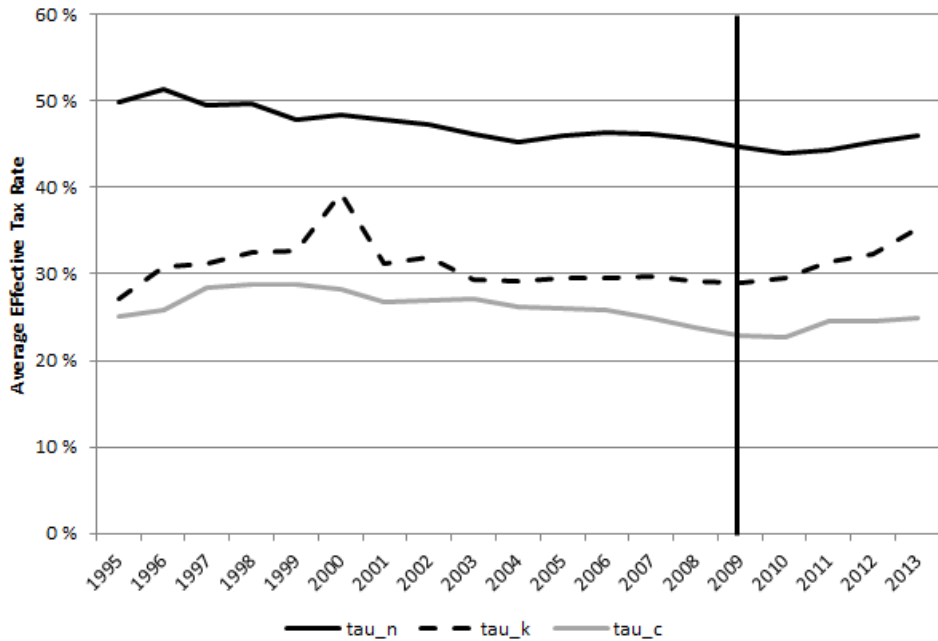
⁴Other taxes include taxes on payroll and workforce and taxes on property.

increased from 7.4 % and 11.6 % to 12.9 % and 14.4 %, respectively.

In 2015, income tax of households and corporations was 13.4 % and 2.1 % of GDP, respectively. Pension contributions were 10.1 % and other social security contributions 2.8 % of GDP. Property income taxes consisted of tax on real-estate (0.8 %), inheritance and gift tax (0.3 %) and transfer tax (0.4 %). Finally, the most important components of taxes on goods and services were user charge on passenger vehicles (0.4 %), excise duty on alcoholic beverages (0.7 %), VAT (9.2 %), excise duty on motor cars (0.4 %), energy taxes (1.9 %) and excise duty on tobacco (0.4 %).

The aggregate tax ratios give a useful, but imprecise description of tax revenues and of the tax system as a whole. A slightly more informative picture can be obtained by investigating effective tax rates, which relate tax revenues to the relevant tax bases. A seminal work in this field is by Mendoza et al. (1994) and the method developed by the authors is also utilized in the essays of this dissertation. The effective tax rates used in the essays are depicted in figure 2. The general picture is the same as drawn in figure 1: the AETRs were in a declining path up until 2010 after which an increase can be observed in all the effective tax rates.

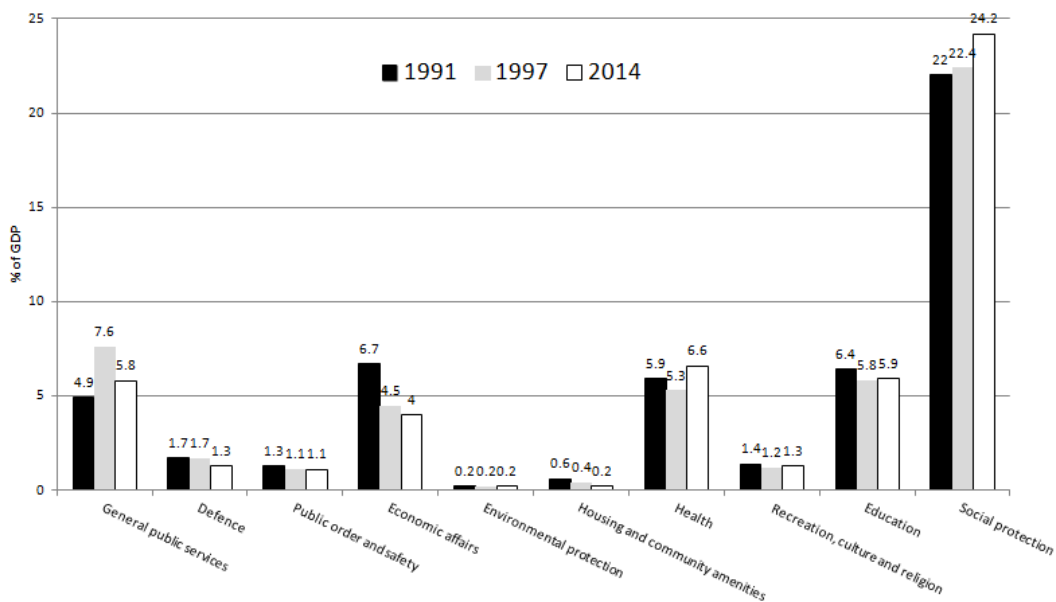
Figure 2: Average Effective Tax Rates 1995-2013



Source: OECD, AMECO and own calculations

The public sector collects taxes mostly in order to finance public expenditures. The aggregate expenditures in Finland in 1991, 1997 and 2014 are depicted in figure 3. The observation years are chosen to represent, as closely as possible, the GDP ratio of the newest observation, that is, 2014. In 1991, the expenditure to GDP ratio was 51.5 %, in 1997 it was 50.2 % and in 2014 it was 50.6 %. The expenditure ratio is clearly a more volatile variable than the tax ratio; if the GDP falls, the tax ratio remains quite stable, but the public expenditure GDP ratio usually increases “mechanically”.

Figure 3: Public (net) Expenditures 1991, 1997 and 2014, % of GDP



Source: Statistics Finland, General government expenditure by function

If the modern tax systems are complex, then so is the determination of the public expenditures. The ten usually reported aggregate expenditure categories are depicted in figure 3 - clearly the category of social protection is the most significant single category in terms of expenditures. It encloses a number of benefits targeted towards, for instance, the sick and disabled, the old, families and the unemployed. The share of it has grown since the 1990s. The expenditures of for the old-aged have grown most in the recent years due to the demographic shift in Finland. General public services, economic affairs, health and education in 2014 are, respectively, 5.8 %, 4.0 %, 6.6 % and 5.9 % of GDP. The rest of the categories are smaller than 2 % of GDP. It’s obvious, that the social protection is the most significant

single expenditure component - even if the old-age category, which is 11.8 % of GDP in 2014, is controlled for. Effectively, the expenditures that in many ways build the foundation to the Finnish well-fare state, also contribute to the high tax rate and the potential welfare losses associated with it.

4 Incidence of Taxation

A common misconception is to think that the agent that pays the tax also bears the burden of the tax. This is known as the flypaper theory of tax incidence - taxes stick where they first come (Salanie (2002)). Consider a situation where the labor income tax rate is increased and consequently the disposable income of the employee is then decreased. Some workers will withdraw from the labor market, reducing labor supply, pushing up the wage rate and, consequently, labor costs. In the end, net-wages have decreased and labor costs increased. Both workers and entrepreneurs share the costs of the tax hike. It doesn't matter who actually pays the tax and with which combination - only the gross wage and the net wage matter. The incidence will fall on both of the agents, and the tax change has both real economic and distributional effects. Price changes are key in the analysis economic incidence of taxation.

In the previous example, nothing was said about the use of government revenue or about how changes in the labor market change the returns to capital and labor; the "analysis" was of partial equilibrium. These more general effects are sometimes interesting and maybe even crucially important - which leads us to general equilibrium theory. A pioneer in the theory of tax incidence was Harberger (1962) who was the first to study tax incidence in general equilibrium framework. He studied the effects of a corporate tax in an economy given certain simplifying assumptions. A very good and interesting discussion of general equilibrium modelling is also given in a seminal work by Auerbach and Kotlikoff (1987).

In the competitive market, steepness of the demand and supply curves define the incidence of taxation. Consider another, related example. Assume that the labor demand is completely elastic in the long run - wage rate fully reflects labor productivity.⁵ What follows is that, in equilibrium, change in the labor supply schedule leads to one to one change in quantity of labor supplied while the horizontal labor demand curve stays put (assuming that the output

⁵This is also an outcome in a standard long-run general equilibrium model with Cobb-Douglas production function where steady state interest rate, deduced from the consumption Euler equation, is $r = 1/\beta - 1 = \alpha \left(\frac{k}{n}\right)^{\alpha-1}$, where β is the utility discount factor and α capital share in production.

per unit of labor stays constant). The long run employment is fully determined by labor supply. Consequently, the incidence of labor income tax, for instance, is on workers (in the form of unemployment). On the other hand, if the tax was on labor used in production, the adjustment would take place through the wage rate *and* labor supply.⁶

Another often used example is a tax on land - the supply of land is assumed to be highly inelastic. If the market is competitive, a tax on land would be fully borne by the land owners' via lower rate of return; the demand schedule stays put and there is no effect on the market price. This is one of the reasons why real estate tax is often seen to be a very good form of taxation as the economic agents have harder time escaping it and the incidence is approximately known.

5 Labor Taxation and Deadweight Loss

It is widely acknowledged among social scientists, that labor income taxation has negative effects on labor supply (*ceteris paribus*). This observation is backed up by theory, the Standard Model for example (see Salanie (2002) p. 38), or by a mountain of empirical evidence which is returned to later in this introduction. The major discussion within the field is more in the lines of *how much* taxation affects labor supply. It appears, that the literature is characterized by significant controversy upon the responsiveness of labor supply to changes in wages and taxes. The question of the strength of the labor supply response is in the very core of labor economics, because it actually determines the welfare loss of taxation in a society - the bigger the elasticity, the larger the welfare loss of taxation.

Government needs revenues in order to finance its expenditures, but, at the same time, the use of labor income taxation causes people to work less, thus, translating into efficiency loss. This is the central trade-off that give rise to the literature of optimal taxation. The efficiency loss, or, the excess burden of taxation is related to the compensated elasticity of labor supply. This can be illustrated as follows.

For simplicity, assume an elastic labor demand curve and a linear labor supply curve⁷ ie. $w = a + b h$, where h denotes hours of work and w is the wage rate. The excess burden of

⁶The story is slightly different if the real wage in the long run is not fully determined by labor productivity. This could be the case if, for example, there was negotiation upon wages and the long-run equilibrium wage rate was permanently above that of the competitive market.

⁷The linear approximation of labor supply curve is most credible assumptions for an infinitesimally small tax change.

taxation is now the triangle between the labor supply and (horizontal) labor demand curves:

$$DWL = \frac{1}{2}e^H wh\tau^2, \quad (1)$$

where e^H is the compensated labor supply elasticity. On the grounds of equation (1), dead weight loss of taxation (DWL) increases with tax rate (*ceteris paribus*). Also, the greater the (compensated) elasticity of labor supply, the larger the DWL. The policy implication is also, in this setup, rather straightforward. If the elasticity is large, the DWL of taxation can be high even with relatively low tax rates. On the other hand, if the elasticity is low, the economy can uphold high tax rate with relatively low deadweight loss. In the latter case, an increase in taxation would not be very detrimental to the economy.

To concretize the equation(1), consider a simple example. Assume that the compensated labor supply elasticity for aggregate hours is around 0.5 (Chetty (2012)) and that the Average Effective Tax Rate (AETR), including payroll taxes, is 45 % (see essay 2 of this dissertation). Then, still assuming linear labor supply curve and an infinitely elastic labor demand schedule, a following calculation can be made:

$$\frac{DWL}{wh} = \frac{e^H\tau^2}{2} = \frac{0.5 \times 0.45^2}{2} \approx 5\% \quad (2)$$

This back-of-the-envelope calculation thus implies, given the assumptions made, that DWL of labor income taxation in Finland would be approximately 5 % of wage sum on a yearly basis which adds up to approximately 5 billion euros. The aforementioned number is not to be taken as a serious estimate for the DWL of labor income taxation, but, it is a good starting point for thinking about the quantitative size of it. As is evident from equation (1), the (compensated) labor supply elasticity plays a crucial role when quantifying the DWL. If the labor supply elasticity was, say, 2, as some argue, the DWL of taxation would be fourfold and the policy advice should be adjusted accordingly. The very important topic of labor supply elasticities is turned to next.

6 Theoretical Basis on Labor Supply Elasticities

At this point, a few theoretical notes on the labor supply are in order.⁸ The concept of labor supply elasticity is often used loosely, although, theoretically, the term is well-defined. In the research literature, the labor supply elasticity is often categorized into two main types; static and dynamic. Assume a standard utility function where utility depends positively on current consumption (C_t) and negatively on hours of work (h_t):

$$U_t = \frac{C_t^{1+\sigma}}{1+\sigma} - \gamma \frac{h_t^{1+\phi}}{1+\phi}, \quad (3)$$

where γ is a scale parameter for disutility of labor, ϕ governs the strength of the substitution effect and σ determines the strength of the income effect. Let the (static) budget constraint be $C_t = (1 - \tau)w_t h_t + N_t$, where w_t is the wage rate, τ is the tax rate on earnings, and N_t denotes nonlabor income. The budget constraint of the static model implies three assumptions: (i) there is no saving, (ii) human capital accumulation is ignored, and (iii) demographic features are taken as given. The static model is one where all the intertemporal linkages are shut down, or agents are assumed to be myopic.

Differentiating (62) with respect to h_t subject to the static budget constraint yields the marginal rate of substitution (MRS) condition:

$$MRS = \hat{w}_t = \frac{\gamma h_t^\phi}{(\hat{w}_t h_t + N_t)^\sigma} = \frac{MUL(h)}{MUC(h)}, \quad (4)$$

where $\hat{w}_t = (1 - \tau)w_t$. The equation (4) represents very fundamental economic thinking. The MRS condition equates the net wage with the ratio of the marginal utility of leisure to marginal utility of consumption, in other words, MRS reveals the rate at which an agent is ready to give up one unit of leisure in exchange for one unit of consumption while maintaining the same level of utility. Differentiating (4) with respect to w_t and re-organizing, one obtains the uncompensated, or, Marshallian labor supply elasticity (e):

$$e = \left. \frac{\partial h_t}{\partial \hat{w}_t} \frac{\hat{w}_t}{h_t} \right|_{N_t} = \frac{1 + \sigma S}{\phi - \sigma S}, \quad (5)$$

where S is the share of labor income in total income: $S = \frac{(1-\tau)w_t h_t}{(1-\tau)w_t h_t + N_t}$. Assuming that total income is mostly labor income, the Marshallian elasticity can be approximated with

⁸The theoretical part concerning Hicks, Marshall and Frisch elasticities are mostly due to Keane and Rogerson (2012).

$(1 + \sigma)/(\phi - \sigma)$. Given, that σ is a large negative number ($\sigma < -1$), the Marshallian elasticity can be negative, that is, an increase in the wage rate can induce less labor supply. Empirically, backwards bending labor supply curves are observed in some instances, but not commonly.

Uncompensated elasticity can be further decomposed to the substitution and income effects using the Slutsky equation:

$$\frac{\hat{w}_t}{h_t} \frac{\partial h_t}{\partial \hat{w}_t} = \frac{\hat{w}_t}{h_t} \frac{\partial h_t}{\partial \hat{w}_t} \Big|_u + \frac{\hat{w}_t h_t}{N_t} \left[\frac{N_t}{h_t} \frac{\partial h_t}{\partial N_t} \right], \quad (6)$$

where the first term of equation (6) is the Hicksian, or, compensated labor supply elasticity, and the second term is the income elasticity multiplied by $S/(1 - S)$. The income elasticity can be solved by differentiating (4) with respect to N_t and re-organizing:

$$\frac{N_t}{h_t} \frac{\partial h_t}{\partial N_t} \Big|_{\hat{w}_t} = \frac{\sigma(1 - S)}{\phi - \sigma S} \quad (7)$$

The income effect (ie), that is, the second term in (6), is then given by:

$$ie = \frac{\sigma S}{\phi - \sigma S} \quad (8)$$

The income effect is clearly negative, because $\sigma < 0$. An increase in income induces an individual to consume more leisure, or, work less hours. The Hicksian elasticity (e^H) can now be defined in a straightforward fashion:

$$e^H = \frac{\hat{w}_t}{h_t} \frac{\partial h_t}{\partial \hat{w}_t} \Big|_u = e - ie = \frac{1}{\phi - \sigma S} > 0 \quad (9)$$

The compensated (Hicksian) elasticity must be larger than the uncompensated (Marshallian) elasticity, because income effect is always negative. An exception is the case when the “income effect parameter” σ equals zero, in which case $e^H = e$ and there is no income effect.

As noted earlier, the static labor supply specification shuts down the intertemporal linkages such as saving. Earlier, the non-labor income was taken to be fully exogenous. Consider now a problem where there are infinitely many periods of working life, thus, a model that allows for transferring resources between periods. There is an intertemporal utility function:

$$V_t = \sum_{t=0}^{\infty} \beta^t U_t \quad (10)$$

Furthermore, the dynamic budget constraint now reads: $C_t + b_{t+1} = (1 - \tau)w_t h_t + N_t + (1 + r_t)b_t$, where b_t denotes net saving (or borrowing if negative). This optimization problem can now be solved, and the solution yields the familiar intra-temporal and inter-temporal Euler equations:

$$C_t^\sigma = \beta(1 + r_{t+1})C_{t+1}^\sigma, \quad (11)$$

$$C_t^\sigma(1 - \tau)w_t = \gamma h_t^\phi. \quad (12)$$

Note that the equation (12) is equivalent to the MRS condition in equation (4). Differentiating (12) with respect to the wage rate, holding the marginal utility of wealth ($\lambda = C_t^\sigma$) constant, the Frisch elasticity of labor supply is obtained:

$$e^F = \frac{\hat{w}_t}{h_t} \frac{\partial h_t}{\partial \hat{w}_t} \Big|_\lambda = \frac{1}{\phi}. \quad (13)$$

The different elasticities can now be expressed in an inequality:

$$\frac{1}{\phi} > \frac{1}{\phi - \sigma S} > \frac{1 + \sigma S}{\phi - \sigma S} \quad (14)$$

$$\Leftrightarrow \quad (15)$$

$$e^F > e^H > e \quad (16)$$

To summarize different elasticities so far, the Frisch elasticity is larger than the Hicksian elasticity, which is larger than the Marshallian elasticity. In the framework presented here, the reason for this ranking order is the “risk aversion parameter”, $\sigma < 0$, which ensures that the marginal utility of consumption is diminishing. The different elasticities are based on different assumptions. Marshallian elasticity concept holds income constant, Hicksian holds utility constant and Frischian holds marginal utility of wealth constant.

In addition to the three aforementioned elasticities, there is also a fourth widely used elasticity known as the Elasticity of Taxable Income (ETI). ETI measures how much a relevant tax base changes as a response to a change in the tax rate. ETI is not reviewed in depth here, instead, an interested reader is pointed to Saez et al (2012).

7 General Equilibrium Considerations

The previous section considers labor supply elasticities in partial equilibrium framework. Significant portion of reasoning in economics research is made following partial equilibrium framework thinking which ignores many crucial mechanisms of possibly important effects. One key idea of this dissertation is to encourage into general equilibrium thinking. Assuming away general equilibrium considerations can lead to incomplete policy conclusions. On the other hand, it is true that general equilibrium effects are much harder to quantify and measure than partial equilibrium effects, thus, their empirical, or, in general, numerical, treatment is challenging. Here, with the aid of a simple model, the potential importance of general equilibrium effects is demonstrated. There are many sources where the general equilibrium effects can stem from. Only one such is presented here.

Consider an economy where there are positive output externalities to public investments. The notation is as before. Time subscripts are dropped to simplify the notation. Utility is derived from consumption and disutility from working: $U = c^{1+\sigma}/(1+\sigma) - \gamma h^{1+\phi}/(1+\phi)$. Consumption is given by: $c = (1-\tau)wh$, that is, all labor income is consumed in the same period as it is earned. Compared to previous section, the share of labor income to total income, S , now equals unity and the relevant uncompensated labor supply elasticity (e) is given by $e = (1+\sigma)/(\phi-\sigma)$ as derived in the previous section.

There is a representative firm that maximizes its profits ($\pi = y - wn$) by choosing labor demand. Profits go to the consumption of the representative entrepreneur. Firms are using labor (h) and public capital (g) as factors of production. Production function is given by:

$$y = (h)^\alpha (g)^{1-\alpha} \tag{17}$$

Wage rate equals the marginal product of labor. The public sector taxes labor income in order to maintain public capital and the public sector budget constraint reads:

$$T = \tau wh, \tag{18}$$

where T denotes the public sector revenue. Finally, the aggregate resource constraint reads $y = c + \pi + g$.⁹

Now consider a reform where the labor income tax rate is increased. What is the effect of

⁹Remember that profits go to the representative entrepreneur who consumes it periodically.

this reform on public sector finances? First consider an expected partial equilibrium effect in response to a change in labor income tax rate. A tax-cut has a direct effect and an indirect “behavioral effect”:

$$\frac{\partial T}{\partial \tau} = wh + \tau w \frac{\partial h}{\partial \tau} = wh \left(1 + \frac{\tau}{h} \frac{\partial h}{\partial \tau} \right) \quad (19)$$

In the model described above, the final, explicit partial equilibrium impact on public sector finances can then be written as follows:

$$dT^{PE} = wh \left(1 - \left(\frac{\tau}{1-\tau} \right) \left(\frac{1+\sigma}{\phi-\sigma} \right) \right) d\tau \quad (20)$$

The first term in equation (20) can be called the “static effect” and the second term the “behavioral effect”. An increase in tax rate increases public sector revenue (T) in relation to the tax base. Additionally, the behavioral response of a tax hike lowers the aggregate impact, because increased labor taxation decreases individual incentives to supply labor to the market. The size of the behavioral impact depends on the level of labor income tax rate ($\frac{\tau}{1-\tau}$) and on the uncompensated labor supply elasticity ($\frac{1+\sigma}{\phi-\sigma}$).

Next, consider the general equilibrium effects. Additional to the partial equilibrium effect of equation (19), there is an impact also on wages and output through behavioral change in labor supply and through the positive externality of public capital.

$$\begin{aligned} \frac{\partial T}{\partial \tau} &= wh + \tau w \frac{\partial h}{\partial \tau} + \tau h \frac{\partial w}{\partial \tau} \\ &= wh \left(1 + \frac{\tau}{h} \frac{\partial h}{\partial \tau} + \frac{\tau}{w} \frac{\partial w}{\partial \tau} \right) \end{aligned} \quad (21)$$

Also here, the first term can be called “the static effect”, the second term “the behavioral effect” and the third term “the general equilibrium effect”. The general equilibrium impact on public finances can explicitly be written as follows:

$$dT^{GE} = wh \left[1 - \left(\frac{\tau}{1-\tau} \right) \left(\frac{1+\sigma}{\phi-\sigma} \right) + \frac{1-\alpha}{\alpha} \left(1 + \left(\frac{1+\sigma}{\phi-\sigma} \right) \right) \right] d\tau \quad (22)$$

The difference between “partial equilibrium” and “general equilibrium” impact estimates is given by the difference of equations (22) and (19):

$$dT^{GE} - dT^{PE} = wh \left[\frac{1-\alpha}{\alpha} \left(1 + \frac{1+\sigma}{\phi-\sigma} \right) \right] d\tau \quad (23)$$

The general equilibrium effect, or, in this case, “the true effect”, is larger than the partial equilibrium effect. The first term in equation (23), $wh \left(\frac{1-\alpha}{\alpha}\right) d\tau$, denotes the (positive) output externality of the public economy. An increase in tax rate and, thus, public revenue, enhances production, enlargens the tax base and consequently enables higher tax revenue. The size of the effect depends on α ; the higher the term $1 - \alpha$, the larger the output externality of public consumption. This effect is neglected if only partial equilibrium effects are considered.

The second term in equation (23), $wh \left(\frac{1-\alpha}{\alpha}\right) \left(\frac{1+\sigma}{\phi-\sigma}\right) d\tau$, represents an additional positive effect of increased labor supply. If the labor income tax rate is increased, public revenue increases and, consequently, output increases. At the same time, due to increase in labor productivity, also wage rate increases and therefore there is an additional positive effect on individual labor supply, which goes to the opposite direction from the usual labor supply effect of taxation. Also this additional effect is ignored if only partial equilibrium effects are examined.

Figure 4: Measurement error of partial equilibrium analysis as a function of α

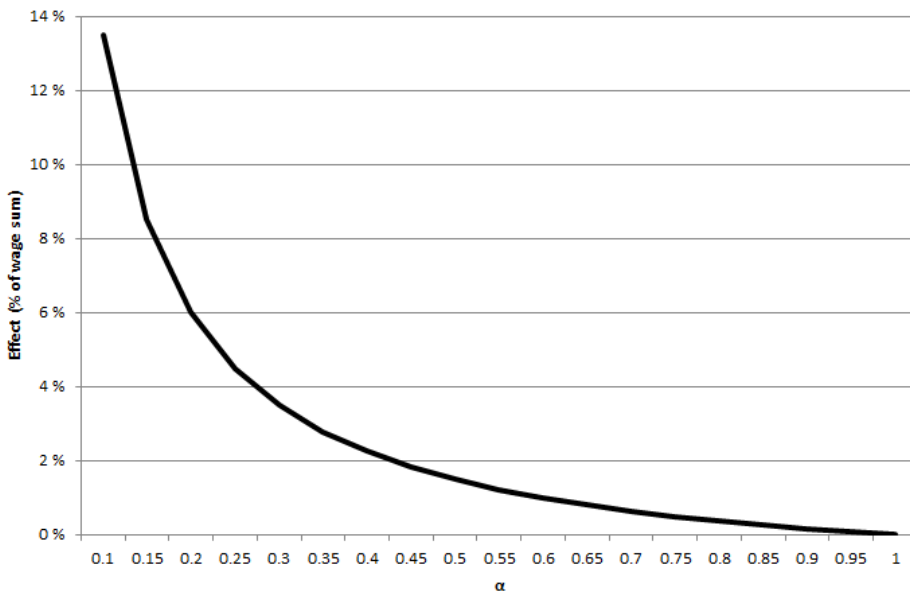


Figure 4 plots the general equilibrium effect (equation (23)) as a function of α . The uncompensated labor supply elasticity is assumed to equal 0.5. The vertical axis describes the change in tax revenue as a percentage of wage sum. If the value of α was, say, 0.5,

the difference between general equilibrium and partial equilibrium analysis would be 1.5 % of wage sum, that is, partial equilibrium analysis would neglect an effect on public sector revenue that is 1.5 % of wage sum. The smaller the effect of tax change is on wage rate (α approaches unity), the smaller the measurement error of the partial equilibrium model is.

The message of this section is that general equilibrium considerations potentially matter, and, consequently, this dissertation utilizes general equilibrium modelling in the analysis.

8 Overview of Labor Supply Elasticities in Empirical Studies

The labor supply elasticity is in many ways an important parameter in economic models with endogenous labor supply. In this dissertation, for instance, in the first essay, the labor supply elasticity parameter is used in a life-cycle framework. In the second essay, labor supply elasticity of aggregate hours is utilized. In the third essay, an extensive margin elasticity of labor supply is determining the employment impact of the EITC reform. The deep parameter of labor supply elasticity is, thus, very important in this dissertation, and, therefore, an overview of empirical estimates is provided in the following. This section concentrates mainly on the magnitude of the labour supply elasticity. The more complicated details of relevant explanatory factors and estimation of the parameter is not explicitly addressed here.

There are a number of comprehensive surveys on labor supply elasticities. The research literature has been reviewed recently by, at least, Meghir and Phillips (2010), Keane and Rogerson (2012), Keane and Rogerson (2012), Chetty (2012), Chetty et al (2011a), Chetty et al (2011b) and Saez et al (2012). The following overview is concentrating on the aforementioned existing surveys. The aforementioned surveys are very comprehensive and their excellence cannot be truly represented in this brief discussion.

According to Meghir and Phillips (2010), incentives matter and taxation can generate important distortions. In the review, the authors conclude that in the intensive margin, hours of work are fairly inelastic for men. A notable exception is males with low or medium level of education whose participation responsiveness can be very high to the design of the tax and benefit schemes. The same observation is made for women with young children (particularly for lone mothers) with the addition that also the intensive margin can be highly responsive. On the other hand, individuals with high education levels seem almost

completely inelastic to work incentives. Still the authors conclude that: “A well designed tax and benefit system will need to recognise that all groups in the population can be quite sensitive to taxes and benefits in many different dimensions”.

Keane and Rogerson (2012) provides a comprehensive survey on the theoretical basis of labor supply elasticities and also of their empirical applications. The author concludes that the literature is characterized by considerable controversy upon the labor supply elasticity. A somewhat common view is that the labor supply elasticity is small for working males and somewhat larger for females. Often this conclusion is reached without taking certain potentially important factors into account. These important factors include, for example, measures for human capital, fixed costs of work or endogeneity of fertility and marriage. Keane and Rogerson (2012) stresses this point and infers: “My review suggests that labor supply of men may be more elastic than conventional wisdom suggests”. Furthermore, he points out a number of shortcomings in the research literature that relate to his inference. First, there are no papers that deals with participation margin, human capital and progressive taxation simultaneously. It’s possible, that ignoring one of these fetures can lead to underestimation of the elasticity. Second, labor supply of couples is not usually considered as a joint decision. Third and finally, equilibrium effects of taxes on wages are largely ignored in the literature.

Keane and Rogerson (2012) considers 22 papers¹⁰ that yield an (unweighted) average Hicksian elasticity of 0.31 for males. The distribution of parameter estimates has two peaks; fourteen papers produce Hicksian labor supply estimate lower than 0.13 and eighth papers higher than 0.27, the highest being 1.32. This leads to the author to conclude that there is no clear consensus upon this value. Further, Keane and Rogerson (2012) surveys 11 “seminal” articles on female labor supply and infers that the elasticity eastimates are generally rather large. It is, however, harder to summarize the female response because the nature of what is estimated differs across studies.

Keane and Rogerson (2012) also question the conventional wisdom of low labor supply elasticities and argue that the traditional model is lacking certain key ingredients. In the traditional model, the only source of dynamics is savings/borrowing decision whereas the true model probably contains also other sources of dynamics. The authors augment the standard model with i) human capital accumulation and ii) nonconvex labor supply choice

¹⁰Papers are chosen to be reviewed if they are methodologically important or otherwise influential in some way. The selection of articles to be reviewed is, thus, highly subjective and doesn’t necessarily represent the whole universe of earlier research.

and show that the conventional wisdom is not necessarily correct when the data is viewed through the standard model. They state, referring to earlier research literature, that the labor supply elasticity estimates are underestimated in the standard framework. The key argument of Keane and Rogerson (2012) is that labor supply elasticity is actually more than a one-to-one mapping of individual preferences; also other aspects of economic environment matter such as the wage formation process (human capital accumulation) and production technology. Keane and Rogerson (2012) conclude, referring to their reading of the literature, that “compensated and intertemporal elasticities at the macro level fall in the range of 1 to 2”.

Chetty (2012) considers optimization frictions and, at the same time, ends up creating a survey on intensive and extensive margin Hicksian labor supply elasticities. He goes through 23 intensive margin studies and 11 studies in the extensive margin. The method or conditions of how the intensive margin studies are selected to the sample is not clearly stated in the paper. The extensive margin studies are from the meta-analysis of Chetty et al (2011a). The author finds, somewhat unsurprisingly, that microeconomic studies of the full population find the smallest elasticities whereas studies of top income earners and macroeconomic studies find larger responses. Chetty (2012) estimates, assuming 0.5 % of net income optimization frictions, that the structural Hicksian elasticity is 0.33 in the intensive margin and 0.25 in the extensive margin. The value for the elasticity increases (the bounds widen) as a function of frictions; the bigger the optimization frictions are, the larger the structural elasticity is. Finally, Chetty (2012) concludes that the steady state aggregate hours elasticity is approximately 0.5 (when controlling for frictions and indivisible labor).

Chetty et al (2011b) conduct a meta-analysis of extensive margin labor supply elasticities using fifteen studies that include a broad range of countries, demographic groups, time periods, and sources of variation. The focus is on reduced-form studies that use changes in tax policies or long-term wage trends for identification. According to the authors, there is a consensus about extensive margin elasticities; the analysis of the microeconomic evidence suggests Hicksian elasticity of 0.3 on the intensive and 0.25 on the extensive margin and Frisch elasticity of 0.5 on the intensive and 0.25 on the extensive margin. Chetty et al (2011b) explicitly state that “Even with indivisible labor, models that require a Frisch elasticity of aggregate hours above 1 are inconsistent with micro evidence”. This conclusion stands in contrast to Keane and Rogerson (2012), which puts the claim of consensus into question.

Chetty et al (2011a) consider a number of existing studies and form a “consensus estimate” upon certain elasticities. The recommendation of Chetty et al (2011a) is to calibrate

macro models to match Hicksian elasticities of 0.3 and 0.25 in the intensive and extensive margins, respectively. The Frisch elasticity should be calibrated to 0.5 and 0.25 values on the intensive and extensive margins, respectively, which adds up to 0.75 for the Frisch elasticity of aggregate hours.

9 Capital Taxation

Capital is an important factor of production and therefore it is also relevant in terms of tax policy. Capital can be abstract, human capital, but in this section, in a very general manner, only more concrete capital is addressed, that is, physical capital such as machines, buildings and housing, but also financial capital e.g. bonds and shares. There can be two types of taxes on capital: tax on the stock (wealth tax, tax on bequests or property taxes) or taxes on the income from savings (corporate income tax, taxation of interest and dividends, and the taxation of capital gains). In the end of the day, however, all capital is originated from accumulated savings, thus, the distinction of “stock” and “flow” play no role in the analysis of this section. The analysis relies in many places on the treatment of Salanie (2002) in this matter.

