Essays on behavioural response to tax-benefit reforms

Thesis submitted in fulfilment of the requirements of the PhD Degree in Economics and Management sciences

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Acknowledgements

First and foremost, I would like to thank my supervisors Tom Truyts and André Decoster, who have encouraged me and given guidance from the beginning of my PhD on.

Tom, I will remember your permanent good mood as well as your patience and kindness towards your students, from the early stages of their journey in "Economie 1 NL", to the latest steps of the PhD journey, that I observed and had the chance to experience. You also have an impressive understanding across a wide variety of topics, that goes well beyond the field of economics (how many times did you, in a coffee machine discussion, refer to a sportsman, fashion designer, tv-show or scientist that no one knew about?). It was also a pleasure to be the teaching assistant of your courses and transmit together the basics of economics and public economics to the younger generations.

André, I am grateful for your help from the early stages of my PhD on, where you introduced me to micro-simulation, labour supply models and allowed me the present my first results in front of the team of economists that you lead at the KULeuven. I am also particularly grateful for having put me in contact with researchers that shared interests with me, which allowed me to benefit from their knowledge: Sebastiaan Maas for introducing me to the RURO model as well as Toon Vanheukelom and Stijn Van Houtven for their expertise in micro-simulation and the Belgian tax-benefit system. Later on, it is also thanks to you that I met Ugo Colombino and Pia Rattenhuber, during research stays respectively at the University of Torino and at the United Nations University in Helsniki.

Next, I would like to thank the thesis committee, who accompanied me through the PhD journey. First, Bruno, thank you for sharing the knowledge in labour economics accumulated during your long career, through the course of Advanced Labour Economics you gave in Louvain-la-Neuve to PhD students, as well as through the comments you gave on my work at various occasions, that often gave me substantial food for thought and always allowed me to improve my work. I must also thank you for your presence at all the doctoral workshops we organized in Saint-Louis, but also those to which we participated in UNamur or UCLouvain, which is unique in PhD student memory and further reveals your strong consideration for

early-career researchers.

Gilles, it was always possible to enter your office to discuss a particular topic regarding the PhD, whether on an economic topic, a practical, strategic or administrative question. Your frank and often humorous answers made you a great person of confidence. Your perseverance and perfectionism also pushes our common research on UBI to higher levels of quality.

Koen, I appreciated your to-the-point and valuable comments on the first chapter of my thesis that you thoroughly reviewed and helped me to successfully publish. Thanks also for your availability and encouragements.

Tom P., you joined the committee later, but I really appreciated the time and energy you spent reviewing my work. I remember the first online meeting we had to discuss my second paper: I ended with four recto-verso pages of notes to improve my article, which made it one of the most productive meetings of my PhD. Your passion for understanding economic phenomenon around you and your general enthusiasm and joyfulness at the conference in London we met, will remain in my memory.

I am also very grateful to Yannick Vanderborght, for his open door, sharing his knowledge on the topic of universal basic income, and the book he wrote with Philippe Van Parijs, which is a gold mine for any researcher that wants to address the topic of universal transfers.

Saint-Louis University has been an amazing and stimulating place to work. The unique atmosphere, the variety of profiles and interest topics, the benevolence and warmth between colleagues, and the overall harmony of our research center has rendered the years spent here fantastic. I will remember my cheerful E6 office mate Rodrigo, switching from an hilarious gossip to a deep reflection about corporate lobbying in a blur. Together with my polymath and generous colleagues from our twin E7 office Samuel en Jerôme, and later on Emilia and Astrid, he has rendered that little corner of St-Louis, on the fourth floor, a place where I felt perfectly well. I have to thank the irreplaceable comrade Arnaud for this desk, freed up when he decided to install himself in a humid monk cell in the staircase to focus on his cliometrics. His imitations and his Radio CEREC entertaining us during the lockdown, have lead us burst into laughter numerous times. Pierre, with whom I enjoyed to

play board-games and roam the streets of Köln, as well as Hugues, the joyful yes-man who can project datasets in higher-dimensional spaces, Youssef, the curious philosopher, Remy and Lyna, complete this remaining batch of great pre-covid PhD students. Later joined by an even amazing batch of fresh recruits, David, Audric, Emilia, Francesco, Ilyass, Astrid, Maxime, Daniel, Jean-Paul, Carlos and Rory, who will keep the standards high. I'll remember the epic football matches, the zombie hunt, the board-game nights and numerous other events spent together.

Thanks to the academic and administrative staff of the CEREC too: Hélène, Cédric, Alexandre, Ana, Julie, Xavier, Anouck, Wim, Bertrand and Jean-François, for their openness', reachability and for organizing all the activities of our research center. I also wanted to thank former colleagues, Christophe, Alessandro, Arnaud Dorsi, Tanguy, Fanny, Simon, Kristel, Abdel, Ata, Sylvain E. and F., Juni and Huguette, for their presence in St-Louis that contributed to the great work and after-work environment during those years. Finally, I want to thank Daniel and Jesse, that rendered my research stays in Torino and Helsinki memorable.

Those years were also enriching years on a humane level. I have a special thought for my "coloc's" with whom I spent most of my time during the beautiful and intense years at Lazare Belgique: Raja, Abdel, J-C, Gass, Nico, Thierry, Yann, Gui, Geof, Armando, Laurent, Benoît, Irénée, Thomas, Stéphane and Augustin. I add to those names, those other close and old friends that come to my mind and that I had the priviledge to spend plenty of quality time with in the last years: James, Alexis (x2), Alice, Laurent (x2), Tessa, Ardoin, Alexandre, Céline, Pierre, Thomas (x2), Sebastien, Joachim, Astrid, Emilie, Maxence, Antoine, Laureline and Ségolène.

I want to dedicate this last paragraph to the people I love the most, my family, for their unconditional love and support. To my parents, my siblings Joseph, Laurent and Natacha, my almost-siblings Marité and Jean-Benoît, my family-in-law and above all my wife Nathalie, thanks for having made that period of my life amazing.

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Introduction

The path that led me to do a PhD in economics was a bit unexpected. After a bachelor's degree in civil engineering that gave me a basic understanding of the natural phenomena that surround us, my curiosity gradually shifted to understanding the interactions between economic agents in complex societies. At the time, the financial crisis of 2008 was still fresh in the memory and the European debt crisis was ongoing. The Arab spring, one of the most striking geopolitical events that occurred during my studies, was also to a large part due to worsening economic conditions. The unprecedented economic and societal developments were manifold, the analysts and experts commenting those events were plentiful, and the open questions were numerous.

This led me to abandon my master's degree in electronics to pursue a research master's degree in economics, which eventually led me, after a diversion in the energy sector and a round-the-world bicycle journey, to apply for a teaching and research assistant position. The field of public economics, which mainly covers the broad questions of why and how the state should intervene in economic markets, has always been my favourite area. Faced with the important structural inequalities and poverty rates that seem to prevail in most parts of the world, as well as the disruption of many of the precarious equilibria governing economic relations in the recent years, I wondered whether and how governments could help building a stable, equitable and sustainable economic environment for their populations. One topic that particularly tantalized me at the start of my PhD, universal basic income (UBI) policies, touches on many contemporary economic issues and has become a guiding thread in my research.

1.1 A not so kooky idea

The first time I heard about UBI, from an old university friend shortly after my studies, I reacted in a way I have often encountered in recent years: "It sounds utopian and hardly affordable !". Indeed, how could a state distribute money unconditionally to all citizens without curbing the labour supply, raising taxes considerably or generating inflation. I quickly filed universal basic income in the box of kooky ideas where it remained for some time.

Some of my later questionings led me back to the topic. One of these questions is, as an amateur futurist who likes to imagine what the world will look like in 10, 20 or 50 years' time, what would be the place of work and how wealth would be shared. A long-running debate among economists is whether new technologies reduce the need for human labour. Some argue that job losses are offset by new jobs in sectors that emerge with those new technologies, as well as by increased demand for goods that become more affordable, keeping labour demand and employment rates more or less constant. Others believe that new technologies could replace a significant portion of human labour in the medium to long term, by becoming increasingly capable of outperforming human skills at ever lower costs.

Those who believe in the first scenario often point out that technological unemployment has been wrongly predicted for decades. In 1931, for example, the eminent economist J.M. Keynes wrote a short essay in which he predicted that a hundred years later people would work no more than 15 hours a week and spend the rest on leisure [Keynes, 1931]. Today, Keynes' famous 15-hour week is far from reality, and new employment opportunities have emerged with the demand for new goods and services associated with our modern standards of living.

Those who believe that automation will one day displace individuals from the labour market argue that recent revolutionary technological developments are different from those of the 20^{th} century, as they now allow machines to surpass humans in both dexterity and discernment, thanks to progresses in robotics, connectivity and advanced forms of artificial intelligence. A striking example is the likely advent, in this decade or the next, of automated vehicles, which may make millions of transport jobs obsolete. Transport alone is responsible for more than 11.6 million jobs in the European economy, or about 6% of all jobs [Eurostat, 2019]. Economists have also projected that about 47% of US jobs could disappear fairly quickly [Frey and Osborne, 2017]. Another contemporary argument supporting this position is that our planet can hardly support an ever-increasing production of goods. The eco-system is not robust enough to support everyone's greed and a levelling off of production combined with an increase in labour productivity is likely to lead to a decrease in the demand for labour.

If this second prediction is true, as I tend to believe, new ways of redistributing wealth equitably will probably be needed, as the share of value created in the

economy flowing to the owners of capital will most likely increase at the expense of the labour income share. In addition, the shrinking labour income could disproportionately be captured by high-skilled workers. As MIT researcher Andrew McAfee expressed it [Bernstein and Raman, 2015]: "There's no economic law ensuring that as technological progress makes the pie bigger, it benefits everyone equally". In this context, a universal basic income system, possibly combined with an increase in subsidized employment and work-sharing measures, appears to be a simple and natural instrument for redistributing income from capital owners to the growing share of the population that does not find a place in the traditional labour market.

1.2 An evolution through time

But the idea of a universal basic income, even if it has gained ground with the revival of debates on technological unemployment, is a much older idea, with proposals appearing as early as the 18$^{\text{th}}$ century, in the writings of the philosophers Thomas Paine and Thomas Spence. Thomas Paine observed that in civilised societies, in contrast to primitive societies, some people live in states of extreme misery and wretchedness. He considered that, since "every man, as an inhabitant of the earth, is a joint proprietor of it in its natural state", every proprietor of cultivated land owed to the community a *groundrent*, that should be redistributed equally in the form of an unconditional income. He proposed to levy this *groundrent* on bequests and to finance a lump sum transfer for people aged 21, as well as an annual basic income for people aged 50 and over [Paine, 1795]. Thomas Spence also saw the UBI as a matter of social justice and an anti-poverty tool, but went further by proposing to re-collectivise arable land and use its rent to fund a periodic, universal basic income for the members of the community [Spence, 1797].

More recently, in the context of strained welfare systems that sometimes fail to provide adequate income and job securities, the idea was revitalized by many philosophers and economists, of which one can certainly cite Anthony Atkinson [Atkinson, 1995] and Philippe Van Parijs [Van Parijs et al., 1992]. Different political parties, from different parts of the political spectrum have also shown interest in the idea. The first traces of UBI in Belgian political programmes dates back to in mid-80s, where ECOLO and AGALEV (green parties) introduced the scheme in their medium term objectives, but without elaborating on the exact contours the scheme could take. A concrete proposition was made in 1997 with the foundation of the party Vivant, by entrepreneur Roland Duchâtelet, whose main objective was

to introduce a UBI in Belgium. He proposed to finance his UBI, of 500 euros per month[1], by increased and modulated VAT rates [Van Parijs and Vanderborght, 2019]. More recently, Ecolo has integrated the idea of UBI in its 2019 elections programme. Their proposition was to give a 460 euros UBI to young adults aged 18 to 26, replacing child benefits and tax credits for dependent children [LLB, 2019]. In 2022, Les Engagés (ex-Cdh, centrist party), also included a UBI[2] of 600 euros monthly in their programme [Les Engagés, 2022].

Besides those proposals, some other political personalities, as Georges-Louis Bouchez (president of the MR, liberal party) and Philippe Defeyt (Ecolo) are active in promoting the debate around UBI. The first one imagined a UBI of 1000 euros monthly for the working-age population, and 1600 for retired individuals, financed among others through the suppression of most existing benefits and small healthcare reimbursements [Bouchez, 2017]. The second one proposed a UBI of 600 euros monthly for adults and 300 for children. This scheme would be financed mainly by the suppression of child benefits and related tax credits, the tax-free allowance, the marital quotient, a reduction of other benefits and increased taxes on high pensions [Defeyt, 2017]. Both also include consequent administrative savings in their estimations.

The arguments of proponents of basic income schemes are in fact diverse. Many rely on some form of justice arguments comparable to the ones developed by Thomas Paine. One can add to those that according to some UBI proponents, UBI also is a way to recognize the contribution to the well-being and prosperity of the society of individuals outside the labour market, as stay-at-home parents. In addition, UBI is argued to be an efficient instrument to guarantee real freedom to all individuals, by allowing them to refuse undesirable jobs or increasing their negotiation power with employers. Regarding economic dynamism, it has been argued that basic income could strengthen entrepreneurial spirit, by providing income security in the early stages of the development of an undertaking, and loosening financial constraints. In addition, universal basic income can under certain conditions importantly reduce participation tax rates and hence unemployment traps, compared to existing welfare schemes. Finally, as developed earlier, it is sometimes seen as an efficient remedy to

[1] Children, young adults and retired would receive UBI of 125, 275 and 750 euros per month respectively. The 500 euros basic income represented 23 percent of the GDP per capita at the time.