Figure 5 plots the level of capital taxation in EU countries. Finland is approximately an average taxer of capital with the GDP share of 6.3 %. The figure doesn’t tell a story about the strictness of capital taxation, because the denominator is the GDP instead of tax base. What we do see from the figure is that some countries, as a source of public revenue, rely more on capital taxes than others; Estonia receives approximately 2 % of GDP in capital taxes whereas France, Italy and Luxembourg collect over 10 percent of GDP in capital taxes.

When a society taxes capital income, it is actually taxing future consumption; today’s savings are tomorrow’s consumption. This can be demonstrated with the aid of a simple model. Consider an individual living two periods, facing an optimization problem of the following form:

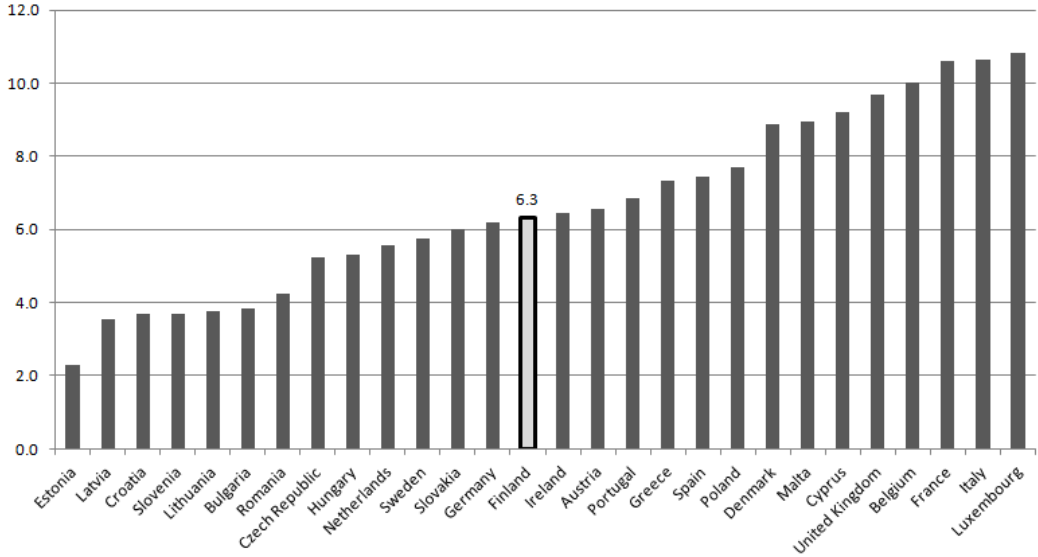
$$\max U = \log(c^1) + \beta \log(c^2), \quad (24)$$

s.t.

$$c^1 + s = w, \quad (25)$$

$$c^2 = (1 + (1 - \tau)r)s, \quad (26)$$

Figure 5: Taxes on capital as % of GDP in 2012



Source: Eurostat (2014). Capital is defined broadly, including physical capital, intangibles and financial investment and savings. A more detailed description see Eurostat (2014), Annex B p. 275.

where c^1 , c^2 , s , w , τ and r denote, respectively, first period consumption, second period consumption, saving, wage rate, capital tax rate and real interest rate. To make things as simple as possible, logarithmic preferences, a proportional (linear) capital tax rate and inelastic labor supply are assumed. The solution to this problem, the optimal behaviour of consumer, is given by:

$$c^{1*} = \frac{1}{1 + \beta} w, \quad (27)$$

$$c^{2*} = (1 + (1 - \tau)r) \frac{\beta}{1 + \beta} w, \quad (28)$$

$$s^* = \frac{\beta}{1 + \beta} w \quad (29)$$

As is evident from equations (27)-(28), capital tax has no effect on the optimal saving decision or first-period consumption. The second period consumption is, however, directly affected by the capital income tax rate. The higher the capital income tax is, the lower the second period consumption is. A question then emerges, which is not so much an economic question, but of a moral kind. Consider two apparently identical individuals (identical w), but the

other one, according to his or her preferences, is an impatient spender (β is low) and the other one is of a thrifty kind (β is high). Effectively, in this laboratory world, the thrifty person is taxed more heavily than the big spender. Is it desirable to tax a person only because he or she is innately different (more patient) in terms of propensity to save? This question will be left unanswered in this introduction.

The next economically relevant question is, that is taxation of capital efficient in general? Should we tax future consumption more heavily than the current consumption? According to the Corlett-Hague (1953) result, it is possible, be the case that preferences are non-separating between goods and leisure and future consumption is complementary with leisure. Retirement is one example, where obviously leisure is complementary with consumption. According to Corlett-Hague (1953), positive tax rate on capital might be advisable when and if a society wishes to encourage the labor supply of pensioners.

Overdover and Phelps (1979) showed that, given weakly separable utility functions and socially optimal capital stock level, the optimal tax rate on capital is zero. Later, Stiglitz (1985) gave a more readable proof of the zero tax result. But is it reasonable to assume, that the government can fix the capital stock at its optimal level? Probably not. And if capital is already at the optimal level, why tax it with a single tax instrument that can only distort the optimal level? This observation takes us to the famous Chamley-Judd result.

Consider a representative agent who lives an infinitely many periods. Equivalently the agent can be interpreted to be a sequence of generations leaving bequest to their children, in which case the capital tax is actually a tax on bequests. Define the utility function, aggregate resource constraint of the economy and government's budget constraint, respectively, as:

$$V_t = \sum_{t=0}^{\infty} \beta^t u(c_t, h_t), \quad (30)$$

$$f(k_t, h_t) = c_t + g_t + k_{t+1} - k_t, \quad (31)$$

$$b_{t+1} = (1 + (1 - \tau^k)r_t)b_t - \tau^k r_t k_t - \tau^h w_t h_t + g_t, \quad (32)$$

where the notation is as before. Also assume constant returns to scale so that $f(k_t, h_t) = w_t h_t + r_t k_t$. A Lagrangean for the government can now be formulated (not written out here) where λ_t is associated with the aggregate resource constraint (31) and θ_t with the government budget constraint (32). The government doesn't have lump-sum taxation in its disposal, and the optimization problem is a Ramsey-type problem. Note that the usual Euler equation of

the consumer holds at all times:

$$\frac{\partial u_t}{\partial c_t} = \beta(1 + (1 - \tau^k)r_{t+1})\frac{\partial u_{t+1}}{\partial c_{t+1}}. \quad (33)$$

Derivate the Lagrangian expression of the government with respect to c_t, c_{t+1} and k_{t+1} :

$$\frac{\partial \mathcal{L}}{\partial c_t} = \beta^t \frac{\partial u_t}{\partial c_t} - \lambda_t = 0, \quad (34)$$

$$\frac{\partial \mathcal{L}}{\partial c_{t+1}} = \beta^{t+1} \frac{\partial u_{t+1}}{\partial c_{t+1}} - \lambda_{t+1} = 0, \quad (35)$$

$$\frac{\partial \mathcal{L}}{\partial k_{t+1}} = -\lambda_t + \lambda_{t+1}(1 + r_{t+1}) + \theta_{t+1}\tau^k r_{t+1} = 0. \quad (36)$$

Using equations (33), (34) and (35), we find that λ_t and λ_{t+1} are proportional to each other in relation to after-tax interest rate, which is the inverse of the utility discount rate:

$$\lambda_t = (1 + (1 - \tau^k)r_{t+1})\lambda_{t+1}. \quad (37)$$

Plugging (37) into (36), the following expression is obtained:

$$(\lambda_{t+1} + \theta_{t+1})r_{t+1}\tau^k = 0. \quad (38)$$

By construction the Lagrangean multipliers are positive, thus, it must be the case that $\tau^k = 0$. Optimal (linear) capital tax rate (in equilibrium) equals zero, which is the famous Chamley-Judd result due to Chamley (1986) and Judd (1985). The result is very strong because it doesn't impose any strong assumptions on consumer preferences.

There are, however, certain dimensions that are not taken into account in the analysis presented in this section. It was shown, that the equilibrium capital tax rate is zero at the optimum. If, however, the planner has the power to change the period 0 tax rates, it should be set very high because the individuals can not directly respond to it and their optimal program is not distorted. For instance Chari and Kehoe (1999) deduce that the capital income taxes should be initially very high and then roughly zero.

10 Taxation of Consumption

It was brought forth in the previous section, that taxing capital can be equivalent to taxing future consumption. On the other hand, it can also be stated that the taxation of consumption is equivalent to taxing labor income - given appropriate assumptions. This can be seen by inspecting an individual's intertemporal budget constraint, which in a simple two-period OLG reads:

$$c_t^1 + \frac{c_{t+1}^2}{1 + r_{t+1}} = w_t + \frac{w_{t+1}}{1 + r_{t+1}} \quad (39)$$

In a simple, static framework, it doesn't matter whether the government taxes consumption or labor income - they both decrease the purchasing power of the agent. A uniform tax on consumption, τ^c , is equivalent to a uniform tax of $\tau^n = \tau^c / (1 + \tau^c)$ on labor income. In a slightly more complicated economy, it is no longer irrelevant whether to tax consumption or labor income. This will be returned to later.

Next, the very significant Ramsey formula (due to Ramsey (1927)) is derived. There are many ways to derive the formula, depending on the assumptions used. Chari and Kehoe (1999) analyze the Ramsey formula in a general framework for the representative agent. Salanie (2002) derives the formula for I agents. Here, some more simplifying assumptions are made in order to keep the analysis tractable. Assume a linear, downward sloping demand curve and an infinitely elastic supply curve for a good i :

$$p_i = a_i - b_i x_i, \quad (40)$$

$$p_i = c_i, \quad (41)$$

where a_i , b_i and c_i are constant parameters and p_i and x_i denote price level and demand, respectively. Further notice that the cross-price elasticities between goods are zero ($\partial x_i / \partial p_j = 0$). Assumptions on demand and supply are strong, but can be defended in certain environments. First, linear demand curve is approximately equivalent to analyzing very small changes around the original equilibrium. This is a common assumption in the business cycle macro, for example, where variables are linearized around the original steady state and the models then study the behaviour around those locations. Second, the perfectly elastic supply curve implies that a change in tax rate is fully reflected in the price level and the incidence of taxation falls to the consumer. This assumption is, thus, can be argued to be plausible in the long run.

With the demand and supply schedules specified above, the deadweight loss of taxation (DWL) is given by:¹¹

$$DWL = \frac{|\Delta x_i \Delta p_i|}{2} = \frac{(\tau_i)^2 (c_i)^2}{2b_i} \quad (42)$$

The Ramsey problem is now to choose a tax system that minimizes the DWL subject to the government budget constraint $\sum_i \tau_i c_i x_i = G$, where G is a predetermined level of government consumption. Remember that in the Ramsey problem there are no lump-sum tax instruments available, or else the solution would be to set all proportional taxes to zero and only to use lump-sum taxation. The optimal solution for the planner is to solve the following program:

$$\mathcal{L} = \sum_i \frac{(\tau_i)^2 (c_i)^2}{2b_i} + \lambda \left(G - \sum_i \tau_i c_i \frac{a_i - (1 + \tau_i)c_i}{b_i} \right) \quad (43)$$

The Lagrangean multiplier can be interpreted as the marginal DWL of government spending. Following the “marginalist tradition”, the planner should equate marginal DWL of each tax instrument. Solving for λ and rearranging, the inverse elasticity rule can be obtained:

$$\frac{\eta_i}{\tau_j} = \frac{\eta_j}{\tau_i}, \quad (44)$$

where $\eta_i = \frac{c_i}{a_i - (1 + \tau_i)c_i}$ is the price elasticity of good i . According to the equation (44), all goods should be taxed some positive amount. In addition, goods with high price elasticities should be taxed less than goods with low price elasticities. The idea is that if a tax base was very flexible (some capital income taxes, for example), taxing it might not be reasonable because the tax base would deteriorate more than the tax hike collected money.

The inverse elasticity rule reflects the design of an efficient tax system. Efficiency is but one criterion, and the formula has some uneasy implication on equity issues. Even though demand for certain necessities, say, insulin, is inelastic, it might not be desirable to tax them at a very high rate. Especially if it is consumed for the most part by the poor. So if the society cares about equity, it might be optimal to depart from the Ramsey formula. On the other hand, if the government has other policy instruments at its disposal, it can be optimal to maximize tax revenue approximately following the Ramsey rule, but redistributing the resources via, for example, means-tested subsidies. It all comes down to what are the assumptions that the planner is willing to make and what are the social weights on different consumer groups. Second, the consumption patterns of different agents matter. If “the rich”

¹¹DWL is merely the area of a triangle because the demand curve is linear and supply horizontal.

and “the poor” have identical consumption patterns, redistribution via consumption tax system is not generally possible and once again, other policy instruments become necessary.

The Corlett-Hague result by Corlett-Hague (1953) was briefly discussed in the context of capital taxation, but it is also relevant here. The result stated that one way to proceed towards more efficient taxation is to tax leisure. But unfortunately it is not possible to tax leisure, but it *is* possible to tax goods that are complementary to leisure, which is one way for the planner to get to leisure. Once again, this is a possible departure from the Ramsey rule if a good is both highly elastic, but complementary with leisure at the same time. The optimal tax rate for the aforementioned good, in relation to a good that is *not* complementary with leisure and is *not* highly elastic, is ambiguous.

11 Financial Incentives to Work

The scarcity of resources forces people to make decisions - trading off one goal against another. Reacting to these trade-offs means that people respond to incentives. This is one of the key notions in economics and also something that this dissertation builds upon. In terms of the labor market, there are a number of causes that affect individual incentives to participate in the labor market - both financial and non-financial. In economics, interest traditionally lies in the financial incentives to work, because (i) financial incentives can be measured and (ii) the economic environment can be altered towards, in some sense, a better functioning system, thus, there is political relevance. Non-monetary incentives that are related to, for instance, individual preferences, are not that easily modified or even measured. Non-monetary incentives are not, by any means, unimportant, but they are outside the scope of the analysis presented here.

Financial incentives to work are often measured by the Marginal Effective Tax Rate (METR) or by the Participation Tax Rate (PTR). METR is an indicator of work incentives in the intensive margin, which refers to the decision of whether to work more or less hours in a given time unit. The extensive margin, on the other hand, refers to the decision of whether to work at all and this is captured by the PTR. Of course, in practice, the decision is not merely a decision on labor supply. Also other factors are in play for example labor demand by firms and wage setting. The central argument is, however, that labor supply matters and because individuals respond to incentives, work incentives and labor supply are positively correlated - the better the incentives to work, the more individuals are willing to supply labor into the labor market.

Consider the two margins a bit more formally. In the economy, the aggregate working hours (H_t) can be decomposed into the intensive and extensive margins:

$$H_t = h_t \times e_t, \quad (45)$$

where h (subscripts dropped) refers to the average working hours per person (the intensive margin) and e to the total number of people working (the extensive margin). Elasticity of aggregate hours ($\frac{\hat{w}}{H} \frac{\partial H}{\partial \hat{w}}$) is then the sum of extensive and intensive margin elasticities ($\frac{\hat{w}}{h} \frac{\partial h}{\partial \hat{w}} + \frac{\hat{w}}{e} \frac{\partial e}{\partial \hat{w}}$). The labor input in the economy can be increased only by increasing the average work hours per person or by increasing the employment rate. A more detailed treatment of empirical elasticity estimates at different margins was given previously in section 8.

Marginal Effective Tax Rate can be defined as follows:

$$METR = \frac{\text{The net change in taxes and transfers when labor income increases by a small amount}}{\text{The small amount}} \quad (46)$$

The definition of PTR is identical to that of METR apart from one detail; METR examines small changes in labor income whereas the PTR examines (usually) larger changes, that is, transition from full unemployment to work. PTR can then be defined in the following way:

$$PTR = 1 - \frac{\text{The financial gain for the decision unit when the individual works}}{\text{Gross income of the individual when at work}} \quad (47)$$

Empirical values of METR or PTR for certain household types are usually calculated with the aid of a microsimulation model. The third essay in this dissertation, for example, conducts this microsimulation exercise on PTRs in Finland. The complicated legal frameworks of each individual country makes, however, the international comparison of work incentives difficult.¹² Here, the OECD Tax-Benefit calculator¹³ is used to calculate certain essential indicators with respect to work incentives which again are used in compare Finland, Sweden and the EU average. Finland and Sweden are often considered as close peers in matters of social security. Figure 6 shows PTRs for three household types that receive average wage (AW) when moving into work. The household types considered are single parent, lone parent with 2 children and two-earner married couple with two children. PTRs are calculated so that only (earnings-related) unemployment benefits are taken into account - no social assistance, housing allowances or childcare benefits (or costs) are included. The analysis is, thus, partial, but presumably still informative.

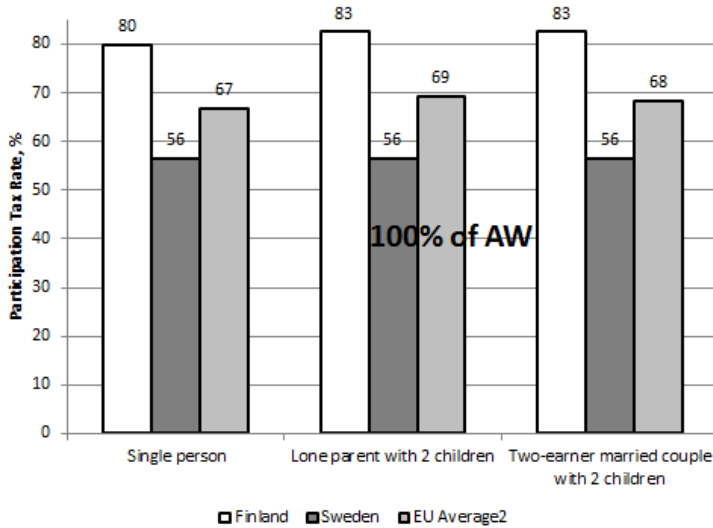
Sweden seems to have better (financial) work incentives in place than Finland according to figure 6. Even if the participation wage rate is varied from 33 % of AW to 150 % of AW, according to the OECD Tax-Benefit Calculator, the participation tax rates are lower in Sweden in basically all household types compared to Finland. The three very basic examples of figure 6 point towards substantial differences in PTRs. Finland is clearly above the EU average with over 80 % PTRs whereas Sweden is clearly below with 56 %.

The aforementioned numbers reflect largely features of the earnings-related UI system which results in rather high PTRs. However, approximately every other unemployed is entitled to earnings-related UI benefits in Finland. The picture changes somewhat when the

¹²Although there are some papers that utilize, for example, the EUROMOD microsimulation model in this respect. See Immervoll et al (2007) for example.

¹³See <http://www.oecd.org/els/soc/benefitsandwagestax-benefitcalculator.htm>.

Figure 6: PTRs in Finland and Sweden and EU average in 2014. Individual receiving earnings-related UI benefit.

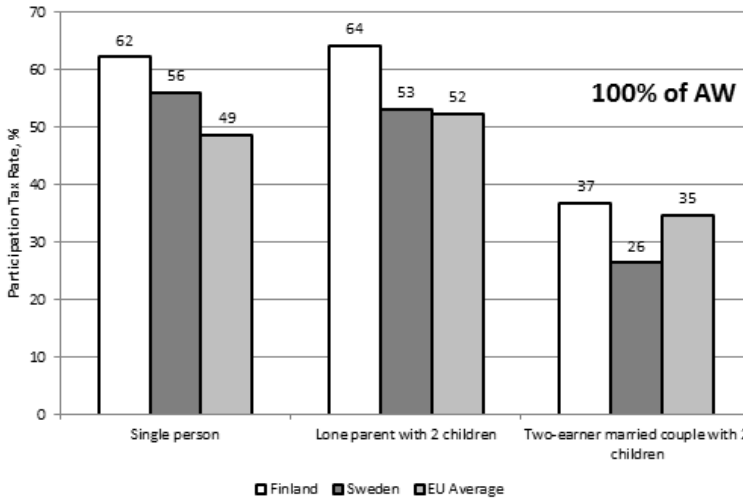


Source: OECD Tax-Benefit Calculator

UI system is not taken into account, but the other social security scheme instead. Figure 7 depicts a situation where earnings-related UI benefits are not available; individuals receive social assistance and housing benefits instead.

Still, in the context of figure 7, Finland has higher PTRs than Sweden with basically all participation wage rates and households types reported by the OECD Tax-Benefit Calculator. Consider the single person household for instance. In Finland, the PTR (assuming participation wage rate of 100 % of AW) is 62 % whereas it is 56 % in Sweden and, on average, 49 % in EU as a whole. The difference between Finland and Sweden is still large, but not nearly as large as in figure 6. Furthermore, in the case of social assistance, work incentives of two-earner couples seem to be a lot better in general because social assistance is often household level benefit whereas unemployment benefit is target towards an individual. In the case of two-earner couples with no eligibility on earnings-related UI, the work incentives in Finland are actually rather close to the average EU level. Once again, Sweden does considerably better job in this respect.

Figure 7: PTRs in Finland and Sweden and EU average in 2014. Individual not entitled to earnings-related UI benefit.



Source: OECD Tax-Benefit Calculator

12 Summary of the Essays

12.1 The Pension Scheme Need not be Pay-as-you-go: An Overlapping Generations Approach

In this study, the organization of the Finnish pension scheme is considered. The Finnish pension scheme is a mixed system with an emphasis on the pay-as-you-go (PAYG) part. In other words, the scheme is partially funded. According to, for example, seminal Diamond-Samuelson OLG model, a fully funded scheme is superior to a PAYG scheme as long as the Aaron condition holds and the model economy is dynamically efficient. In general, it seems to be a rather well-established argument that a PAYG pension scheme has negative effect on saving and therefore capital accumulation is diminished, leading to lower output and wellbeing. These notions raise a question upon the optimal organization of the pension scheme.

In this paper, both the transitional and steady state effects of moving from a mixed pension scheme to a PAYG scheme are illustrated. It is shown, that moving from the current system to a full PAYG scheme may not be a wise policy. On the contrary, it is shown, given a number of simplifying assumptions, that a country should actually switch over to a fully

funded pension scheme. In practice, a reform of this significance would probably be highly tedious, but not unheard of in the international context; for example Chile is in a transition from a PAYG to a fully funded system.

12.2 Laffer Curves and Home Production

In the earlier related macroeconomic literature, consumption tax rate Laffer curve is found to be strictly increasing - sometimes even up to several hundred percent. In this study, Laffer curve is defined to be a tax function that determines aggregate tax revenues as a function of a tax rate, holding all else constant. A general equilibrium macro model is augmented by introducing a substitute for private consumption in the form of home-production. There is, thus, an additional adjustment channel that enables a consumer to substitute market produced goods with home production in the case of a tax hike.

Indeed the introduction of home-production brings about an additional margin of adjustment - an increase in consumption tax rate not only decreases labor supply and reduces the consumption tax base, but also allows for a substitution of market produced goods with home-produced goods. It becomes more attractive to produce certain goods and services at home and as a consequence, some people at the margin change their consumption composition towards home produced goods.

It's important to keep in mind, that home production is but one possible substitute for market consumption. There can also be other types of compositional changes in consumption; an increase in the tax of a typical consumption good can induce a greater demand for black market goods, or, imported (tax free) goods. This paper concentrates on home production only, but it should be kept in mind that similar mechanism works also for other consumption substitutes.

As discussed in the paper, the previous theoretical literature has found the presence home production to have important effect on both the magnitude and even the direction of results. Furthermore, not only the theoretical literature, but also empirical literature confirms that home production plays an important role in the individual decision making. This paper attempts to explain the somewhat strange behavior of Laffer curves with the absence of substitute for market consumption by augmenting the standard model with home production. It is found that the previous results are altered with this addition.

The main contribution and objective of this paper is to show that, after the introduction of home production, the consumption tax Laffer curve exhibits an inverse U-shape. Also the income tax Laffer curves are significantly altered. The results shown in this paper cast doubt on some of the earlier results in the literature.

12.3 Participation Tax Rates in Finland - Earned-income Tax Credit Investigated

During the recent period of low or even negative GDP growth and rising unemployment rate in Finland, there has been a lot of discussion about improving the financial incentives to work. One of the main concerns has been the low-income earners' (low) incentives to work as, by and large, individuals with relatively low productivity, measured by the participation wage rate (PWR), face the lowest incentives to actively search for work.

This paper reviews the previous estimates on incentives to work and unemployment traps in Finland. It seems that the incentives to work have improved between 1995 and 2010. Furthermore, an analysis of where we are at the moment is presented. It is often important to understand the current position before reforms can be considered. The results indicate that there has been an increase in the average PTR in Finland after 2011.

The sensitivity of PTR calculations is tested in order to understand the dynamics behind the results. The contribution of different parts of the social security system to the level of PTR is calculated. This is something that is lacking in the earlier literature. The results show that the removal of the day-care fee would lower the PTR by 0.6 % in the aggregate. Naturally, the effect within the population is rather heterogenous - the effect on households without children is zero, whereas households with small children are usually the target of this fee. Finally, calculations show that the contribution of the General Housing Allowance to the PTR is - 2.8 % and contribution of the social income support to the PTR is -1.7 %.

Finally, this paper discusses the (ex-ante) employment effects of a recent reform aiming to increase incentives to work – an increase in the Earned-income Tax Credit (EITC). It could be possible to utilize the underlined methodology when evaluating and designing policy reforms in the ministries, for example. The methodology is as follows. First, the reform's effect on average participation tax rate is calculated. Second, the obtained result with respect to average PTR is plugged into a search theoretic general equilibrium model, and an employment effect is estimated. Also a more traditional “partial equilibrium” effect is

calculated. The EITC reform, that costs (in static terms) EUR450 million, lowers the average PTR by 1 pp., which is calculated to induce a 0.6-0.8 % increase in the number of employed using 0.25 elasticity of labor supply.

12.4 When Unemployment Insurance Doesn't Insure. Towards a More Inclusive UI Scheme.

The Finnish social security system guarantees all unemployed a certain level of basic security. In addition, members of UI fund that fulfill the employment condition are entitled to earnings-related unemployment benefits that are, on average, twice as high as the basic unemployment allowance or labor market subsidy.

UI expenditures are financed by the state (41.7 %), employees and employers (52.9 %) and UI fund membership fees (5.5 %). It's worth underlining that also the non-members are obligated to pay UI contributions. In other words, non-members are, in part, providing insurance to the members. Descriptive evidence shows that members fare better in the labor market; members are typically better educated and have higher income than non-members. It's then possible, that individuals who would need the UI most only end up funding other people's insurance.

One possible reform scenario would be to make the system more inclusive by making it universal. In other words all employees who fulfill the employment condition could receive earnings-related unemployment benefits. This kind of system is in place, for instance, in Norway. This paper analyzes cost-neutral reforms that are funded either by 1) increasing the UI contribution, 2) introducing a ceiling to the unemployment allowance or 3) combining 1) and 2). The calculations are conducted using the SISU microsimulation maintained by the Statistics Finland.

13 Motivation and Contribution of the Dissertation

The first essay¹⁴ is motivated by the question: what is the optimal organization of the pension scheme? From the earlier literature we know, that a fully funded pension scheme is more efficient than a PAYG given that the economy is dynamically efficient. It is not

¹⁴“The Pension Scheme Need not be Pay-as-you-go”

clear, however, that the transition from a mixed scheme or from a PAYG scheme to a fully funded scheme would be optimal, because a transition also bears costs. The contribution of the paper is to show that, in the case of Finland, given certain simplifying assumptions, a transition from a mixed scheme to a fully funded scheme would be welfare enhancing in the long run.

The second essay¹⁵ studies primarily consumption taxation and how changes in consumption tax rate affect aggregate tax revenue. The essay augments the “textbook” model of Trabandt and Uhlig (2011) by discussing how a substitute for market consumption changes the tax revenue curve. The earlier research literature has shown that the consumption tax Laffer curve is strictly increasing in a neoclassical general equilibrium model. One of the main contributions of the second essay is to show that, given certain assumptions, the case isn’t necessarily so. Actually, it is possible that the Laffer curve features the usual hump shape if the market consumption has a substitute, in the case of this essay, home production. The various dimensions of this results are discussed in the essay.

The third essay¹⁶ is motivated by a recent reform that considerably increased the Earned-income tax credit (EITC) in Finland. The analysis is conducted in two parts. First participation tax rates (PTR) are calculated and discussed after which the effect if EITC change is applied in the SISU microsimulation model and PTRs are calculated in order to get the quantitative effect of EITC on work incentives. This result is then taken to a general equilibrium model and a behavioral response to the policy change is obtained. The contribution of this paper is three-fold. First, the effect of EITC on work incentives is calculated. Second, two different approaches are combined in order to generate quantitative effects on tax changes. Third, the quantitative behavioral labor supply effect is obtained which gives out information whether a reform of this sort is beneficial in terms of costs and benefits.

The fourth essay¹⁷ is motivated by a relevant policy question of how the UI scheme in Finland should be organized and costs shared among the insured. At the moment, the system is not actuarially neutral and actually, as is shown in the paper, those who might benefit from the system most are not insured, but they do participate in sharing the costs of the system. The fourth essay asks whether the system could be brought towards a more actuarially neutral scheme in two particular ways and considers what are the effects on public finances and income distribution in the economy. The main contribution of the paper is to

¹⁵“Laffer Curves and Home Production”

¹⁶“Participation Tax Rates in Finland. Earned-income Tax Credit Investigated.”

¹⁷“When Unemployment Insurance Doesn’t Insure. Towards a More Inclusive UI Scheme.”

give concrete and analytical options on how to reform the system. It also discusses, in length, the pros and cons of the imaginary reform.

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Essay 1: The Pension Scheme Need Not Be Pay-as-you-go: An Overlapping Generations Approach

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The Pension Scheme Need Not Be Pay-as-you-go: An Overlapping Generations Approach

Mauri Kotamäki

Abstract

A relevant question in research on pension schemes is: Should a country gradually unload its pension funds in order to, for example, counter some of the negative effects of the ageing population and thus to prevent pension contribution rate from rising too much. As both Diamond (1965) and Samuelson (1975) have emphasized, ignoring transitional welfare effects is not a good idea and can potentially lead to wrong policy conclusions. Still many choose to concentrate solely on steady state effects. In this paper I illustrate the transitional and steady state effects of moving from a mixed pension scheme to a pay-as-you-go scheme and I show that, given a set of simplifying assumptions, this may not be a wise policy. On the contrary, a country should gradually switch over to a fully funded scheme.

Keywords: General equilibrium, Overlapping generations, Pensions

1 Introduction

For many countries, a relevant question in pension scheme research is whether they should gradually unload their pension funds in order to counter some of the negative effects of the ageing population and, thus, to prevent pension contribution rate from rising or replacement rate from lowering too much. As both Diamond (1965) and Samuelson (1975) have emphasized, transitional welfare effects should be taken into account when analyzing a transition from one system to another. In another words, only comparing steady states in the analysis is not sufficient, yet, exploration of the transitional effects is surprisingly rare in the literature.

In this paper I illustrate both the transitional and steady state effects of moving from a mixed pension scheme¹ to a pay-as-you-go scheme.² I show that, given a set of simplifying assumptions, this may not be a wise policy. On the contrary, a country should gradually switch over to a fully funded scheme. This conclusion is backed up by, for example, the Nobel laureate Franco Modigliani: "In a word, we need to abandon the pay-as-you-go system, which is a wasteful and inefficient system, and replace it with a fully funded system."³ In addition, a reform of this size is not unheard of or unrealistic. Many countries, Chile in 1981 being the most prominent example, have made the political decision of moving from a PAYG to a funded system.

This subject of optimal pension system is particularly topical in the case of Finland as the population is ageing and there is a lively public debate on whether or not to start unloading the pension funds in the near future. Consequently, the analysis of this paper concentrates on Finland. In a bigger picture, however, the analysis carried out in this paper can be generalized to any similar country with a mixed pension system.

One essential question is how a social security system affects saving behavior. In general, there are three effects at play; wealth substitution effect, retirement effect and bequest effect. Wealth substitution effect is referred to when an individual saves less than she would have without social security system in place. Agent knows that a part of her saving is done via the system and therefore saves less on her own. The aggregate response of saving depends on the details of the social security system in place. With a pay-as-you-go system, aggregate

¹In a mixed system, a part of contributions are funded and the rest are given directly to beneficiaries as pensions.

²Pay-as-you-go is abbreviated PAYG from hereon.

³In an interview from 1999 published in "Inside the Economist's Mind: Conversations with Eminent Economists." eds. Samuelson and Barnett 2007.

saving is reduced meaning less physical capital and, thus, reduction of output in the long run. The reduction is due to the different return on saving in different pension schemes (real interest rate versus the population growth rate). The Retirement effect means that individuals might retire earlier with a social security in place. However, if the retirement period lengthens, as it has due to longevity, an individual needs to save more to maintain the preferred level of consumption. This effect increases saving. The bequest effect refers to a desire to leave bequests for the young which also increases saving.

In a seminal study, Feldstein (1974) concluded that the wealth substitution effect dominates the retirement and bequest effects, thus, the PAYG significantly lessens capital accumulation in United States. Samwick (2000) finds that countries which operate PAYG seem to have lower saving rates, especially if the PAYG covers a large portion of the population. Feldstein (1996) estimates that the social security program in the US reduces the overall saving by nearly 60 % of their potential. There are also opposite conclusions (c.f. Leimer and Lesnoy (1982)), but in general the consensus seems to be that PAYG pension scheme has negative effect on saving (Hurd (1990)). In addition, according to for example Maddison (1992), "There is a general positive relationship between the faster postwar growth in output per head and the acceleration in saving rates..." If this was indeed the case, one might ask why moving from a mixed system to a PAYG would be a good idea?