[2] Which could however be conditional on "participating" to society: raising children, taking care of an old parent, volunteering, etc. This type of basic income is sometimes referred to as a "participation income" in the literature.

the worsening inequalities due to an ever-increasing automation and robotization of the economy.

But despite various scientific contributions exploring those aspects, many questions remain unsolved, and the main reason is that a nation-wide full basic income scheme has never been implemented, in any country. Only short-term, small-scale, often partial (i.e. not sufficient to live only from it) UBI schemes provide some clues. Among the open questions, three major ones fall in the field of economists: how could and should a UBI scheme be financed, how well does it work as a poverty alleviation or inequality reduction tool and how does it affect behaviour of individuals, especially in terms of labour supply.

1.3 Tax-benefit systems and behaviour

It was natural for me to turn to arithmetic microsimulation models to answer the first two questions: first by getting acquainted with EUROMOD, and by contributing to the early stages of the home-grown BEAMM model. These models can be thought of as big calculators that compute the taxes that individuals should pay and the benefits to which they are entitled, based on their gross incomes and household characteristics. By appropriately modifying the parameters of the tax and benefit rules, these models can predict the economic effects that a reform would have on each individual. Summing up the results provides estimates of overall changes in income distribution, inequality, poverty and the government's fiscal position. The third question however opened a wide field of economic literature to me, that explores how individuals adapt their behaviour when facing changes in their choice (or opportunity) sets, following changes in the tax-benefit system they are subject to. Four different and complementary approaches are usually taken to shed light on those questions. Those approaches are walked through in the next paragraphs, with some examples of research conducted to address UBI-related questions.

The most straightforward is probably surveying a sample of individuals about what they would do if tax X or benefit Y would be introduced or reformed. An example of such a survey exploring the effects of a UBI is the one conducted by Dalia Research [Dalia Research, 2017], that finds that 3% of individuals surveyed would stop working and 8% of individuals would work less following the introduction of a universal basic income. They also find that 17% of individuals would spend more

time with their family and 7% would do more volunteering work. Stated preference surveys however suffer the weakness that one cannot be sure of our reactions to changes, until we actually face them.

An other option is to exploit natural experiments, i.e. situations where some individuals are exposed to choice sets that have similarities with those that would prevail under a tax-benefit scheme of interest. Those situations arise in a variety of contexts. An example of a famous natural experiment mentioned in the universal basic income literature is the Cherokees' casino dividend programme. This programme began in 1996 and provides a portion of the profits from a casino on a reservation to all tribal members through annual dividends of about USD 4,000 per person per year. [Akee et al., 2010] use a difference-in-differences approach to estimate the impact of the casino transfer payment on labour supply. They compare Native American families that receive the transfers to non-Native families, before and after the payment started. They find no impact of the payment on labor supply, whether on working at all or on working part-time. [Jones and Marinescu, 2022], for their part, study the effect of the state-managed Alaska Permanent Fund's unconditional and annual dividends. This fund, financed by the important Alaskan oil revenues, provides unconditional transfers that mostly oscillated between USD 1,000 and USD 3,000 annually (in 2021 values) to all adult Alaskan citizens, since 1982. They use citizens of other states as control, and find no effect on employment rates, and a slight increase in part-time work. An other original example is the analysis of the behaviour of individuals that won Win-For-Life lotteries, which is the approach taken by [Marx and Peeters, 2008]. Their results point to no extreme consequences of introducing a UBI akin to Win-For-Life, with very few changes regarding quitting work, diminishing working time or becoming self-employed. Internal and external validity of those empirical studies however are often limited. Inferring causal links between UBI-like transfers and behaviour requires having control-groups (similar individuals, not benefiting from the transfer) to compare outcomes with, which are not always straightforward to find. Moreover, those natural experiments often concern specific demographic groups in specific contexts that are not necessarily representative of the country's population.

Experiments can also be controlled (those are in some cases also called pilot programmes), in the sense that the individuals are assigned to the treatment and control groups by the researchers. Controlled experiments have the advantage of minimizing the risks of confounding variables, that bias results, but necessitate im-

portant means to be put in place, and often raise ethical questions. This was the approach taken by the Finnish government, that ran an experiment from 2017 to 2018 in which 2000 unemployed were offered a UBI for two years. Small but fragile positive effects on employment were found [Verho et al., 2022]. It is also the approach chosen by GiveDirectly, an NGO that studies UBI effects by distributing unconditionally cash to inhabitants of some poor Kenyan villages, in an ongoing 12-year experiment [GiveDirectly, 2022].

The fourth option is to model and estimate individuals' utility functions, that represent their preferences over a domain of choice options, in order to predict their behaviour when facing a different choice set on that domain. Those utility functions can be estimated on administrative or survey data, which contain some clues about preferences of the observed or surveyed individuals and households. For example, the number of children could reveal preferences regarding the presence of children, time worked could reveal preferences regarding the "leisure - labour supply" trade-off, etc. The difficulty however is that choice (or opportunity) sets are unobserved, and therefore need to be imputed. In the case of labour supply decisions, choice sets can be estimated using the arithmetic microsimulation models mentioned above, by using them to calculate the leisure - labour supply combinations supposedly available to the individuals given their estimated earnings capacity, their demographic characteristics and the tax-benefit rules.

1.4 Explored questions and findings

The topic of how individuals and households react to tax-benefit system changes became the common denominator my PhD Research. In the first phase of my PhD, I studied how labour supply reactions to tax-benefit reforms could be predicted by taking the fourth approach mentioned above and worked on the construction of a so-called "random-utility - random-opportunity" (RURO) model for Belgium.

This model allowed me to estimate the effects of an extension of the *work-bonus*, in Chapter 2. That research starts from the observation that Belgium has implemented, following the example of other countries, in-work benefit policies since the early 2000's, with the objective of increasing employment rates and fighting poverty. This in-work benefit takes the form of a reduction of social security contributions and taxes for individuals that have low hourly wages. I studied the effects extensions of those benefits would have both on labour supply and welfare and found

that further increasing the benefits would mostly slightly increase labour supply and welfare of low-to-middle income deciles, but at very high net cost per job created.

My subsequent research, detailed in Chapter 3, focused on cohabitation decisions. In most European countries, poor cohabiting adults are eligible to lower per capita social assistance benefits than single adults, as they are supposed to benefit from economies of scale in household expenses as renting, heating costs, etc. I show that this aspect of social assistance varies strongly within Europe and use this variation to identify a possible causality of social assistance scheme parameters on cohabitation decisions. The statistical analysis suggests that higher benefits for cohabitants decrease the number of poor one-person households significantly. I also discuss the consequences of this result on government expenditures, estimate the net cost of marginally increasing benefits for cohabitants and touch upon externalities that strengthen the case for higher cohabitant benefits in countries with strongly differentiated rates. This research can be seen as a natural experiment, the second of the four approaches mentioned in previous section, in which individuals becoming poor adults (either by losing their source of revenue, either by reaching majority without revenue), experience different incentives to cohabit, based on the country they live in. The ratio of benefits cohabitants are eligible to, to the benefits singles are eligible to, is used as multi-valued treatment, and different control variables are included in the statistical model to take into account that populations and societal norms differ.

In Chapter 4, I finally explored the labour supply effects of the introduction of a UBI scheme in Belgium. To give new insights on the question of how the labour market and more broadly the society could be impacted, I gave special attention to the time allocation consequent to labour supply changes, i.e. what individuals would do with the freed up time when decreasing worked hours, or what activities they would give up when increasing worked hours. These activities, that are usually categorized as "leisure" by economists, encompass a variety of productive activities, that are often valuable not only to the individual but also to the society. This is done by imputing time allocations on various activities in the base and reform situations, using a fractional multinomial logit model estimated on time-use data.

Although there are still grey areas that need to be further investigated and validated, the policy implications of this research are diverse. Chapter 2 indicates that

an additional reduction in taxes and social security contributions for low hourly earners creates a large deficit and only slightly increases employment rates. While increasing the purchasing power of low-wage workers is certainly a positive aspect of the policy, my research points out that extending the work-bonus is probably far from being cost-effective, as some politicians like to think on the basis of very optimistic forecasts of increased employment rates. Chapter 3 also has important policy implications, as it shows that poor cohabitants in Belgium are strongly disadvantaged compared to other European countries. Moreover, it is shown that making the system slightly more favourable for them would be a very cheap policy and would allow many individuals to choose their cohabitation status without fearing large losses in purchasing power. Furthermore, it can be inferred from the results that UBI policies, which grant the same minimum income to singles and cohabitants, could strongly increase the share of poor individuals who choose to cohabit. Chapter 4, however, is more exploratory. Although many politicians or political parties have expressed interest in the UBI idea, their visions of the scheme are far apart, if not incompatible, and it is therefore unlikely that a UBI scheme will be implemented in Belgium in the short term.

I wish the bravest readers a pleasant journey through the next chapters, and hope that the topics covered, which are the most developed of the many research questions I have explored during my doctoral odyssey, will be instructive and insightful.

In-Work Benefits and Labour Supply

2.1 Introduction

Persistent high unemployment rates, especially for low-skilled workers (Figure 2.1), have an important impact on the government budgets, by on one hand lowering the tax revenues and social security contributions, and on the other hand increasing social security expenses as unemployment and social assistance benefits. An important public policy question is therefore if and how those high rates could best be reduced by means of adequate active labour market policies.

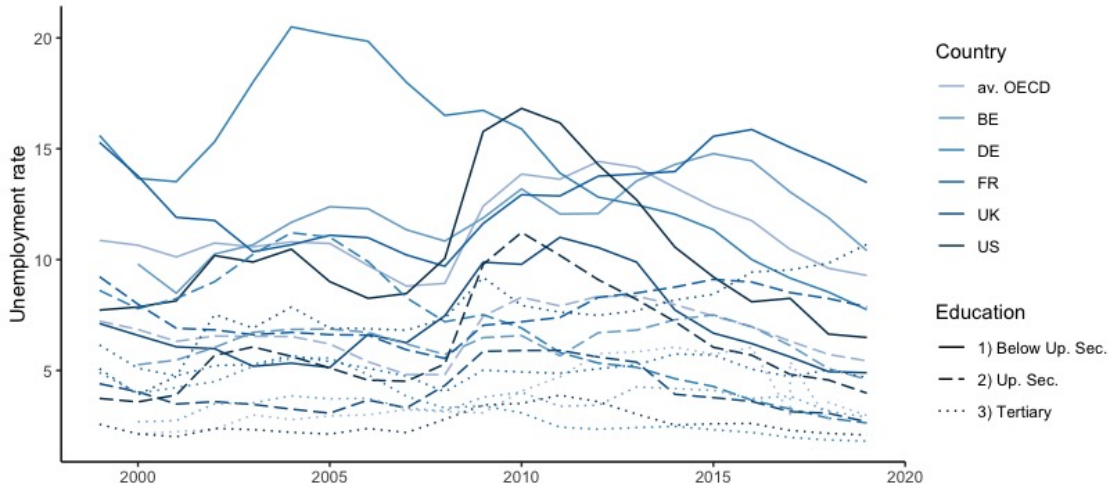


Figure 2.1: Unemployment rate by level of education (Source: OECD)

Active labour market policies are, in their broad definition, government programmes that intervene in the labour market to help the unemployed find work. They can be divided in five categories: coaching and controlling unemployed in their job searches, training schemes that aim at reducing potential qualification mismatches, flexibilization of labour regulations,[1] direct creation of public jobs and tax-benefit reforms that consist of rendering hiring more affordable for employers and working more attractive for unemployed. Measures of this last category typically consist of diminishing labour income taxes and social contributions (or increasing subsidies).[2] When those measures are specifically designed with the pur-

[1] Note that flexibilization can concern wage regulations, hours regulations, conditions of dismissal, ... and that less regulation is not necessarily synonym of more jobs: there is for example no unanimity about the effect of minimum wages on employment ([Neumark and Wascher, 2006])

[2] Other measures in this category consist for example of lowering unemployment benefits or rendering

pose of providing an income supplement to those that work, they are called "in-work benefits" (IWB). IWB are usually presented by policy-makers as a financial boost for workers by "making work pay" that has the advantages to reduce unemployment traps[3] and to create large compensatory cost effects due to the increase in employment rates. By targeting disadvantaged groups on the labour market, IWB also have the attractive feature of often redistributing income, and seem to therefore combine both equity and efficiency improvements.

Two main paths can be taken regarding eligibility to IWB: using labour income (at individual or household level) in the eligibility test, or using hourly labour income[4] in the eligibility test. Most in-work benefits (see section 2.2), are designed according to the first approach. The French "Prime pour l'Emploi" (PPE) and the Belgian "Work-bonus" (WB) are examples of the second approach. While both approaches increase the attractiveness of working situations relative to being unemployed or inactive, they have different consequences on the net wages of working options. The first approach creates part-time traps, which is a situation in which a worker has an incentive to work less in order to become eligible to an earnings-tested benefit, or seen differently, a situation where a part-time worker has little incentive to work more due to the phase-out of IWB. To some extent, the scheme also creates low-wage traps, which is a situation where an increase in gross wage will be passed through only to a limited extent to the net wage due to the phase-out of the IWB. This makes it expensive for an employer to increase the net wage of an employee, and reduces the relative attractiveness of higher-paid jobs, giving distorted market-signals to workers. The second approach aims at shifting the reward from low-earning to hard-working but low-earning capacity individuals, by linking the benefit level to hours of labour supplied and restricting eligibility to low hourly wages. This reduces the part-time trap but worsens the low-wage trap, and thus represents a different choice of trade-off between the indirect effect of incentivizing part-time work vs. low-paid work. Besides this dimension, IWB can vary with respect to eligibility thresholds, tapering mechanisms, duration, etc.