Sometimes it's easy to get lost in details and not see the big picture. In this paper I simulate a (numerical) dynamic general equilibrium model in which I neglect the small details and concentrate on the big picture. The usual way of illustrating the differences between funded pension scheme and pay-as-you-go is to use the Diamond-Samuelson overlapping generations framework. The two systems in the model diverge only in the way in which pensions are funded. In the funded system the mandatory pension contributions, x_t , are collected from the young generation in a lump-sum manner. The contributions are then collectively invested and returned with interest in the next period, $(1 + r_{t+1})x_t$. The idea is to collectively save for old age. In the PAYG scheme, on the other hand, pension contributions, x_t , are used to finance pensions for the old generation in the same period. This translates to each young individual paying x_t in contributions and each old person receiving $(1 + n)x_t$, where n is the population growth rate (or economy's growth rate, if you will). This immediately displays the problems with a declining n . Also, PAYG is not neutral to saving decisions as long as $n \neq r$. The funded scheme, on the other hand, tends to be neutral to aggregate saving. The young people will fully offset the savings which the social security fund does on their behalf and therefore the aggregate saving is not distorted. The PAYG, on the other hand, tends to diminish aggregate saving compared to a world without the system in place, given that

$n < r_{t+1}$. This situation is referred to as dynamic efficiency as in Malinvaud (1953), or, from another point of view, the Aaron condition (Aaron (1966)). The policy conclusion within the traditional Diamond-Samuelson overlapping generations framework is straightforward; a dynamically efficient economy should increase saving in the long run and the pension scheme should be shifted towards a fully funded system. The opposite applies in a dynamically inefficient economy. The conclusion is not as straightforward in a more complex model, for example, in a model with open economy or endogenous growth. Also, taking the transition path into account is of crucial importance as is shown later in this paper.

The most cited article in empirically assessing dynamic efficiency is by Abel et al (1988). The authors conclude that "In the United States, profit has exceeded investment in every year since 1929. This finding leads us to conclude that the United States economy is dynamically efficient." They reach the same conclusion for the United Kingdom, France, Germany, Italy, Canada and Japan between 1960 and 1984. The underlying logic is such that the capital sector is constantly contributing to the level of consumption instead of being a drain which would mean that investments exceed profits. Also Barbie et al (2004) argue that the US economy does not overaccumulate capital between 1890-1999. From a more theoretical side, d'Albis and Decreuse (2007) argue that strong intergenerational altruism and high life expectancy prevent the occurrence of inefficient equilibria. They run a simulation exercise and conclude that the actual life expectancy is sufficiently low to guarantee that the US economy is dynamically efficient. The same general conclusion is reached, with a more minimal inspection, by Modigliani et al (2000).

The matter of dynamic efficiency is, after all this evidence, still a bit ambiguous and quite subtle issue to say the least. Be it this way or that way, many policy recommendations implicitly assume that the economy is dynamically efficient. Also the results presented in this paper depend on this observation. The reader is advised to familiarize herself with, for example, Weil (2008), Abel et al (1988) or Blake (ch. 4, 2006) for a deeper discussion of Dynamic efficiency.

The paper is organized as follows. The next section introduces the framework used to investigate the problem at hand, that is, the comparison of different pension schemes. The third section discusses the calibration of the model and its steady state properties. The fourth section studies differences between the two pension systems and discusses the policy implications of this analysis. The fifth section concludes.

2 The Framework

The model used here is an extended version of the Diamond-Samuelson overlapping generations framework. Again, in the words of Franco Modigliani: "[...] the notion of parsimoniousness is a useful notion, the notion that one should try to construct models that are not too big, models that are more compact in size." Thus, I have tried to keep the model as simple and tractable as possible, yet still trying to capture the relevant features of the Finnish pension system. The model includes five cohorts, a mixed pension system and endogenous labour supply.

2.1 Demographics

There is a large number of identical agents (workers) born each period. There are five cohorts.⁴ The first three cohorts constitute the labour force. Each cohort encloses approximately 12 age groups of one year. Individuals fare through their lives deterministically. Individual that is born in the beginning of period t works for three periods, t , $t + 1$ and $t + 2$. Last two periods of her life, $t + 3$ and $t + 4$, she spends enjoying leisure, that is, she is fully retired.⁵ Death is for certain, thus, the particular individual no longer exists at $t + 5$.

Formally I write the demographics in the following way:

$$\begin{aligned} POP_t &= N_t^1 + N_t^2 + N_t^3 + N_t^4 + N_t^5, \\ POP_{t+1} &= (1 + n)(1 + g)POP_t. \end{aligned} \tag{48}$$

N_t^i is the size of a cohort i at time t , POP_t is the (technology adjusted) total population at time t , n is the constant population growth rate and g is the Harrod-neutral technical progress.

⁴Multi-cohort structure better captures the life-cycle aspects of the problem at hand than the usual two-cohort representation.

⁵Also smoother retirement was tried, that is, individual was allowed to be both working and to be retired in the fourth period. The results of this article remain principally the same.

2.2 Individuals

The decision problem of an individual is to choose a sequence of consumption, leisure, and asset holdings, given the factor prices, a sequence of exogenous variables for demographic developments and pension contributions, that maximize the discounted value of lifetime utility subject to her constraints. There is perfect foresight. The problem of an age- i individual born at t is written as

$$V_t^i = \max_{s_{t+i-1}^i, l_{t+i-1}^i} \sum_{i=1}^5 \beta^{i-1} \left(\frac{(c_{t+i-1}^i)^{1-\sigma^c}}{1-\sigma^c} + \gamma^i \frac{(1-l_{t+i-1}^i)^{1-\sigma^l}}{1-\sigma^l} \right), \quad (49)$$

s.t.

$$\begin{aligned} c_{t+i-1}^i + s_{t+i-1}^i &= w_{t+i-1} \epsilon^i l_{t+i-1}^i + (1+r_{t+i-1})s_{t+i-2}^i + p_{t+i-1}^i - x_{t+i-1}^i, \\ c_t^i &\geq 0 \quad \forall t, i, \\ l_t^i &\geq 0 \quad \forall t, i \end{aligned} \quad (50)$$

The periodic utility function is characterized by separating isoelastic preferences to keep the analysis as simple as possible. c_{t+i-1}^i denotes consumption, s_{t+i-1}^i saving, l_{t+i-1}^i labour supply⁶, p_{t+i-1}^i pension income and x_{t+i-1}^i is the pension contribution. As usual, w_{t+i-1} and r_{t+i-1} denote wages and real interest rate, respectively. γ^i is a positive parameter that denotes the relative weight given to utility from leisure and $1/\sigma^c$ and $1/\sigma^l$ denote the intertemporal elasticity of substitution with respect to consumption and leisure, respectively. The parameter ϵ^i is an age specific efficiency index of an age i individual. Individuals are born with zero assets ($s_t^0 = 0 \forall t$). There is no saving in the last period of life because individuals know that they die after retirement period ($s_t^5 = 0 \forall t$). In other words I do not consider the bequest effect of saving. Also, retirement is exogenous so that individuals do not work in the fourth or fifth period of their lives ($l_t^4 = l_t^5 = 0 \forall t$). For all c_{t+i-1}^i and $1-l_{t+i-1}^i$, the usual Inada conditions hold with the assumed form of utility function (equation (49)).

Pension contributions, x_t^i , are determined in the following way:

$$x_t^i = \begin{cases} \tau^p w_t \epsilon^i l_t^i, & \text{for } i = 1, 2, 3 \\ 0, & \text{for } i = 4, 5 \end{cases} \quad (51)$$

where τ^p is the pension contribution rate. The pension contribution distorts the labour supply decision, thus, the steady state solution of the model is different with and without a

⁶Individuals are endowed with one unit of time, hence $(1-l_{t+i-1}^i)$ denotes leisure.

pension scheme. This would not be the case with lump-sum contribution scheme. Pension contributions are partly funded and partly used in a PAYG scheme. The total paid out pension benefits, B_t , are determined by:

$$B_t = \mu_t^f(1+r_t)(N_{t-1}^1x_{t-1}^1 + N_{t-1}^2x_{t-1}^2 + N_{t-1}^3x_{t-1}^3) + (1-\mu_t^f)(N_t^1x_t^1 + N_t^2x_t^2 + N_t^3x_t^3), \quad (52)$$

where μ_t^f is an exogenous policy variable that describes the share of pension contributions that are funded. If $\mu_t^f = 0$, funding rate is zero and the scheme can be characterized as PAYG. If $\mu_t^f = 1$, funding rate is one and the scheme is a fully funded pension scheme. While $0 < \mu_t^f < 1$, the pension scheme is a mixed one, in other words, part of the funding comes from the previous period (with interest) and the rest is collected from the workers of the present period. The first line of (52) is the total contributions paid out from a pension fund at time t . Thus, the maturity of the investment in the pension fund is one period. The second line of (52) is the pay-as-you-go part of the pension system. The pension scheme is described in figure 8.

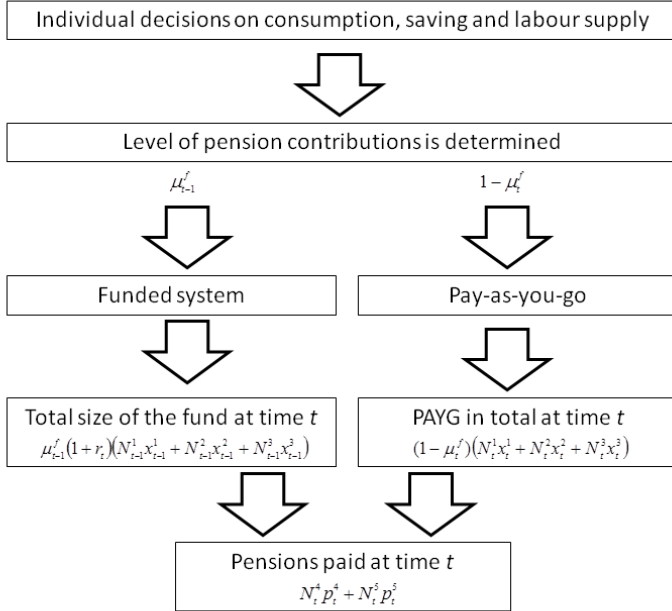


Figure 8: Pension system in the model

Pension benefits are given by:

$$p_t^i = \begin{cases} 0 & \text{for } i = 1, 2, 3 \\ \mu_t^{rr} \frac{\sum_{j=1}^3 w_t \epsilon^j l_t^j}{3} & \text{for } i = 4, 5 \end{cases} \quad (53)$$

where μ_t^{rr} is the replacement rate, that is, the percentage amount of mean gross wage income that is given to the retirees, and it adjusts endogenously to the changes in the pension scheme.

Maximization problem gives out the following first-order conditions for an individual born at t :

$$\frac{1}{(c_{t+i-1}^i)^{\sigma^c}} = \frac{\beta(1+r_{t+i})}{(c_{t+i}^{i+1})^{\sigma^c}} \text{ for } i = 1, 2, 3, 4, \quad (54)$$

$$\frac{(1-\tau^p)w_{t+i-1}\epsilon^i}{(c_{t+i-1}^i)^{\sigma^c}} = \frac{\gamma^i}{(1-l_{t+i-1}^i)^{\sigma^l}} \text{ for } i = 1, 2, 3, \quad (55)$$

Equation (70) is the Euler equation which determines the optimal consumption path and (71) gives out the intratemporal condition for labour supply.

2.3 The Production Sector

Firms operate in a competitive market and maximize profits with respect to capital and labour. Every period the firms will use capital until marginal product equals the rental rate and employ labour until marginal product of labour equals the wage rate. Constant returns to scale are assumed. Production function is given by:

$$Y_t = (K_t)^\alpha (L_t)^{1-\alpha}, \quad (56)$$

where Y_t , K_t and L_t are output, capital and effective labour supply, respectively.⁷ Labour share of output is given by $(1-\alpha)$.

According to, for example, Antras (2004), the aggregate elasticity of substitution is between 0.5 and 1, thus, I assert that the Cobb-Douglas form is a reasonable specification.

⁷Capital letters denote aggregate variables from here onwards.

Wage rate and interest rate are determined by the following equations:

$$w_t = (1 - \alpha) \left(\frac{K_t}{L_t} \right)^\alpha, \quad (57)$$

$$r_t = \alpha \left(\frac{K_t}{L_t} \right)^{\alpha-1} - \delta, \quad (58)$$

and δ denotes the depreciation rate of capital. The Inada conditions apply. The resource constraint of the economy holds at all times, thus, the next period capital is given by:

$$K_{t+1} = Y_t - C_t + (1 - \delta)K_t. \quad (59)$$

3 Properties of the Model

3.1 Calibration

I calibrate the model to match the long-run features of the Finnish economy. Individuals are assumed to be born as workers at the age of 21 and live for 60 years. A period in the model corresponds to 12 years and individuals live for 5 periods. This fits the data quite well. In 2012, the life expectancy at birth was a little over 80 years and the expected duration of working life⁸ in Finland in 2011 was a little over 37 years.

Preferences

I set the yearly discount factor, β , to be 0.97, thus, I have $0.97^{12} \approx 0.6938$. This value produces empirically reasonable capital-output ratio of approximately 3. The risk aversion parameter or, if you will, the inverse intertemporal elasticity of substitution with respect to consumption, σ^c , is calibrated to be unity, thus, I assume logarithmic preferences with respect to consumption. According to Rogerson (2007), the estimates of the inverse elasticity of substitution with respect to labour, σ^l , are in the range between 1 and 3. The inverse of elasticity with respect to labour is calibrated to be equal to 2.

I calibrate the cohort-specific parameter, γ^i , that measures the relative weight of leisure

⁸Eurostat calculates the duration of working life indicator as the number of years a person aged 15 is expected to be active in the labour market throughout his or her life.

to consumption in the utility function so that the working hours of the Finnish economy are replicated. The working hours of an average individual as a function of age is an inverse U-shaped curve so that 15-24, 25-44 and 45-64 year olds work, on average, 9 %, 24 % and 21 % of their active time, respectively.⁹ Using this information and the assumption that the average value of a group is also the median value, I use standard interpolation methods to find that $\bar{l}^1 = 0.169$, $\bar{l}^2 = 0.250$ and $\bar{l}^3 = 0.236$, where the upper bar denotes a steady state value and l^i is cohort i 's labour supply. The emerging γ^1, γ^2 and γ^3 are reported in table 1.

Technology

The share of capital in the production function, α , is set to 1/3. Capital depreciation rate is set to 0.08 which means that approximately 63 % of capital depreciates in 12 years. The age specific efficiency index is taken from Auerbach and Kotlikoff (1987) who use the formula:

$$\epsilon(exp) = 4.47 + 0.033 exp - 0.00067 exp^2, \quad (60)$$

where exp is the work experience of an individual in years. The index is given in table 1. I am implicitly assuming, that wages represent efficiency. Empirically wages keep on rising until the very last years of working career, thus, I assume that efficiency, within the model framework, is rising as well.

Table 1: Labour Supply Parameters

Generation (i)	1	2	3
Efficiency index (ϵ^i)	4.656	4.851	4.853
Appreciation of leisure (γ^i)	4.358	3.059	2.626

The exogenous index of the level of technology, also known as Harrod-neutral technical progress, is set to grow 1% a year. This means that $g = (1 + 0.01)^{12} - 1 = 0.1268$.

Demographics

Population growth has been quite stable in Finland since the 1970s. The volatility in population growth is mostly due to the World Wars and years right after. Motivated by the most recent decades, I set n to be 0.046 in the benchmark scenario. This translates to yearly

⁹Source: Statistics of Finland, Time use survey

population growth of approximately 0.38% which matches the average growth rate in the data in 1970-2011.

Pension Scheme

The average earnings-related contribution rate, including employers and employees, in 2011 was 22.1 %. As the contribution rate is the only policy rate, I set the total contribution rate to be $\frac{0.221}{1+0.221} = 0.1810$.

Total pension benefits in 2012 were 22.0 billion euros. Of that amount 2.6 billion came from the pension funds and the rest, 19.4 billion, were taken directly from the pension contributions. Therefore I set μ_t^f to $\frac{2.6}{22.0} = 0.118$ and $(1 - \mu_t^f)$ to 0.882.

Table 2: Benchmark Calibration.

α	β	δ	σ^c	σ^l	n	μ_t^f
.33	.6938	.6823	1	2	.046	.118

3.2 Steady State

Inspection of steady states gives us insight upon how the model behaves. In steady state all aggregate variables grow at the exogenously given rate which equals $(1+n)(1+g)$. Table 3 presents the steady state capital-output ratio K/Y , consumption-output ratio C/Y , the annualized interest rate r , the wage rate w , ratio of total contributions to output X/Y , ratio of total pension benefits to output B/Y , aggregate labour supply per capita l and the endogenous replacement rate μ^{rr} in the absence of pension scheme, with the benchmark¹⁰ pension scheme and both polar extremes of pension schemes (funded and PAYG).

The capital-output ratio in reported steady states varies from 2.90 with PAYG to 3.34 with competitive market. For comparison, the Finnish capital-output ratio was at its highest¹¹ in 1993 being 3.4 and at its lowest in 2007 being 2.4. The 1975-2010 mean is 2.9. The capital-output ratios obtained from the model are thus reasonable. All scenarios are dynamically efficient so that there is no overaccumulation of capital in steady state.

¹⁰Benchmark is the case where 11.8% of the contributions are funded.

¹¹In 1975-2010 data.

I shall first examine the effect of social security in the scenarios. Pension contributions are collected as a percentage of periodic labour income, thus, the labour supply decision is distorted with the social security in operation. The wage income net of social contributions is lower and therefore labour supply is depressed. The capital-output ratio is also lower with social security compared to competitive economy, translating into lower wage rate and higher real interest rate. In addition, aggregate consumption decreases when social security system is in place, but the consumption-output ratio increases because the aggregate output decreases even more than consumption. There is clearly less aggregate saving with the social security in place, and this means lower capital accumulation and lower capital-output ratio.

The differences between different forms of pension schemes are less significant, but the direction of the change is quite clear. At first glance, the welfare loss¹² seems to be smaller within the fully funded system as the replacement rate is higher and capital accumulation is larger. This stems from the fact that the return of a fully funded pension scheme (r_t) is higher than the return from PAYG scheme (n). I will analyze the overall and transitional welfare effects in section 4.

Table 3: Steady States

	No Social Security	Mixed*	PAYG**	Funded system***
C/Y	.774	.803	.804	.797
K/Y	3.34	2.91	2.90	3.01
r (annual)	.038	.047	.048	.045
w	.352	.328	.328	.334
l	.770	.714	.716	.704
X/Y	0	.121	.121	.121
B/Y	0	.127	.121	.174
μ^{rr}	0	.427	.404	.578

* $\mu^f = 0.118$

** $\mu^f = 0$

*** $\mu^f = 1$

3.3 Sensitivity Analysis

Table 8 shows the response of the benchmark steady state values (in bold) to changes in utility discount factor β , inverse of intertemporal elasticity of consumption σ^c , inverse of elasticity with respect to labour σ^l and contribution rate τ^p with respect to consumption-

¹²Welfare will be more precisely defined in subsection 4.2.

output ratio C/Y , investment to output ratio I/Y , capital to output ratio K/Y , time allocated to labour l , annual real interest rate r , wage rate w and replacement rate μ^{rr} .

Sensitivity to:		β		σ^c		σ^l		τ^p	
		.96 ¹²	.98 ¹²	.5	2	1	3	.15	.21
C/Y	.803	0.832	0.771	0.795	0.822	0.798	0.801	0.799	0.808
K/Y	2.91	2.49	3.40	3.03	2.63	2.99	2.94	2.98	2.85
I/Y	.197	0.168	0.230	0.205	0.178	0.202	0.199	0.201	0.192
r	.047	0.058	0.037	0.045	0.054	0.046	0.047	0.046	0.049
w	.328	0.304	0.355	0.335	0.312	0.333	0.330	0.332	0.325
l	.714	0.698	0.735	0.345	1.154	0.701	0.620	0.724	0.705
μ^{rr}	.427	0.436	0.419	0.409	0.440	0.396	0.427	0.351	0.498

Table 4: Sensitivity analysis

Increasing β makes agents more patient (see equation (70)). They save more and consume less relative to output¹³ and, as a result, they work more. Due to working more and accumulating more capital, production increases, interest rate decreases and wage rate increases. The final outcome is that aggregate consumption increases, consumption-output ratio decreases, because output increases more than consumption, capital level increases and so does the capital-output ratio.

Increasing σ^c decreases the intertemporal elasticity of consumption (again see (70)) and makes the agents care more about consumption smoothing. Agents become more risk averse. Individuals are less willing to delay consumption. Consumption increases in all cohorts and as a result the right hand side of (71) decreases and the agent wants to supply more labour in order to equate the equation (71). Labour supply increases significantly, saving (and thus capital) decreases a little and the result is higher output, but clearly lower capital-output ratio.

If σ^l increases, individuals appreciate leisure more than before. Labour supply decreases and, by equation (71), also consumption must decrease. All in all, people are basically poorer because they work considerably less. The great ratios, however, remain approximately the same.

Increasing the contribution rate, τ^p , induces agents to appreciate leisure more as labour

¹³Actual individual consumption increases but consumption-output ratio decreases.

supply decision is more distorted than before. Labour supply decreases. At the same time, agents realize that the government does more saving on their behalf than before and adjust their own saving rate accordingly. In the aggregate, saving decreases, capital accumulation decreases and as a result, output decreases. Youngest workers are worse off, because they bear most of the costs of increased contribution rate, but already the second cohort is better off compared to utility level in benchmark steady state.

4 Policy experiments

4.1 Transition Path

Figure 9 shows the evolution of capital-output ratio, labour supply, interest rate and replacement rate when economy is transitioning from the original steady state with a mixed social security scheme ($\mu_t^f = 0.118$) to a pure pay-as-you-go scheme ($\mu_t^f = 0$) with various numbers of transition periods¹⁴. Figure 10 shows the transition from original steady state to a purely funded system ($\mu_t^f = 1$). One time unit is approximately 12 years. The regime shift is introduced in period 2.

From the figures 9 and 10 it is obvious that longer the transition period, smoother the transition; the bang-bang type of reform introduces huge swing to the system in the first period after which it converges smoothly to the new steady state.

In transition to the PAYG system (figure 9), at first, there are "excess" funds from the previous period, because part of the previous period's pension contributions were funded to be used in the current period. This induces the replacement rate (μ_t^{rr}) to increase temporarily after which it adjusts to a new, lower level.

In figure 10 one sees the opposite case from figure 9. When moving to a fully funded system, there is, at first, a period where the PAYG scheme is no longer functional. Only a small amount amount of contributions is brought from the previous period, and, on the other hand, there are no intra-period pension transfers. This, again, induces a decrease in the replacement rate on impact, before it adjusts to a higher (than original) steady state. As the transition progresses and the pension scheme is now fully funded, the amount of capital

¹⁴Transition takes place in N equal sized steps, for example, transition from benchmark economy to fully funded economy in five steps translates to $\{\mu_t^f, \mu_{t+1}^f, \mu_{t+2}^f, \mu_{t+3}^f, \mu_{t+4}^f, \mu_{t+5}^f \dots\} = \{.1180, .2944, .4708, .6472, .8236, 1, 1, \dots\}$ where each step size is .1764.

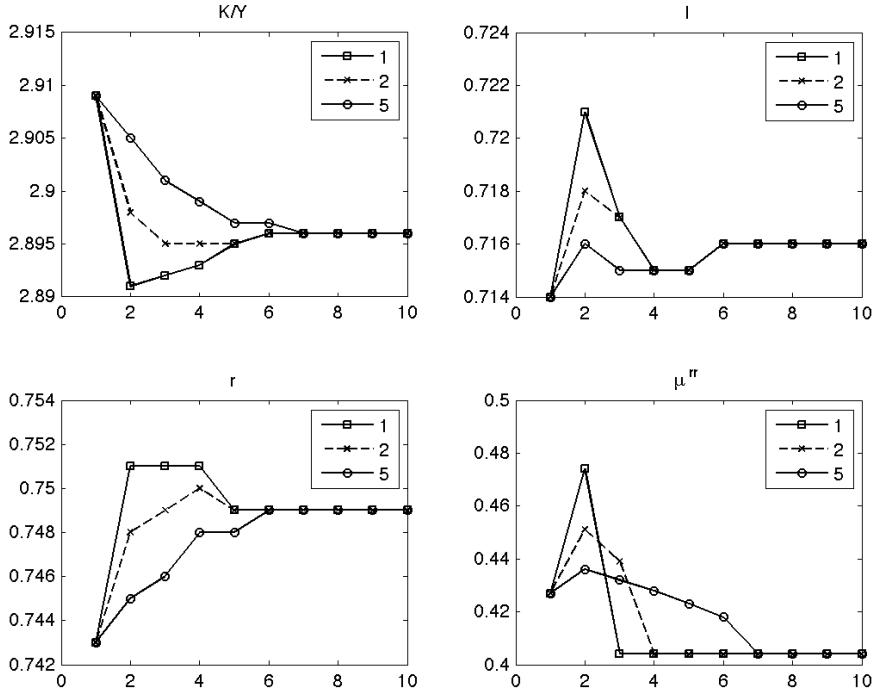


Figure 9: Transition to a full PAYG scheme. Transition to a new system takes place in 1, 2 or 5 periods.

in the economy increases, albeit the aggregate private saving decreases. This is a reaction to government saving on individual's behalf via the pension scheme.

4.2 Welfare analysis

Figure 11 presents how total steady state lifetime utility varies as a function of μ_t^f . The more there is funding in the pension scheme, the higher is the first cohort lifetime utility. The opposite applies to the second, third, fourth and fifth cohorts. This is mostly due to the fact that, with a fully funded pension scheme, agents' saving decisions are not as distorted as in PAYG and, thus, agents are able to smooth their consumption better. Also the institution (funded scheme) is a lot more efficient in the sense that the agreed pension contribution rate produces a significantly higher replacement rate.

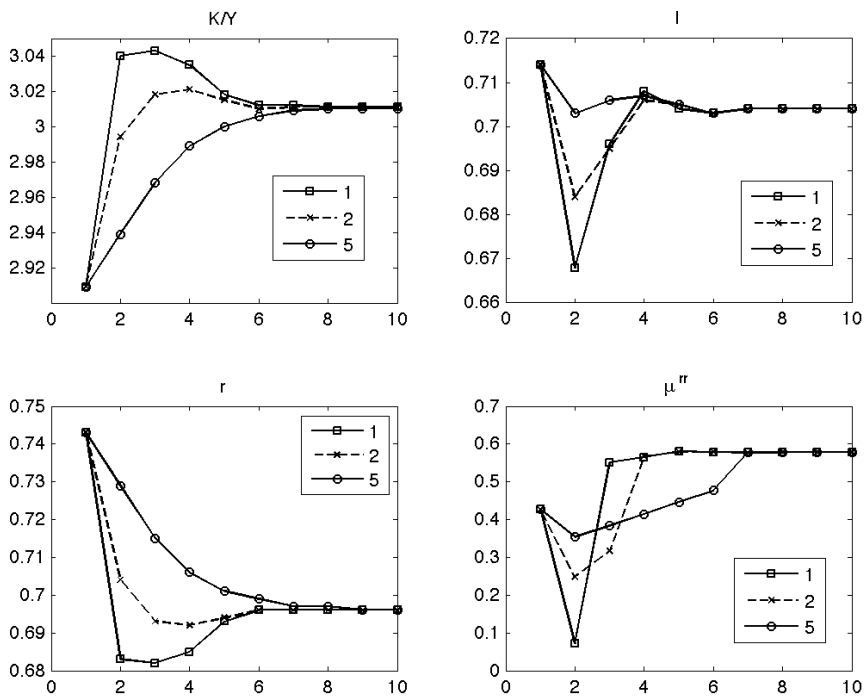


Figure 10: Transition to a fully funded scheme. Transition to a new system takes place in 1, 2 or 5 periods

These results give interesting insights regarding the political economy of this framework. Assume that agents vote in the beginning of the period. The median voter in this framework is found in the third cohort implying political pressure on decreasing the funding of the system. So actually, no matter what the total welfare of the society from this moment on is, the political economy of this model suggests that, as long as politicians try to please the median voter, the funding of the system will be decreased. The society with this sort of demographic structure will end up in the system with $\mu_t^f = 0$.

Still thinking in terms of steady states, figure 11 implies that there are no possible Pareto improvements to be made by adjusting the funding scheme of the pensions. Whenever funding is increased, the second, third, fourth and fifth cohorts are worse off in the steady state. The opposite applies to the youngest cohort and also all future, yet unborn, cohorts. One must construct a measure of welfare if one wants to compare different pension schemes from the perspective of the whole society. As a sidenote, it might be possible to accomplish

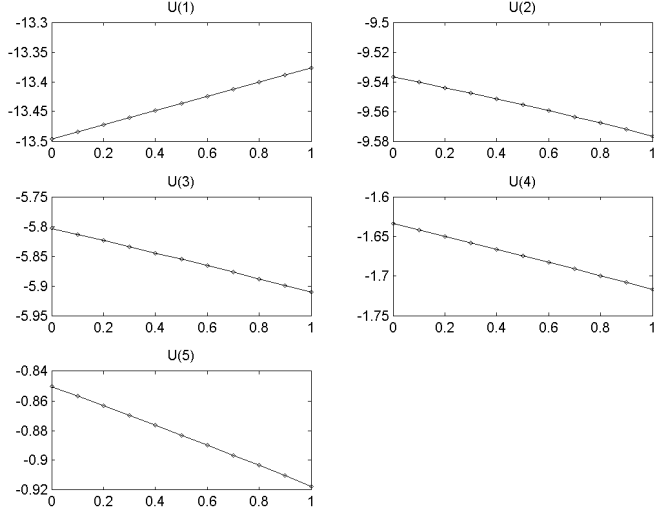


Figure 11: Utility levels in steady state as a function of μ_t^f . $U(i)$ is the remaining life time utility of cohort i .

Pareto improvement if one is allowed to use lump-sum transfers in the transition phase. This also is left for future research. Next I shall construct a measure of welfare to compare the steady state values with different levels of funding in the pension scheme. After that, I shall turn to analysis of the transition path.

The measure of welfare used in this paper is based on the Hicks compensation principle. I will follow Cooley and Soares (1999) in the construction of this measure. Let s_t^i be the total level of assets of an agent of age i , u_t^i be the compensation given to an agent of age i and S_t is the aggregate state of the economy. The question is, how much must an agent be compensated, in terms of consumption in the first period, so that the lifetime utility level is the same as in the world without social security (competitive economy). Thus, it must be that $V(s_t^i + u_t^i, S_t; \mu_t^f) = V_t^i$, where V_t^i is the lifetime utility level of agent in the competitive economy. The total discounted welfare cost is:

$$SW = \sum_{t=0}^{\infty} \hat{\beta}^t \psi^1 u_t^1 + \psi^2 u_0^2 + \psi^3 u_0^3 + \psi^4 u_0^4 + \psi^5 u_0^5, \quad (61)$$

where $\hat{\beta}$ is the discount factor and ψ^i is the population share of cohort i ($= \frac{N_t^i}{POP_t}$). The measure of welfare cost is $SW(1+r)/y$ where r is the real interest rate and y is the real

output per capita in the original steady state. The question is how to choose $\hat{\beta}$, the "inter-generational" discount factor. Arrow et al (2012) provide an answer on how intra- and intergenerational discounting could be made consistent: "This is an easy question: if benefits and costs are to be discounted at a constant exponential rate, the same rate must be used to discount costs and intra- and inter-generational benefits." Thus, I will set $\hat{\beta}$ to equal individual utility discount factor β .

The measure of welfare in different steady states is plotted in figure 12.¹⁵ This measure is interpreted to be the wellbeing after the transition period is over and the economy has converged into a new steady state.

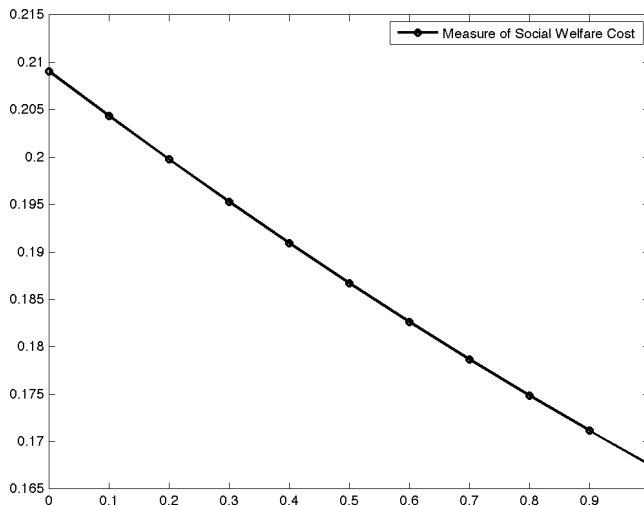


Figure 12: Measure of social welfare cost (y-axis) as a function of μ_t^f (x-axis)

The measure of welfare is a decreasing function of μ_t^f . This means that agents must be compensated more in the scenario where $\mu_t^f = 0$ compared to scenario where $\mu_t^f = 1$. The conclusion is crystal clear: in steady state, the funded pension scheme is better, because the welfare costs are smaller.

Figure 13 plots the measure of welfare cost as a function of different transition lengths. If the pension reform is introduced in bang-bang manner, the economy is best off by not reforming at all. If the choice is between funding or PAYG, the economy is better off in

¹⁵ $\sum_{t=0}^{\infty} \delta^t \psi^1 \bar{u}_t^1 + \psi^2 \bar{u}^2 + \psi^3 \bar{u}^3 + \psi^4 \bar{u}^4 + \psi^5 \bar{u}^5$, where \bar{u}^i is the steady state value of u^i .

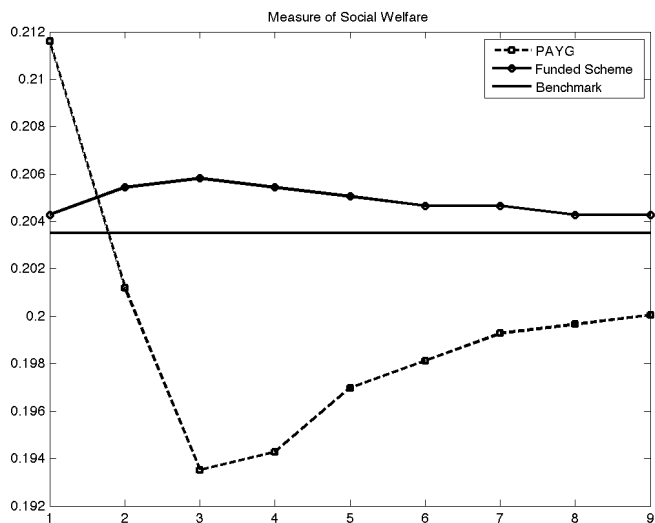


Figure 13: Measure of social welfare cost (y-axis) given different transition periods (x-axis)

moving towards the pay-as-you-go scheme. This is because the "sudden" drop in the pension replacement rate is too large, thus, the welfare loss for the pensioners of the time is bigger than the sum of discounted welfare gains for the first cohort of the now and the future. If the transition length is more moderate, that is to say longer than one period, transition to a funded pension scheme pays off in terms society's wellbeing.

From the figure 13, we do not only see that reforming the system into a fully funded one is a favourable decision (if it is not carried in haste), but also that the optimal speed of adjustment is three periods, or, about length of an individual's working career. If the reform takes place in t , in period $t+3$ the pension scheme already provides (almost) steady state benefits, which are higher than the original benchmark benefits, thus, the cohorts born in t or later are the ones that mostly harvest the profit from the reform, and also, they get the biggest weight in the calculation of the measure of social welfare cost ($\psi^1 > \psi^i, \forall i = \{2, 3, 4, 5\}$).

5 Conclusions

Using an overlapping generations dynamic general equilibrium model, I show that, in steady state, the society is better off having a funded pension scheme instead of a PAYG

scheme or a mixed scheme. This result is not new as such and it is demonstrated in many macroeconomic textbooks in a lot more simplified framework, usually with lump sum taxes (cf. Heijdra and van der Ploeg (2002)).

In the model used in this paper, there is a richer labour market, several cohorts and a particular pension scheme. Within this framework, a (mixed) pension scheme is described as a linear combination of PAYG and funded pension scheme. This simple extension is, to my knowledge, a novel way of describing the pension scheme.

I show that, in steady state, social welfare is an increasing function of the amount of funding. This is mostly driven by an increase in the saving rate. Also, the model specification enables to portray a transition from a mixed pension scheme either to a PAYG scheme or to a fully funded scheme. Having the knowledge of a transition path, I can compare the welfare implications of a regime shift. Given a certain measure of welfare, I show that transition, if not implemented as a bang-bang solution, to a fully funded system is better than transitioning to a PAYG scheme given my framework.

All the results hinge on the fact in the long run, real interest rate outweighs the population growth rate¹⁶, the economy is dynamically efficient and the return on the funded system is greater in steady state compared to a PAYG scheme. This raises another question: is the economy dynamically efficient? According to, for example, Abel et al. (1989) the answer is yes, at least between 1929-1989 in the US. However, as the authors put it *"In an uncertain world, there is no obvious metric for economic growth; nor is there a single rate of return."* Thus in practice, the matter is far more complicated than what is suggested in this article.

Subjects for future research include a richer description for the demographic process. An endogenous population growth and/or immigration flows would be good additions as the pension system critically depends on the changes in the demographic pyramid.

Another addition for the future research would be uncertainty. There are two key features in a pension scheme: time and risk. The risk is that pension benefits will be less than expected when the plan was first started. This risk could be partly accounted by introducing uncertainty to the return of the pension fund.

A third, interesting and important addition would be an inclusion of a more elaborate public sector. Social security isn't only about pension benefits, as in framework used in this paper, but also about the services that the public sector provides. As the population ages,

¹⁶Or, actually, the real growth rate of payrolls outweighs the population growth rate, to be more precise.

this feature is critical when assessing the long term budget balance of the public sector. A richer public sector would probably not, however, turn around the conclusions of this paper. This is because, as Auerbach and Kotlikoff (1987) demonstrated, PAYG system is equivalent to debt-financed fiscal policy thus the analysis in this paper partly takes this fact into account.

A fourth extension left for future research, perhaps the most important one, is to show that a gradual shift from the baseline economy to a fully funded system can (or cannot) be Pareto improving. Already Modigliani et al (2000) have calculated that the US would be able to reduce the social security contribution rate just by transitioning to a fully funded pension scheme. The estimate is a change from the projected future 18% contribution rate to below 6% without any sacrifices, using the purported surplus of the pension scheme to increase national saving.

Although a reform to a fully funded pension scheme seems far fetched from a pragmatic point of view, from an academic or positive point of view, it would not have to be.

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Essay 2: Laffer Curves and Home Production

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Laffer Curves and Home Production

Mauri Kotamaki

Abstract

In the earlier related literature, consumption tax rate Laffer curve is found to be strictly increasing (see Trabandt and Uhlig (2011)). In this paper, a general equilibrium macro model is augmented by introducing a substitute for private consumption in the form of home-production. The introduction of home-production brings about an additional margin of adjustment - an increase in consumption tax rate not only decreases labor supply and reduces the consumption tax base, but also allows a substitution of market goods with home-produced goods. The main objective of this paper is to show that, after the introduction of home production, the consumption tax Laffer curve exhibits an inverse U-shape. Also the income tax Laffer curves are significantly altered. The result shown in this paper casts doubt on some of the earlier results in the literature.

Keywords: Laffer curves, taxation, general equilibrium, home production

”Nor should the argument seem strange that taxation may be so high as to defeat its object, and that, given sufficient time to gather the fruits, a reduction of taxation will run a better chance than an increase of balancing the budget.”

- John Maynard Keynes in 1933¹

1 Introduction

If it is the case that there are always two tax rates that yield the same tax revenues, are we on the left or right side of the Laffer curve’s peak? And how far is the revenue maximizing tax rate ie. what is the fiscal space? What are the mechanisms that affect the shape of the Laffer curve?²

This paper dwells into one mechanism that has influence on Laffer curves - *home production*. It turns out, that a substitute for market consumption, home production in this case, has a significant impact on Laffer curves, thus, bringing some uncertainty on the existing Laffer curve estimates. In a ”traditional” model, an increase in consumption tax rate reduces consumption tax base, but the negative effect is usually small - in the aggregate, tax revenue increases as a result of a tax hike, therefore, a strictly increasing Laffer curve. Adding home production into the model changes this mechanism by accelerating the deterioration of the tax base compared to the traditional model, because a consumption tax hike, additionally, induces agents to substitute market based consumption with home produced goods. The result of strictly increasing consumption Laffer curve breaks down.

Recently, at least Trabandt and Uhlig (2011), Trabandt and Uhlig (2012), Fève et al. (2013), Holter et al. (2014), Zanetti (2012), Nutahara (2013) and Auray et al. (2015) have considered taxation and Laffer curves from various perspectives.³ In all the papers, the model specification is such that there is no substitute for market consumption, which typically implies that the Laffer curve is strictly increasing with the consumption tax rate. In a recent paper, Hiraga and Nutahara (2016) show the necessary conditions with certain utility function specifications, that yield a hump-shaped consumption tax Laffer curves. The authors show that Laffer curve for consumption tax rate can be hump-shaped if the utility function is additively separable in consumption and labor supply and, on the other hand, it cannot be hump-shaped if the utility function is non-separable. In this paper, it is shown, that

¹<http://www.gutenberg.ca/ebooks/keynes-means/keynes-means-00-h.html>

²In this paper, Laffer curve is defined to be the *aggregate* tax revenue curve as a function of a tax rate.

³See Kotamäki (2014) for a brief treatment of these papers.

the result by Hiraga and Nutahara (2016) breaks down when home production is introduced into the model.

This result of monotonically increasing Laffer curve for consumption tax, that stems from the often used model specification, can be questioned. When the relative prices change, individuals do not adjust only the leisure-consumption relation, but also the composition of consumption can change.

One example of a compositional change in consumption is home production. If the relative price of market produced goods increases (consumption tax rate increases for example), it becomes more attractive to produce certain goods and services at home. As a consequence, some people at the margin move from market based consumption towards home produced good consumption. There can also be other types of compositional changes in consumption. An increase in the tax of a typical consumption good can induce a greater demand for black market goods, or, imported (tax free) goods. This paper concentrates on home production, but it should be kept in mind that similar mechanism works also for other consumption substitutes.

There is a considerable research literature on the economics of home production. Furthermore, home production has also been studied in the context of taxation - the relevant context for this paper. Holmlund (2002) studies the effects of labor taxes on labor market outcomes in a model of equilibrium unemployment. He finds that home production brings the basic search equilibrium model of labor market closer to reality so that the neutrality result of proportional tax rate on employment disappears with the introduction of home production.

Engström et al. (2001) explore tax differentiation between (physical) goods and services in a labor market search and matching model with home production. The authors show that a tax cut on service sector reduces unemployment and also, that the introduction of sectoral tax differentiation with lower tax on services is welfare improving.

Olovsson (2009) argues that home production can explain most of the differences in labor supply between the US and Europe. Including home production in the model of economic behavior, Olovsson (2009) shows that the total amount of work only differs by 1 % between Sweden and the US. With this paper, the author participates in wider discussion in which Prescott (2004) argues that virtually all differences in labor supply between the US and Europe are due to differences in tax systems. Prescott has been, however, criticized by many because the labor supply elasticities he finds are higher than what has been found in the previous literature. Olovsson's contribution is to show that when home production is

included in the model, the US-Europe difference in labor supply can be explained irrespective of the magnitude of labor supply elasticity, and one possible explanation is home production.

In another recent paper, Olovsson (2015) argues that it is important that the government takes home production into account when designing the tax system. The author derives optimal consumption tax rate, which shows (among other things) that the optimal tax rate on market services is lower than the tax rate on market goods. The intuition is the following. Taxation of labor income is distortionary and, in order to minimize this distortion, a strictly positive tax on leisure (including home production) should be set. It is not, however, possible to tax home production directly, but decreasing taxes on market services is equivalent to increasing taxes on home production when home production and market services are substitutes.

On the empirical side, Rupert et al. (2000) argue that neglecting home production can lead to downwards biased estimates of the intertemporal labor supply elasticity. The result is in many ways potentially important, not least because higher the labor supply elasticity, the greater the welfare loss of taxation.

In summation, the previous theoretical literature has found the presence home production to have important effect on both the magnitude and even the direction of results. Furthermore, not only the theoretical literature, but also empirical literature confirms that home production plays an important role in the individual decision making. This paper attempts to explain the somewhat strange behavior of Laffer curves with the absence of substitute for market consumption by augmenting the standard model with home production. It is found that the previous results are altered with this addition.

This paper is organized as follows. The second section describes the model used in this paper. The third section presents the results in tax revenue curves (Laffer curves). The fourth section conducts a sensitivity analysis on the results. The fifth section concludes.

2 The Model

The model utilized in this paper is a standard general equilibrium model along the Baxter and King (1993) tradition. The main difference to the standard model is the introduction of home production as a substitute for market produced goods.

The model economy, presented in more detail below, consists of a large number of identical agents and firms and a government. In this paper, only steady states, that is, the long-run equilibrium is analyzed. A representative agent consumes goods, produces goods for his or her own consumption, works and saves in the form of capital and government bonds. Firms produce goods using capital and labor as factors of production. The government collects capital, consumption and labor income taxes, and issues bonds to finance its consumption, transfer payments and debt services.

2.1 Individuals

A representative individual chooses consumption (c_t), hours worked (n_t), capital stock (k_t), private investment (i_t), and government bond holdings (b_t) in order to maximize his or her discounted expected utility. Utility is derived from consumption and leisure ($1 - n_t$). The representative agent maximizes

$$U_t = \max E_0 \sum_{t=0}^{\infty} \beta^t u(c_t, 1 - n_t)$$

subject to

$$(1 + \tau_t^c)c_t^m + i_t + b_t = (1 - \tau_t^n)w_t n_t^m + (1 - \tau_t^k)(r_t^k - \delta)k_t + \delta k_t + (1 + r_t^b)b_{t-1} + s_t + \Pi_t, \quad (62)$$

$$k_{t+1} = (1 - \delta)k_t + i_t, \quad (63)$$

where $\beta \in (0, 1)$ is the utility discount rate, c_t^m consumption of market goods, n_t^m denotes labor supplied to the market, and τ_t^c, τ_t^n and τ_t^k denote consumption, labor and capital tax rates, respectively. On the income side, w_t denotes wage rate, s_t government transfers, Π_t profits of the firms, and r_t^k and r_t^b the interest rate applied to capital and government bonds, respectively. Total hours worked is the sum of hours worked in the market sector and hours worked in home production: $n_t = n_t^m + n_t^h$. The capital depreciation rate is given by δ .

A representative agent derives utility from a composite consumption good:

$$c_t = (\omega (c_t^m)^\kappa + (1 - \omega) (c_t^h)^\kappa)^{1/\kappa}, \quad (64)$$

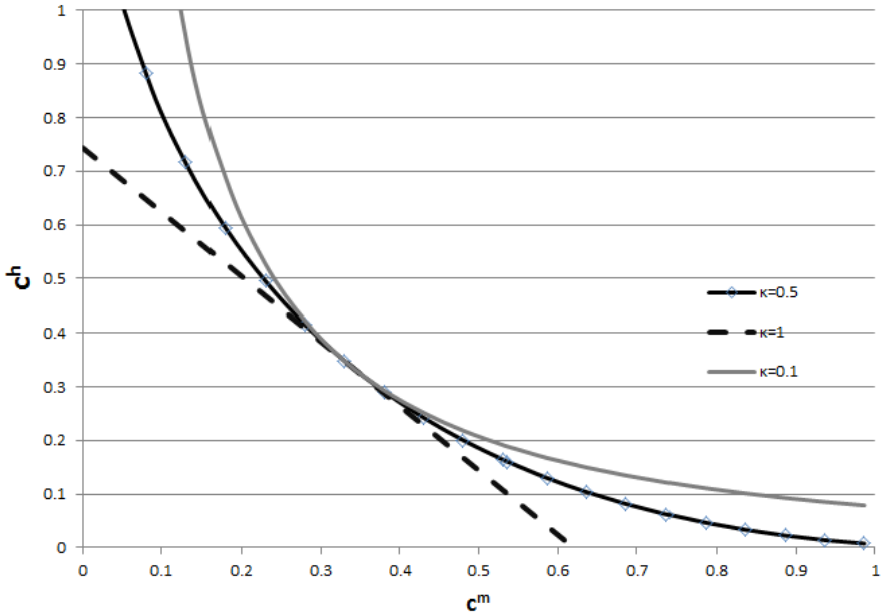
where the superscripts m and h denote market goods and home produced goods, respectively. The parameter ω denotes the share of market produced goods in private consumption, and

κ measures the elasticity of substitution between home and market produced goods. The equation (64) is important in terms of results and, thus, a more detailed inspection of it is in order. Take a total differential of equation (64) and hold the composite consumption constant by setting $d(c_t) = 0$. The resulting equation is given below:

$$\frac{d(c_t^m)}{c_t^m} = -\frac{(1-\omega)}{\omega} \left(\frac{c_t^h}{c_t^m}\right)^\kappa \frac{d(c_t^h)}{c_t^h}. \quad (65)$$

Equation (65) states that, conditional on c_t , individual is willing to substitute market consumption with home production as a function of ω and κ . A change in economic environment, a consumption tax increase for example, induces individual to substitute market produced goods with home produced goods. In figure 14, an iso-consumption curve is drawn (holding c_t constant) illustrating the trade-off between c_t^m and c_t^h .

Figure 14: Consumption holding c_t constant



Continuing with the model description, there is a production function, which defines the production technology of home-produced goods:

$$c_t^h = (n_t^h)^{\alpha^h}, \quad (66)$$

The periodic utility function is increasing and concave in consumption and leisure and is

assumed to be of the following form:

$$u(c_t, 1 - n_t) = \frac{(c_t)^{1-\sigma} \left(1 - \gamma(1 - \sigma)n_t^{1+1/\phi}\right)^\sigma - 1}{1 - \sigma}, \quad (67)$$

where ϕ , σ and γ denote, respectively, Frisch elasticity of labor supply, measure of risk aversion ($\neq 1$) and a scale parameter for dis-utility of labor. Utility function of this form feature a constant Frisch elasticity of labor supply, which is convenient in this type of analysis, because the magnitude of the labor supply elasticity is important in terms of results. Particularly this type of utility function is relevant, because it allows comparisons to the related research. A more in-depth treatment of a utility function of this specification is given in Trabandt and Uhlig (2011).

The first order conditions of the household's optimization are as follows:

$$\frac{\partial u(\cdot)}{\partial n_t^m} = -\frac{\partial u(\cdot)}{\partial c_t} \frac{\partial c_t}{\partial c_t^m} \frac{(1 - \tau_t^n)}{(1 + \tau_t^c)} w_t, \quad (68)$$

$$\frac{\partial u(\cdot)}{\partial n_t^h} = -\frac{\partial u(\cdot)}{\partial c_t} \frac{\partial c_t}{\partial n_t^h}, \quad (69)$$

$$\frac{1}{(1 + \tau_t^c)} \frac{\partial u(\cdot)}{\partial c_t} \frac{\partial c_t}{\partial c_t^m} = \beta E_t \left[\frac{1}{(1 + \tau_{t+1}^c)} \frac{\partial u(\cdot)}{\partial c_{t+1}} \frac{\partial c_{t+1}}{\partial c_{t+1}^m} (1 + (1 - \tau_{t+1}^k)(r_{t+1}^k - \delta)) \right], \quad (70)$$

$$\frac{1}{(1 + \tau_t^c)} \frac{\partial u(\cdot)}{\partial c_t} \frac{\partial c_t}{\partial c_t^m} = \beta E_t \left[\frac{1}{(1 + \tau_{t+1}^c)} \frac{\partial u(\cdot)}{\partial c_{t+1}} \frac{\partial c_{t+1}}{\partial c_{t+1}^m} (1 + r_{t+1}^b) \right]. \quad (71)$$

Equation (68) characterizes the labor supply decision of an individual in the labor market, equation (69) determines the labor supply in home production, and finally, equations (70) and (71) determine the equilibrium rate of return for capital, and guarantee that there are no arbitrage opportunities between the rate of return for capital and government bonds, ie. $(1 - \tau_t^k)(r_t^p - \delta^p) = r_t^b$.

2.2 Firms

There is a large number of identical final good firms, that produce a homogeneous product by choosing k_t and n_t^m . The firms maximize their profits, which are given by the following:

$$\Pi_t = y_t - r_t^k k_t - w_t n_t^m$$

Output, y_t , of a representative final good firm is given by

$$y_t = A_t (k_t)^\alpha (n_t^m)^{1-\alpha}, \quad (72)$$

where $A_t = (1 + g^A)A_{t-1}$ is the total factor productivity, g^A denotes the trend growth of the total factor productivity, α and $(1 - \alpha)$ are the share parameters of private capital and labor, respectively. The rental rate of private capital and wage rate are respectively given by:

$$r_t^k = \frac{\partial y_t}{\partial k_t}, \quad (73)$$

$$w_t = \frac{\partial y_t}{\partial n_t^m}. \quad (74)$$

2.3 Government

The government collects taxes, T_t , and issues bonds (b_t) in order to finance expenditures for government consumption (g_t), investments (i_t^g), transfers (s_t) and debt services:

$$T_t = \tau_t^c c_t^m + \tau_t^n w_t n_t^m + \tau_t^k (r_t^k - \delta) k_t, \quad (75)$$

$$g_t + i_t^g + s_t + (1 + r_t^b) b_{t-1} = b_t + T_t. \quad (76)$$

The no-ponzi constraint of public sector debt must apply:

$$\lim_{T \rightarrow \infty} \left(\frac{b_{T+1}}{\prod_{j=1}^T (1 + r_j^b)} \right) = 0. \quad (77)$$

The no-ponzi condition states that the discounted stream of taxes must equal the current value of outstanding government debt plus stream of government expenditures.

In the baseline specification, when taxes, government consumption, or debt is altered, government adjusts transfers (s_t) according to the government budget constraint:

$$s_t = b_t + T_t - g_t - i_t^g - (1 + r_t^b) b_{t-1}. \quad (78)$$

Alternatively, one could make government transfers, s_t , exogenous, and adjust government consumption, or government debt instead. These modeling choices are explored in the section 4.

2.4 General Equilibrium

In the competitive (decentralized) equilibrium individuals maximize their utility, firms maximize profits, all constraints are satisfied and all markets clear. Specifically, general equilibrium is the path of endogenous variables $\{ y_t, c_t, c_t^m, c_t^h, n_t^m, n_t^h, k_t, i_t, r_t^k, r_t^b, w_t, T_t, s_t, \Pi_t \}$ which satisfies the individual budget constraint (62), law of motion for capital (63), equation defining composite consumption (64), individual first order conditions (68) - (71), production technology for market goods (72), and home-produced goods (66), factor price equations (73) and (74), and the characterization of government (75)-(77), given the exogenous variables that are government consumption (g_t), government investment (i_t^h), government debt (b_t), and the tax rates τ_t^c, τ_t^n and τ_t^k .

3 Results

3.1 Benchmark Calibration

The model is calibrated to match the essential features of the Finnish economy. The data used is of annual frequency, and the period of interest is post-2008 to capture the recent challenges in the economic environment, particularly the deteriorated fiscal position of the economy since 2009.

There are a number of parameters to be calibrated. Following the usual practice, as many parameters as possible are calibrated using evidence from existing research literature, and the rest are set to match certain ratios in the data. All the calibrated values of parameters and exogenous variables are reported in tables 5 and 6.

The exogenous total factor productivity, γ^A , is assumed to be 0.9 % in accordance with the long-run scenarios of the European Commission (2015). The labor share parameter in the production function, $(1 - \alpha)$, is calibrated to match the wage sum share of national income which is, on average, 0.611 in Finland between 2009 and 2014.

Deep preference parameters of the representative agent are σ, γ and β that represent, respectively, the measure of risk aversion, the consumption weight in utility function and the time discount factor of the utility function. The utility discount factor, β , defines, in steady state, the real interest rate of the economy which, in turn, is a function of capital-

Table 5: Calibration of Parameters

Parameter	Value
γ^A	0.009
ϕ	0.82
α	0.349
α^h	1
δ	0.060
σ	2
γ	2.420
ω	0.545
β	0.969
κ	0.5

output ratio. Accordingly, β is calibrated to match the 2009-2014 capital-output ratio of the Finnish economy which is equal to 2.617. The consumption weight in the utility function, γ , following, for example Cooley and Soares (1999) and Papageorgiou (2012), is set so that the average working hours matches the data. According to the Finnish Time Use Survey 2009-2010, 19 % of wake time is spent in gainful employment (n_t^m), whereas 16 % is spent in domestic work (n_t^h), which, in turn, is used to calibrate the share parameter ω . The measure of risk aversion, or, “the curvature parameter”, σ , is set to equal 2, which is in line with previous related literature.

There is a lively discussion upon the “correct” value of the labor supply elasticity (ϕ). Values used in macroeconomic literature are typically larger than values estimated from micro data. Keane and Rogerson (2012) raise a number of important points challenging the micro elasticities and argue that elasticities between 1 and 2 can be credibly supported. On the other hand, in a recent survey, Chetty et al (2012) conclude that the microeconomic evidence of Frisch elasticity points towards intensive margin elasticity of 0.54 and extensive margin 0.28 and macroeconomic (cross-country) evidence points towards 0.54 intensive margin elasticity and 2.3 on the extensive margin.⁴ In the analysis of this paper, following the quasi-experimental evidence reviewed by Chetty et al (2012), a value of 0.82 is set for the (combined) Frisch elasticity of labor supply, ϕ .

The substitution parameter, κ , is a very important one with respect to the shape of consumption Laffer curve. There is also some empirical evidence on the value of this parameter. Aguilar et al. (2011) consider older individuals, and find that the parameter value is between 0.5-0.6. McGrattan et al. (1997) report values between 0.4 and 0.44. Finally, Chang

⁴See Chetty et al (2012) page 2 Table 1.

and Schorfheide (2003) estimate values between 0.44 and 0.6. Referring to this evidence, the substitution parameter, κ , is set to 0.5 in the same spirit as, for instance, Rogerson and Wallenius (2012).

Exogenous variables are, as well as the parameters above, calibrated to match the 2009-2014 data, if possible. This implies that the government consumption-to-output and the debt-to-output ratios are set to, respectively, 0.243 and 0.509. Finally, the benchmark tax rates τ_t^n , τ_t^k and τ_t^c are specified using the method developed by Mendoza et al. (1994) wherein the idea is to relate relevant tax revenue to the relevant tax base. The tax rates are interpreted to be the average effective tax rates (AETR). Naturally, the method is not able to capture the complex nature of the tax system. On average, however, it is presumably a reasonable approximation of the reality.

Table 6: Calibration of Exogenous Variables

Variable	Value
g/y	0.243
i_g/y	0.04
τ^c	0.239
τ^n	0.448
τ^k	0.307
b/y	0.509

3.2 Steady States

The essential steady state values produced by the model, are provided in table 7. The baseline steady state calibration fits the data reasonably well. The calibration given in table 7 give rise to the Laffer curves depicted with dashed line in figures 15, 16 and 17. The regular line depicts the "traditional model", the model *without* home production, in other words, with identical calibration method but setting $\omega = 1$. The figures 15, 16 and 17 depict aggregate tax revenue (T_t), which is normalized by the Laffer curve peak value of the model without home production. The gray vertical line marks the steady state tax level, which is also the tax rate where the two Laffer curves cross. The figures tell a story of different mechanisms in taxation with and without home production.

The Laffer curves, or, aggregate tax revenue curves (see equation (75)), are calculated so that one tax instrument at a time is varied between 0 % and 100 %, while all the other parameters and exogenous variables (including the two other tax rates) in the model are

Table 7: Steady State and Data Averages 2009-2013

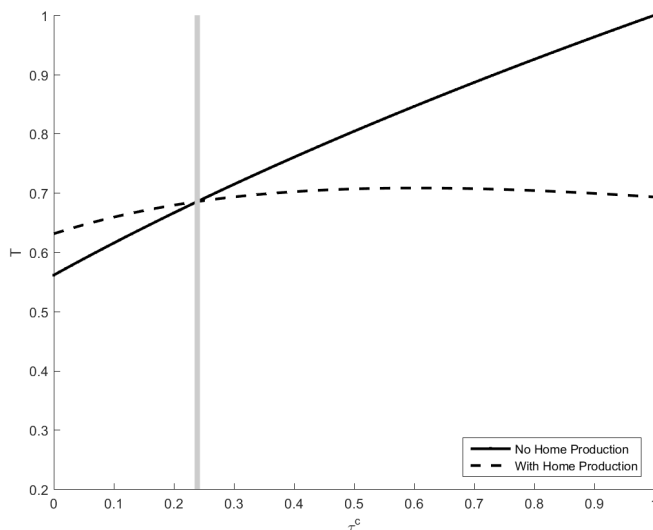
Variable	Model produced value	Data value
c/y	0.536	0.539
i/y	0.181	0.182
r^b	0.051	0.015*

* average yield on 5 year government bond 2009-2014.

held constant (the *ceteris paribus* assumption). Setting one tax rate to zero does not, thus, imply tax revenue of zero, because there are still two other strictly positive tax rates. The Laffer curves with home production are *not* of the expected form and do *not* follow the same pattern as the Laffer curves in the earlier literature (c.f. Trabandt and Uhlig (2011)).

The consumption tax Laffer curves are depicted in figure 15. The model without home production implies strictly increasing Laffer curve between 0 and 100 percent tax rates, whereas the consumption Laffer curve exhibits a hump shape, when home production is included in the model. The peak of the consumption tax Laffer curve lies at 60 % (100 %) with (without) home production.

Figure 15: Consumption Tax Laffer Curves



Not only the location of the Laffer peak, but also the shape of the curve differs between these two specifications. This has significant effects on the tax revenue estimates. The

average tax revenue elasticity⁵ with respect to consumption tax rate, that is, steepness of the aggregate tax revenue curve, is much lower in the model with home production. In both cases, the tax revenue elasticity decreases with tax rate, but the decrease is much more pronounced with home production. Naturally the elasticity becomes negative in the right side of the Laffer peak (> 60%) whereas the Laffer peak is not identified in the model without home production.

The inclusion of home production, thus, lowers the aggregate tax revenue elasticity considerably which implies that in order to achieve a given increase in consumption tax revenue, a larger increase in tax rate is needed. On the other hand, a decrease in the tax rate is not as detrimental to the public sector revenues as is in the case without home production.

The labor income tax Laffer curves are depicted in figure 16. The Laffer curve with (without) home production, is increasing up to 35 % (57 %) implying that the Finnish economy is in the “wrong” side of the Laffer peak with home production, but on the “right” side without home production in the model. The recommended policy advice in terms of tax revenue, thus, depends crucially on whether or not home production is included in the model. In terms of maximizing the aggregate tax revenue, labor income tax rate should be decreased (increased) in order to maximize tax revenue with (without) home production in the model.

Finally, figure 17 depicts capital tax rate Laffer curves. The two curves are of completely different form. The Laffer curve is strictly decreasing with home production, while, without home production, it increases up to the tax rate of 29 %, after which it decreases rather abruptly. In both cases, the capital Laffer curve is flatter than labor income or consumption tax Laffer curve, implying lower tax revenue elasticity in the flat part of the curve. Increasing the capital tax rate from 0 to 29 % would lead, in the steady state equilibrium, to a -3.0 % (1.7 %) change in aggregate tax revenue with (without) home production. In general, the impact of capital taxation on aggregate tax revenue is clearly smaller than that of labor income or consumption taxation.

The reasoning behind the not so familiar looking Laffer curves is the following. With home production in the model, compared to a model without it, there is an additional margin of adjustment (see equation (69)). Suddenly individuals do not alter only labor supply (see equation (68)) in response to a tax change, but directly also consumption. The equation (69)

⁵Tax revenue elasticity with respect to tax rate τ^i is approximated with $\frac{\partial T_i}{\partial \tau^i} \approx \frac{T(\tau^i) - T(\tau^i - \epsilon)}{\epsilon}$, where $\epsilon = 1\%$

Figure 16: Labor Income Tax Laffer Curves

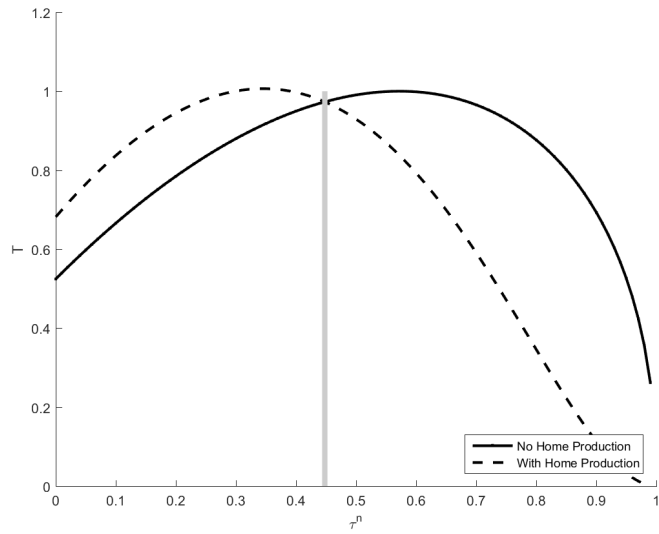
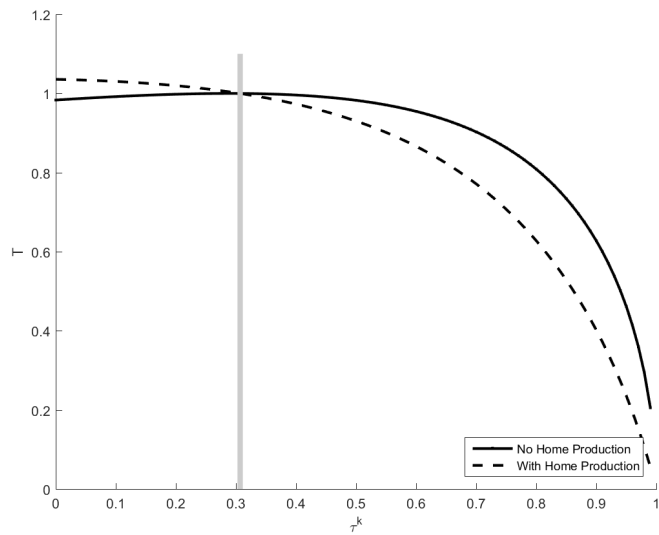


Figure 17: Capital Income Tax Laffer Curve



ensures that the marginal utility of consuming market produced goods and home produced goods equalizes.

When the consumption tax rate increases, consumption of market goods becomes relatively more expensive and labor supply adjusts according to the intra temporal Euler condition (see equation (68)), which lowers the disposable wage income and, consequently, has a negative effect on consumption. This is the traditional effect of a consumption tax change. Furthermore, also the marginal utilities from market consumption and home production must equalize. In this case, if there is a tax hike, home production becomes relatively more attractive and home production increases in detriment to market consumption. The outcome is that the consumption tax base deteriorates more quickly as the tax rate increases, thus, making a crucial difference in the shape of the Laffer curve. In other words, inclusion of home production brings forth a mechanism that accelerates the deterioration of the tax base. This second mechanism is not present in the model without home production.

As seen in the above, the effects of home production are not limited only to the consumption Laffer curve. Also income Laffer curves exhibit different behavior with home production. The intuition behind the result is similar to that of the consumption Laffer curve. An increase in income tax rate, be it capital or labor tax, lowers the disposable income and, thus, has a direct effect on labor supply. At the same time, the relative prices of consumption and leisure change, inducing a decrease in market based consumption and an increase in home production. The mechanism is such that it amplifies the negative tax revenue effect of taxation. Another angle of the same mechanism is that inclusion of home production makes labor supply more responsive to taxation. This is the argument also made by Rupert et al. (2000).

3.3 Tax Revenue Maximizing Tax Mix

The previous subsection calculated the Laffer curves when one tax rate at a time was varied. In this section, a more general approach is taken; all tax rates are allowed to vary between 0 and 100 %, and the tax revenue maximizing tax mix is calculated. Once again, the analysis is of tax revenue and doesn't take welfare implications into consideration.

First, the tax revenue maximizing capital tax rate is zero if other tax rates are free to adjust. This observation is verified by numerical calculations.