Our purpose is to study the effects of in-work benefits targeting individuals having a low hourly wage. For this, we run a partial equilibrium analysis by simulating

them decreasing over time.

[3] An unemployment trap is a situation in which a generous social security scheme (relatively to wages) lowers the financial difference between working and being inactive.

[4] Or equivalently, using "full-time equivalent" (FTE) labour income, the gross salary an employee would receive if he worked full-time at his gross hourly wage.

3 hypothetical reforms that increase the generosity of the Belgian WB and analyzing resulting effects on employment, using a random-utility random-opportunity model estimated on SILC data. Besides complementing existing research and providing a useful benchmark for countries with similar economies considering such benefits, we shed light on model assumptions of previous simulations that possibly led to an underestimation of the negative labour supply reactions and budgetary costs of such schemes. Moreover, our model uses cross-sectional datasets of different years, which allows to use policy variations over time to improve the identification of the model. Lastly, our study includes a welfare analysis, essential for a thorough policy evaluation.

The paper is structured as follows: Section 2.2 discusses briefly past research on in-work benefits, and gives an overview of the roll-out of those kind of policies in Belgium. Section 2.3 details the current Belgian WB scheme. Section 2.4 presents the labour market model that is used to simulate the reforms. Section 2.5 presents and discusses the effects of our different reforms on labour supply and income distribution. Results are then compared with previous research. Section 3.6 concludes.

2.2 State of research

2.2.1 International examples of in-work benefits

The most famous and researched examples of in-work benefits are the US Earned Income Tax Credit (EITC) and the UK Working Tax Credit (WTC). Besides those two schemes, we also give some attention to the French PPE, which shares the feature of the Belgian WB of targeting benefits to individuals having low hourly earnings. Other IWB that received significant attention from academic researchers are the German Mini-jobs reform in 2003 and the Self-Sufficiency Project experiment in Canada in the 90's. A detailed overview of IWB policies in OECD countries and a summary of research findings are available in [Immervoll and Pearson, 2009].

EITC The EITC, enacted in 1975 and still lasting, is a refundable tax credit for low- to moderate-income working individuals and couples. In this scheme, the amount of the benefit depends on a recipient's earned income and number of children. Most studies (see for example [Crandall-Hollick, 2016] for a detailed overview) indicate that the scheme has a positive effect on the labour force participation of

single mothers.[5] Regarding the impact on married secondary earners' decisions to start working, research still is inconclusive. Looking at the intensive margin, most of the empirical evidence indicates the EITC has had a negligible to small effect on the number of hours unmarried people worked, while it has had a negative effect on the hours worked by secondary earners. Lastly, as the EITC was not primarily focused on childless adults, their opportunity sets are less affected and little information has been published regarding potential effects on their labour supply decisions.

WTC The ancestor of the current WTC was introduced in Britain in 1970, under the name Family Income Support.[6] The WTC is similar to the EITC but is more generous and is based on net (rather than gross) family income. It has been shown consistently (see [Brewer et al., 2006] for a discussion) across a number of studies that the scheme increased participation of single parents significantly. Moreover, it has been estimated that WFTC reduced labour supply of married women, both at the intensive and extensive margin, but that this was more than compensated by labour supply increases among married men.

PPE The PPE was introduced in 2001, reformed a couple of times in the later years, and lasted until 2015, where it was merged with an other IWB, the "RSA activité", into the "Prime d'activité". It's value is lower than the EITC and WFTC schemes, culminating at a few hundreds of EUR per year. Eligibility is based on full-time equivalent earnings. The benefit also depends on the family situation, and the scaling with respect to working time is not linear, so that the scheme still creates a part-time premium. Almost all studies (see [Sterdyniak, 2007] and [Arnaud et al., 2008] for a detailed overview) find positive but very small employment effects of less than 0.5 percentage points. [Stancanelli, 2008] even suggests employment losses among married women and no significant gains for non-married women.

[5] However this wide consensus among economists has recently been affected by new study of Henrik Kleven [Kleven, 2019] showing that employment increases align closely with the confounding effects of welfare reforms and a booming macro-economy. He concludes that the case for sizable extensive margin effects of the EITC is fragile.

[6] The scheme changed a couple of times, and its name changed successively to Family Credit and Working Families Tax Credit, before its final name Working Tax Credit (combined with Child Tax Credit). Most of the evaluations of employment effects refer to the period where the IWB was named WFTC, and was significantly increased.

2.2.2 In work benefits in Belgium

History of in-work benefits

The first in-work benefits were deployed at the turn of the century, with the goal of reducing structural unemployment. They were introduced on the one hand through a reduction of social security contributions in December 1999,[7] and on the other hand through a refundable earned income tax credit, gradually phased in and phased out and conditional on working at least 13 hours a week, in the summer of 2001.[8] Both reforms were intended for low-wage earners. In 2005, those two policies were abolished and replaced by the WB, an extended social security contribution reduction for low-wage earners. The main reason was that the WB, by depending on full-time equivalent labour income instead of actual labour income, avoided part-time traps. Also, the WB had an immediate effect on monthly net earnings, while the tax credit was only computed after the fiscal year: by moving towards an extended WB, the policy maker aimed to render the link between working and the benefit more obvious, to increase the perception of work incentives.

In 2007, using fiscal freedom gained in 2001 in the Lambermont agreements, the Flemish region introduced the "jobkorting" (JK).[9] The JK gives a tax credit to those people who earn more than 5500 EUR/year, that phases out between 21.000 EUR/year and 22.250 EUR/year. As it was the case for the first federal income tax credit, eligibility to the JK scheme depended on actual earnings. In 2011 however, for budgetary reasons and after a threat from the European Commission to start a procedure against the measure at the European Court for discrimination,[10] the measure was abolished.

In 2011, the WB was complemented with a "fiscal work-bonus" (FWB) that reduces the personal income tax for those eligible to the WB, to further reduce unemployment traps. The level of the FWB is a fixed rate of the WB. In 2015 the government increased the WB and FWB schemes further, as part of a broader tax-shift aiming at reducing the tax burden on labour.[11]

[7] Loi du 20 décembre 1999 visant à octroyer [un bonus à l'emploi sous la forme d'] une réduction des cotisations personnelles de sécurité sociale aux travailleurs salariés ayant un bas salaire [et à certains travailleurs qui ont été victimes d'une restructuration].

[8] Loi du 10 août 2001 portant réforme de l'impôt des personnes physiques.

[9] Note that this measure is not the same as the "Federale Jobkorting", the name given to an increase in the amount of deductible professional expenses.

[10] The measure was accused to discriminate people working in Flanders but living outside Flanders, as those would not have the right to the jobkorting.

[11] Other measures part of this tax shift include: decreases of the personal income taxes through expan-

The Flemish government announced in September 2019 the introduction of a large in-work benefit scheme in Flanders, the "Jobbonus" (JB). According to the Flemish government, the policy will be one of the main measures to get 120.000 more people at work in Flanders. At the time of writing, the exact parameters are not known, but the government gives the number of 50 EUR extra net monthly income for low-wage earners, and a complete phase-out at a gross monthly wage of 2500 EUR. They estimated the budget for the measure to be around 350 million EUR yearly.

Research findings

As explained in the introduction, Belgian in-work benefits are quite innovative in the sense that they depend on the full-time equivalent gross labour income and not on the actual labour income, which is supposed to create less negative labour supply incentives at the intensive margin of the labour market. [Orsini, 2006a] and [Dagsvik et al., 2011] discuss this particular feature more in detail and analyze for the first time rigorously the effects of the Belgian WB. They use a discrete-choice labour supply model and compare the policy with some alternative situations, including the tax credit on low earnings that was temporarily implemented in 2001-2004. They conclude that both measures have a positive impact on labour supply but that the WB is more efficient as it avoids the "part-time trap" created by the tax credit system.

[Decoster and Vanleenhove, 2012] analyze the Flemish Jobkorting. The authors compare the JK with 2 alternative scenarios of JK and show that in all three types of tax credits, labour supply reactions are negative at the intensive margin, and positive at the extensive margin, with a slightly positive net effect. However, the compensatory effects (specifically tax and social security contributions increases due to increases in labour supply) are small and the costs of the measure therefore important.

[Vandelannoote and Verbist, 2016][12] analyze various types of hypothetical in-work benefits, playing with income thresholds, tapering mechanisms, individual or

sions of the brackets and the abolition of the 30-% bracket, decreases of the social security contributions for employers and self-employed, the introduction of an increased and uniform tax free amount, etc.

[12] See also the reworked version [Vandelannoote and Verbist, 2019].

household schemes, etc., to give an overview of how the design of the scheme can lead to different effects on poverty and employment. They conclude that such benefits imply a trade-off between poverty reduction and labour market activation which has to be considered in light of the aim of the policy. Regarding labour market activation, individual schemes with an income threshold and a tapering-in mechanism seem to work the best, while household schemes perform the best when looking at poverty reduction.

Regarding the future Flemish Jobbonus, [Decoster and Vanheukelom, 2019] question to what extent those benefits will be effective in increasing labour supply, given already existing federal in-work benefits, and underline the risk of low-wage traps due to high effective marginal tax rates for low-wage earners. Moreover, they show that the purchasing power gains are spread over the income distribution and not concentrated at low disposable income households. Finally, they estimate the cost of the measure at 174 million EUR, quite less than what the Flemish government announced.

2.3 The Work-Bonus: policy details

The WB is a Belgian in-work benefit that consists of a reduction of social security contributions for individuals with low earning capacity. The level of the WB depends on the full-time equivalent (hereafter FTE) gross salary, denoted W_{ft}, of the employee: for FTE gross salaries lower than a certain threshold θ_1, the WB is equal to a fixed amount A weighted by the work regime, calculated as $\frac{L}{L_{FT}}$ where L is the number of hours worked and L_{FT} corresponds to a full-time regime. For FTE gross salaries higher than θ_1 the fixed amount is tapered out at a rate of ρ_1, until it reaches 0 at θ_2. As explained in 2.2.2, the WB is complemented with a fiscal work-bonus. The fiscal work-bonus is a tax reduction that is calculated as a percentage ρ_2 of the WB. The WB and FWB granted can thus be written:

$$WB = \begin{cases} A.\frac{L}{L_{FT}} & : W_{ft} \leq \theta_1 \\ (A - \rho_1.(W_{ft} - \theta_1)).\frac{L}{L_{FT}} & : \theta_1 < W_{ft} \leq \theta_2 \\ 0 & : \theta_2 < W_{ft} \end{cases} \tag{2.1}$$

$$FWB = \rho_2.WB \tag{2.2}$$

The values for the above-mentioned parameters for white-collar workers for the

year 2016 are given in table 2.1.[13] Note that the WB cannot exceed social security contributions, and that the fiscal bonus cannot a exceed a maximum value (set at 640 EUR/year in 2016).

Parameter	unit	Value
A	EUR/month	193.79
θ_1	EUR/month	1,577.89
θ_2	EUR/month	2,461.27
ρ_1	%	21.94
ρ_2	%	28.03

Table 2.1: Policy parameters (2016): Work-Bonus and Fiscal Work-Bonus

2.4 Model

To model workers' labour supply decisions, we estimate a random utilty-random opportunity (RURO) model, where labour supply is seen as the outcome of agents choosing from a set of job offers. Our model builds on [Capéau et al., 2016]. For a detailed derivation of the RURO model, see also [Dagsvik and Strøm, 1992].

We first discuss the database we use and filtering we do in subsection 2.4.1. Then we go through the building blocks of the model in subsections 2.4.2 and 2.4.3: the utility functions and the opportunity functions. In section 2.4.4 we calculate the probability that an individual chooses a job with a given wage and amount of required hours. Having the actual worked hours in the database, we can compute the parameters of the utility and opportunity functions that maximize the likelihood that the sample was observed. This procedure is explained in section 2.4.4.

2.4.1 Data

To estimate our model, we use the Belgian database of the European Union Statistics on Income and Living Conditions (EU-SILC). This database is representative for the Belgian population and contains information on income, socio-demographic situation and various other dimensions related to labour supply. We assume preferences of individuals did not change over the time of the different EU-SILC surveys

[13] The amount of the basic reduction is slightly different for blue and white collar workers. Since it is not possible to distinguish between these types based on SILC data, only the amount for white collar workers is given here and simulated in EUROMOD.

used (2006-2017) in our estimation.[14] If preferences did indeed not change significantly over time, our method would increase the accuracy of the estimates on one hand because there are more observations, and on the other hand because people are observed in different tax-benefit contexts, helping for the identification of preferences. The tax-benefits system of the corresponding years are used to calculate the disposable incomes (see section 2.4.3), which are up-rated with consumer price indices to render them comparable.

We consider two types of households: singles workers (hereafter: singles) and couples of workers (hereafter: couples). Singles are defined as households with one adult person that is available to the labour market (i.e. aged between 16 and 64 years and not being sick, in education, disabled or (pre-)retired). Couples are households with 2 adult people that are available to the labour market, and those 2 people form a couple. All other types of households are dropped as their labour supply decision processes might differ too much from the typical cases (e.g. households with one parent and one child available to the labour market are excluded). We also exclude people declaring outlying (>70 h/week) numbers of weekly worked hours, and outlying wages (>60 EUR/h), as well as self-employed for whom information on labour income and worked hours might be less reliable. The percentage of labour market available individuals included in our sample varies from 64.9% to 69.4%, depending on the survey year. Descriptive statistics of the selected households are given in table 3.1.