Next, the Iso Tax Revenue Curves are plotted in figure 18, when capital income tax rate is set to zero. Revenue maximizing tax mix with home production is found to be $\{\tau^c, \tau^n, \tau^k = 100\%, 9\%, 0\%\}$. The corresponding tax mix without home production is

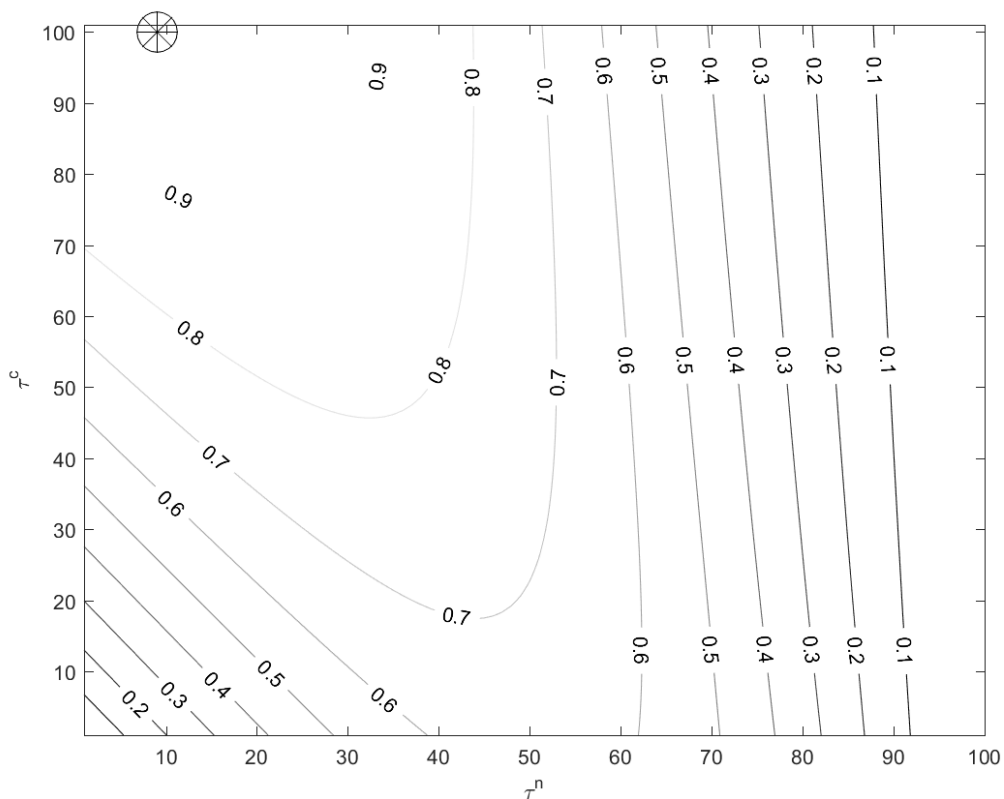
$\{\tau^c, \tau^n, \tau^k = 100\%, 42\%, 0\%\}$. The introduction and modelling of home production, thus, implies lower labor income tax in the tax revenue maximizing tax mix and therefore less fiscal space. The revenue maximizing tax mix reflects the somewhat common result that consumption taxation is the most efficient tax form to collect taxes in this type of models. The “efficiency of consumption taxation” can also be seen using the equation (68). Assuming exogeneous w_t , taxation distorts the optimal labor supply decision by the factor $\frac{1-\tau^n}{1+\tau^c}$ which, in turn, implies that, for example, 30 % labor income tax rate is as distorting as 43 % consumption tax rate and so forth.⁶

The Iso Tax Revenue Curves in figure 18 are plotted so that each curve to the right is at 10 % lower aggregate tax revenue level. This illustrates the trade-off in tax revenue between the two plotted tax rates. An identical aggregate tax revenue, 0.7 of maximum for instance, can be collected when $\{\tau^n, \tau^c\} = \{0\%, 55.8\%\}$, when $\{\tau^n, \tau^c\} = \{43.0\%, 16.4\%\}$ or when $\{\tau^n, \tau^c\} = \{50.4\%, 100.0\%\}$.

The figure 18 also reveals that, given a consumption tax rate of 20 %, for instance, a 0.6 aggregate tax revenue can be achieved by setting τ^n to approximately 20 % or to 61 %. This implies, that the $\{\tau^n, \tau^c\} = \{20\%, 61\%\}$ tax mix is on the slippery side of the Laffer curve and a decrease in labor income tax rate would lead to, *ceteris paribus*, an increase in aggregate tax revenue. Furthermore, the figure 18 actually reveals all tax rate combinations that are on the slippery side of the Laffer curve.

⁶ $\frac{1-30\%}{1+0\%} \approx \frac{1-0\%}{1+43\%}$

Figure 18: Iso Tax Revenue Curves when $\tau^k = 0$



4 Sensitivity Analysis

How do the assumed parameter values affect the results? It is known that the assumptions made make the results, thus, a comprehensive sensitivity analysis is very important, even though the focus in this paper is not on the quantitative results, but instead in the introduction of a new, previously lacking mechanism to the model.

Fiscal space increases when the Laffer peak moves to the right; the set of reasonable choices grows when the objective is to collect more tax revenue. The movement of the Laffer peak is not, in any way, a statement of welfare, but merely a interpretation of the fiscal environment conditional on the relevant parameter values. In this section, the underlying assumptions

of the model framework are tested. Sensitivity testings also sheds light on the dynamics of the model. Table 8 reports the results of sensitivity analysis. The first row reports the tax revenue maximizing tax rates in the benchmark model with home production. In general, the qualitative results are very robust to the calibration of the model.

Table 8: Sensitivity of the Model with Home Production

Parameter	Baseline value	Modified value	Laffer Peak		
			τ^n	τ^c	τ^k
Baseline			35 %	60 %	0 %
Behavioral parameters					
σ	2	0.5	+ 4 %	+ 11 %	0 %
ϕ	0.82	0.1	+ 5 %	+ 12 %	+ 2 %
κ	0.5	0.4	+ 1 %	+ 33 %	0 %
β	0.969	0.95	- 2 %	- 5 %	0 %
γ	1.874	3	0 %	0 %	0 %
Firm level parameters					
g^A	0.009	0.02	- 2 %	- 8 %	0 %
δ	0.06	0.09	0 %	- 8 %	0 %
The government					
g/y	0.243	0.3	0 %	- 16 %	0 %
b/y	0.493	0.8	0 %	0 %	0 %

It's been argued that the elasticity of labor supply would be small, even close to zero for certain groups. The behavioral parameter determining the elasticity of labor supply, ϕ , has important implications also on the shape of the Laffer curve. If the elasticity of labor supply was considerably lower, 0.1 instead of 0.82, the fiscal space would increase by 5 pp. in labor income taxation and 12 pp. in consumption taxation. Lower labor supply elasticity implies lower dead-weight loss of taxation and, consequently, an economy can uphold a higher tax rate with smaller negative effects. Interestingly, a low labor supply elasticity also makes the case for strictly positive linear capital taxation (in the tax-revenue maximizing sense) as the negative effect of capital tax on labor supply is muted.

As stated earlier, the consumption substitution parameter, κ , is rather important parameter in terms of results. The higher the value of this parameter, the lower the substitution elasticity between market produced goods and home produced goods is. A decrease in κ makes consumption less sensitive to a consumption tax change, because the adjustment in consumption is realized mostly through home production - larger substitution elasticity in consumption is equivalent to larger fiscal space in consumption taxation.

5 Conclusions

Using a standard neoclassical growth model of general equilibrium, it is shown that the inclusion of home production has significant implications on tax policy. In a standard model (no home production), an increase in the consumption tax rate has an effect on labor supply, but, it doesn't change the composition of consumption as there is only one consumable good. In a corresponding model with home production, an increase in consumption tax rate, additionally, shifts more weight from consumption of market based goods to consumption of home produced goods. Most models of general equilibrium do not take this channel seriously.

This mechanism, generated by the inclusion of home production, makes the consumption tax base more sensitive to a change in the tax rate. The deterioration of consumption tax base due to a tax hike is more pronounced because individuals substitute consumption of market goods with home production.

The implication in terms of tax policy is that if indeed home production is a genuine substitute for market consumption, tax revenue estimates produced by standard models are too optimistic. Consequently, the estimated revenue maximizing (steady state) tax rates in previous studies are possibly too high. As is shown in this paper, the policy implication can be drastic.

We can think through the lens of a model without home production, that the economy is located on the left side of the Laffer peak meaning that an increase in a tax rate increases tax revenues. In certain cases, it might then be optimal to increase taxation in order to generate more tax revenue for the government to use. If, however, the model takes home production into account, the same economy could be located on the "wrong" side of the Laffer peak and the only reasonable policy advice would then be to lower the level of taxation in the long run in all possible instances. Fiscal space has turned into a fiscal gap when the model is augmented in certain way.

The objective of this paper is not to give exact quantitative estimates of the Laffer curve, but instead to point out that the introduction of a simple and well-known mechanism can turn the policy advice of a "traditional model" upside down. One topic of future research is to explore the relationship between home production and tax policies with quality data and setup that allows for credible causal inferences.

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Essay 3: Participation Tax Rates in Finland - Earned-income Tax Credit Investigated

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Participation Tax Rates in Finland - Earned-income Tax Credit Investigated

Mauri Kotamäki

Abstract

Previous estimates on participation tax rates (PTRs) are reviewed and new, updated PTR estimates of the Finnish case are provided with 2013 data. The results indicate that there has been an increase in the average PTR in Finland after 2011. The sensitivity of PTR calculations is tested in order to understand the dynamics behind the results. This is something that is lacking in the earlier literature. The contribution of different parts of the social security system to the level of PTR is calculated. Furthermore, a recent reform, an increase of Earned-income Tax Credit (EITC), is evaluated in an ex-ante manner. It could be possible to utilize the underlined methodology when evaluating and designing policy reforms. First, the reform's effect on average participation tax rate is calculated. Second, the obtained result with respect to average PTR is plugged into a search theoretic general equilibrium model, and an employment effect is estimated. Also a more traditional "partial equilibrium" effect is calculated. The EITC reform, that costs (in static terms) 450 million euro, lowers the average PTR by 1 pp., which is calculated to induce a 0.6-0.8 % increase in the number of employed using 0.25 elasticity of labor supply.

Keywords: Microsimulation, Participation Tax Rate, EITC, Employment effect

1 Introduction

During the recent period of low or even negative GDP growth and rising unemployment rate in Finland, there has been a lot of discussion about improving the financial incentives to work. The Finnish government, for instance, has stated as one of its main projects, that “incentive traps preventing acceptance of work will be removed and structural unemployment reduced” (Prime Minister’s Office (2016)). Before the incentives can be improved, however, it’s important to know the current situation, that is, what is the size of the problem and what types of individuals face the biggest challenges. This paper concentrates on the Finnish case, but the phenomenon is more or less universal.

One of the main concerns has been the low-income earners’ (low) incentives to work as, by and large, individuals with relatively low productivity, measured by the participation wage rate (PWR)¹, face the lowest incentives to actively search for work. This paper reviews the previous estimates on incentives to work and unemployment traps in Finland, presents an analysis of where we are at the moment, and, finally, discusses the employment effects of a recent reform aiming to increase incentives to work – an increase in the Earned-income Tax Credit (EITC).

Incentives to work are often measured by the participation tax rate (PTR), which describes how the tax and benefit system affects the financial gains to work on the extensive margin². If the participation tax rate was, say, 50 %, then half of the participation wage would be lost due to increased taxation and decreased social security benefits upon accepting a job offer. The reduction of average participation tax rate is often seen as a central policy objective when discussing incentives to work on the extensive margin. This incentive problem, however, is not easily solved.

In a static world, there are basically only three means of tackling the problem of too low incentives to work. First, the level of social security transfers, unemployment benefit, for example, could be lowered. This channel is cost-efficient, but politically difficult, and furthermore, can lead to other undesired outcomes such as increased income inequality.

Second, it is possible to increase the incentives to work part-time, by, for example, protecting part of the social security benefits from decreasing when the labor income increases. In

¹Participation wage rate is defined to be the (hypothetical) wage that an unemployed person receives when he or she becomes employed.

²The extensive margin refers to the decision of whether to work or not. The Intensive margin, on the other hand, refers to the decision whether to work more or less.

2013 in the Structural Policy Programme, the Finnish government decided that, “to remove incentive traps, a protected portion of work income will be introduced in unemployment security.”³ This type of measure doesn’t, however, remove incentive traps, but instead, relocates the problem. In the case of the aforementioned measure, the incentive to work part-time did increase, but the incentive to move from part-time work to full-time, on the contrary, decreased (Kotamäki and Kärkkäinen (2014)). In theory, it is then possible, that the aggregate hours worked in an economy decrease, even though the employment rate increases. The question is about the relative sizes of the labor supply elasticities on the intensive and the extensive margin, which is outside the scope of this paper.

Third and finally, (effective marginal) tax rates, or, the social security benefit adjustment rates, can be diluted in order to increase the disposable income when employed. The central idea is to make employment relatively more attractive than unemployment. The most common example of this type of measure is the Earned-income Tax Credit (EITC) in the US, although, a variation of EITC is in place in many developed countries; the Finnish EITC is presented and analyzed in more detail later in this paper. The problem with these measures is the price – an increase in the EITC, for instance, affects a large group of people and, in order to achieve significant changes in the incentives, the tax relief should be sufficiently big, and, consequently, expensive.

A good social security system puts efficiency and equity into a “correct” balance. This paper focuses on the efficiency part of the Finnish social security by discussing the financial incentives to work and reviewing some recent relevant research evidence. The equity part is not in the scope of this paper, and, consequently, income distribution will not be discussed here.

The organization of this paper is as follows. The second section reviews the earlier literature. The focus is on the Finnish research literature, but also selected papers of international flavor are considered. The third and fourth section present, respectively, the data and research methods. The fifth section discusses the calculated participation tax rates, and the sixth ponders the labor market effects of Earned-income Tax Credit. The seventh section concludes.

³<http://valtioneuvosto.fi/documents/10184/1043920/Structural+policy+programme-29082013.pdf/411abbb0-966d-4aae-b2a8-eeafcd70675c>

2 Theoretical and Empirical Background

This section concentrates first and foremost on the empirical evidence on participation tax rates in Finland, although, a number of selected articles of international flavor are also presented. The focus is on the economic incentives to become employed. The subject is, however, first approached with the help of a theoretical model.

2.1 Theoretical Background on Incentives to Work

This subsection presents a highly stylized theoretical framework, which models individual agent's incentive to transition from unemployment to work. The model is based on the work by Hopenhayn and Nicollini (1997). The purpose of the model is to formally show the most basic mechanisms that are in the background when interpreting the participation tax rate. The model is, thus, one that attempts to describe primarily the individual incentives to search for work and, therefore, the demand side of the economy is not explicitly modeled. The model does produce qualitatively similar results as the current labor market workhorse model of Pissarides (2000).

An unemployed individual makes a decision on how much to invest in the higher probability of becoming employed. In practice this would mean, for example, time invested in training and in labor market search in general. Assume a value function of the following form:

$$V_t^U = u(c_t^U) - v(e_t) + \beta (p(e_t)V_{t+1}^E + (1 - p(e_t))V_{t+1}^U) \quad (1)$$

$$V_t^E = u(c_t^E) + \beta V_{t+1}^E, \quad (2)$$

where V_t^U and V_t^E denote, respectively, value function of the unemployed and of the employed. For simplicity, once an individual becomes employed, he or she will remain employed. The model is, thus, intended to capture first and foremost the incentives that an unemployed individual faces. The disposable income of the unemployed and employed are denoted by c_t^U and c_t^E , $p(e_t)$ denotes the probability of becoming employed, e_t is the time invested in activities that increase one's chance of becoming employed, and β is the utility discount factor. The budget constraints in the individual problem are

$$c_t^U = c(0) \quad (3)$$

$$c_t^E = c(w_t) = w_t - T(w_t) \quad (4)$$

where $c(0)$ denotes the disposable income when unemployed and w_t is the gross wage rate.

The model can be solved for an optimal search effort, e_t , which enables one to make inferences relevant to this paper. In order to obtain an analytical solution, following Hopenhayn and Nicolini (1997), assume a linear utility function, $v(x) = x$, logarithmic utility function $u(x) = \log(x)$, and a hazard function $p(x) = 1 - \exp(-rx)$, where $r > 0$. The optimal search effort can then be solved:

$$e_t = \frac{\log(\beta r(V_{t+1}^E - V_{t+1}^U))}{r} \quad (5)$$

The future value of employment must be greater than the future value of unemployment in order for e_t to be well-defined ($V_{t+1}^E > V_{t+1}^U$). Equation (5) will not be developed further here, but, instead two stylized facts are presented. These effects are the most basic and obvious effects, but also quantitatively most important. More subtle effects, that do exist, are outside the scope of this paper.

First, assuming a marginal tax rate below 100 %, an increase in the next period (participation) wage rate will induce an individual to invest more effort into labor market search.

$$\frac{\partial e_t}{\partial w_{t+1}} = \frac{\partial u(c_{t+1}^E)/\partial w_{t+1}}{r(V_{t+1}^E - V_{t+1}^U)} = \frac{1 - T'(w_{t+1})}{r(V_{t+1}^E - V_{t+1}^U)(w_{t+1} - T(w_{t+1}))} > 0 \quad (6)$$

The strength of the effect depends on taxation and wage rate. If the response in utility, that is, in consumption, was very high, then the increase in search efforts in response to wage change would also be high. If the marginal tax rate, $T'(w_{t+1})$, is very high, the incentive to search for work is low. As a matter of fact, if the marginal tax rate is higher than 100 %, an increase in wage rate will lower the search efforts. Furthermore, $V_{t+1}^E - V_{t+1}^U$ in the denominator implies that the higher the difference in utility between working and being unemployed, the lower the change in search effort in response to wage rate. If the difference between working and being unemployed was very high in the first place, a small change in the wage rate wouldn't induce a big behavioral response, because the relative change would be low.

Second, an increase in the unemployment benefit level will lead to lower search efforts.

$$\frac{\partial e_t}{\partial c(0)} = -\frac{\partial u(c_{t+1}^U)/\partial c(0)}{r(V_{t+1}^E - V_{t+1}^U)} = -\frac{1}{r(V_{t+1}^E - V_{t+1}^U)c(0)} < 0 \quad (7)$$

This is also something that is reflected in the participation tax rate; the higher the unem-

ployment benefit (relative to net wage), the lower the probability of employment and the higher the PTR. Furthermore, this theoretical result is backed up by a mountain of empirical evidence (see Tatsiramos and van Ours (2014) for an extensive review on the subject).

2.2 Earlier PTR Estimates in Finland

There are two approaches to the calculation of PTRs. The legislation can be described and inspected with the help of example households. Good citations from Finland are Viitamäki (2015) and Laitila and Viitamäki (2009) in this research branch. With this method, problems of the legal system can be identified, although, in a non-representative manner. Viitamäki (2015), among other things, shows that for an average one child single-parent who receives Earnings-related Unemployment Allowance, the effective marginal tax rate is around 100 % up to gross income of eur 2,500. The financial incentives to work for this household type are, thus, non-existent.

In this paper, a more data oriented method is used, where the average PTRs are calculated using data, thus, trying to create a representative description of the current situation and locate the groups that are observed to be in the most dismal position in terms of financial incentives to work. There are a number of earlier papers of this research branch in Finland.

Parpo (2004) examined the 2003 Finnish social transfer scheme and incentives to work using microsimulation methods. The results show that, in most cases, employment is economically worthwhile. There are, however, a number of exceptions. In households that received unemployment benefits, approximately 3.4 percent had an effective marginal tax rate over 100 percent and 13 percent of unemployed households had PTR over 80 percent.⁴ Furthermore, unemployment traps existed mostly in the two lowest income deciles. Of different household types, single parents stood out in having the highest risk of being trapped in unemployment; every other single parent was in a situation, in which transition from unemployment to full-time work was not financially reasonable.

According to Honkanen et al (2007a), PTRs fell significantly as a result of policy changes between 1995 and 2004; the average PTR fell by 13 percent during this period. Running (micro)simulations with 1995 legislation, 68 percent of single parent households were found to be in unemployment trap, while in 2004, the corresponding figure was 43 percent. Both Hakola-Uusitalo et al (2007) and Honkanen et al (2007b) further discover, that the incentives

⁴An individual is defined to be in unemployment trap when the PTR is higher than 80 %

Legislation Year	2003
Data Year	2001
I Single	7.8
II Childless couple	5.3
III Single parent	51.3
IV Two parents	5.3
V Others	5.2
	12.8

Table 1: Individuals in unemployment trap (%) according to Parpo (2004)

to work have continued to improve since 2004, mainly due to the easing of income taxation. PTRs have further fallen by almost two percentage points between 2004 and 2007.

Legislation Year	1995^{a1}	1995^{a2}	2000^{a1}	2000^{a2}	2004^{a1}	2004^{a2}	2004^b	2007^b
Data Year	2004	2004	2004	2004	2004	2004	2004	2004
I Single	77.1	66.5	71.5	61.5	68.5	58.1	-	67.6
II Childless couple	67.2	60.1	62.6	55.7	60.3	52.7	-	59.0
III Single parent	85.1	80.8	79.6	74.9	77.3	71.8	-	73.4
IV Two parents	77.5	69.8	71.0	61.7	68.6	58.6	-	64.9
V Others	62.1	56.1	57.4	51.6	54.5	48.2	-	53.5
	77.2	58.8	66.8	58.8	64.2	55.7	64.2	62.4

Table 2: Participation tax rates by Honkanen et al (2007a,b) and by Hakola-Uusitalo et al (2007)

^{a1} Honkanen et al (2007a) with the within-year unemployment duration in the wage equation

^{a2} Honkanen et al (2007a) without the within-year unemployment duration in the wage equation

^b Hakola-Uusitalo et al (2007) and Honkanen et al (2007b)

Honkanen (2008) examines a register based data from November 2006. According to the author, November is a reasonable proxy for the yearly average. All households in the data had received housing allowance during the study period, thus, there is a risk of selection bias, and the results may not be externally valid. The author finds that the average PTRs for a single unemployed person is 57.4 % when he or she becomes employed with the average wage rate as participation wage rate, and 71.6 % when the participation wage rate is half of the average wage rate. Single parents, on the other hand, have PTR of 63 % with average wage rate, and, 75 % with half of the average wage rate, thus, single parents face clearly higher PTRs than their counterparts without children. On the other hand, single parents are less dependent on social income support, whereupon the marginal effective tax rate (METR) is slightly lower for single parents than for singles.⁵ The inference is that acquisition of some work income is slightly more profitable for an unemployed single parent than for a single

⁵The METR is the percentage of an extra income that a person loses due to income taxes, payroll taxes, and any decline in tax credits and welfare entitlements.

unemployed individual.

Kärkkäinen (2011) estimates the Finnish PTRs with 2006 data and 2010 legislation. He finds that the average PTR with 2010 legislation was 62.1 %, which again indicates a moderate decrease in the average PTR since 2007 (see table 2 and 3). Kärkkäinen (2011) also calculates the PTRs for part-time work, using participation wage rate of 50 % of full time workers' estimated full participation wage rate. He finds that singles and single parents have the highest PTRs to part-time work - a little over 70 % with adjusted unemployment benefits.⁶ If the adjusted unemployment benefit is assumed to be completely lost when becoming employed, the average PTR will go as high as 100 % for single parents.

Legislation Year	2010^{c1}	2010^{c2}	2010^{c3}
Data Year	2006	2006	2006
I Single	67.2	73.8	90.9
II Childless couple	61.1	64.0	94.8
III Single parent	74.5	72.8	102.3
IV Two parents	63.1	66.4	93.3
V Others	51.8	56.8	79.1
	62.1	66.1	91.3

Table 3: Participation tax rates according to Kärkkäinen (2011)

^{c1} Employment to full-time job

^{c2} Employment to part-time job with adjusted UB

^{c3} Employment to part-time job without adjusted UB

VATT (2013) considered the employment effects of social policy and tax reforms that entered into force in the beginning of 2012 in Finland. The data used was the 2010 Income Distribution Statistics. Individuals that had over 10 months of employment or unemployment history in 2010 were divided into 20 groups by age, household type and education. As can be seen from table 4, the estimated PTRs are considerably lower than in earlier studies. This can be explained, at least partly, by the different estimation of the participation wage rate; group averages of selected groups are used instead of regression model analysis. Nevertheless, once again single parents are found to have the highest average PTR.

Finally, Kotamäki and Kärkkäinen (2014) find that average PTRs have increased since 2011 by, on average, 3.5 percentage points. The change has been rather uniform across all household types. The authors also calculate the PTR to part-time work ($U \rightarrow 1/2E$ in Table 5), ie. PTR with 50 % lower wage rate compared to full-time work. The results show that

⁶Adjusted unemployment benefit means that an unemployed can continue to receive a part of the old unemployment benefit when working. The adjustment rate at the moment in Finland is 50 % ie. an additional euro decreases the unemployment benefit by 50 cents.

Legislation Year	2012 ^{c1}	2012 ^{c2}	2012 ^{c3}	2012 ^{c5}
Data Year	2010	2010	2010	2010
I Single	55.6	53.6	53.7	50.9
II Childless couple	45.7	44.8	51.9	51.3
III Single parent	59.5	55.8	62.0	58.4
IV Two parents	55.5	52.9	56.3	53.4
V Others	58.9	49.2	54.1	52.2

Table 4: Participation tax rates according to VATT (2013)

^{c1} Below 40 year-olds, at most secondary degree education

^{c2} Below 40 year-olds, higher than secondary degree education

^{c3} At least 40 year-olds, at most secondary degree education

^{c4} At least 40 year-olds, higher than secondary degree education

the change in PTRs of part-time workers is clearly negative, whereas the incentive to move from part-time to full-time job has significantly decreased ($1/2E \rightarrow E$ in Table 5). These effects are mostly due to the reform where a eur 300 protected portion on monthly work income was added to unemployment benefits and to the general housing allowance.

Legislation Year	2011	2015	Change
Data Year	2012	2012	
$U \rightarrow E$	59.4	62.9	+3.5
$U \rightarrow 1/2E$	64.2	59.7	-4.5
$1/2E \rightarrow E$	54.6	66.2	+11.6

Table 5: Average PTRs in 2011 and 2015 according to Kotamäki and Kärkkäinen (2014)

The studies reviewed in this section are not fully comparable for at least three reasons: (i) the used data year in the microsimulation varies, (ii) the microsimulation model evolves potentially affecting the results and (iii) the estimation method and specification of PWRs varies across studies. Still, the general trend with respect to work incentives was clear; the incentives to work have improved from the 1990s until approximately 2010.

2.3 Finland in the International Context

Each country has its own unique tax and social security scheme, and therefore a data-based comparison of countries is difficult. There are some papers that use the EUROMOD microsimulation model to compare European countries' social security and tax systems. Immervoll et al (2007), for example, calculate that the participation tax rates are the highest in the Nordic countries (Denmark, Finland, Sweden), relatively high in the continental Europe (Austria, Belgium, France, Germany, Luxembourg, and the Netherlands), and the lowest in

the Anglo-Saxon and Southern European countries (Greece, Ireland, Italy, Portugal, Spain, and the UK).

Countries can also be compared using example households. OECD provides calculations on participation tax rates given certain assumptions on participation wage rate and family structure. Figure 1 show PTRs for a single person receiving unemployment benefit in a number of OECD countries. The OECD calculations discussed briefly here are reported in Appendix A.

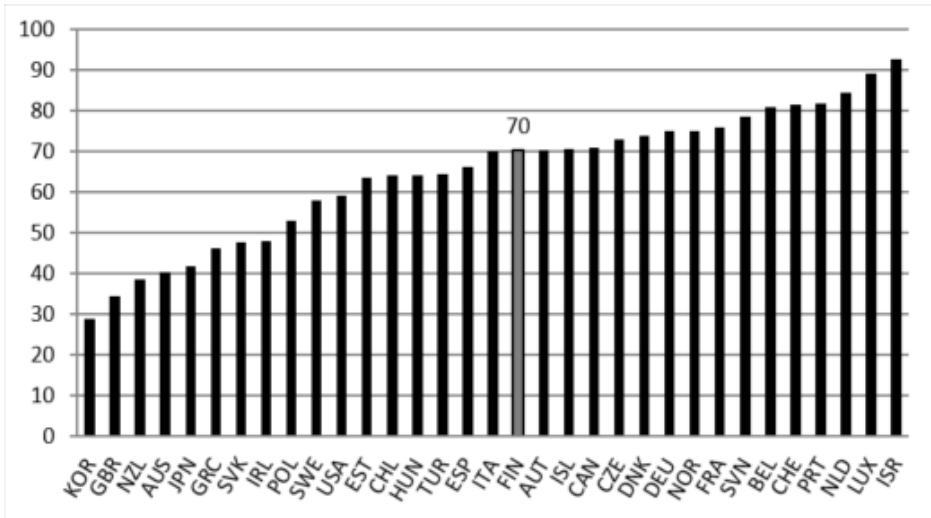


Figure 1: Participation Tax Rates for a transition into full-time work (with average wage) for a single person receiving unemployment benefits at the initial level (OECD)

Finland is rather close to the OECD average in terms of participation tax rate when comparing single individuals with average wage (AW) as the participation wage rate. The picture changes slightly if we change the assumptions on family composition or average wage. Two observations arise. First, the lower the PWR, the better Finland seems to fare in the country comparison in terms of work incentives. For instance, if a single person with no children became employed with 33 % of the AW, the PTR would be 72 %, which is still high, but 5 pp. lower than the EU average. On the other hand, if a person became employed with 150 % of the AW, the PTR would be 67 %, which is 5 pp. higher than the EU average.

Second, family structure, in particular, children, turn this picture around. Especially lone parents in Finland, according to the OECD calculations, have low work incentives compared to other EU or OECD countries. A lone parent with two children, receiving 33 % of AW when becoming employed, is calculated to have 79 % PTR, which is 6 pp. higher than the

EU average. The situation doesn't markedly improve if the PWR increases; the lone parent with two children receiving 150 % of AW is calculated to have 69 % PTR, which is still 5 pp. above the EU average.

3 Data and the Legal Framework

The data used in this paper is a registry based micro data from 2013. The same data is utilized in the background of the Finnish microsimulation model (SISU), which is used when calculating the PTRs. The data is a random sample, combined from various registries covering approximately 15 percent of all Finnish households, that is, approximately 800 000 individuals. In this section, essential statistics of variables and parameters related to the PTR calculations are presented ie. the legislative framework of the unemployment benefit scheme is described. Also the Finnish income tax code is briefly described.

There are three types of unemployment benefits in Finland: Earnings-related Unemployment Allowance, Basic Unemployment Allowance and Labor Market Subsidy.

An unemployed individual will receive Labor Market Subsidy if she is not eligible to any other unemployment benefit. The Labour Market Subsidy is a means-tested benefit, that is, any other income that the unemployed person receives (or his or her parents in the same household) may decrease the amount of the subsidy. The Labour Market Subsidy can be paid for an indefinite period. According to the data, approximately 251,500 individuals in 2013 received labor market subsidy, which amounts to 41 % of all individuals that received unemployment benefits for at least a day. The average (gross) subsidy per weekday was eur 36.8 or eur 9,298 per year.

The Basic UA and Earnings-related UA are paid to persons who meet the eligibility condition regarding previous employment (6 months), and they are paid for a maximum of 500 days.⁷ If an individual is dismissed for business or production related reasons, and he or she is eligible for either Earnings-related UA or Basic UA, he or she will be paid the allowance at a higher rate. Also participation in active labor market measures will entitle a person to the increased allowance rate. If the allowance runs out, the unemployed person is

⁷Individuals with less than 3 years of work experience are entitled to 400 days. The current government has decided to cut the maximum duration of unemployment benefits by 100 days as of 2017. Over 58 year-olds can still in the future receive 500 days of benefits, or even more if they are entitled to the so called "unemployment tunnel".

eligible for the Labor Market Subsidy.

The Basic Unemployment Allowance is a flat-rate benefit of the same base amount as the Labor Market Subsidy. In 2013, there were 62,400 individuals, or, 10 % of all unemployed, that received the Basic UA, with the average allowance being eur 32.8 per day, or eur 8,267 per year.

Finally, the Earnings-related Unemployment Allowance is claimed from an unemployment fund, and it is available only to the members of the unemployment fund who fulfill the eligibility criteria. Membership is voluntary. The level of Earnings-related UA is a function of pre-unemployment earnings, with the average allowance being approximately eur 64.8 per day, and the average increased allowance being eur 74.4 per day. There were 300,300 individuals receiving Earnings-related UA in 2013, which sums up to 49 % of all the unemployed.

It should be noted that the number of unemployed used above and in Table 6, is the number of unemployed over the whole year. According to the KELA statistics, the relevant numbers at the end of the year 2013 for Labor Market Subsidy, Basic UA and Earnings-related UA are, respectively, 173,284, 39,761 and 181,405; in total, approximately 400,000 unemployed.

The Labor Market Subsidy and the Basic Unemployment Allowance are both funded by the state⁸, whereas the Earnings-related UA is funded primarily by the state and partly with compulsory insurance payments from the wage. Only approximately 5.5 % of the funding is taken directly from the pocket of the insured themselves. The financing of unemployment protection is described in more detail in Kela (2015). Key statistics of the unemployment benefits are presented in Table 6.

	N	eur/day	Expenditure (millions)	Share of total
Labor Market Subsidy	251,496	36.0	eur 1,344	41 %
Basic UA	62,354	32.8	eur 246	10 %
Earnings-related UA	300,251	65.8	eur 2,322	49 %
	614,100	50.3	eur 3,912	100 %

Table 6: Unemployment benefits in the Finnish system in 2013

There are also additional benefits that the unemployed typically receive (Table 7). Approximately one third of the unemployed receive General Housing Allowance, which is originally intended for low-income households, and it is available for both rental and owner-occupied

⁸Also municipalities take part in the funding of Labor Market Subsidy for the long-term unemployed.

homes. Additionally, roughly one fifth of the unemployed receive social income support according to the SISU data. Unlike the unemployment benefits, which are individual level benefits, the General Housing Allowance and Social Income Support are household level benefits.

	Labor market subsidy		Basic unemployment allowance		Earnings-related benefit			
	%	N	%	N	%	N	%	N
Housing Allowance	53.5	16,812	57.0	3,584	12.0	4,333	33.7	25,950
Income Support	38.5	11,822	35.6	2,556	4.3	1,537	22.1	17,064

Table 7: Link between unemployment benefits and other social security in 2013

Another important factor related to work incentives is taxation. The Finnish labor income tax code is depicted in figure 2. It is clearly progressive; the average tax rate increases with income. The average tax rate is approximately 8 % up to the earned gross income of 10,000 after which the average tax rate starts to steadily increase. An individual earning eur 100,000 p.a. has an average tax rate of 44.4 %.