An histogram of the hours worked, by gender, is displayed in Figure 2.2. The hours worked are those declared by the surveyed individuals, when asked how much hours per week they work on average (including overtime) in their main and complementary jobs. It is important to note that in our sample, overtime workers (that we define as workers working more than 40 hours per week, as will be explained in 2.4.3) represent 19% of the population. This is substantially more than what is observed in administrative data, where overtime hours are due to people combining different jobs and represent less than 2% of situations.[15] While self-reported data is known to be vulnerable to exaggeration or biases,[16] we believe that this discrepancy reveals

[14] We use the data as different cross-sections (we abstract from the fact that a share of individuals might appear in different surveys).

[15] Estimated based on figures 2 and 3 in [Dagsvik et al., 2011]. Note also that there are very specific situations where for technical and organizational reasons the law authorizes derogations to the 38 (to 40) hours week, but those should mostly be compensated by periods of rest in a way that average weekly hours do not exceed the legal working week.

[16] As the social desirability bias (a tendency of survey respondents to answer questions in a manner that

	Single		Couple	
	Male	Female	Male	Female
Number of observations	4057	4585	8344	
Av. working time - Workers (h/week)	39.6	34.9	40.7	32.9
Average hourly gross wage	20.3	19.9	22.2	19.7
Participation (%)	77.3	74.7	96.1	92.6
Highest level of education (%) - Workers				
- Primary or no education	6.1	5.2	4.4	3.8
- Lower secondary education	13.3	10.7	11.0	8.0
- Upper secondary education	37.2	31.4	36.0	30.2
- High education	43.5	52.8	48.6	57.9
Highest level of education (%) - Non-workers				
- Primary or no education	24.1	25.3	22.5	14.8
- Lower secondary education	28.4	23.1	22.2	24.7
- Upper secondary education	27.8	33.2	36.4	35.6
- High education	19.7	18.5	18.8	25.0
Household composition				
Average household size	1.4	1.8	3.3	
- of which children	0.1	0.6	1.3	

Table 2.2: Descriptive statistics - households included in the estimation sample

that many workers work more than contractual (or legal) hours, what may lead to different estimations of hourly wages, that are computed as gross earnings divided by worked hours. Our assumption is that people working more than contractual hours are generally compensated by a higher wage (in other words, they accept a job that is expected to necessitate frequent overtime, if this job provides a consequential salary). This assumption seems supported by the fact that people working overtime declare higher monthly earnings. In this regard, using survey data might bring an insightful and more accurate estimation of hourly wages, especially when used as a proxy for earning capacity. Moreover, as tax-benefit reforms might alter the relative attractiveness of such over-time opportunities (see sub-section 2.5.2), including them more accurately in the opportunity sets of individuals will provide a more complete picture of likely behavioural changes. The profiles of those overtime workers are detailed in Table 2.3.

2.4.2 Utility

Let $U_{ij}(d_j, l_j, \epsilon_{ij})$ denote the utility of an individual i choosing a job j, and $U_i(d_j^m + d_k^f, l_j^m, l_k^f, \epsilon_{ijk})$ denote the utility function of couple i choosing jobs j and k, where d is the disposable income, l the weekly hours of leisure (equal to time endowment minus

will be viewed favorably by others) that could for example result from individuals desiring to be seen as hard-working.

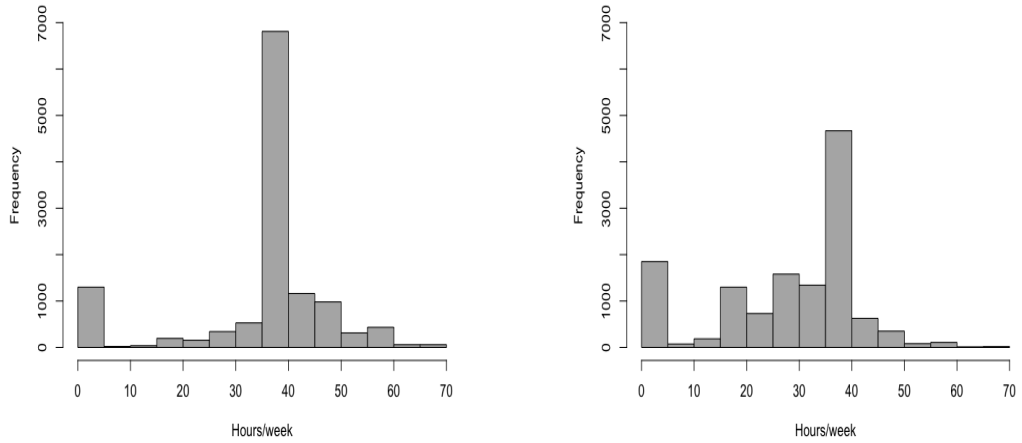


Figure 2.2: Labour supply distribution of men (left) and women (right) in the sample

	Work regime		Comparison
	All (>0h/w)	Overtime (>40h/w)	
Average age	40.4	40.4	+0
Average working time (h/week)	37.1	49.5	+12.4
Average years of education	13.3	14.4	+1.1
Average gross hourly wage (EUR_{2016})	20.7	21.5	+0.8
Average gross earnings (EUR_{2016})	3310.5	4569.7	+1259.2
Percentage of males	51.9	72.6	+20.7
Type of ISCO occupation (%)			
- 0: Armed forces	0.7	0.5	-0.2
- 1: Senior officials and managers	6.5	18.2	+11.7
- 2: Professionals	23.5	32.2	+8.7
- 3: Technicians	16.0	15.0	-1.0
- 4: Clerical support workers	19.3	11.9	-7.4
- 5: Services and sales workers	9.9	6.7	-3.2
- 6: Skilled agricultural	0.4	0.3	-0.1
- 7: Craft and trade workers	8.5	6.4	-2.1
- 8: Plant and machine operators	6.0	5.9	-0.1
- 9: Elementary occupations	9.2	2.8	-6.4

Table 2.3: Descriptive statistics - overtime workers in sub-sample

the number of working hours required for the job opportunity) and ϵ a taste shifter corresponding to the job choice(s). Superscripts m (male) and f (female) represent the respective variables of the members of a couple. The utility function is assumed to be decomposable into a deterministic function and the random taste shifter that represents utility derived from unobserved (by the researcher) attributes of a job.

This taste shifter is assumed to be i.i.d. distributed across job combinations and households according to a Gumbel distribution with location parameter 0 and scale parameter 1.

$$U_i(d_j, l_j, \epsilon_{ij}) = V_i(d_j, l_j) + \epsilon_{ij}$$

$$U_i(d_j^m + d_k^f, l_j^m, l_k^f, \epsilon_{ijk}) = V(d_j^m + d_k^f, l_j^m, l_k^f) + \epsilon_{ijk}$$

The deterministic part of the utility function is assumed to have the following Box-Cox structural specification[17] for singles (Equation 2.3), where the parameters are allowed to differ for single males and single females, and couples (Equation 2.4), for which a cross-leisure term is added:

$$V(d, l) = \alpha_d . \left(\frac{d^{\alpha_1} - 1}{\alpha_1} \right) + \alpha_l . \left(\frac{l^{\alpha_2} - 1}{\alpha_2} \right) \tag{2.3}$$

$$\begin{aligned} V(d^m + d^f, l^m, l^f) = \alpha_d . \left(\frac{(d^m + d^f)^{\alpha_3} - 1}{\alpha_3} \right) + \alpha_l^m . \left(\frac{(l^m)^{\alpha_4} - 1}{\alpha_4} \right) \\ + \alpha_l^f . \left(\frac{(l^f)^{\alpha_5} - 1}{\alpha_5} \right) + \alpha_l^{mf} . \left(\frac{(l^m)^{\alpha_4} - 1}{\alpha_4} \right) . \left(\frac{(l^f)^{\alpha_5} - 1}{\alpha_5} \right) \end{aligned} \tag{2.4}$$

We allow for heterogeneity in the marginal rates of substitution between leisure and income by introducing covariates related to age, number of children in different age-categories, region and education linearly into the leisure parameters (α_l, α_l^m, α_l^f):

$$\alpha_l = \alpha_{l0} + \alpha_l^{'} X_l$$

$$\alpha_l^m = \alpha_{l0}^m + \alpha_l^{m'} X_l^m$$

$$\alpha_l^f = \alpha_{l0}^f + \alpha_l^{f'} X_l^f$$

where X are vectors of covariates.

2.4.3 Opportunities

We assume hourly wages are drawn from a log-normal distribution $g_1(w)$ and are independent of hours worked.

$$g_1(w) = \frac{1}{w\sigma\sqrt{2\pi}} \exp\left(\frac{-1}{2} \left(\frac{ln(w) - \gamma'.X_w}{\sigma} \right)^2 \right)$$

[17] We abandon i, j and k subscripts for clarity.

where σ and the vector γ are parameters.X_w is a vector of covariates that might affect the median of the wage distribution: education, gender, (potential) experience and survey year.

Average weekly working hours of job opportunities are assumed to be drawn from a uniform-with-peaks distribution, where the peaks are chosen to correspond to typical part-time regimes as well as the full-time regime, and where parameters allow to calibrate their height. Peak height can differ only by gender, reflecting the fact that part-time jobs are mostly available in female-dominated sectors of activity ([Meulders and O'Dorchai, 2009]): health and social work, other community, social and personal service activities, private households with employed persons and also, although to a lesser extent, education. The domain H represents the possible values, and is assumed to range from 0 to 70.

$$g_2(h) = \begin{cases} exp(\alpha^g_{h0}) & : h \in H \setminus \{[18.5, 20.5], [29.5, 30.5], [37.5, 40.5]\} \\ exp(\alpha^g_{h0} + \alpha_{h1}) & : h \in [29.5, 30.5] \\ exp(\alpha^g_{h0} + \alpha_{h2}) & : h \in [18.5, 20.5] \\ exp(\alpha^g_{h0} + \alpha_{h3}) & : h \in [37.5, 40.5] \end{cases} \tag{2.5}$$

In addition, a number of "out-of-market" job opportunities can be available to the individuals. The intensity of job offers relative to out-of-market opportunities is allowed to vary across individuals, according to the gender and a set of covariates.

$$g_0 = exp(\alpha_{o0} + \alpha'_o X_o) \tag{2.6}$$

where X_o is the vector of covariates that includes region, education level and group-specific unemployment rate. The group-specific unemployment rate corresponds to the unemployment rate per gender-education group, taken from Eurostat. Those rates vary across years and are assumed to be inversely related to the number of suitable jobs accessible to those groups of individuals at a particular point in time. The inclusion of this variable therefore could improve the identification of job-offer intensities.

For each job opportunity requiring an amount of hours h, the gross wage is computed as the multiplication of required hours h and the hourly wage w. EUROMOD[18] then allows to calculate the disposable income corresponding to the job

[18]EU-wide arithmetic tax-benefit model widely used by the European commission for policy analysis and developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex.

choice: it takes gross income values as an input and determines, based on the socio-demographic characteristics of the households, the amount of taxes and benefits they are subject and eligible to, which are respectively subtracted and added to the gross income. This transformation is denoted $d_i(l, w)$.

We assume that people opting for an out-of-market opportunity apply for means-tested social assistance. In practice, people not working are eligible to unemployment benefits under the condition that they have a sufficient work-history and are involuntarily unemployed. When, on the contrary, an employee voluntarily quits his job, he can be subject to a penalty of some weeks (from 4 to 52) before being eligible to unemployment benefits. If the employee leaves his job with the intention of relying on unemployment benefits on the long run, he can even be sanctioned indefinitely. Those not eligible to unemployment benefits can apply for social assistance. In that case a thorough means-test, encompassing also means of relatives and assets owned, can be expected. Those being ineligible or not applying to those two schemes (due to stigmatization for example) probably rely on some types of private transfers, personal savings, informal work, mendicancy, etc., as basic needs have to be fulfilled. It is difficult to infer from the data in which of those situations workers opting for an out-of-market opportunity would end up, due to limited information on their preferences and financial situation. For those that are observed not working the same assumption is made, even tough some report unemployment benefits. The reason is that it would be difficult to consider those benefits, that are observed at one point in time, as representative of the level of revenue those individuals (expected to) receive when not working, as such benefits decrease importantly over time.

Considering means-tested social assistance benefits as the out-of-labour income is therefore a simplification needed to compensate the lack of information and an approximation of a consumption floor for survival. An additional argument could be that, especially since the reform of 2012,[19] the declining unemployment benefits come near (and even drop below, for cohabitants) social assistance benefit levels in the long-term [Galand and Termote, 2014], and that our assumption thus does not misrepresent too much the evaluation of out-of-market opportunities by forward-looking agents with reasonably low discount rates counting on unemployment benefits.

[19] Arrêté royal du 23 juillet 2012 modifiant l'arrêté royal du 25 novembre 1991 portant la réglementation du chômage dans le cadre de la dégressivité renforcée des allocations de chômage, Moniteur belge, 30 juillet 2012.