The vertical lines and numbers mark the biggest “jumps” in the marginal tax rates. The first big jump, at about eur 14,000 income p.a., is due to the fact that the Earned-income Allowance reaches its maximum level, thus, paid municipal income tax, church income tax and insurance payments start to increase.

The second step increase, at about eur 19,000 of earned gross income, is due to the first bracket of the income tax scale in central government taxation. The third change, a drop in marginal tax rate of approximately 4 pp., exists because the Basic Allowance fades out at an income level of approximately eur 26,000. The fourth, fifth, sixth and seventh vertical lines in figure 1 denote the tightening of progressivity in central government income taxation. Finally, the eighth vertical line denotes a slight drop in the marginal tax rate because the Earned-income Allowance fades to zero.

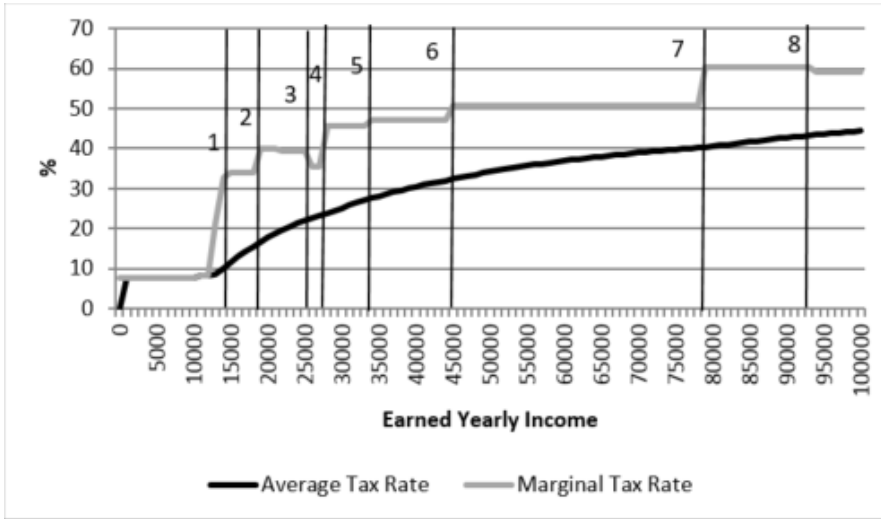


Figure 2: The Finnish Tax Scheme in 2016

4 Methods

4.1 Participation Wage Regression

Honkanen et al (2007a) discuss the importance of participation wage rate (PWR) estimation in the context of PTR calculations. The authors conduct the wage estimation in two ways. The first model is a standard OLS, where the monthly wage rate is explained with a number of variables such as age, sex, family status, level of education, field of education and region. The second model is as the first one, but augmented with the within-year duration of unemployment. The two regression models produce somewhat different results in that, when the duration of unemployment is an explanatory variable, the out-of-sample predicted average wage rate is clearly lower, and consequently the PTRs are higher. The estimation of PWRs has a significant effect on the level of PTRs, but the effect should be smaller when examining yearly changes. Honkanen et al (2007a, Table B.1) wage regression's predicted values are documented in table 8.

The first wage regression, Model 1 in Table 8, attempts to factor in the duration of within-year unemployment as a proxy for the fact that the objective group is the unemployed. Nevertheless, the specification might still suffer from selection bias. Those individuals that have been unemployed for the whole year have no observation of any wage income at all,

	Predicted values	
	<u>Model 1¹</u>	<u>Model 2²</u>
Minimum	1,200	1,200
1. quartile	1,200	1,463
Median	1,411	2,197
Mean	1,569	2,341
3. quartile	1,770	2,850
Maximum	4,695	8,340

Table 8: Predicted monthly wage rate according to Honkanen et al (2007a)

¹ Duration of unemployment is an explanatory variable

² Duration of unemployment is not an explanatory variable

thus, it is hard to say if the predicted wage rate is really representative for those individuals. Consequently, it is difficult to say how severe the selection bias truly is. It can be argued, though, that the inclusion of within-year unemployment into the regression mitigates the selection bias to a certain extent.

In the earlier literature, there is practically only one method used in order to account for selection bias – the Heckman selection model (cf. Heckman (1976, 1979)) or a related selection model. In the Heckman model, two equations are estimated. First, a selection equation is formalized, where each individual’s probability to participate in the labor market is estimated. Second, the wage regression itself is estimated using the Mills ratio from the first equation as an explanatory variable that attempts to control for the potential selection bias.

To sum up, there are three methods used in predicting the wage rate to the unemployed: 1) to use simple group means as in VATT (2013), 2) to use OLS as in Honkanen et al (2007a), Hakola-Uusitalo et al (2007), Kärkkäinen (2011) or Kotamäki and Kärkkäinen (2014) or 3) to use a selection model as in Kalb et al (2003a), Kalb and Scutella (2003b), Mercante and Mok (2014), Creedy and Mok (2015) or Siebertova et al (2015). Although the determination of the wage equation is very important, it is not in the heart of this paper, thus, the further comparison of different models is left for future research.

This paper uses the method applied by Honkanen et al (2007a, 2007b); the forecasting model is estimated with standard OLS using the data presented in the previous section. The estimated model is documented in detail in Appendix A. Also, a number of sensitivity checks are conducted in order to analyze the goodness of the estimated model in this context. Sensitivity checks are returned to at the end of next section.

The wage regression is conducted for all full-time workers. Groups that are left out include individuals that are retired, on parental leave, in the military service and students. Furthermore, also entrepreneurs and individuals receiving adjusted unemployment benefit are excluded from the estimation sample. The explained variable is the logarithm of monthly wage rate and explanatory variables include gender, region, level and field of education, marital status, number of small children, age, age squared, amount of capital income and, finally, the duration of within-year unemployment. The relevant predicted monthly wage rates for unemployed individuals are reported in table 9.

	Predicted values
	<u>Model 1¹</u>
Minimum	1,200
1. quartile	1,628
Median	1,952
Mean	2,134
3. quartile	2,435
Maximum	17,607

Table 9: Predicted monthly wage rate used in PTR calculations

¹ Duration of unemployment is an explanatory variable

The predicted wages from Model 1 in Table 10 are further categorized according to household types in the following way; (I) singles, (II) childless couples, (III) single parents, (IV) couples with children and (V) others.

	Average monthly wage, eur		N	
	Male	Female	Male	Female
I Single	2,068	1,977	15,942	7,959
II Childless couple	2,377	2,022	11,884	9,027
III Single parent	2,172	1,872	585	3,093
IV Two parents	2,542	1,994	7,892	7,959
V Others	2,076	1,848	2,760	2,445
	2,260	1,972	39,063	30,483

Table 10: Predicted participation wage rates for the unemployed by household

Two adult households, either childless couples or two parents, have the highest monthly PWR of approximately eur 2,200 and eur 2,300, respectively. On the other end, one-adult households have the lowest PWRs. The predicted participation wage differences are more pronounced when inspecting the PWRs by gender. Unsurprisingly, males have higher PWRs, but also, it is possible that the unemployment risk is higher for a male than for a female. The

only exception is the category of single parents where there are considerably more females than males.

Already from the estimation results of table 9 and 10, it can be inferred that, *ceteris paribus*, the participation tax rate will be higher for one adult households compared to two adult households.

Table 11 reports the average predicted participation wage rates for the unemployed by benefit type. A lower unemployment benefit predicts a lower PWR⁹ – the level of unemployment benefit is, thus, positively correlated with the level of PWR. This is partly due to the fact that individuals receiving Labor Market Subsidy are, on average, younger than those receiving some other type of benefit. On the other hand, this observation reflects selection. Measured by observable characteristics, those that insure themselves against unemployment seem to also earn higher wages in the labor market.

	PWR	N
Labor Market Subsidy	1,905	32,466
Basic Allowance	2,062	6,022
Earnings-related UI	2,388	31,058
	2,134	69,546

Table 11: Predicted monthly participation wage rate for the unemployed by benefit type

The distribution of the predicted PWR is of the expected shape (figure 2). The distribution is positively skewed, that is, the right tail is longer and the mass of the distribution is concentrated on the left of the distribution.

A number of sensitivity checks are conducted. The results of sensitivity checks are reported in Appendix B. First, the wage equation is estimated without the duration of unemployment as an explanatory variable. The mean PWR is clearly higher when the within-year duration of unemployment is not an explanatory variable. The difference in the average monthly wage rate between these two models is nearly eur 500. Second and third, a constant average monthly wage of, respectively, eur 2,134 and eur 2,598 are used for all individuals in order to estimate the significance of PWR variation between different groups. Fourth and finally, an observed wage that determines the level of Earnings-related Unemployment Allowance is used. It is observed to approximately 50 % of the sample. All these sensitivity scenarios are documented in Appendix B and discussed in more detail in the next subsection.

⁹This is not a causal statement, but merely a result of the OLS regression.

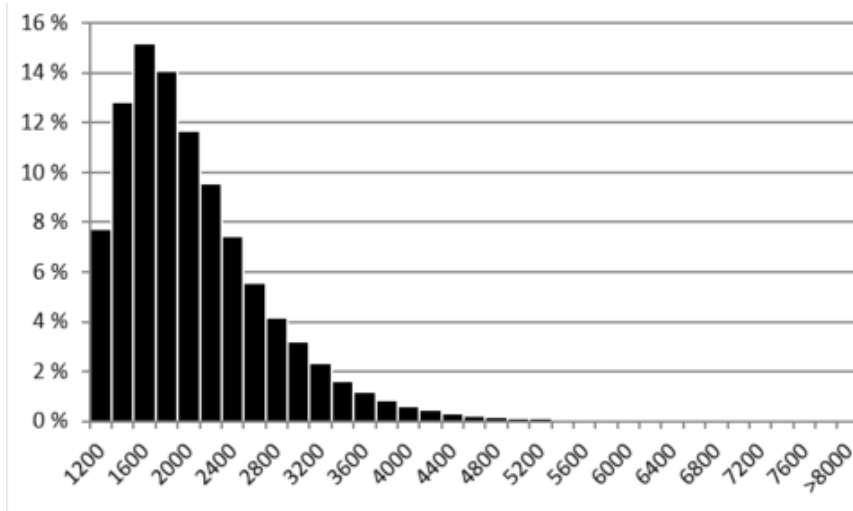


Figure 3: Distribution of the Participation Wage Rate

4.2 Calculation of PTRs

The participation tax rate (PTR) measures how much taxes increase and transfers decrease, when one becomes employed from full unemployment. PTR is a good indicator for gains to work; the lower the PTR, the stronger are an unemployed person's financial incentives to work.

The calculation of the PTR is no different from the calculation of effective marginal tax rates, other than that the focus is on the extensive margin, that is, in the transition from unemployment to full-time work. PTR, τ , can thus be defined as the change in the net tax rate when a person becomes employed:

$$\tau = \frac{T(w) - T(0)}{w} = \frac{(w - c(w)) - (0 - c(0))}{w} = 1 - \frac{c(w) - c(0)}{w} \quad (8)$$

where w , $T(w)$ and $c(w)$ denote, respectively, participation wage rate, transfers net of taxes and disposable income, which, again, equals participation wage minus net taxes: $c(w) = w - T(w)$.

PTR is low, when the difference between disposable income when working and when

unemployed ($c(w) - c(0)$) is high, and in general, this is where to an efficient tax/social security system aims at. As discussed earlier, there are only so many direct ways of lowering the PTR; by decreasing the level of unemployment benefit ($c(0)$), or, by lowering wage taxes ($T(w)$). Also the gross wage, w , could be influenced with, for example, wage subsidies or the minimum wage. This mechanism is outside the scope of this paper.

In theory, the participation tax rate can exceed 100 %, but only if disposable income is greater when unemployed than when employed ($c(0) > c(w)$). This can be the result of either the participation wage (w) being very low, labor income taxation being very high and/or the unemployment benefit being very high. Usually the PTR is below 100 %, but as earlier research has shown, there are exceptions. In this paper, following the usual practice, an individual is regarded to be in an unemployment trap when the PTR is above the 80 % threshold.

The method for calculating PTRs is roughly the same as in Honkanen et al (2007a, b) and in other related papers. The method is described in detail in the following steps.

1. All unemployed individuals, that is, all individuals between 18 and 63 years of age, that have received some sort of unemployment benefit during the data year 2013, are collected from the data to the sample. These benefits include Earnings-related UA, Basic UA and Labor Market Subsidy. Individuals receiving adjusted UBs are excluded from the sample. In the microsimulation (step 4 below), individuals NOT receiving UB are NOT dropped out as, for example, family composition determines the level of certain benefits such as housing allowance and social income support. These individuals' sample attributes are not, however, modified in any way.
2. Many of the sample individuals have been unemployed only part of the year. In the "first stage", these individuals are converted into full-year unemployed. Similarly, some individuals have received several types of unemployment benefits during the year. In this case, the primary benefit is assumed to be the Labor Market Subsidy, the secondary is the Basic Unemployment Allowance and the third benefit is the Earnings-related Unemployment Allowance. Finally, the sample is modified so that all labor income, pension income, parental subsidies, sickness allowances and student aid are set to zero.
3. In the "second stage", the sample individuals (see item 1) are converted into workers using the predicted participation wage rate. Again, unemployment benefits, pension income, parental subsidies, sickness allowances and student aid are set to zero. Workers are assumed to bring their 1-6 year-old children to the public day care for 11 months.

4. In both stages (“full-year unemployed” and “working full-year”), the full SISU microsimulation model is executed - separately for each member of the sample household. This is how the estimate for disposable income for each individual in the sample is obtained. Household level benefits, such as General Housing Allowance, Social Income Support and daycare fees are distributed evenly among the household adults.
5. Finally, the PTRs are calculated according to equation (8), where $c(w)$ is taken from the “first stage”, $c(0)$ is taken from the “second stage” and w is determined according to a wage regression described in subsection 4.1.

5 Findings

5.1 Participation Tax Rates

In this section, PTRs with 2013 data and with 2011-2016 legislation are reported. Calculations are conducted with the SISU microsimulation model. The model calculates disposable incomes for all individuals, taking into account the details of tax and benefit systems and the composition of households. The results stem from changes in the tax and benefit systems only, and not from the changes in the data, because the data is held constant in all the simulations. The results reflect, thus, changes in only those factors that the government has fairly direct control of - the business cycle or demographic changes play no role in the analysis, except indirectly in the selection of the base year, which is taken to be 2013 (the newest data year). All the monetary parameters are inflated or deflated with consumer price accordingly.¹⁰

The average PTR has increased approximately 2.6 pp. between 2011 and 2016. The year 2012 was an important year, because the basic amount in all unemployment benefit types was increased by roughly 20 %, which had a significant effect on the average PTR. Furthermore, the introduction of a new General Housing Allowance scheme in 2015 simplified the system considerably, but, at the same time, changed the incentives to work. Also several smaller adjustments have been made to the parameters of the system, such as a small cut in the higher Earnings-related UBs, an increase for single parents in the Social Income Support,

¹⁰The selection of the index variable is non-trivial as Honkanen and Tervola (2014) show. Using index of wage and salary earnings, for example, can lead to slightly different results. This paper is primarily interested in changes in purchasing power, instead of income distribution, thus, the use of consumer price inflation as the index variable is justifiable.

and a large number of changes in the tax scheme. The most recent major change, the eur 450 million increase of the Earned-income Tax Credit, contributed to a significant decrease in the average PTR in 2016.

Table 12 reports the average PTRs by unemployment benefit (UB) type. Individuals receiving Earnings-related Unemployment Allowance have clearly higher PTRs than individuals receiving Labor Market Subsidy or Basic Unemployment Allowance. In 2016, an individual receiving Earnings-related Allowance loses around 76 percentage of increased income when he or she becomes employed, whereas an individual receiving Labor Market Subsidy or Basic Unemployment Allowance loses “only” about 60 percent. Financial incentives to seek for a job are, thus, much lower with Earnings-related Unemployment Allowance than with other benefit types ie. for approximately half of the unemployed. The benefit level of Earnings-related UB is, in gross terms, approximately double compared to the benefit level of other benefit types, which naturally leads to higher PTRs. It’s important to keep in mind that the level of the PTRs is sensitive to the specification of PWR, which is why a comprehensive sensitivity analysis is conducted at the end of this section.

	2011	2016	Change
I Labor Market Subsidy	56.0	59.4	3.4
II Basic Allowance	56.5	59.7	3.1
III Earnings-related UI	74.5	76.3	1.7
	64.3	67.0	2.6

Table 12: Average PTRs by benefit type

Table 13 reports the average PTRs, categorized by household type. The average PTR of a single parent is higher than others’, primary due to three distinct factors. First, the estimated PWR of a single parent is, on average, lower than PWRs of other groups. A single parent is predicted to earn, on average, a monthly wage of eur 1,920, which is about 10 % lower than the average PWR, and 20 % lower than the average PWR predicted for the two-parent household. Moreover, the average female PWR for a single parent is only eur 1,872. Second, the (income contingent) daycare fee increases the PTR of households with small children. Remember that in the simulation, it is assumed that children below the age of seven are in public daycare for 11 months per year. The Finnish day-care system actually affects the two-parent households the most, because their wage rate is higher. Nonetheless, also single-parents are affected to a certain extent. Third and finally, in the Finnish unemployment benefit scheme, there is a top-up for families with children. Also General Housing Allowance and Social Income Support are relatively speaking more beneficial for families with children. These factors increase the level of the unemployment benefit for families with children and,

consequently, the PTRs increase as well.

	2011	2016	Change
I Single	66.8	68.2	1.3
II Childless couple	59.9	63.6	3.7
III Single parent	74.6	73.8	-0.8
IV Two parents	65.7	69.4	3.7
V Others	59.2	62.9	3.8
	64.3	67.0	2.6

Table 13: Average PTRs by household type with 2013 data and 2016 legislation

Figure 4 plots the distribution of PTR in the aggregate (upper-left corner) and categorized by unemployment benefit type with 2013 data and 2016 legislation. The distributions are rather concentrated around the mean value. Median value is close to the mean value. Standard deviation is around, or, a little above 10 %. The aggregate histogram is actually two-peaked; there is a lot of mass around 60 % where the mean of Labor Market Subsidy and the Basic Unemployment Allowance are located, and then there is another mass-concentration around 75 % where the mean of the Earnings-related Unemployment Allowance is.

Table 14 reports the frequency of unemployment traps by household type. An individual is in an unemployment trap when the disposable income doesn't significantly increase once the person becomes employed. Quantitatively, an individual is assumed to be in unemployment trap when his or her PTR is higher than 80 %. Single parents have the highest risk of being in unemployment trap – with 2016 legislation, approximately 30 percent of single parent households are trapped in unemployment, whereas the frequency for other households is between 12 and 21 percent. These relatively high numbers are partly the result of the PWR specification. The numbers are clearly lower and yearly changes different with different PWR specification. As noted before, PWR estimation is very relevant in terms of the PTR levels. These sensitivity of the results are addressed next.

	2011	2016	Change
I Single	17.4	14.4	-3.0
II Childless couple	10.4	12.3	1.9
III Single parent	37.7	30.6	-7.1
IV Two parents	17.8	21.0	3.2
V Others	10.2	12.0	1.8
	15.9	15.9	0.0

Table 14: Individuals in unemployment trap

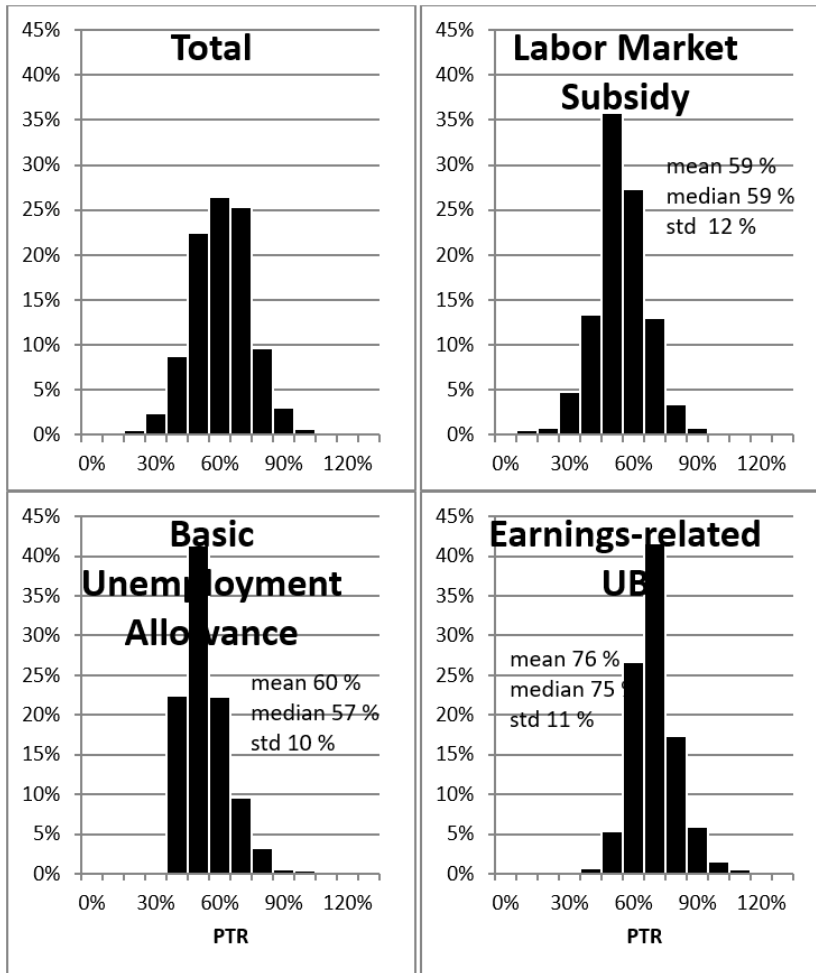


Figure 4: Distribution of participation tax rates in 2016, total and by benefit type

5.2 Decomposition of Results

A number of additional decompositions or, sensitivity simulations, are conducted. This is one of the contributions of this paper – a sufficient sensitivity testing is missing in most of the studies in the field. All the numerical results are reported in Appendix C. These calculations are meant to be interpreted as no more than sensitivity checks and, not as policy advices. One of the main objectives of this paper is to locate, and show the existence of major problems in the Finnish social security scheme, and with sufficient sensitivity testing the pictures starts to clear with respect to various assumptions.

First sensitivity check (Table C.12) is such that the top-ups related to children in the unemployment benefit scheme and Social Income Support scheme are removed. These benefits are tied to unemployment and, thus, actually financially encourage unemployment. These features of the system are, thus, problematic from the point of view of incentives to work. Work-related benefits are also discussed in depth in Immervoll et al (2007), who find that a “working poor” policy is more desirable than a demogrant policy on efficiency grounds. The removal of top-ups generates an average PTR decrease of 1.3 percentage points, and, furthermore, the average PTR of single parents and two-parent households would decrease 3-4 percentage points each with the removal of these benefits. It is then clear, that the top-ups are not the only problem of the system, but still a significant one in terms of participation tax rates.

Second (Table C.9), the assumption of 11 months of day-care is tested. Day-care system is heavily subsidized in Finland, which is argued to be one of the important features of the Nordic system in the sense that it is a feature that allows the co-existence of high employment rate and high taxation (see Kleven (2014)). A decrease in the day-care fee would lower PTRs. Accordingly, if the day-care fee was completely free of charge, the average PTR would be approximately 0.6 pp. lower. Single parent households would have 0.7 pp. lower PTR and two-parent households 2.5 pp. lower PTR. This difference between single parents and two-parent households comes from their different levels of income, as the day-care fee is income contingent in Finland.

Third (Table C.10), both day-care fee and General Housing Allowance are removed from the simulation. The sensitivity check is, of course, radical, but at the same time, some major changes are starting to be seen. Without these two features of the system, the average PTR in 2016 decreases by 3.4 pp. The yearly change in PTR between 2011 and 2016 is rather uniform between different household types except for one-adult households. Also, both, single-person households and single-parent households observe a significant decrease in their PTR level. It can then be inferred, that the General Housing Allowance scheme is definitely one that has a very big decreasing effect on PTRs: on average 3.4 pp. and around 6 pp. for one-adult households.

Fourth (Table C.11), all the household level benefits, General Housing Allowance, Social Income Support and day-care fees, are completely removed in order to evaluate their total contribution on PTRs. The results from this sensitivity check are significant. The average PTR decreases by 5 pp. and by almost 12 pp. for single parent households. Also one-adult households observe a 9 pp. drop in their PTR compared to the baseline. In this sensitivity

scenario, households with one adult actually face better incentives to work than two-adult households. The change in PTR between 2011 and 2016 is now uniform, around 4 pp., across all household types.

From this fourth sensitivity check, it can be inferred that both the General Housing Allowance and Social Income Support are potentially very problematic in terms of financial incentives to work. On the other hand, lowering it might lead to undesired outcomes in terms of income distribution. Moreover, cuts in the Social Income Support may even be against the Finnish constitution. The core problem is that clearly the Social Income Support is not functioning as it should, but at the same time, reforming its structure is very challenging. One critical bug in Social Income is that it should be, according to the law, temporary, but, for many, it has turned into a permanent support, which totally devastates the incentives to acquire low-paid work.

The *fifth*, *sixth*, *seventh* and *eighth* sensitivity checks are tests on the wage regression. *Fifth* (Table C.5), the wage regression is estimated so that the within-year unemployment duration is removed from the wage regression (Model 2). The differences in the PTR levels are significant. While the average PTR with 2016 legislation is 62 % without unemployment duration in the wage regression, it is approximately 5 pp. higher with it. This sensitivity check underlines the crucial significance of the PWR estimation and the uncertainty that surrounds it. The year to year PTR changes are rather uniform across household types except one-adult household. The one-adult households are most subject to Social Income Support and General Housing Allowance (as seen above), which has a negative effect on PTRs when the PWR is low.

Sixth (Table C.6), the observed previous wage rate is used as the PWR estimate. This observation is only for those that have received Earnings-related Unemployment Allowance, because the benefit is related to previous earnings and it is therefore saved to the official registries, whereas there is no direct information on the previous wage rate for those that have received either the Labor Market Subsidy or the Basic Unemployment Allowance. This sensitivity check is, thus, conducted only on 47 % of the relevant sample. It is possible, that this scenario, if something, overestimates the participation wage rate, because typically wages decrease after a period of unemployment.

The participation tax rates are quite high when using only the observed wage rate as the PWR. Mostly the high PTR is explained by the fact that almost all the individuals in this sample receive Earnings-related Unemployment Allowance. This case underlines

the observation that PTRs are quite high for individuals with unemployment insurance in Finland. The total average PTR in this case is 72.3% in 2016 and 78.7 % for single parents. The average PTR is, however, slightly lower in this case than in the benchmark case where the average PTR for individuals receiving Earnings-related UA is 76.3 % (see Table 12).

Seventh and *eighth* sensitivity test is the use of constant PWR (Tables C.7 and C.8). At first, a constant monthly wage of eur 2,134 is used. Thereafter, a constant PWR of eur 2,600 is used. All the differences between households in these cases are due to the variation in the social security system and family structure, and not at all due to the differences in PWRs. These cases produce, respectively, average PTRs rather close to the ones produced by the Model 1 (Table C.4) and Model 2 (Table C.5). This is no surprise as the average PWRs are the same. In both cases, singles and single parents observe a decrease in PTR because their average wage rate increases. The opposite is observed for two-adult and two-parent households.

In general, the variation between household types stays rather constant despite the differences in PWR estimation. Even if there is considerable uncertainty in the true level of PTRs, the inferences drawn previously hold – single parent household and individuals entitled to Earnings-related Unemployment Allowance still have clearly the highest PTRs. On the other hand, their PTR has increased the least from 2011 to 2016. It can be concluded, that at least the qualitative inferences drawn in this section are rather robust to the estimation of PWR. The average PTRs (in 2016) that are discussed in this subsection are reported also in Table 16.

	Average PTR	Description
1	67.0 %	Baseline
2	66.4 %	No day-care fee
3	63.6 %	No day-care fee or General Housing Allowance
4	61.9 %	No day-care-fee, General Housing Allowance or Social Income Support
5	63.3 %	Duration of unemployment is not an explanatory variable in PWR estimation
6	72.3 %	Observed wage as PWR for those that receive Earnings-related UA
7	66.8 %	Constant monthly PWR of eur 2,134
8	62.8 %	Constant monthly PWR of eur 2,600

Table 15: Decomposing the results with 2016 legislation

6 Application: Earned-income Tax Credit, PTRs and Labor Supply Response

6.1 Description of the Reform

In the summer 2015, the Finnish government decided, in its strategic program, of a number of reforms.¹¹ One of the tax reforms was to increase the EITC. The bottom line was to increase incentives to work, focusing on low and medium incomes. The total size of the measure was estimated by the MoF to be eur 450 million and it was implemented in the beginning of 2016.¹²

Earned-income Tax Credit (EITC) is a tax relief that is directly deducted from the state income tax. All earned income is included in the total: pension income, unemployment benefits and sickness allowance are also included. If an individual has too little state income taxes to deduct from, the credit is applied to municipal income tax, to Church tax, and to the health insurance contribution. The calculation of the credit is as follows (2016 parameters without the reform in parenthesis). In 2016, the EITC equals 11.8 % (8.6 %) of base income that exceeds eur 2,500. The maximum total credit is, however, eur 1,260 (eur1,045). If the net taxable earned income exceeds eur 33,000, the credit is reduced by 1.46 % (1.2 %) of the excess that goes over eur 33,000. The maximal amount of credit is eur 1,260 between approximately eur 11,000 and eur33,000 of earned income. The credit ceases to exist after approximately eur 120,000 of relevant yearly income. The EITC scheme and the reform are depicted in figure 5.

The reform is analyzed with the aid of SISU microsimulation model. Increase in the EITC clearly lowers PTRs because it is a cut in the overall tax rate. The effect of the reform in terms of PTRs for different household types is reported in table 16 below. The reform scenario is identical to that of previous section's values for 2016.

The gain from the reform is rather uniform across household types that have received some unemployment benefit in 2013; the change in the average PTR is around 1 pp. and all household types clearly benefit from the reform. Unemployment traps decrease by, on average, 1.9 pp. and the biggest impact is once again directed to the single-parent households; one-adult single household risk of being trapped in unemployment decreases by 1.7 pp., two-

¹¹See Prime Minister's Office (2015)

¹²http://vm.fi/artikkeli/-/asset_publisher/tyotulovahennyksen-kasvattaminen-keventaa-verotusta

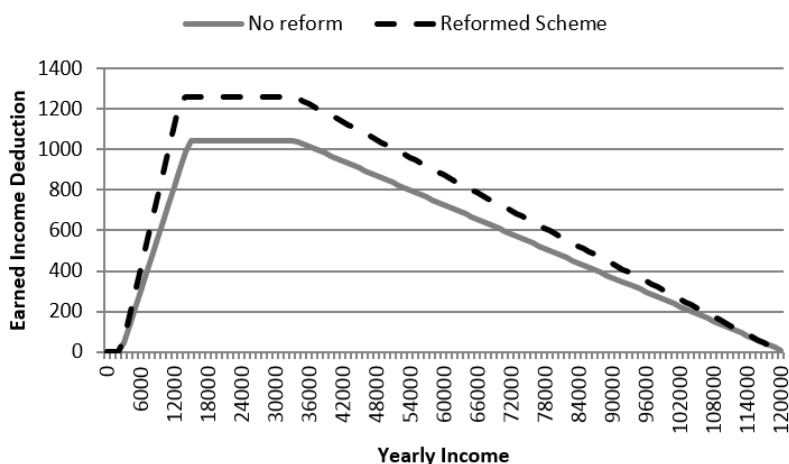


Figure 5: Earned-income Tax Credit before and after the reform

	Baseline	Reform	Change
I Single	69.1	68.1	-1.0
II Childless couple	64.7	63.6	-1.0
III Single parent	74.7	73.8	-1.0
IV Two parents	70.5	69.4	-1.1
V Others	63.9	62.9	-1.0
	68.0	67.0	-1.0

Table 16: Changes in participation tax rates due to EITC reform in 2016, percentage points

adult household risk by 1.4 pp, single-parent risk by 3.5 pp. and the two-parent household risk by 2.9 pp.

There is vast literature on the effects of tax breaks such as the EITC. The most researched single subject is probably the Earned-income Tax Credit in the US. Eissa and Hoynes (2005) provide a nice review where they conclude that there are clear labor supply responses to EITC, and that the mechanism seems to point towards the extensive margin. These matters are turned to next.

6.2 Dynamic Response in General Equilibrium

As there is a clear change in PTRs, there can also be a behavioral response. It is not possible to calculate behavioral responses with the static SISU microsimulation model, thus,

an alternative method is used in order to estimate the long-run change in employment; the extensive margin labor supply response is calculated using a simple search theoretic macroeconomic model. In practice, two separate steady state equilibria are compared. A similar model is used in a different context in Zanetti (2012). The model is presented briefly in the following.