2.4.4 Probability and MLL Estimation

Let's define $\Psi_i(h,w) = exp(V_i(d_i(T-h,w),T-h)) = exp(V_i(d_i(l,w),l))$. The likelihood that an individual i will choose a particular job offer requiring labour time $h = T - l$, and paying a wage w, can, given our assumptions on the random utility term, be written (for a detailed derivation see for example [Dagsvik and Strøm, 1992])

$$P_i(w,h) = \frac{\Psi_i(w,h)g_{0i}g_{1i}(w)g_{2i}(h)}{\Psi_i(0,0) + \int_{r\in W}\int_{t\in H}\Psi_i(r,t)g_{0i}g_{1i}(r)g_{2i}(t)drdt}$$

and

$$P_i(0,0) = \frac{\Psi_i(0,0)}{\Psi_i(0,0) + \int_{r\in W}\int_{t\in H}\Psi_i(r,t)g_{0i}g_{1i}(r)g_{2i}(t)drdt}$$

in case of an out-of-market opportunity.

In practice, we do not observe the set of wage and time regimes offers. We therefore draw a set of offers for each individual, denoted D_i, from a prior density function, denoted $\mathbb{S}$, conditional on the observed choice being included.[20] The probability to observe a given choice, conditional on this choice being in the drawn set of offers, is therefore given respectively by:

$$P_i(w,h \mid D_i) = \frac{\Psi_i(w,h)g_{0i}g_{1i}(w)g_{2i}(h)/\mathbb{S}(w,h)}{\sum_{(r,t)\in D_i}\Psi_i(r,t)g_{0i}g_{1i}(r)g_{2i}(t)/\mathbb{S}(r,t)}$$

for market opportunities, and

$$P_i(0,0 \mid D_i) = \frac{\Psi_i(0,0)/\mathbb{S}(0,0)}{\Psi_i(0,0)/\mathbb{S}(0,0) + \sum_{(r,t)\in D_i\setminus\{(0,0)\}}\Psi_i(r,t)g_{0i}g_{1i}(r)g_{2i}(t)/\mathbb{S}(r,t)}$$

for out-of-market opportunities.

As we know the probability an individual works a given amount of hours, given his characteristics and given parameters, we can compute the likelihood that our observed sample was indeed observed, by multiplying those probabilities over all observations. We then look for the parameters that maximize the log-likelihood by using the Broyden–Fletcher–Goldfarb–Shanno (BFGS) optimization algorithm, a quasi-Newton method for solving unconstrained nonlinear optimization problems. The estimated parameters are in Appendix A.1. Table 2.4 summarizes the covariates

[20] We use uniform distributions for the hours (from 0 to 70) and hourly wages (from 0 to 60). The prior probability to draw an out-of-market offer is set at 0.10.

used in the different building blocks of the model, which are similar to those used in [Capéau et al., 2016], with the exception of the year-dummies in the wage-offers. For a discussion regarding the identification of RURO models, see for example [Capéau et al., 2016] or [Aaberge et al., 1999].

	Preferences	Opportunities		
		intensity job offers	hours	wages
	X_l	X_o	X_h	X_w
Regional dummies	yes	yes	no	no
Education dummies	yes	yes	no	yes
Age	yes	no	no	no
Group-specific unemp.	no	yes	no	no
Number of children	yes	no	no	no
Gender	yes	yes	yes	yes
Experience	no	no	no	yes
Year	no	yes[1]	no	yes

1: Included implicitly as group-specific unemployment rates are year-specific.

Table 2.4: Model specification - covariates

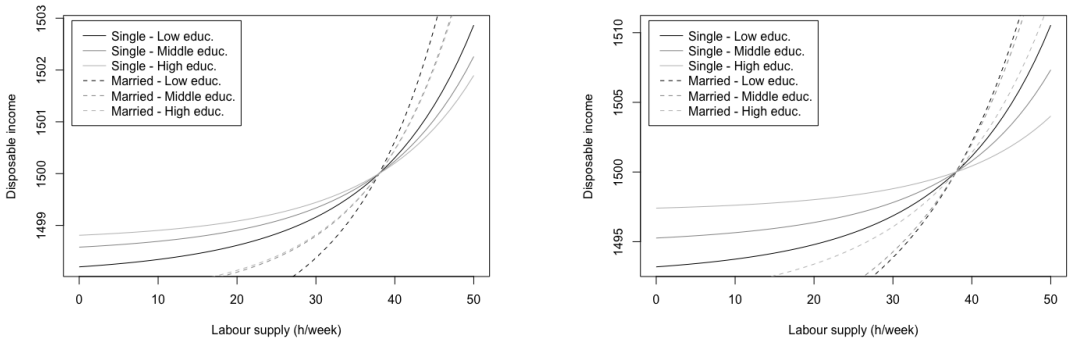
2.4.5 Estimation results

Preferences

Preferences are defined over the positive "leisure time - disposable income" domain, with heterogeneity allowed in the leisure parameter. We estimate that utility increases with both disposable income and leisure time for almost all the individuals, as summarized in Table 2.5. Higher education in contrast decreases preferences for leisure time. We illustrate this with indifference curves of individuals with different education levels on Figures 2.3a and 2.3b. Moreover, the number of children younger than 7 y.o. increases the importance of leisure time, except for single men.

Opportunities

The estimated percentage of job offers in workers' opportunity sets is given in figure 2.4. One can observe that higher education strongly increases the number of job opportunities. For women, higher unemployment rates in an age category slightly decreases the number of job offers for those in that category, in line with the intuition that higher unemployment rates increase competition between unemployed and diminishes the probability to find suitable jobs. For men however, this effect is estimated to be smaller and opposite, resulting in young man having more job offers, despite higher unemployment rates.



(a) Male (b) Female

Figure 2.3: Estimated indifference curves

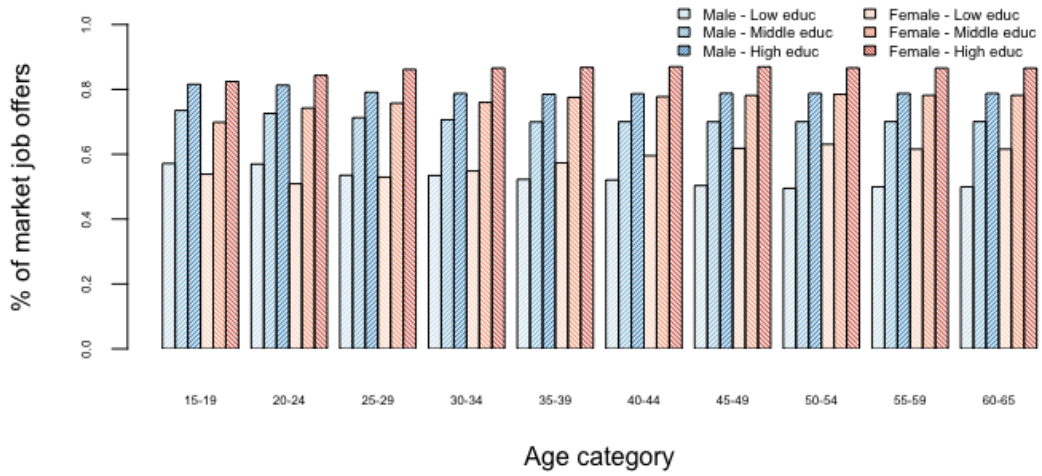
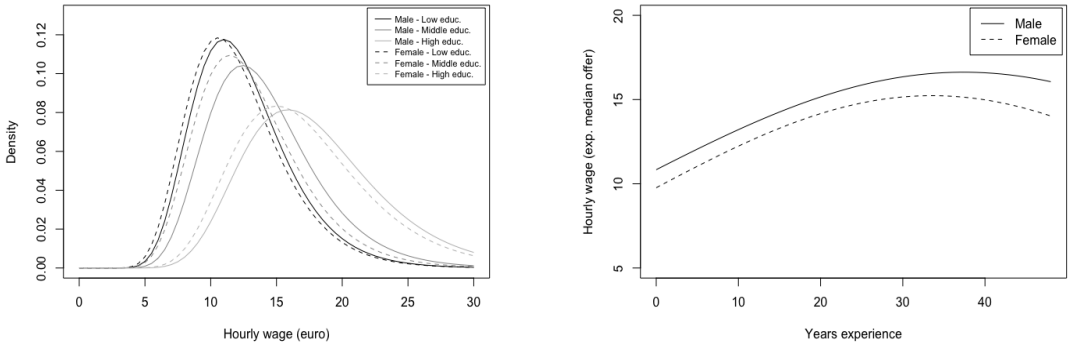


Figure 2.4: Estimated job offer intensity (2016)

The estimated wage distributions and evolution are given in figures 2.5 and 2.6. Education has the strongest positive impact on wage offers. Males also receive slightly higher wage offers than females. Years of (potential) experience, calculated as age minus expected age of labour market entry,[21] have a positive impact on wage offers, up to a certain limit (34 for men and 35 for women) at which the person is close to retirement and possibly becomes less attractive for employers, resulting in lower wage offers.

[21] Estimated at 15 for low educated individuals (ISCED levels 0,1,2), 19 of middle educated individuals (ISCED levels 3,4,5), and 23 for high educated individuals (ISCED level 6).



(a) Education and gender

(b) Experience

Figure 2.5: Effect of covariates on wage offers

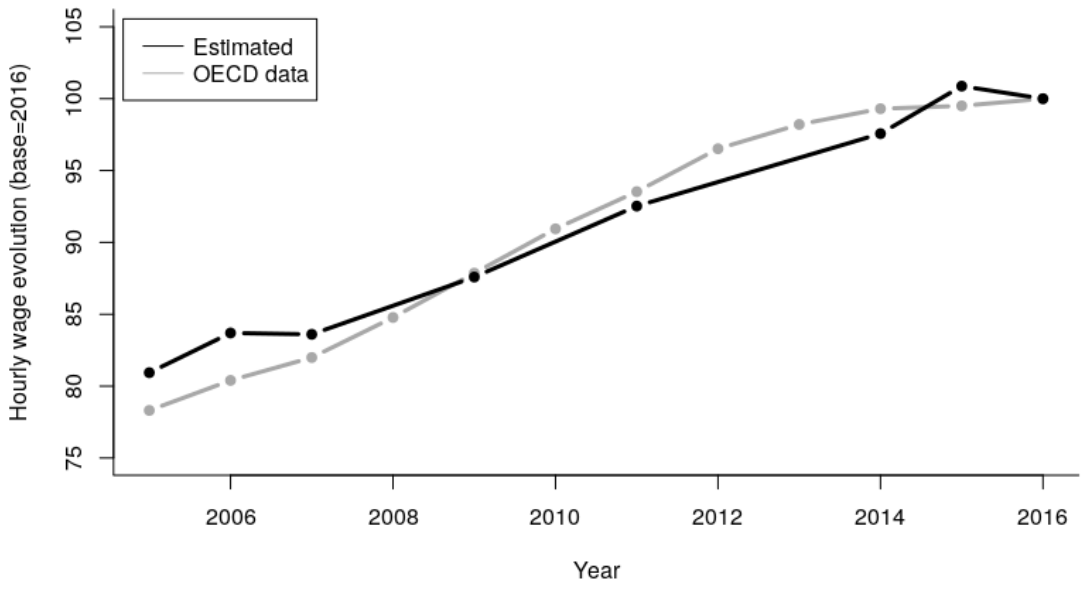
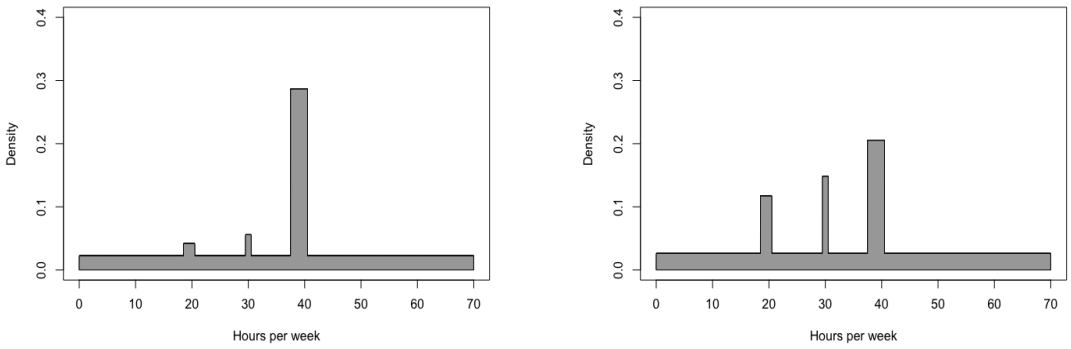


Figure 2.6: Estimated evolution of hourly wages

The estimated hours distributions are illustrated on figure 2.7a and 2.7b. We estimate that men receive more full-time job offers than any other regime. The same holds for women, who however receive a significant amount of part-time offers.



(a) Male (b) Female

Figure 2.7: Estimated hours offers distribution

Fit

A first check to see whether our model fits common perception of leisure and income preferences, is to verify the marginal utilities with respect to those variables are positive. Reasonably assuming most people would accept extra money or extra holidays *ceteris paribus*, those marginal utilities should be positive for a vast majority of people.[22] The percentage of people for whom those marginal utilities are positive at the observed choices are in Table 2.5.

% Observations	Single Male	Single Female	Couples
$U_d^{'} > 0$	100	100	100
$U_l^{'} > 0$	100	100	Male: 99.89 Female: 99.86

Table 2.5: Marginal utilities

Secondly, Table 2.6 reports the estimated elasticities following an increase of 10% of the wage offers. Besides total elasticities, we also report intensive margin elasticities, that reflect the average changes in labour supply of people who are already working. The third and fourth lines give the percentage (with respect to the total number of people in the gender-marital status category) of people starting/stopping to work. The estimated elasticities are in the range (and rather at the right of the distribution) of those estimated in the literature (see for example [Keane, 2011]).

[22]The exception in our eyes that could be significant is the case of unemployed finding no suitable job offer. In that case the unemployed might be desiring to find a good job, which provides a feeling of accomplishment, even if it would not be associated with an income increase. Also, young workers could be desiring to work many hours, even without additional salary, to build human capital and increase future utility.

Single men increase their labour supply slightly more than single women after an increase in wage offers, both at the intensive as at the extensive margin.[23] Regarding married[24] individuals, estimates indicate that married women would increase their labour supply more than men. This can be partly explained by the fact married women more often are out of the labour market or work part-time, and thus have more room to increase their supply of labour.

A number of married individuals will also react to an increase in their partners' wage. This is due on one hand to an income effect, and on the other hand to the complementarity between partners' leisure time. The income effect will tend to reduce the partners' labour supply, while the effect of leisure complementarity will depend on the labour supply change of the first partner. Positive and negative labour supply reactions are predicted both at the intensive and extensive margin, but in both cases the negative effect dominates when looking at the aggregate level. Married individuals will thus on average decrease their labour supply or leave the labour market following an increase in their partners' wage offers.

	Increase of male wages			Increase of female wages		
	Single	Couple		Single	Couple	
	Male	Male	Female	Female	Male	Female
Total elasticity	0.270	0.117	-0.072	0.210	-0.067	0.163
Intensive margin	0.049	0.068	-0.090	0.042	-0.087	0.106
Participation (entering, % of total)	1.791	0.506	0.193	1.388	0.214	0.548
Participation (leaving, % of total)	0.025	0.000	0.531	0.000	0.535	0.000

Table 2.6: Elasticities and participation changes (10% wage increase)

Lastly, we compare the observed distribution and the predicted distribution of some variables, using random draws for the stochastic part of the utility in the latter case. Density plots of observed and simulated hours worked, wages and disposable incomes are given in Appendix A.3.

[23] Note that the number of men that stop working after a wage increase is slightly positive. This seemingly counter-intuitive result is due to the fact disposable income does not always increase monotonically with labour income due to discontinuities in certain means-tested benefits (for example due to a yearly 250EUR exemption in the means-test for social assistance).

[24] We use the adjective married to refer to members of the couples. Those can also be in a consensual union.

2.5 Simulated policies

2.5.1 Reform scenarios

We simulate 3 hypothetical scenarios that increase the generosity of the workbonus, named respectively reform 1, 2 and 3.[25] Those scenarios do not change the structure of the scheme, but only its generosity, in terms of base amount and/or in terms of eligibility thresholds, and are calibrated to have the same budgetary cost before behavioural changes, set at 300M EUR yearly. The first scenario consists of increasing the maximum amount of the reduction (parameter A), thereby further decreasing the participation tax rate for low earning capacity workers. The second scenario consists of increasing both the maximum amount and the thresholds proportionally (parameters A, θ_1 and θ_2), which, besides further decreasing participation tax rates, also extends the scheme to higher earning capacity workers. Finally, in the third scenario the maximum amount is kept constant, but the eligibility range is increased (parameters θ_1 and θ_2).[26]

The base case policy is represented on Figure 2.8 together with the 3 reform scenarios. The continuous line represents the level of the existing WB granted to a full-time worker, in function of his gross monthly wage. The dotted lines represent the 3 hypothetical reform scenarios. The domain starts at the level of the minimum wage, and one can observe that the phase-out area starts soon after, as explained in Section 2.3. It can also be seen that reforms 1 and 3 will change the withdrawal rate of the policy, respectively to 29.2% and 16.9%, while reform 2 keeps this rate unchanged at 21.9%. Lastly, the bars represent the distribution of monthly FTE gross wages across the population, and show that our reforms will change the budget set of a significant number of individuals.

2.5.2 Theoretical predictions

Two effects can arise when changing the shape of the budget constraint of an individual working for a given hourly wage. If in the reform scenario, for a given amount of hours, income increases, a person working that amount of hours will feel richer and might reduce his labour supply in order to have more leisure time with an income higher or equal to the initial one. This effect is called the income effect, and

[25] Note that we use 2016 as reference scenario, even though the workbonus has (very) slightly and gradually been augmented during the 2015-2019 tax-shift.

[26] Note that in the reference scenario, the WB cannot exceed social security contributions due, and the FWB cannot exceed 640EUR/year. In our reforms we allow the WB and FWB to be refundable benefits in case they would outreach those limits.

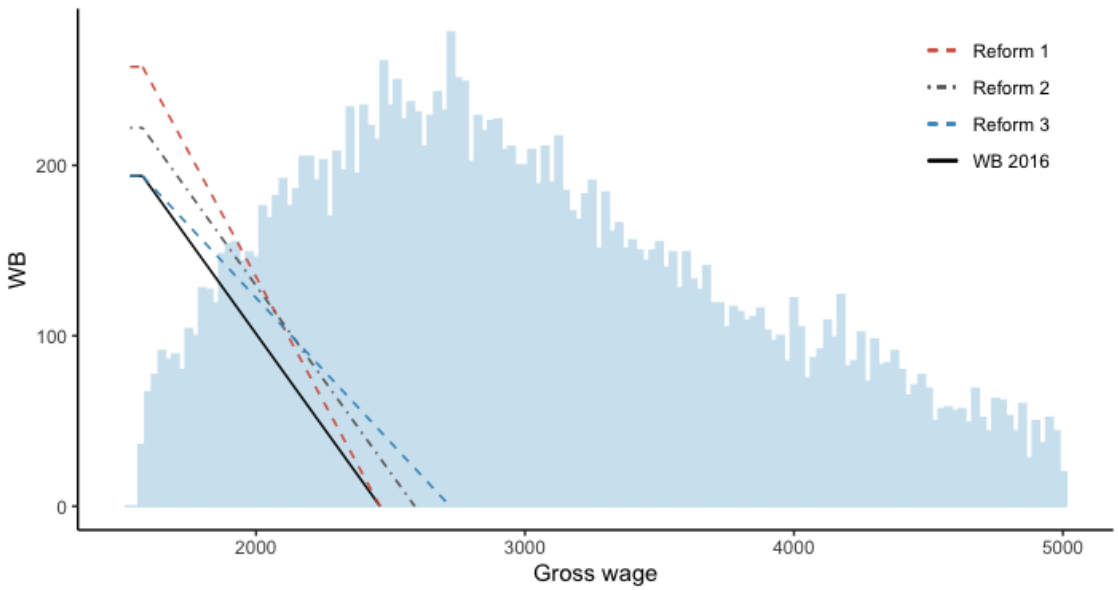


Figure 2.8: Level of WB in function of gross wage (full-time worker) and gross wage distribution

is stronger when the marginal utility of income is relatively small, at the condition that leisure is a normal good. On the other hand, a reform of in-work benefits will also change the marginal return to work (corresponding to the slope of the budget constraint). An increase in the marginal return to work means that "not working" (or "leisure") implicitly costs more in terms of foregone wages. People facing a higher (lower) marginal return to work will therefore have a stronger incentive to work more (less). Those effects are called substitution effects. Note that besides those two effects, occurring on a budget constraint for a given wage, workers can also opt for jobs paying different wages.

The change in budget constraint is illustrated for reform 1, for a single individual working at the minimum wage, on Figure 2.9. The dotted and continuous black lines represent the disposable incomes in the base and reform 1 scenarios, which is decomposed into different components in the reform case. We see that the reform renders many in-work options more attractive. The reason of the flat part on the left is that for small numbers of hours worked the benefit of the reform is offset by lower means-tested social assistance benefits. Then come part-time and full-time job situations where the reform has a strong and increasing (with labour supply) effect, which is straightforward given the design of the scheme. The benefit will start decreasing when working overtime. This result comes from the fact that the FTE wage, used for the determination of the WB level, is calculated by dividing

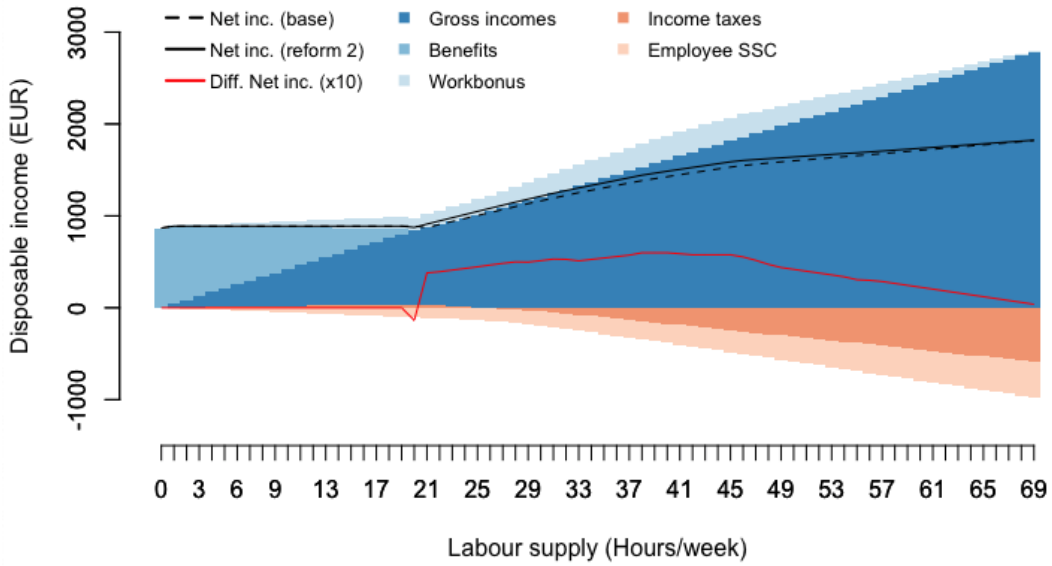


Figure 2.9: Budget set of single working at min. wage - base and reform 1

gross earnings by contractual hours of work. People that have accepted a better paid job requiring frequent (informal) overtime, thus see their hourly wage overestimated in that calculation.[27] The option to work less and by doing so become eligible to the WB therefore becomes relatively more attractive. This third effect is not detectable with administrative data, where informal overtime is not taken into account. Lastly, note that for higher levels of hourly wages, the reform would have less impact, as the WB phases gradually out with hourly wages. Our reforms might thus incentivize individuals to switch to lower-paid jobs, that become relatively more attractive.

In summary, we can say that the options that become relatively more attractive following a WB increase are those that pay low wages, and that require hours that are not too low (as the means-tested benefits will offset the WB), nor too high (as the hourly wage will be overestimated in case of frequent overtime work).

[27] As an illustration, imagine a low-level manager earning a gross wage of 2500 EUR per month for a job that requires on average 200 hours of work monthly (of which some informal overtime). This person's hourly wage equals 12,5 EUR/hour. However, as the legal or contractual working week counts 38 hours (about 165 per month), his earning capacity in the eyes of the fiscal authority will be estimated at more than 15 EUR/hour, excluding him from the WB scheme.

2.5.3 Simulation procedure

We use a procedure proposed by [Duncan and Weeks, 1998] to simulate the behavioural changes resulting from our tax-benefit reforms. The procedure is essentially a Monte Carlo method relying on repeated random sampling of the random utility term. The different steps of this procedure are detailed next.

The first step of the procedure consists of, for each household, drawing a set of k opportunities (market and out-of-market) from the estimated hours and wage distributions, conditionally on the observed opportunity being included. For each opportunity, we calculate the corresponding disposable income in the base and reform scenarios with the arithmetic micro-simulation model EUROMOD, of which the parameters are adapted in the case of the reform scenario. This allows to calculate the deterministic part of the utility function for each opportunity.

We then draw a vector of random utility terms from a Gumbel distribution in a way that guarantees that the total utility will be the highest for the observed choice, following a procedure proposed in [Bourguignon et al., 2001]. This operation is repeated m times to get m vectors of random Gumbel draws that predict choices that correspond to the observed choice.

Lastly, in each of the m cases we predict which would be the "reform opportunity" chosen by the household by adding those random utility terms to the deterministic utilities under the reform scenario. This gives rise to a probability distribution over the set of opportunities of each household under the new tax-benefit system. This probability distribution then allows to calculate the expected hours of labour supply after the reform as well as expected income, tax and benefit amounts. Our simulations are run on the 2017 SILC dataset, which has income reference year 2016, and we set $k = 50$ and $m = 10$.

2.5.4 Simulation results

Labour supply

All 3 scenario's predict an increase in labour supply if measured in terms of participation (number of people working positive hours). If measured in FTE, only scenario 1 and 2 predict an increase, while scenario 3 predicts a small decrease. An

overview of the impact of the 3 different reforms is given in Table 2.7.[28] Those effects are further decomposed for the different gender-marital status groups in Figure 2.10.

One can clearly observe that in all scenarios women increase their labour supply the most. The same holds for singles versus married. The first observation can be explained by the fact women receive lower wage offers on average and therefore potentially benefit from the increased workbonus more often. In addition, they start from higher unemployment/inactivity rates, and decreased participation tax rates have thus a higher potential effect on labour market entry. In addition, men have more jobs requiring overtime, and as explained in 2.5.2, such jobs can in certain cases become relatively less attractive than other jobs after a workbonus increase, leading overtime workers to switch to jobs requiring less hours.

The smaller or negative labour supply reactions of couples are mainly explained by stronger income effects: low-wage workers experience a revenue increase, resulting in a reduction of labour supply of one (or both) of the household members. Note also that married men reduce worked hours on average, which is explained by a partial substitution of male labour by female labour supply. Overall, the WB leads to a more homogeneous distribution of work.