A representative household has a utility function of the form:

$$\sum_{t=0}^{\infty} \beta^t \left(\log(c_t) - \mu \frac{n_t^{1+\phi}}{1+\phi} \right) \quad (9)$$

Utility is thus drawn from consumption and disutility from working. A common simplifying assumption is made; individuals are fully insured against variations in labor income due to labor market status of household members (Merz (1995)). The representative households makes decisions in the extensive margin ie. the household chooses employment instead of working hours. The household budget constraint reads:

$$(1 + \tau^c)c_t + k_{t+1} + b_{t+1} = (1 - \tau^n)w_t n_t + (1 - n_t)ben_t + s_t + (1 + (1 - \tau^k)r_t)k_t + (1 + r_t^b)b_t + \pi_t \quad (10)$$

$$0 \leq n_t \leq 1 \quad (11)$$

where c_t , n_t , k_t , w_t , r_t and ben_t denote consumption, labor supply (employment), wage rate, real interest rate and unemployment (net) benefit, respectively. Utility discount factor, disutility of labor and inverse of extensive margin labor supply elasticity are denoted respectively by β , μ and ϕ . Furthermore, τ^c , τ^k and τ^n denote consumption, capital and labor tax rate, respectively. Every period, an exogenous amount of jobs are destroyed. Total employment evolves according to:

$$n_t = (1 - \delta^n)n_{t-1} + h_t, \quad (12)$$

where δ^n is an exogenous job separation rate and h_t denotes the periodic number of new hires. The evolution of unemployment is a mirror image of equation (13):

$$u_t = 1 - (1 - \delta^n)n_t \quad (13)$$

Job creation rate, f_t , is defined to be the ratio of new hires to the number of unemployed

workers:

$$f_t = \frac{h_t}{u_t} \quad (14)$$

The marginal value of accepting a work relationship, W_t^N , is the net wage less the marginal disutility from working, and the expected discounted gain from taking part in the labor market:

$$W_t^N = (1 - \tau^n)w_t - \mu \frac{n_t^\phi}{\lambda_t} + \beta E_t \frac{\lambda_{t+1}}{\lambda_t} (1 - \delta^n (1 - f_{t+1})) W_{t+1}^N + \delta^n (1 - f_{t+1}) W_{t+1}^U \quad (15)$$

where λ_t is the marginal utility of consumption: $\lambda_t = \frac{1}{(1+\tau^c)c_t}$. The marginal value of unemployment is given by the following:

$$W_t^U = ben_t + \beta E_t \frac{\lambda_{t+1}}{\lambda_t} \{f_{t+1} W_{t+1}^N + (1 - f_{t+1}) W_{t+1}^U\} \quad (16)$$

The equilibrium wage is a solution of Nash bargaining, where the surplus of a job is divided among workers and employees according to their bargaining power, η . Firm surplus, J_t , is given by the cost of hire, ν . The bargaining rule for a match is of the standard form:

$$\eta J_t = (1 - \eta)(W_t^N - W_t^U) \quad (17)$$

Substituting equations (16), (17) and $J_t = \nu$ into (18), the following wage setting equation is obtained:

$$(1 - \tau^n)w_t = \mu \frac{n_t^\phi}{\lambda_t} + ben_t + \frac{\eta}{1 - \eta} \nu \left(1 - \beta \frac{\lambda_{t+1}}{\lambda_t} (1 - \delta^n)(1 - f_{t+1}) \right) \quad (18)$$

A representative firm maximizes its profits, π_t , with respect to production technology (20) and evolution of employment (12), by choosing n_t and k_t . Profits are given by:

$$\pi_t = y_t - w_t n_t - (r_t + \delta)k_t - \nu h_t \quad (19)$$

where ν denotes the cost of posting a vacancy.

Output of the firm is y_t and physical capital depreciation rate is denoted by δ . The production function of a firm is given by the usual Cobb-Douglas specification:

$$y_t = A k_t^\alpha n_t^{1-\alpha} \quad (20)$$

Output elasticity of capital is denoted by α and $A_t = (1 + \gamma^A)A_{t-1}$, where γ^A denotes an exogenous growth rate of the economy. The public sector budget constraint is given by:

$$b_{t+1} + \tau^n w_t n_t + \tau^c c_t + \tau^k r_t k_t = g_t + (1 - n_t)ben_t + s_t + (1 + r_t^b)b_t \quad (21)$$

where b_t , g_t , and s_t denote respectively public debt, government consumption and government transfers. The government transfers is allowed to vary (it is the endogeneous variable in the government budget constraint) in order to make sure that the public sector budget constraint holds at all times. Finally, the economy wide resource constraint must hold at all times:

$$y_t = c_t + i_t + g_t + \nu h_t \quad (22)$$

where i_t denotes investments and is given by:

$$i_t = k_{t+1} - (1 - \delta)k_t \quad (23)$$

As many parameters as possible are calibrated using existing research knowledge. The rest are set to match certain average key ratios in the data between 2009 and 2014. The relevant exogenous variables and parameters are presented in table 17.

The output elasticity of labor, $1 - \alpha$, is calibrated to match the wage sum share of national income, which is 0.649 which implies the value of $\alpha = 0.351$. The TFP growth rate, γ^A , is assumed to be 0.9 % following European Commission (2015). Physical capital depreciation rate, δ , and public consumption expenditures, g , are calibrated match the National Accounts data. The exogeneous job destruction rate is set to 0.6 following Obstbaum (2011a, 2011b).

Utility discount factor, β , is calibrated so that the capital to output ratio matches the data. The parameter for bargaining power, η , is set to 0.5 following most of the earlier literature. This implies that the employer and employee have equal power in the wage bargaining process. The parameter denoting the disutility of labor, μ , is calibrated so that the share of employed in labor force matches the data value of 91.8 %.

The labor supply elasticity parameter, ϕ , is an important parameter in terms of results. There is, however, some controversy upon the reasonable value of this parameter (see, for instance, Keane (2011) or Keane and Rogerson (2012)). In a recent survey, Chetty (2012) concluded that the preferred estimate of structural Hicksian elasticity on the extensive margin is 0.25. The Frisch elasticity of labor supply is the upper bound of Hicksian elasticity,

thus, the elasticity proposed by Chetty (2012) is a conservative value for the Frisch elasticity. The value of $\phi = 0.25$ is used in this paper.

The hiring cost parameter, ν , is calibrated, in accordance with the earlier literature, so that hiring costs equal 1 % of total output. The unemployment benefit level is difficult parameter to calibrate in a representative agent model. As discussed in section 3, there are three different unemployment benefit types which are hard to summarize in one variable. A simplifying assumption is then made; the exogenous unemployment benefit level is calibrated so that the aggregate unemployment benefit expenditure to gdp ratio matches the data.

Finally, the effective consumption, capital income and labor income tax rates are calculated using the Mendoza et al (1994) methodology.

Parameter	Value	Description
α	0.351	Output elasticity of capital
γ^a	0.009	TFP growth rate
δ	0.06	Capital depreciation rate
δ_n	0.06	Separation rate
μ	0.139	Utility function parameter for disutility of labor
β	0.960	Utility discount factor
$1/\phi$	0.25	Frisch elasticity of labor supply
η	0.5	Parameter for bargaining power
τ^c	0.239	Consumption tax rate
τ^k	0.315	Capital income tax rate
τ^n	0.448	Labor income tax rate
$\nu h/y$	0.01	Hiring costs to gdp ratioe
ben/y	0.019	Unemployment benefits to gdp ratio
b/y	0.493	Debt to gdp ratio
g/y	0.243	Government consumption to gdp ratio

Table 17: Calibration of the model

The participation tax rate can be defined, according to equation (1), as follows:

$$\tau^{PTR} = 1 - \frac{(1 - \tau^n)w_t - ben_t}{w_t} = \tau^n + \frac{ben_t}{w_t} \quad (24)$$

Consequently, the change in the participation tax rate equals the change in the average effective tax rate, $\frac{\partial \tau^{PTR}}{\partial \tau^n} = 1$. Hence, we can compare the values of two separate steady states, one with $\tau^n = 0.448$ and another with $\tau^n = 0.438$, in other words, the PTR change of 1.0 pp. is plugged into the general equilibrium model. The results and relevant mechanisms in the long run are described in the following.

A level decrease in labor taxation impacts first and foremost the labor market. Lower labor income tax rate increases the disposable wage income, inducing higher willingness to search for a job – the number of new hires will increase, thus, employment will increase with consumption and output. It can be shown, that in the model framework, the long-run change in employment will be exactly as high as the change in output due to the Cobb-Douglas specification of the production function. The results implied by the model are reported in Table 18.

Variable	Deviation from the original steady state (%)	
y	0.64	Output
c	0.64	Consumption
n	0.64	Employment
k	0.64	Capital
π	0.64	Profits
s	-2.53	Government transfers
f	4.83	Job creation rate
h	0.64	New hires

Table 18: The results due to 1.0 pp. decrease in average PTR

The model implies, that the number of employed will increase in the long run by approximately 0.6 %. According to the Labor Force Survey, there were, on average, 2.46 million employed yearly between 2009 and 2014, thus, the reform would increase the average number of employed by 16,000. If the Ministry of Finance static public sector cost estimate of eur 450 million was taken as such, the cost of one employee due to the reform would be around eur 29,000.

The estimated labor supply response is sensitive to the calibrated parameter values. Some sensitivity analysis is then in order. Table 19 shows the sensitivity of the model to certain key parameters. The sensitivity check is conducted so that first the model is calibrated with the new parameter value, after which impact of the reform is recalculated.

A ten percentage point increase in consumption tax rate in baseline calibration induces a 0.57 pp. increase in employment as a result of the reform; the higher the consumption tax rate, the lower the effect of the reform. A ten percentage point increase in labor income tax rate has a significant effect on labor supply response. The impact of the reform is now approximately 0.3 pp. higher. The capital income tax rate doesn't have a big impact on the results. The capital income tax rate is not explicitly part of the wage determining equation (19)

Parameter	Change in value	Labor supply response to the reform (%)	Description
-	-	0.64	Baseline
τ^c	+ 10 pp	0.57	Consumption tax rate
τ^n	+ 10 pp	0.93	Labor income tax rate
τ^k	+ 10 pp	0.63	Capital income tax rate
ben	+ 10 %	0.69	Unemployment benefit
$1/\phi$	+ 0.2	0.72	Elasticity of labor supply
ν	+ 1.5 pp	0.69	Cost of hiring
η	+ 0.1	0.61	Employer bargaining power

Table 19: Sensitivity analysis: labor supply response with changed parameter value

and as a result, the effect is small. A 10 percent increase in the recalibration of unemployment benefit expenditures has a clear effect on the results. The labor supply response to the reform is now stronger. If the cost of a hire is calibrated to be, in total, 1.5 percent of GDP (instead of 1 percentage as in the baseline scenario), the labor supply response of the reform would increase to 0.69%. Finally, an increase in the employer bargaining power (η) allows employers to get higher share of the “good” that comes from the reform, thus, reducing the labor supply response.

In basically all cases, in the recalibration, the parameter measuring disutility of labor, μ , is changed, which implies a different labor supply response in the model. Additionally, of course, the altered parameter values also contribute to the changed response.

Furthermore, another interesting sensitivity check is to make government transfers, s_t , an exogenous variable and government debt, b_t , or government consumption, g_t , an endogenous variable. It turns out that government debt has no effect on the labor supply response of the reform, that is, labor supply response is 0.64 also when the government debt is an endogenous variable. The debt to gdp ratio does decrease in order to balance the government budget constraint. Endogenizing government consumption, on the other hand, reduces the impact of the reform. As a result of a tax cut, the level of government consumption decreases directly reducing the aggregate demand. Private consumption does increase, but all in all, aggregate demand increases less than in the baseline scenario.

6.3 Behavioral Response in Partial Equilibrium

The previous subsection’s general equilibrium model is in many ways subject to criticism. The model calibration can be, for instance, imprecise, or in general the specification of the model can be questioned. Does it take all the relevant factors into account? Are the interconnections between variables simplified in a correct manner? As an illustration, also a more traditional partial equilibrium employment response is calculated, which is not directly linked to an economic model.

The formula for the calculation of employment response is straightforward:

$$\frac{dn_t}{n_t} = \phi \frac{du_t^n}{u_t^n} \quad (25)$$

where the notation is as before and u_t^n denotes the relative gains from work $u_t^n = \frac{(1-\tau^n)w_t - ben_t}{w_t}$. Using this expression, equation (26) can now be written in terms of the participation tax rate:

$$\frac{dn_t}{n_t} = \phi \frac{d\tau^{PTR}}{1 - \tau^{PTR}} \quad (26)$$

As before, using an extensive margin elasticity of 0.25, the equation (27) yields a relative employment effect of approximately 0.8 %¹³. Given the same level employment as in the previous section, the increase in employment is approximately 19,000.

Interestingly, the “partial equilibrium” approach here produces higher employment effect than the general equilibrium model. Ex-ante, one might think that the general equilibrium models labor supply effect would be stronger, because there is a feedback loop in the model that reinforces the positive effect of a tax cut. However, when comparing these two methods of calculation, this turns out not to be the case.

There are also uncertainties in the partial equilibrium calculation. One central source of uncertainty is the estimation of participation wage rate. If, for example, the regression model without the within year duration of unemployment was used, the average (before reform) participation tax rate would be 64.3 % instead of 68 %. In this case, the relative change in employment would be 0.7 %¹⁴ and, consequently, the increase in employment roughly 17,000.

Partial equilibrium estimates are criticized for not taking general equilibrium effects into

¹³ = $0.25 * 1.0\% / (1 - 68.0\%) \approx 0.8\%$

¹⁴ = $0.25 * 1.0\% / (1 - 64.3\%) \approx 0.7\%$

account, thus, undermining the aggregate effect. General equilibrium models, on the other hand, are often based on rather strong assumptions, which create uncertainty upon the results. In this paper, depending on assumptions used, the long-run employment effect of the reform in employment is estimated to be something between 16,000 and 19,000.

7 Conclusions

This paper has sought to increase understanding of the functioning of the labor market in two different ways. First of all, in this study, participation tax rates have been calculated using 2013 data and 2011-2016 legislation. Second, this paper has attempted to estimate the (ex-ante) economic effects of newly legislated reform, where the Earned-income Tax Credit was increased significantly. First, the effect of the reform on participation tax rates were calculated, after which the impact of the reform was estimated using a simple general equilibrium model. Also a more traditional partial equilibrium employment effect is calculated.

According to the earlier literature, the average participation tax rate has decreased in the first decade of the 21st century. The trend seems to have turned, however, as the participation tax rate has increased from 64.3 in 2011 to 67.0 in 2016. A 2.6 percentage point increase only due to legislation in half a decade is not trivial. Depending on the details of the PWR estimation, the timely increase can go as high as 3.6 pp. if we assume a constant PWR of eur 2,100.

The claim is confirmed that the single parents and individuals receiving Earnings-related Unemployment Allowance still have the highest PTRs. The observation in itself is not surprising, but what is surprising is that so little legislative changes have been made to remedy the situation. Future research should hope to dwell deep into the situation of these individuals and suggest concrete, corrective improvements. Some selected propositions from the earlier literature include, for example, i) making Earnings-related Unemployment Benefit profile declining in time, ii) making further, targeted reductions on the daycare fees¹⁵, iii) making Earned-income Tax Credit dependent on the number of children, iv) introducing the idea of basic income or negative income tax into the system and so on. Restructuring the system should be made patiently, analytically and comprehensively.

In addition and for the first time in the literature, also the effect of the Finnish day-care

¹⁵There is a government proposal that aims to increase daycare fees, but at the same time, the fees for certain low-income households are decreased

fees, General Housing Allowance and Social Income Support schemes on PTRs are quantitatively calculated. Not taking the aforementioned features of the Finnish social security system into account when calculating PTRs, the between group differences even out almost completely and the average PTR decreases by approximately 5 pp. and 10 pp. for the single-household category. These components of the system are an important part of the solution of making work more attractive in Finland.

Furthermore, this paper discusses the effects of one very recent reform – a significant increase in the Earned-income Tax Credit, in other words, a decrease in taxation. The reform is estimated to lower the participation tax rate by 1.0 percentage points, which, in monetary terms, translates to an increase of, at most, eur 215 p.a. in disposable income. The reform impacts almost all wage earners in the economy, thus, in this sense it is not a well targeted measure.

The Finnish microsimulation model SISU is not dynamic in nature, that is, it is not possible to simulate behavioral responses with the model. In order to make a prediction on the potential employment effects, a different model must be used. A standard search theoretic general equilibrium model is calibrated and solved in order to estimate the long-run employment effect of the reform. According to calculations made in this paper, the long-run employment effect of the reform could be approximately 0.6 % increase in the number of employed or, approximately 16,000 workers. Using a more straightforward partial equilibrium method would give an approximate employment effect of 19,000. Consequently, given the uncertainty around the matter, it might be reasonable to conclude that the estimated increase in number of employed is around 15-20,000.

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Appendix A: Participation Tax Rates (OECD)

PWR (% of average wage)	No children			2 children		
	Single person	One-earner married couple	Two-earner married couple	Lone parent	One-earner married couple	Two-earner married couple
33	72	72	72	79	79	79
50	69	69	69	76	76	76
67	69	69	69	74	74	74
100	70	70	70	74	74	74
150	67	67	67	69	69	69

Table A.1 Participation Tax Rates in Finland with certain household types and Participation Wage Rates. Source: OECD, Tax-Benefit Models.

PWR (% of average wage)	No children			2 children		
	Single person	One-earner married couple	Two-earner married couple	Lone parent	One-earner married couple	Two-earner married couple
33	77	79	76	73	76	80
50	73	74	73	70	72	75
67	71	72	71	71	71	72
100	67	66	67	70	67	68
150	62	62	62	65	62	63

Table A.2 Participation Tax Rates, EU average with certain household types and Participation Wage Rates. Source: OECD, Tax-Benefit Models.

Appendix B: Estimation of Participation Wage Rate

Explanatory variable: log of monthly wage rate			
Variable	Estimate	Standard Error	T
Constant	7.369	0.03	237.63
Gender 1 (=male)	0.088	0.04	2.19
Gender 2 (=female)	0.000		
Education level and field			
Male: Pre-primary education	-0.466	0.02	-23.56
Male: Upper secondary level education	-0.550	0.01	-73.72
Male: Lowest level tertiary education	-0.398	0.01	-51.07
Male: Lower-degree level tertiary education	-0.315	0.01	-41.29
Male: Higher-degree level tertiary education	-0.084	0.01	-11.11
Male: Doctorate or equivalent level tertiary	0.000		
Female: Pre-primary education	-0.556	0.03	-21.24
Female: Upper secondary level education	-0.628	0.01	-76.44
Female: Lowest level tertiary education	-0.499	0.01	-60.09
Female: Lower-degree level tertiary education	-0.433	0.01	-52.08
Female: Higher-degree level tertiary education	-0.143	0.01	-17.39
Female: Doctorate or equivalent level tertiary	0.000		
Male: General Education	0.185	0.02	9.85
Male: Teacher Education and Educational Science	-0.081	0.02	-4.05
Male: Humanities and Arts	-0.092	0.02	-4.77
Male: Social Sciences and Business	0.135	0.02	7.26
Male: Natural Sciences	0.052	0.02	2.73
Male: Technology	0.157	0.02	8.53
Male: Agriculture and Forestry	0.040	0.02	2.09
Male: Health and Welfare	0.159	0.02	8.37
Male: Services	0.129	0.02	6.90
Male: Other or Unknown Field	0.000		
Female: General Education	0.183	0.03	7.28
Female: Teacher Education and Educational Science	0.044	0.03	1.73
Female: Humanities and Arts	0.015	0.03	0.58
Female: Social Sciences and Business	0.153	0.02	6.14
Female: Natural Sciences	0.119	0.03	4.66
Female: Technology	0.165	0.03	6.60
Female: Agriculture and Forestry	0.084	0.03	3.27

Female: Health and Welfare	0.175	0.02	7.03
Female: Services	0.075	0.02	3.01
Female: Other or Unknown Field	0.000		
Region			
Male: Uusimaa	0.082	0.01	14.88
Male: Varsinais-Suomi	-0.038	0.01	-6.22
Male: Satakunta	-0.015	0.01	-2.13
Male: Kanta-Häme	-0.012	0.01	-1.74
Male: Pirkanmaa	-0.008	0.01	-1.37
Male: Päijät-Häme	-0.017	0.01	-2.42
Male: Kymenlaakso	0.007	0.01	1.03
Male: Etelä-Karjala	-0.002	0.01	-0.28
Male: Etelä-Savo	-0.085	0.01	-10.79
Male: Pohjois-Savo	-0.040	0.01	-5.98
Male: Pohjois-Karjala	-0.101	0.01	-13.33
Male: Keski-Suomi	-0.047	0.01	-7.14
Male: Etelä-Pohjanmaa	-0.087	0.01	-12.12
Male: Pohjanmaa	-0.047	0.01	-6.72
Male: Keski-Pohjanmaa	-0.036	0.01	-3.86
Male: Pohjois-Pohjanmaa	-0.025	0.01	-4.12
Male: Kainuu	-0.093	0.01	-9.94
Male: Lappi	0.082	0.01	14.88
Male: Ahvenanmaa			
Female: Uusimaa	0.086	0.01	15.28
Female: Varsinais-Suomi	-0.010	0.01	-1.69
Female: Satakunta	-0.022	0.01	-3.15
Female: Kanta-Häme	0.008	0.01	1.05
Female: Pirkanmaa	-0.002	0.01	-0.40
Female: Päijät-Häme	-0.012	0.01	-1.65
Female: Kymenlaakso	-0.017	0.01	-2.37
Female: Etelä-Karjala	-0.024	0.01	-2.94
Female: Etelä-Savo	-0.030	0.01	-3.85
Female: Pohjois-Savo	-0.003	0.01	-0.37
Female: Pohjois-Karjala	-0.044	0.01	-5.74
Female: Keski-Suomi	-0.033	0.01	-4.87
Female: Etelä-Pohjanmaa	-0.039	0.01	-5.36
Female: Pohjanmaa	-0.049	0.01	-6.71
Female: Keski-Pohjanmaa	-0.034	0.01	-3.46
Female: Pohjois-Pohjanmaa	-0.013	0.01	-2.11
Female: Kainuu	-0.051	0.01	-5.28
Female: Lappi	0.086	0.01	15.28

Female: Ahvenanmaa			
Other variables			
Male: Not married	-0.056	0.00	-24.00
Male: Married	0.000		
Female: Not married	-0.002	0.00	-0.96
Female: Married	0.000		
Male: Single	0.031	0.00	6.91
Male: Childless couple	0.044	0.00	9.94
Male: Single parent	0.066	0.01	7.03
Male: Two-parent household	0.083	0.00	18.32
Male: Senior household	0.000	0.03	0.00
Male: Others	0.000		
Female: Single	0.044	0.01	8.81
Female: Childless couple	0.023	0.00	4.75
Female: Single parent	0.022	0.01	3.74
Female: Two-parent household	-0.004	0.00	-0.84
Female: Senior household	-0.072	0.01	-6.04
Female: Others	0.000		
Male: Age	0.034	0.00	51.91
Female: Age	0.025	0.00	35.20
Male: Age^2	0.000	0.00	-41.36
Female: Age^2	0.000	0.00	-26.53
Male: Children below the age of 3 in the same household	0.044	0.00	14.19
Male: No children below the age of 3 in the same household	0.000		
Female: Children below the age of 3 in the same household	0.189	0.00	46.80
Female: No children below the age of 3 in the same household	0.000		
Male: Capital income	0.080	0.00	47.70
Female: Capital income	0.047	0.00	24.81
Male: Unemployment months during the year	-0.045	0.00	-53.64
Female: Unemployment months during the year	-0.038	0.00	-30.35
n	254 893		
R ²	0.42		

Table B.1 Regression for Participation Wage Rate (PWR)

Appendix C: PWRs and PTRs 2011-2016

C.1 Sensitivity of the Participation Wage Rate

	Predicted Values				
	Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4	Model 5
Minimum	1,200	1,200	1,200	2,134	2,598
1. quartile	1,628	2,075	1,874	2,134	2,598
Median	1,952	2,459	2,346	2,134	2,598
Mean	2,134	2,598	2,572	2,134	2,598
3. quartile	2,435	2,964	2,984	2,134	2,598
Maximum	17,607	17,607	97,970	2,134	2,598

Table C.1 Predicted monthly wage rate used in PTR calculations

^a Duration of unemployment is an explanatory variable

^b Duration of unemployment is *not* an explanatory variable

^c Observed previous wage; only individuals receiving Earnings-related UA

	Average Participation Wage Rate		
	Model 1	Model 2	Model 3
I Single	2,035	2,565	2,519
II Childless couple	2,217	2,706	2,644
III Single parent	1,927	2,292	2,213
IV Two parents	2,273	2,634	2,621
V Others	1,977	2,427	2,401
	2,133	2,598	2,572

Table C.2 Participation wage rate 2011–2016 with 2013 data

	Average Participation Wage Rate	
	Model 1	Model 2
Labor Market Subsidy	1,908	2,420
Basic Allowance	2,057	2,436
Earnings-related UI	2,384	2,816
	2,133	2,598

Table C.3 Participation wage rate by unemployment benefit type

C.2 Sensitivity of the Participation Tax Rate

	Average Participation Tax Rate, Model 1						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	66.8	68.8	69.8	70.3	69.5	68.1	1.3
II Childless couple	59.9	62.6	64.1	64.8	64.3	63.6	3.7
III Single parent	74.6	77.2	78.3	78.6	76.2	73.8	-0.8
IV Two parents	65.7	68.1	70.2	70.9	70.3	69.4	3.7
V Others	59.2	62.2	63.6	64.0	63.8	62.9	3.8
	64.3	66.7	68.2	68.8	68.1	67.0	2.6

Table C.4 Participation tax rate 2011–2016 with 2013 data using PWRs according to model 1

	Average Participation Tax Rate, Model 2						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	61.1	62.9	63.9	64.5	64.4	63.8	2.7
II Childless couple	56.4	58.7	60.0	60.8	60.4	59.9	3.5
III Single parent	71.6	74.4	75.5	75.9	74.2	72.4	0.8
IV Two parents	62.7	64.9	66.8	67.5	67.0	66.4	3.7
V Others	55.1	57.8	59.0	59.5	59.4	58.8	3.7
	60.2	62.3	63.6	64.3	64.0	63.3	3.1

Table C.5 Participation tax rate 2011–2016 with 2013 data using PWRs according to model 2

	Average Participation Tax Rate, Model 3						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	69.8	71.7	72.3	73.2	72.7	71.7	1.9
II Childless couple	67.6	69.7	70.1	71.2	70.3	69.7	2.1
III Single parent	78.5	80.4	81.2	82.0	80.7	78.7	0.2
IV Two parents	74.3	76.2	76.7	77.8	76.8	76.1	1.8
V Others	68.3	70.4	70.9	71.7	71.1	70.4	2.1
	70.4	72.4	72.9	73.9	73.1	72.3	1.9

Table C.6 Participation tax rate 2011–2016 with 2013 data using PWRs according to model 3

	Average Participation Tax Rate, Model 4						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	63.6	65.8	66.8	67.4	67.5	66.9	3.3
II Childless couple	60.0	62.8	64.2	65.1	64.6	64.0	4.0
III Single parent	72.8	75.9	77.1	77.5	75.7	73.8	1.1
IV Two parents	66.3	68.9	70.9	71.8	71.1	70.4	4.0
V Others	56.3	59.3	60.5	61.1	61.0	60.4	4.1
	63.1	65.6	67.0	67.8	67.4	66.7	3.6

Table C.7 Participation tax rate 2011–2016 with 2013 data using constant PWR of €2,134

	Average Participation Tax Rate, Model 5						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	59.9	61.6	62.5	63.2	63.2	62.6	2.8
II Childless couple	56.8	59.1	60.3	61.2	60.7	60.2	3.4
III Single parent	69.1	72.0	73.2	73.7	73.1	72.1	3.0
IV Two parents	62.3	64.4	66.2	67.0	66.5	65.9	3.6
V Others	53.9	56.3	57.4	58.0	57.8	57.4	3.5
	59.5	61.7	62.9	63.6	63.3	62.7	3.2

Table C.8 Participation tax rate 2011–2016 with 2013 data using constant PWR of €2,600

	Average Participation Tax Rate, Model 1						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	66.8	68.8	69.8	70.3	69.5	68.1	1.3
II Childless couple	59.9	62.6	64.1	64.8	64.3	63.6	3.7
III Single parent	73.5	76.2	77.4	77.7	75.5	73.1	-0.4
IV Two parents	63.2	65.6	67.7	68.5	67.8	67.4	3.8
V Others	58.8	61.9	63.2	63.7	63.4	62.5	3.8
	63.7	66.1	67.5	68.1	67.4	66.3	2.7

Table C.9 Participation tax rate 2011–2016 without day-care fees

	Average Participation Tax Rate, Model 1						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	60.7	62.6	63.6	63.9	63.0	62.4	1.7
II Childless couple	59.3	62.0	63.5	64.2	63.6	62.9	3.6
III Single parent	63.9	67.4	68.7	68.9	68.2	67.7	3.8
IV Two parents	62.1	64.6	66.7	67.4	66.7	66.0	3.9
V Others	57.8	60.9	62.2	62.7	62.3	61.6	3.8
	60.5	63.0	64.4	65.0	64.2	63.6	3.0

Table C.10 Participation tax rate 2011–2016 without day-care fees or General Housing Allowance

	Average Participation Tax Rate, Model 1						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	55.5	59.0	59.8	60.3	60.1	59.3	3.8
II Childless couple	58.7	61.5	63.0	63.7	63.2	62.5	3.9
III Single parent	58.4	62.0	62.9	63.3	63.2	62.3	3.9
IV Two parents	61.0	63.7	65.7	66.4	65.9	65.1	4.1
V Others	56.6	60.0	61.2	61.7	61.5	60.7	4.1
	57.9	61.1	62.4	63.0	62.6	61.9	3.9

Table C.11 Participation tax rate 2011–2016 without day-care fees, Social Income Support or General Housing Allowance

	Average Participation Tax Rate, Model 1						Change 2011-2016
	2011	2012	2013	2014	2015	2016	
I Single	66.6	68.5	69.5	70.0	69.2	67.8	1.2
II Childless couple	59.8	62.4	63.9	64.7	64.1	63.4	3.7
III Single parent	72.8	74.4	75.6	75.8	73.1	70.7	-2.1
IV Two parents	61.8	64.3	66.3	67.1	66.4	65.6	3.8
V Others	58.2	61.3	62.6	63.1	62.8	62.0	3.8
	63.1	65.5	66.9	67.5	66.8	65.7	2.6

Table C.12 Participation tax rate 2011–2016 without top-ups related to children in unemployment benefits

	Model 1		Model 2		Model 3		Model 4		Model 5	
	2011	2016	2011	2016	2011	2016	2011	2016	2011	2016
I Single	17.4	14.4	5.2	5.9	6.7	5.7	12.1	14.5	4.7	6.6
II Childless couple	10.4	12.3	3.0	4.0	0.3	0.4	16.5	18.9	6.5	9.1
III Single parent	37.7	30.6	26.2	24.0	43.5	41.3	30.0	29.5	16.0	22.3
IV Two parents	17.8	21.0	10.8	13.7	17.5	24.6	26.0	28.4	14.4	16.9
V Others	10.2	12.0	2.3	4.0	1.6	3.3	9.3	10.6	3.7	5.1
	15.9	15.9	6.8	8.0	8.3	10.0	17.3	19.5	7.9	10.4

Table C.13 Individuals in unemployment trap, %

Essay 4: When Unemployment Insurance Doesn't Insure. Towards a More Inclusive UI Scheme

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When Unemployment Insurance Doesn't Insure. Towards a More Inclusive UI Scheme

Mauri Kotamäki and Jukka Mattila

Abstract

There is a voluntary unemployment insurance scheme in place in Finland. The system is heavily subsidized by the state. Only approximately 5.5 % of the costs are directly paid by the insured themselves. Furthermore, those that decide not to insure themselves are still forced to contribute to the financing of the system through insurance fees. It can be argued, that the system isn't very attractive to those that are not UI fund members. Members also appear to be in a stronger position in the labor market in relation to education and income level. It's possible, that individuals who need the insurance the most are not getting it. One possible remedy to the problem would be to make the UI scheme universal. This would solve the problem of actuarial fairness, and it would also make the system more inclusive. This paper studies cost-neutral reforms that would make the Finnish UI system universal. Cost-neutrality in these calculations is achieved by increasing the UI contribution rate or introducing a ceiling on earnings-related UI allowance. Public finances, distributional concerns and matters relating to horizontal equity are considered using the SISU microsimulation model.

Keywords: Unemployment, Universal UI, Microsimulation

1 Introduction

The current Finnish earnings-related unemployment insurance (UI) system was introduced in the mid-1980s during a time of very low unemployment. After the recession of the early 1990s, unemployment rate rose and hasn't fallen to its former level since. In particular, the most recent financial crisis and increased unemployment rate has brought issues related to the UI scheme into the public debate. This study focuses on one specific aspect of the Finnish unemployment insurance scheme, ie. the question of how the costs and benefits of the scheme are distributed.

Currently, the earnings-related UI is funded by the state, the employers and employees, and the members of the unemployment funds. All employees and employers pay a UI contribution that is transferred to the Unemployment Insurance Fund (TVR), which, in turn, finances UI expenditures.

A significant share of contributors, however, are not insured. They are paying for insurance of which they get no insurance. In Finland, approximately 85 % of employees belong to a UI fund, but *all* employees must pay the UI contribution out of their wage income. Consequently, it must then be that the costs are not fully covered by the beneficiaries. The basic part of the earnings-related daily allowance is financed by the state, whereas the earnings-related part is covered mostly by UI contributions. Merely 5.5 percent of the total expenditure is covered directly by the insured themselves, that is, by the membership fees of the funds.

Despite the fact that all employees pay UI contributions, roughly nine out of ten employees are truly insured against unemployment shocks and, thus, entitled to earnings-related UI benefit. Of course, the UI contribution *could* be treated as a tax, in which case there is no reason to expect that the costs and benefits should go hand in hand and the UI contribution can be seen to also have other social objectives. In general, however, taxation is considered to have slightly different objectives than social insurance fees.

The current system divides individuals, who become unemployed and fulfill the eligibility criteria, into two categories. The non-members receive basic unemployment allowance which amounts to approximately EUR 33 per day, or, EUR 700 a month (in 2014). Members of a UI fund typically receive more than twice as much as the non-members, and, even allowances of EUR 80 per day or more are not unheard of. In Finland, unlike in Sweden or Denmark, for instance, there is no ceiling on unemployment benefit. Besides the aforementioned division,

also the pre-unemployment wage rates of the non-members are lower than that of members, suggesting that the non-members hold a more disadvantaged position in the labor market.

The underlined challenges of the Finnish earnings-related UI system have been known to exist for a long time (see eg. Kettunen (1991)). To fix the system, it's been suggested that the membership of an unemployment fund should be made compulsory for all. In Norway and in Iceland, there is already a universal earnings-related UI scheme in place. There's been some debate also in Sweden on the introduction of such a system (see Regeringskansliet (2008) or The Swedish Fiscal Policy Council (2011)).