Finally, one can observe total gross labour income decreases. This is driven by the decrease in average wages, due to a number of people switching to jobs that offer lower wages but desirable attributes, as those became relatively more attractive after the reform.

Welfare analysis

Besides equivalized[29] disposable income, we present here, following [Decoster and Haan, 2014], two alternative welfare measures that account for leisure: the rent criterion and the full-time (FT) criterion.

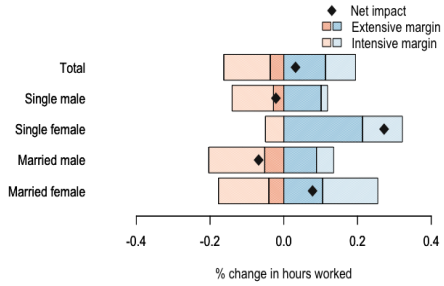
The rent is the income that gives the same utility to an individual as a partic-

[28] Not all workers are included in our simulation sample (see section 2.4.1). Our filtering procedure keeps 64,9% of individuals who are labour market available, for that dataset. If one would be interested in having the absolute changes in labour supply for the whole population, a possibility would be to divide the predictions of the model in Table 2.7 by 64,9%, which would be relatively accurate if people excluded from the sample have comparable reactions to the reforms on average.

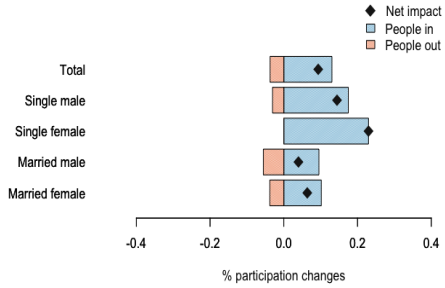
[29] We use the term equivalized income to denote the income divided by an equivalence scale, in order to take into account economies of scale in household expenses.

Overview LS effects	Param.	Base	Ref1	Ref2	Ref3
	A	193.79	257.81	222.05	193.79
	θ_1	1577.89	1577.89	1577.89	1577.89
	θ_2	2461.27	2461.27	2590.07	2721.83
	ρ_1	21.94	29.18	21.94	16.94
	ρ_2	28.03	28.03	28.03	28.03
Δ Labour supply (FTE)			+669 (+0.032%)	+141 (+0.007%)	-362 (-0.017%)
- Ext. margin (FTE)			+1609	+895	+530
- Int. margin (FTE)			-939	-754	-892
Δ Participation			+2024 (+0.093%)	+1200 (+0.055%)	+688 (+0.032%)
- people starting to work			2831	1697	964
- people stopping to work			807	497	276
Δ Total gross labour income (M EUR)			-190.2 (-0.217%)	-166.3 (-0.190%)	-105.3 (-0.120%)
- average gross wage change (EUR/h)			-0.053	-0.041	-0.022

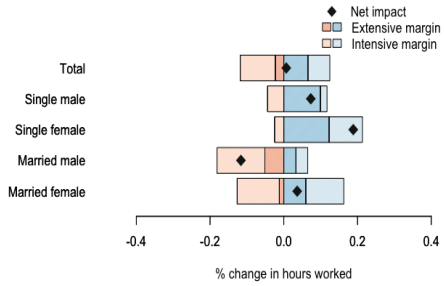
Table 2.7: Effect of the reforms on labour supply



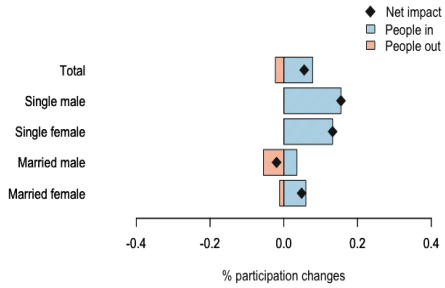
(a) Reform 1 - FTE variation



(b) Reform 1 - Participation variation

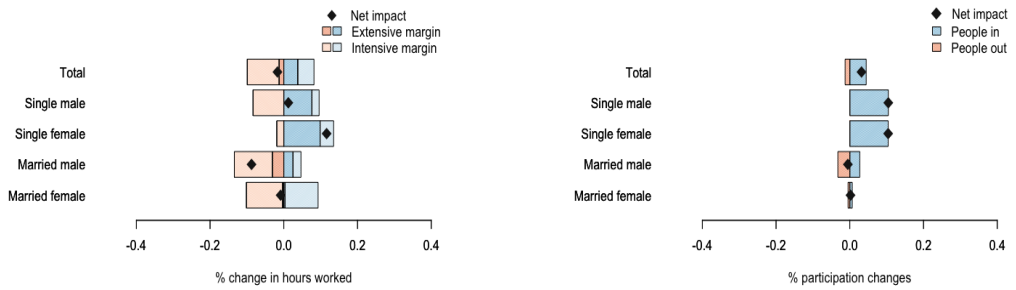


(a) Reform 2 - FTE variation



(b) Reform 2 - Participation variation

ular point in the "leisure-disposable income" space, when his labour supply is 0. In a standard representation of the labour supply decision with labour supply in abscissa and net income in ordinate, it is found at the intersection of the indifference curve passing through a given bundle and the vertical line at labour supply $h = 0$. The FT criterion is found at the intersection of the indifference curve with the vertical line at the level of full-time labour supply. The main reason to prefer those measures over traditional individual welfare metrics (for example equivalent or compensating variations, fixed preference orderings, ...), is that they respect max-



(a) Reform 3 - FTE variation

(b) Reform 3 - Participation variation

Figure 2.10: Decomposition of labour supply changes

imally the heterogeneous preferences of the agents, while bringing the normative choices, unavoidably present in all interpersonal comparisons, clearer to light.[30,31] This can be intuitively understood by the fact those metrics use information on individual preferences, in the form of indifference curves, to translate the chosen "leisure-disposable income" combination into an "equivalent" income (rent or FT in this case). They moreover shed light on the normative assumptions made in the interpersonal comparison. For example, the rent-criterion gives maximal protection for people who give importance to leisure, and renders them minimally responsible for their aversion to work. The FT-criterion on the contrary treats industrious individuals (i.e. those having less distaste for work) more favourably.

The welfare changes per equivalized disposable income decile are represented in Figure 2.11 for reform 1. The same graphs are provided for reforms 2 and 3 in Appendix A.2. One can see that the reform has the strongest impact on lower

[30] Normative analysis in a framework of heterogeneous preferences poses the difficult problems of comparability and aggregation of individual utilities (due to an incompatibility between two sets of axioms, one related to the respect of individual preferences and one related to interpersonal comparability, see [Fleurbaey and Trannoy, 2003]), that are often neglected (e.g. when simply aggregating compensating variations). One way to address these problems is to use a reference preference ordering (or a reference agent/household). The disadvantage of this choice is however that it would create an inconsistency between the positive part of our analysis, where household heterogeneity plays a role in the decision process, and the normative part of our analysis, where this heterogeneity is set aside. [Fleurbaey et al., 2006], [Fleurbaey, 2007] propose an other way to escape this incompatibility problem, by restricting (but retaining maximally) preference heterogeneity to what they call *Subset Dominance*. It is argued that giving priority to respecting preferences is less arbitrary and allows to shed light on the ethical priors used (and thus the cut between personal and social responsibility) when selecting the subsets: The rent-criterion for example gives maximal protection for people who give importance to leisure, and renders them minimally responsible for their aversion to work. The FT-criterion on the contrary treats industrious individuals (i.e. those having less distaste for work) more favourably.

[31] For a detailed overview of the normative foundations of the three most popular approaches to measure well-being in a multidimensional setting: the capability approach, the subjective well-being approach and the equivalent income approach, see [Decancq et al., 2015]. For a discussion on welfare analysis applied to Random Utility Models of Labour Supply, see [Decoster and Haan, 2010].

middle class individuals. The poorest individuals, of whom a significant share is out of the labour market because of stronger preferences for leisure and/or fewer job opportunities[32], do not see their welfare increase much. The reason is that the welfare gains resulting from disposable income increases following the acceptance of a job are almost offset by the welfare losses due to the decrease in leisure time. The third and fourth decile individuals on the contrary have higher employment rates, and many will thus benefit from a higher disposable income, without sacrificing leisure time. In the highest deciles, the average disposable income decrease is explained by a number of individuals opting for lower-paid jobs that have more attractive attributes. Welfare gains are thus small when measured with the FT and Rent criteria: gains in welfare due to preferred job-attributes barely exceed the losses due to the disposable income decreases.

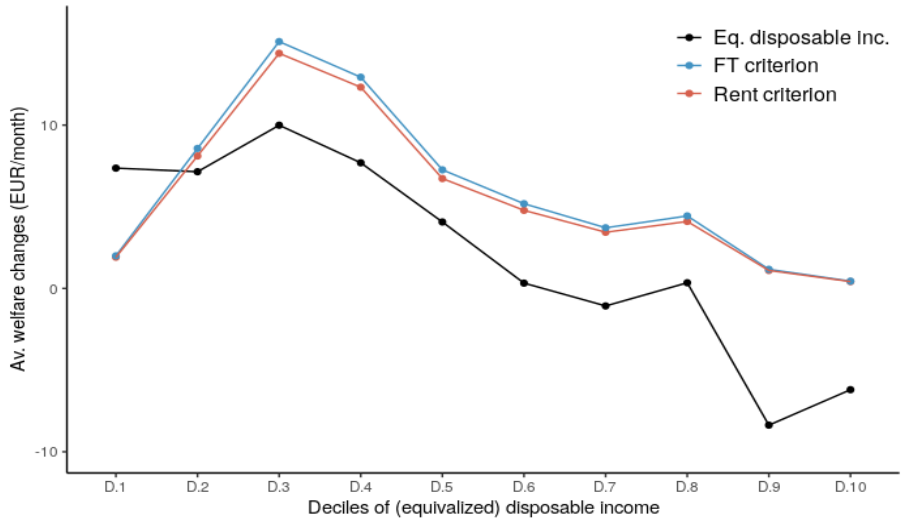


Figure 2.11: Welfare changes following reform 1

In table 2.8, we compute the population-wide weighted Gini-coefficient and poverty rate (assuming people out of the model do not change their labour supply). The Gini is calculated on equivalized incomes (using the OECD-modified scale), and the poverty rate is defined as the percentage of people having an equivalized income lower than 60% of the median equivalized income. All the reforms reduce inequalities and poverty by a small amount, with reform 1 reducing inequalities and poverty the most. This limited impact is due to the fact the purchasing power gains resulting from the WB scheme are, even though concentrated at the

[32]In the lowest decile, individuals have an education level below average. Our estimates suggests that this results in stronger preferences for leisure and less job opportunities. Moreover, in the lowest decile, couples have more children than the average, which also contributes to higher preferences for leisure.

left of the wage distribution, quite spread over the equivalized income distribution.

Poverty and Inequality	Base	Ref1	Ref2	Ref3
Gini	21.25	21.18	21.19	21.20
Poverty rate	10.37	10.20	10.22	10.26

Table 2.8: Effect of the reforms on poverty and inequality

Budget

The total budget necessary for each reform was set at 300M EUR yearly before behavioural changes.[33] The decomposed effects on the government budget, both before and after behavioural changes (where we assume individuals not included in the labour supply model do not change labour supply), are given in Table 2.9. None of the reforms pays for itself. In other words, the reduction of government expenses that follow such reforms, resulting from a decrease in social assistance and unemployment benefits, do not compensate the decreases in revenues from taxes and social security contributions. Those decreases are due to a direct effect resulting from the WB extension that reduces taxes and social security contributions paid by employees. In addition, workers will choose lower-paid jobs on average, which will reduce social security contributions, and to a lesser extent taxes, paid by employees even more. Those effects are not compensated by the additional taxes and social security contributions paid by new entrants.

Budget Balance (Million EUR)	Ref1	Ref2	Ref3
+ Δ Social Security contrib. (static)	-83.4	-82.4	-82.9
+ Δ Personal Income Tax (static)	-234.9	-233.2	-232.1
– Δ Benefits (static)	-16.7	-15.9	-15.2
= Δ Budget balance (static)[(a)]	-301.5	-299.7	-299.7
Additional impact following LS changes			
+ Δ Social Security contrib.	-176.1	-168.8	-160.4
+ Δ Personal Income Tax	+40.9	+53.0	+82.3
– Δ Benefits	-23.8	-17.8	-12.7
= Δ Budget balance (total)[(a)]	-413.0	-397.7	-365.2

(a) A negative balance corresponds to a deficit for the government.

Table 2.9: Effect of the reforms on budget balance

[33] This is done by running EUROMOD iteratively and adapting tax-benefit parameters at each loop in order to approach a pre-defined budget deficit (300M EUR). We used a tolerance level of 1% (3M EUR).

2.5.5 Discussion

All 3 reforms predict labour supply increases when measured in participation. Reform 3 however predicts a labour supply decrease when measured in FTE. An interesting complementary statistic for the parsimonious policy makers that see in-work benefits mainly as a labour market activation policy is the average net cost to increase labour supply by an FTE or alternatively, by a participant. Note however that the denominator of this indicator can be close to 0 in reforms that create positive and negative labour supply changes that on average almost compensate each other, as in our reform 3, and to a lesser extent, reform 2, resulting in high numbers.

We obtain costs per additional FTE ranging from 368.5 thousand EUR in reform 1 to 1660.1 thousand EUR in reform 2. In reform 3 the ratio is not calculated as the number of FTE decreases. Other studies on relatively similar schemes find lower numbers for Belgium. For example [Orsini, 2006b] and [Dagsvik et al., 2011] estimate costs per FTE to be located respectively between 136.0 and 204.1 and between 35.5 and 171.3 thousand EUR depending on the in-work benefit structure and structural model used.[34] Regarding neighbour countries, [Orsini, 2006b] estimates costs per FTE in the the order of 272.1 thousand EUR for the WFTC, 231.3 thousand EUR for the German Mini-Jobs tax reform and 163.2 thousand EUR for the French PPE.