This paper analyzes an imaginary reform, which allows all contributors to receive earnings-related UI benefit (conditional on eligibility). The reform is, thus, one that makes system universal, and the division between members and non-members becomes void in this context. The calculated reforms are all cost neutral in terms of public finances. In the calculations, the expenditure hikes are covered either by introducing a cap on the benefit level, or by increasing the contribution rate. Alternatively, this kind of reform could also be financed, for example, by shortening the potential benefit duration. This option is, however, outside the scope of this study.

The organization of the paper is as follows. The next section briefly reviews the determination of earnings-related UI benefits and characterizes who is receiving and how high a benefit. The third section considers the funding scheme in Finland and contrasts the Finnish UI system with other Nordic countries. The fourth and fifth sections present the methodology used in this paper and provide the reader with one answer of how a universal UI scheme would shape the Finnish system. The sixth section concludes.

2 Earnings-related UI in Finland

2.1 The Current System

According to the 2014 legislation, earnings-related unemployment allowance is paid for 400 days if a person's work history is shorter than 3 years and for 500 days otherwise. The current precondition for receiving earnings-related UI benefits is that a person is a member of an unemployment fund, and during the insured time, he or she has met the 26 weeks employment condition. Furthermore, there are a number of other eligibility conditions (such

as no unemployment benefits for students or inmates and so on) that are not listed here. Once the potential benefit duration is exhausted, an unemployed person can receive labor market subsidy indefinitely, accompanied by other social support in accordance with the law.

Earnings-related allowance consists of a *basic part* and of an *earnings-related component*. The *basic part* is equal to the basic unemployment allowance, which again is equal to the labor market subsidy. In addition, it is possible to receive a EUR 5-10 top-up conditional on the number of under-aged children. The *earnings-related component* is 45 % of the difference between the daily wage and the basic part up to a certain point, after which the earnings-related component is 20%; 20 cents for each additional euro. The corresponding numbers for the increased allowance are 65 % and 37.5 %. An unemployed person is temporarily eligible for the increased allowance if she has sufficient work history or if she is participating in employment promoting services. The determination of earnings-related UI benefit level is plotted in figure 1. A more detailed description of the benefit determination can be found at, for instance, TYJ (2014).

Figure 1: Earnings-related UI benefits in 2014



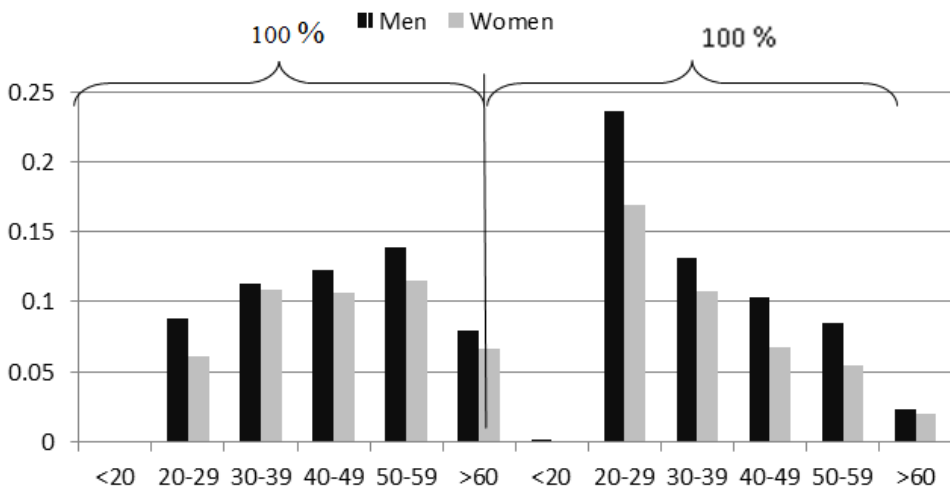
An average wage rate of approximately EUR 3,200 in 2014 yields a monthly earnings-related (gross) benefit of EUR 1,770-2,240. Furthermore, the figure 1 reveals one special feature of the Finnish system; the earnings-related allowance has no ceiling.

2.2 Some Descriptive Statistics

This subsection aims to characterize individuals that are subject to UI with respect to education level, demographic attributes and economic position. The objective is to show that UI fund members are typically better educated and have higher income than non-members. Based on this descriptive evidence, it is likely that UI fund members fare better in the labor market. The implication is, potentially, that individuals who would need the UI the most are not eligible. This phenomenon can partly be explained by selection; UI fund members differ from non-members in terms of, for example, demographic composition.

In terms of age structure, individuals receiving earnings-related UI and basic unemployment allowance seem significantly different from each other. Earnings-related UI is tilted towards individuals over 30 years of age, whereas individuals receiving basic unemployment allowance are more likely to be under 30 years of age. In addition, men are generally more likely to receive unemployment benefits than women; 54 % of all the unemployed are men. Of the uninsured, that is, of all basic unemployment allowance recipients, about 58 % are men.

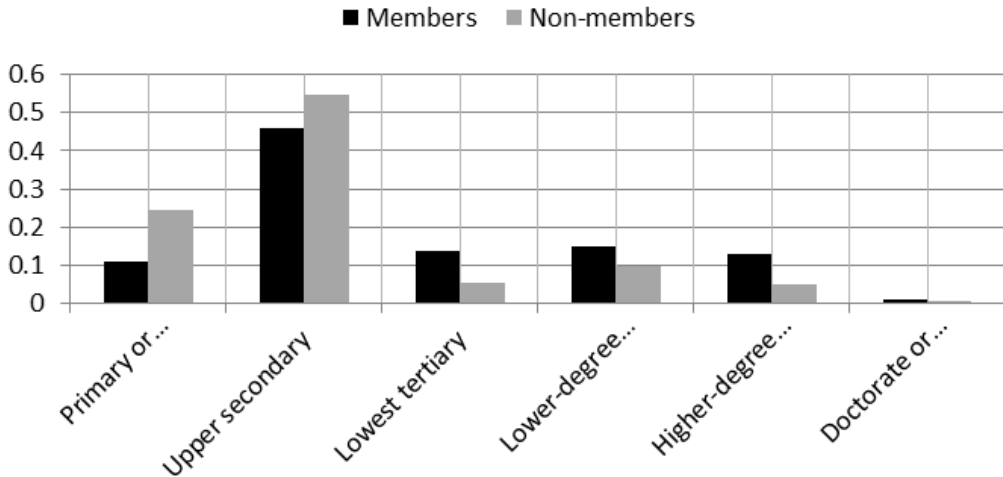
Figure 2: Individuals receiving earnings-related allowance (left) and basic unemployment allowance (right) in 2012 by age and sex. Source: Income Distribution Statistics 2012



The educational structure of UI fund members also differs from that of non-members. One out of four non-members are below the secondary education level, whereas only one out of ten members are in the same educational position. The share of secondary level degrees

is also higher with non-members than with UI fund members. The situation turns upside down with higher level degrees. The difference is most pronounced in the case of higher level tertiary degrees; about 13 % of members have higher level tertiary degree, whereas only 5 % of non-members belong to that particular category. Clearly UI fund members are associated with higher education level.

Figure 3: Fund membership by educational level. Source: Income Distribution Statistics 2012



Level of education, monthly wage, and other labor market outcomes, such as unemployment risk, are strongly correlated. So far, on the basis of descriptive statistics presented in this subsection, UI fund members compared to non-members seem to have properties that are associated with better labor market position; non-members are more likely to be young, men and less educated than UI fund members. Figure 4 also supports this observation; the probability of UI fund membership increases with income.

Finally, figure 5 depicts the distribution of daily earnings-related allowance. The average daily earnings-related UI benefit is approximately EUR 70 and increased benefit approximately EUR 74 in 2012. The average earnings-related UI benefit is, thus, more than twice as high as the daily basic unemployment allowance (approx EUR 33).

Figure 4: Individuals that have paid trade union or UI fund membership fee in 2012, 18-64 year-olds by income deciles. Source: Income Distribution Statistics 2012

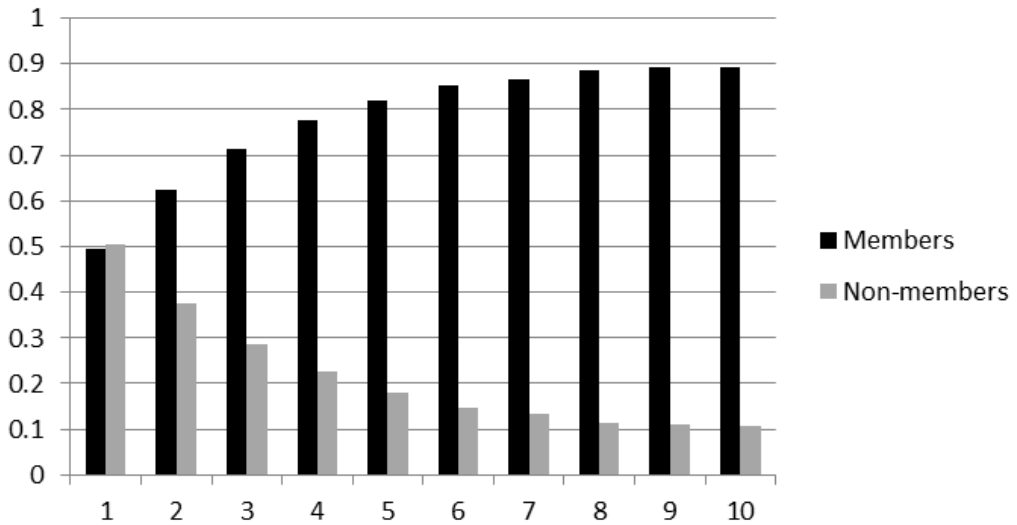
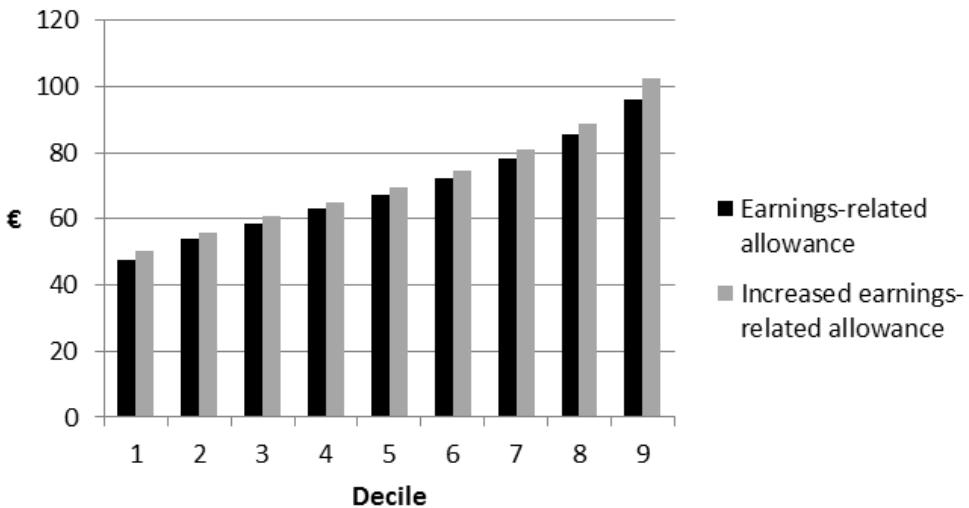


Figure 5: Average daily earnings-related allowance in 2012 by income decile. Source: Income Distribution Statistics 2012.



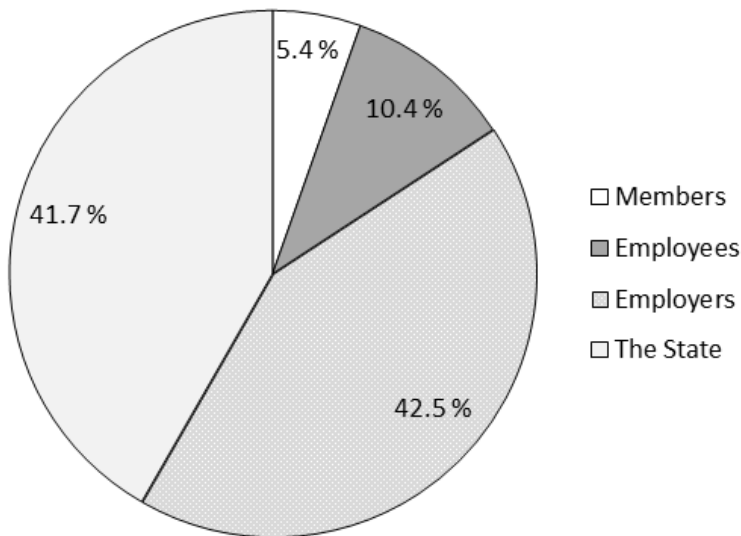
3 Financing the System

Figure 6 describes how different sectors contribute to the financing of the earnings-related UI in 2012. According to the law, membership fees are to finance 5.5 % of earnings-related

UI expenditures (including the job alternation leave). In 2012 members of UI funds financed (directly) 5.4 % of earnings-related UI expenditures. The rest of the financing, approximately 95.5 %, is funded by the state (ie. with taxes) and by the employee and employers UI contributions.

The Unemployment Insurance Fund (TVR) is managed by the social partners. It collects the employees' and employers' UI contributions and, thus, carries out the financing processes of the UI system. All in all, TVR finances more than half of the total costs of the earnings-related UI scheme by collecting UI contributions. Rest of the costs are financed by the state (approx. 42 %) and by membership fees of UI fund members (5.4 %).

Figure 6: Financing of earnings-related UI. Source: Statistical Yearbook on Unemployment Protection in Finland 2013 (The Social Insurance Institution of Finland, KELA)



Each year, TVR returns an amount equivalent to non-member employees' UI contributions to KELA. There is, thus, a mechanism that attempts to correct for the imbalance in the funding scheme. The mechanism is, however, flawed. The employees' contribution is only about 10 percent of total. Employers, on the other hand, are paying more than 40 per cent of the UI expenditures, and there is no refund to the employer if an employee is not a member of a fund. From the practical viewpoint this is understandable, but it leaves an obvious flaw to the system where many individuals contribute to the financing of the system of which they get no benefit.

Earnings-related part of the UI allowance is financed mainly by UI contributions. All

employees are to pay the contribution. Of these, about 85 per cent belonged to an unemployment fund in 2012. That is, about 15 percent of employees (and their employers) have to pay the UI contribution receiving nothing in return.

In 2012, earnings-related UI benefits amounted to EUR 2.1 billion. All in all, unemployment benefits were paid EUR 3.5 billion, of which 59.9 percent were earnings-related benefits. According to the Financial Supervisory Authority (FSA), the number of beneficiaries was 391,000 in 2009 from whence it fell to 295,000 in 2012. Again, in 2013, the number of recipients rose to 323,000. The number of unemployed and benefit expenditures obviously correlate strongly with each other.

3.1 Other Nordic Countries

This subsection provides a brief overview of earnings-related UI schemes and financing of the system in comparable countries, that is, in other Nordic countries. This subsection is mostly based on European Commission's MISSOC Comparative Tables Database, which offers country specific data for the year 2013.

The Swedish earnings-related UI scheme resembles, in many ways, the Finnish system, even though its terms are often more stringent than in Finland. In Sweden, it is possible to receive 300 days of earnings-related allowance. An additional 150 days is granted for parents of children under 18 years of age. The employment eligibility condition is also stricter in Sweden than in Finland. The replacement rate of the earnings-related allowance is approximately 80 % for the first 200 days of unemployment and 70 % thereafter. The maximal possible daily unemployment allowance amounts up to SEK 680 (09/2013), which corresponds to EUR 78; there is a cap in the unemployment allowance, unlike in Finland. An average replacement rate for a single person is approximately 45 %, which is more than 12 pp. lower than the corresponding figure in Finland.

In Sweden the state also participates considerably in the funding of the system. In 2007, however, the financing of the UI was changed in such a way that a greater share of the funding was covered by membership fees. According to Eurufound (2013), the state's contribution was changed from approximately 87 % before 2007 to about 60 % after 2007. As a consequence, the membership fees were increased significantly, which resulted in a several hundred thousand UI fund members leaving the funds (see The Swedish Fiscal Policy Council (2011)). The membership fee of the UI funds has decreased significantly since 2007, but

the membership volumes have remained on a lower level.

The Norwegian unemployment benefit is always earnings-related; the amount of unemployment allowance is determined on the basis of the preceding year's income, or, alternatively, on the basis of preceding three-year average income. The potential benefit duration is, depending on previous earnings, either 52 or 104 weeks. Unemployment benefits in Norway are financed primarily by the state.

Denmark is known for flexicurity, which refers to the idea that the UI is strong, but termination of work relationships is relatively easy. The aim is to increase labor market flows and, thus, increase the dynamism of the labor market. The objective is also supported by comprehensive active labor market policies; Denmark spends the most resources on activation measures in relation to the GDP in OECD (OECD (2014)). In Denmark, as well as in Finland and in Sweden, only UI fund members are insured. Fund's membership is, however, voluntary. In Denmark, the duration of UI benefit is two years within a three year period and the replacement rate is 90 % of previous salary, but no more than 801 DKK per day (approx. EUR 101). In Denmark, the state contribution to the UI expenditures is rather dependent on the business cycle; according to Madsen (2011), the contribution has varied from 80 per cent in the early 1990s with high unemployment to 50 percent in the boom period. The rest is financed by a deduction made out of salary (8 %) and by UI funds.

As with Norway, also Iceland has an universal UI scheme in place. After the first two weeks of unemployment, it is possible to receive three months of earnings-related allowance equal to 70 % of previous wage, but no more than EUR 1,687 monthly. After the three months, an unemployed individual will receive unemployment assistance that amounts to ISK 172,609 (about EUR 1,070) per month. Before the financial crisis, in 2007, the unemployment rate in Iceland was 2 % and the employer contribution to the UI scheme was 0.65 %. In 2010, the unemployment rate was already 8 % and the contribution had risen to 3.81 % of gross salary.

Compared to other Nordic countries, the Finnish earnings-related UI allowance is not, on average, particularly high, even if it is somewhat high compared to other OECD countries. In Finland, however, for certain individuals, it is *possible* to receive very high daily allowances because the daily allowance is not limited. Setting a cap on a daily allowance could potentially lead to significant budgetary savings and improvements in incentives to work. Furthermore, in Finland, there is a discrepancy between those that pay the costs and those that receive the benefits. In Norway and in Iceland, this problem has been solved by

making insurance available for all - making the UI universal. In Finland, the UI scheme is heavily subsidized by the public sector; only 5.5 percent of UI expenditures are financed by membership fees, whereas in Sweden and Denmark the corresponding number is higher.

Table 1: Nordic countries and their UI schemes in 2013

	Employment Condition*	Potential Benefit Duration*	Average RR**	Cap*	Compulsion*	State Contribution in Funding
FIN	i) Worked min 18 hours/week in the past 26 weeks ii) Fund membership lasted at least 26 weeks	400/500 days	57.4 %	No	No	See figure 6, approx. 42 %
SWE	i) Worked min 80 hours/month for 6 months in the past 12 months ii) Fund membership lasted at least 12 months	300/450 days	44.7 %	Yes (SEK 680, or, EUR 78 per day)	No	The state finances approx. 60-70 % of total expenditure
NOR	-	52/104 weeks	64.9 %	no	Yes	State financed
DNK	i) Worked min. of 1924 hours (1 year) in the past three years ii) Fund membership lasted at least 12 months	A max. of two years in three years	62.0 %	Yes (DKK 801, or, EUR 101)	No	State finances a significant share of total expenditures (50-80 %). Business cycle dependent.
ISL	-	3 months	64.1 %	Yes (ISK 272,113, or, EUR 1687 per month)	Yes	Sate has no direct role (financed by employer contributions)

* Source: MISSOC

** Source: OECD, Tax-Benefit calculator. Replacement rate calculated for single person, who is earning average salary in 2012.

4 Estimation of the Participation Wage Rate

In the data used in this paper, the (pre-unemployment) wage rate that is the basis of the earnings-related UI benefit, is not an observable variable for the non-members. In order to correct for this data deficiency, the relevant wage rate is predicted using a linear regression model. This estimate is then utilized in the microsimulation exercise in section 5, when the basic unemployment allowance is replaced by the earnings-related UI allowance.

The pre-unemployment wage rate was also estimated with the Heckman selection model. In the end, however, we decided to use the linear regression model for four specific reasons: (i) the selection model is very sensitive to the model specification, that is, the Heckit model wasn't very robust, (ii) we were not able to find a sufficiently good identifying variable from our data, (iii) the linear regression model is simple and understandable and, thus, also transparent, and, (iv) the results don't seem to change even if more sophisticated methods are used. It would be optimal to be able to use a panel data in the estimations, but unfortunately we do not have data at our disposal. A slightly more in-depth discussion of participation wage rate can be found in Kotamäki (2014).

When predicting the pre-unemployment wage rate for the non-members with a linear regression model, it is implicitly assumed that members do not significantly and systematically differ from the non-members according to unobservable characteristics. If indeed this assumption is valid, in addition to the usual assumptions of the linear regression model, the regression model is applicable. Even if the assumption is not valid, the bias is likely to be rather small and the qualitative results are likely to hold. The regression model itself is such that the observable pre-unemployment wage rate is explained by gender, age, age squared, level of education, employer's sector, area of residence, marital status, logarithmic capital income and the number of children below the age of 7. Also two dummy-variables are added to the model that control for the participation in active labor market policies and adjusted unemployment benefits. The data used is the cross-section of 2012 data, that is used in the microsimulation model (see next section).

The estimated regression model implies that the wage profile is increasing with age. Furthermore, men's wage rate is, on average, significantly higher than women's. Finally, individuals receiving basic unemployment allowance (non-members) are predicted to have much lower wage rate than individuals receiving earnings-related benefit (members). This observation is clearly visible even though selection is not explicitly taken into account in the estimation.

5 Towards a More Inclusive System

This section looks at an imaginary system, in which the earnings-related UI would cover all employees - including those that currently aren't members of an unemployment fund and, therefore not insured. The system, thus, would provide all employees with earnings-related unemployment benefits given that the other relevant eligibility conditions are fulfilled. As the coverage would expand, also the costs of the system would increase. In the simulations that follow, the reforms are financed either by increasing the UI contribution rate or by introducing a cap on the unemployment benefit.

The models considered in this section are the following: i) the reform is fully financed by increasing the UI contribution rate, ii) the reform is fully financed by introducing a cap on unemployment benefits and iii) a combination of i) and ii). The benefit structure of the UI system doesn't change when the reform is fully financed by increasing the UI contribution rate. The system stays the same from the perspective of a recipient. A cap, on the other hand, limits the maximal amount of the allowance. Consequently, the cap cuts the benefit level of some unemployed and improves incentives to work, hence, possibly shortening the average duration of unemployment (cf. Tatsiramos and van Ours (2014) for a comprehensive review on benefit level on unemployment duration). Denmark and Sweden, for example, have a cap on unemployment allowance. The cost-neutrality of the reform could also be achieved in other ways, for example, the potential benefit duration could be shortened.

The system analyzed in this section can be called a universal unemployment insurance system, because no employee is excluded from the system. Of course, the other eligibility criteria are maintained. At the moment, the current system is such that employees that are not members of a UI fund as well as part-time workers (less than 18 hours per week) are excluded from the unemployment insurance.

Analysis is conducted with the Finnish microsimulation model, SISU.¹ The simulation exercise is static, that is, behavioral responses are not taken into account. A micro simulation model is very useful in this context for at least two reasons. First, the model data includes detailed information on, inter alia, unemployment benefits, which allows for a sufficiently detailed analysis on all relevant benefit types. Second, the microsimulation model can be used to model the earnings-related UI benefits to such individuals according to up to date legislation. The data used in this section is the data from the 2012 SISU microsimulation

¹See http://tilastokeskus.fi/tup/mikrosimulointi/index_en.html for a brief introduction.

model, which covers approximately 15 % of Finnish households, or, about 800,000 people.

The reforms have also effects on other social security benefits and income taxation due to changes in income levels. With the aid of a microsimulation model, these changes can be calculated in detail, taking, for instance, housing subsidies, social income assistance and income taxation into account. Microsimulation model is, thus, a rather useful tool when analyzing these types of cost-neutral reforms. The used algorithm is described below after which the results are reported.

1. First, a benchmark simulation scenario is calculated to which reforms are compared to. Benchmark scenario here is the simulation without any modifications. Trade union and UI fund member fees are removed from the definition of disposable income.
2. The data is modified so that non-members, that is, individuals receiving the basic unemployment allowance are given the earnings-related unemployment allowance. Unemployment funds are “removed” from the data by setting membership fees to zero. The unobservable participation wage rate is obtained using the methodology described in section 4.
3. Three cost-neutral reform scenarios are simulated and compared to the benchmark scenario.
 - a. In the first reform scenario the UI contribution rate is increased until cost-neutrality is achieved. Cost-neutrality is defined so that the change in simulated social security expenditures equals the change in aggregate tax revenue (incl. contributions). The end condition of the iteration is 0.01 percentage point accuracy with respect to UI contribution rate.
 - b. The second reform scenario (numerically) solves for a correct UI benefit ceiling that is cost-neutral.
 - c. The third reform sets an arbitrary UI benefit ceiling, after which the UI contribution rate is found that fulfills the requisite of cost-neutrality. This algorithm enables the calculation of all possible ceiling and contribution rate combinations.

Table 2 reports the results of the simulation exercise in 2012 currency and according to 2014 legislation.

In the benchmark scenario, employee UI contribution rate is 0.5 % and UI contribution

Table 2: Results

	Benchmark	Change	
		Reform Scenario I	Reform Scenario II
UI Contribution rate	0.5 %	+ 0.5 pp	0
UI Contribution Accrual	EUR 371.3 M	+ EUR 373.3 M	EUR 0.0 M
Membership Fees	EUR 614.0 M	EUR -185.3 M	EUR -185.3 M
Unemployment Benefit Expenditure	EUR 3,602.0 M	EUR + 167.9 M	EUR - 153.5 M
Maximal Benefit level	-	-	EUR 63 per day (EUR 1,355 per month)
Disposable Income	EUR 99.5 B	EUR 0.0	EUR 0.0
Gini Coefficient	26.90	-0.08	+0.01

accrual approximately EUR 370 million. The gini coefficient equals 26.90.

The UI fund payments reported in table 2 also include the amount that the TVR funds (ca. EUR 50 million in 2012). The funded share is a result of excess (or in the case of negative share, too low) UI payments compared to the actual expenditure. In the reform scenarios, this share has been included in the concept of cost-neutrality. The funded amount hasn't been increased, however, with the expansion of the UI, because the data includes an accurate information on actual unemployment. Hence, the level of payments can be set to match the costs, even though in practice the level of payments have to be set beforehand based on uncertain economic forecasts.

In all the reforms considered here, **earnings-related UI has been made universal**. Reforms are financed either by increasing the contribution rate, setting a cap on the unemployment benefit level or combining the two aforementioned instruments.

5.1 Reform I: Adjustment Through the UI Contribution Rate

The unemployed receiving basic unemployment allowance start to receive earnings-related unemployment allowance instead - their disposable income increases. Those who pre-reform fulfilled the employment condition, but weren't members in a UI fund, benefit from this reform. The employee contribution rate increases by 0.5 pp., which increases the UI contribution accrual up to approximately EUR 745 million.

Labor taxation tightens for those UI fund member employees that observe a higher increase in UI contributions than the assumed EUR 100 membership fee. Low income employees that are members in a UI fund observe a mild decrease in their tax rate. In the aggregate, labor income tax rate increases due to the increased contribution rate. Incentives to work deteriorate slightly due to the rise in unemployment benefits as well as due to the tightened labor income taxation.

Social income support and housing subsidy expenditures will decrease by approximately EUR 25 million mostly because the unemployed (pre-reform) non-members see an increase in their unemployment benefit. Unemployment benefit expenditures, on the other hand, will increase by approximately EUR 170 million. The reduction in gini coefficient of 0.08 is because the reform is effectively redistributive from employees to the unemployed; the reform as a whole will improve income distribution, but, on the other hand, also reduces the incentives to work.

5.2 Reform II: Adjustment Through the Benefit Level

In the second reform scenario, the accrual of UI contributions remains the same, but a cap will be introduced to the earnings-related unemployment allowance. The cap will be EUR 63 a day, which in Nordic comparison is fairly low. As a result, unemployment benefit expenditures decrease by EUR 150 million. UI benefit expenditures must decrease, because the removal of the membership fees is not compensated with a UI contribution increase. Due to factors relating taxation and benefits, the benefit expenditure decrease is, however, smaller than the sum of membership fees. Social assistance and housing subsidy expenditures decrease by EUR 20 million. Tax accrual increases by EUR 7 million, primarily due to tax deductability of membership fees.

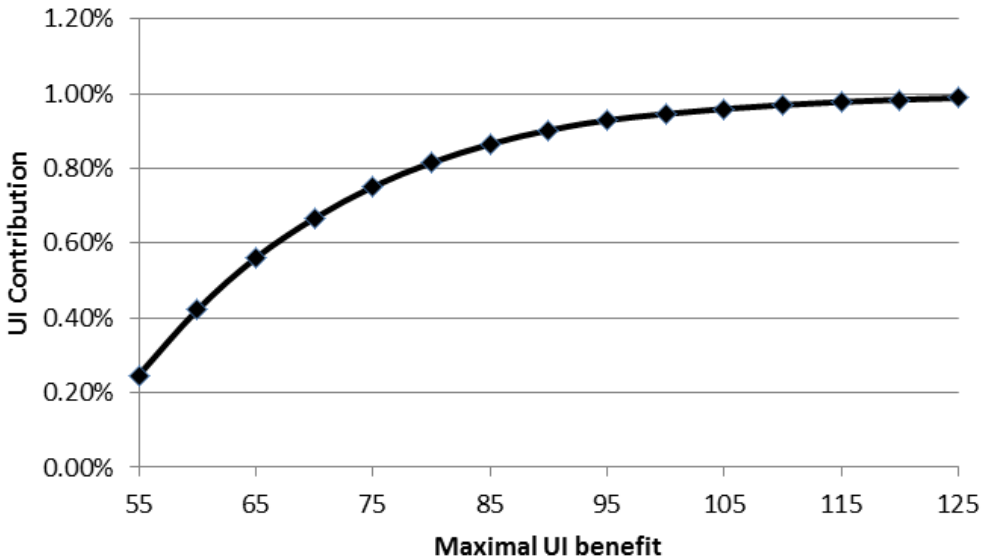
The first reform scenario is a transfer from employees to the unemployed, and, as a conse-

quence, income distribution, measured by the gini coefficient, improves. This second reform scenario, on the contrary, is a transfer from the unemployed receiving more than EUR 63 daily allowance to the rest. In the latter case, income distribution remains rather stable. Furthermore, the incentives to work also change. Those that pre-reform received higher than EUR 63 daily allowance observe better financial incentives to work, whereas individuals that received basic unemployment allowance see their work incentives deteriorate. The average unemployment benefit level will be lower, because the aggregate unemployment benefit expenditures decrease due to a cut in funding.

5.3 Reform III: Adjustment Through both UI Contribution Rate and Benefit Level

The third reform scenario modifies both the UI contribution rate as well as the UI benefit ceiling - retaining cost-neutrality. It is then possible to find all possible cost-neutral combinations of the UI contribution rate and the UI benefit cap. Income distributional effects of the combinations shown in figure 7 are somewhere between reform scenarios I and II.

Figure 7: Combinations of (daily) UI benefit ceiling and UI contribution rate (Reform III)



The contribution rate is determined to be 0.24, or, roughly half of the current fee, when the ceiling is set to be EUR 55. In this case, the gini coefficient rises by 0.05 points, that is,

income differences increase. Benefit ceiling of EUR 80, the Swedish model, would produce a contribution rate of 0.82 %. In Denmark, the benefit ceiling is approximately EUR 100, and if this was introduced in Finland, the contribution rate would converge to 0.95 % from the current 0.5 %.

6 Conclusions and Discussion

This study aims to draw attention to some problematic parts of the Finnish earnings-related UI scheme. The study considers earnings-related UI system and its financing. It's shown that there is a discrepancy between costs and benefits; the system is not actuarially neutral. A share of the unemployed (that are not members of a UI fund) contribute to the financing of the system, even though they do not get an insurance against unemployment. The topic is socially important, because out of all employees, approximately 15 % are not members of a UI fund. Hundreds of thousands employees are, thus, not insured, even though they directly contribute to the financing of the scheme.

The fourth section of this paper examines a variety of cost-neutral ways of re-organizing the system. Extending the earnings-related UI to non-members is explored. The reform can be achieved by, for instance, increasing the UI contribution by 0.5 pp. Consequently, this reform would be mostly financed by employees and the incentives to work would slightly deteriorate. At the same time, income equality, measured by the gini coefficient, would be improved. Here, the decision maker encounters the typical trade-off between equity and efficiency.

Cost neutrality can also be achieved by setting a cap of EUR 63 on earnings-related unemployment allowance. In this scenario, UI benefit expenditures would slightly decrease due to the removal of UI fund membership fees. The reform is mainly a transfer from the unemployed to the other unemployed. In practice, the level of daily allowance would be weakened for those that, at the moment, are receiving more than EUR 63, and improved, quite significantly, for those that are receiving only basic unemployment allowance.

The third alternative reform mixes the previous two models; a range of benefit caps and contribution rate combinations are calculated. Even though this third reform encases the first two reforms, it deserves its own treatment in order to show the trade-off between UI contribution and UI benefit level. The third alternative allows for setting the combination

of UI contribution rate and UI benefit cap flexibly to any given level that is attractive to the decision maker.

In all the three analyzed models, dependence on housing subsidies and social income support would be reduced. In addition, the unemployment benefit scheme would become more transparent and simpler as the basic unemployment allowance could be waived. There isn't much difference between labor market subsidy and basic unemployment allowance in the first place - especially after the removal of spouse's means testing in 2013 from the labor market subsidy. The removal of basic unemployment allowance would also reduce the administrative burden in the system.

This study has focused on how the earnings-related UI system could be reformed - to make it actuarially more neutral. Also horizontal equity has been considered. At the end of the day, a reform is up to voters' and decision makers' preferences. In all the reforms examined in this study, there are winners and losers. The analyzed reforms, however, provide the reader with new options on how to organize the system. The analysis provides the reader with information on how different systems shape the society in terms of, for instance, incentives to work and distribution of income.

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