Costs per new participant are estimated in our simulation to lie between 121.1 and 560.7 thousand EUR, corresponding respectively to reforms 1 and 3. Only [Dagsvik et al., 2011] gives numbers for Belgium, located between 18.8 and 36.3 thousand EUR. For Other European countries, [Bargain and Orsini, 2006] estimate it to vary from 88.9 for France and 127.1 for Germany to 234.4 thousand EUR for Finland. Compared to previous studies and simulations of in-work benefits, we thus estimate rather high costs per FTE and per new participant.

Net costs	Ref1	Ref2	Ref3
Cost / additional FTE	368.5	1660.1	-
Cost / additional participant	121.1	195.1	560.7

Table 2.10: Net costs to increase labour supply (thousand EUR)

[34] Numbers from their publications are transformed in 2016 EUR with CPI indices to be comparable with ours. [Orsini, 2006b] database is from 2000, [Dagsvik et al., 2011] from 2001 and [Bargain and Orsini, 2006] from 1998.

An important difference with some previous research (for example [Orsini, 2006a], [Orsini, 2006b] and [Bargain and Orsini, 2006]) is that our simulation allows people to not only change worked hours, but also opt for lower paid jobs (with preferable attributes). In section 2.5.4 we showed that this would make the reform more costly, as people opt for lower-paid jobs, which mechanically decreases tax and social security contribution revenues of the government. This consequently increases the overall cost/additional worker of the reform. Particular attention should therefore be paid to this effect, especially when analyzing reforms that significantly change the relative attractiveness of jobs offering low wages, as is the case of the Belgian WB.

Those differences might also be explained by a modelling decision regarding how overtime workers are taken into account. It is common when using survey data to exclude people declaring "unrealistic" amounts of hours and it is necessary to round the observed values to values in the choice set when using a discrete hours choice model (in [Orsini, 2006a] and [Orsini, 2006b] people working >80h/week are excluded from the sample and the hours of those working between 45 and 80 hours are rounded to 50 hours), while in administrative data informal overtime workers are not detected (as in [Dagsvik et al., 2011]). Those limits result in potentially underestimated intensive margin elasticity estimations, as one do only take into account overtime workers reducing their labour supply to a limited extent.

As suggested by [Decoster and Vanheukelom, 2019] about the proposed Flemish WB extension, higher costs per additional FTE or participant might also be explained by decreasing marginal utility of income, meaning that further increasing in-work benefits will probably not have effects of the same magnitude as the initial introduction of those benefits. In the same line, it could be explained by the purchasing power increases (following real wage increases) over the last decades that decreased marginal utility of income at a given labour supply level.

Finally, those estimate differences are probably partly explained by differing initial situations and reforms simulated: an in-work benefit is more likely to have a positive impact on employment in situations where more people are jobless. On the contrary, in an economy with full employment, the benefit will be costly and mainly create negative income effects.

2.6 Conclusion

In this paper, we discussed the history and the particularity of in-work benefit schemes in Belgium and simulated the effects of 3 different extensions of the work-bonus scheme, varying in terms of eligibility ranges and benefit amounts. We showed that such reforms would slightly increase labour supply when measured in terms of participation. When measured in terms of full-time equivalent workers, labour supply decreases in one of the 3 scenario's and slightly increases in the 2 others. Those small net effects are the result of opposing effects, both at the intensive and extensive margin.

We then calculated that the cost of such reforms is significant, and that savings in social assistance and unemployment benefits resulting from higher employment rates are far from compensating the important decreases in social security contributions and personal income taxes. Those decreases are exacerbated by the fact some workers will opt for lower-paid jobs, that become relatively more attractive with the work-bonus extension. This results in costs per FTE and new participant that are considerable, starting at 368.5 thousand EUR per FTE and 121.1 thousand EUR per new participant. Compared to previous studies, those figures are rather high. We gave different arguments why those figures could however be more accurate than previous estimations in subsection 2.5.5. We moreover calculated that the welfare gains are the highest for the third and fourth welfare deciles, while the first decile is almost unaffected.

The natural question that arises is whether increasing the workbonus is the most effective way to reach poverty reduction and labour market participation goals. One can reasonably wonder if investing in other active labour market policies as training programmes, additional coaching, more targeted wage subsidies or public jobs, possibly combined with investments in poverty-alleviating programmes, could not be a more adequate government spending.

Living Alone or Together: Effect of Social Benefits

3.1 Introduction

Social assistance, or the provision of resources to households that cannot make ends meet, represents an important last resort "safety net" in most of European countries. Such assistance is often conditioned on strict means-tests that aim at verifying that those households cannot sustain themselves either by working, resorting to savings or relying on relatives. On the contrary of social insurance, having contributed previously is not a condition to receive social assistance.

This assistance can take the form of general-purpose transfers or specific allowances. General-purpose transfers are not meant to cover particular expenses and are paid in cash. Specific allowances are provided to support access to goods and services considered as essential (food, heating, health, travelling, housing, culture, etc.). Those allowances can be provided in-kind, i.e. through a direct provision of those goods and services (either free or at reduced price), or through a reimbursement of proven expenses.

In most countries, social assistance benefit levels depend on household structure. Households are typically categorized in function of the number of household members and their age, as needs and means can vary substantially along those dimensions. Larger households are mostly supposed to benefit from economies of scale in their expenses, for example heating or renting costs, and therefore usually receive lower per capita benefits. On the other hand, families with children have additional needs for the raising of children and often more difficulties to combine work and household duties, justifying a more generous support. In addition, handicapped and elderly people often receive additional support to compensate a lower autonomy and productivity.

A large literature aims at identifying so-called *equivalence scales*, which answer the question: "How much income does a household with characteristics z need to reach the same level of well-being as a reference household (typically a single adult)?". Equivalence scales, whether being "normative" scales set by experts based on minimum baskets of goods, or developed by social scientists based on

consumption data or direct welfare measurement, help policy-makers in defining the parameters of social assistance programmes. Despite the *communis opinio* that differentiated benefits are a cost-efficient way to fight poverty, there is significant variation in equivalence scales implied by social assistance programmes.

We illustrate this for childless adults, who are the focus of our analysis. Figure 3.1 depicts the maximum (per capita) levels of general-purpose social assistance poor single and cohabiting individuals are eligible to in the European Union (hereafter respectively the "single amount" and the "cohabitant amount").[1] The ratios of the cohabitant amounts to the single amounts are given in Figure 3.2. From those figures one can observe that assistance is higher in northern and western European countries, and that the ratios of cohabitant amounts to single amounts vary across Europe, from 0.52 in Malta to 1 in Denmark and Latvia, with numerous countries at 0.75 and 0.9.[2] In other words, socially assisted singles moving in together lose between 0 and 48% of their benefits, depending on the country in which they live. This reflects a significant variation in normative approaches and/or methods used to set equivalence scales. As can be observed too, those ratios mostly remained stable over the 2008 - 2018 decade.

Notwithstanding the fact that economies of scale allow cohabitants to reduce their expenses, criticisms have been voiced against benefits too strongly differentiated according to household size. Strong differences might, according to those, prevent people in need to naturally join forces by sharing costs of living, creating "loniless traps". Worse, they could have destructive effects on poor couples and families, who prefer to live separately to not see their financial means decrease too much.[3] This in turn leads to additional adverse effects as a reduction of available housing space and an underitilization of scarce material resources as energy and

[1] Note that some countries are excluded from the analysis, due to lack of data: Italy, where national measures against poverty and social exclusion are in place only since 2018 (Reddito di inclusione REI, replaced by the Reddito di Cittadinanza RdC in 2019). Before those programmes, only experimental programmes where implemented in specific municipalities. The same holds for Greece where it was only in 2017, after two pilot programmes, that a significant nation-wide guaranteed minimum income scheme was introduced. In Spain, a national minimum income scheme only exists since 2020. Before, minimum income schemes were determined at local level, in the 17 Autonomous Communities, but the variance of the policy parameters was limited. We thus build a country-level value by taking the average of the four main regions (Madrid, Catalonia, Andalusia, Valencia), which represent about 60% of the population.

[2] 2007 data for Croatia is missing, as Croatia was not yet member of EU.

[3] See Appendix B.1 for a detailed description and field reports discussing those issues in Belgium. In the Netherlands, the *kostendelersnorm* is also criticized for pushing young adults into homelessness, preventing cohabitation and preventing the care of dependent adults (see e.g. [García et al., 2021]). The reason is that the level of per capita benefits is inversely related to the number of adults cohabiting. When children enter adulthood, their parents see their benefits decrease strongly, which can create untenable family situations.

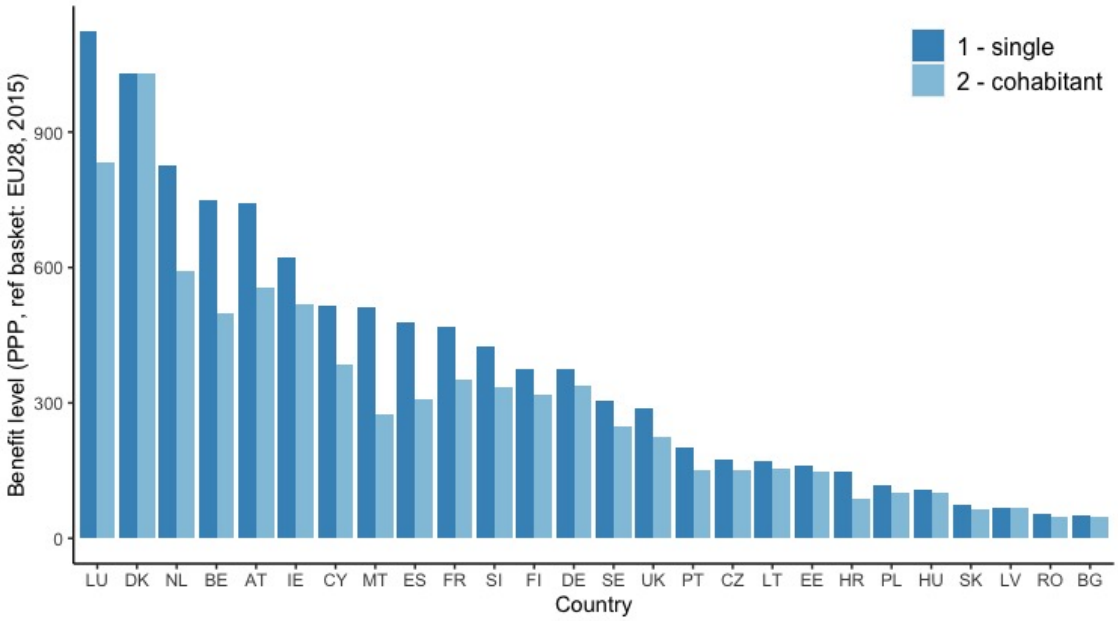


Figure 3.1: Social assistance benefits levels in PPP EUR
Source: Euromod country reports, own calculations

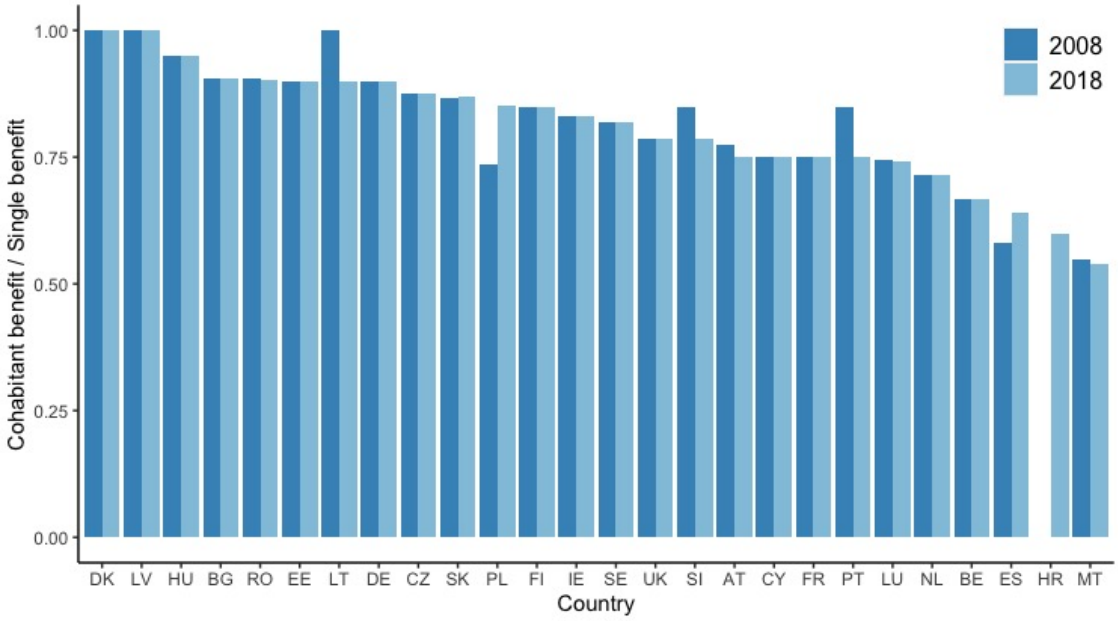


Figure 3.2: Ratio of social assistance benefits for cohabitants (per capita) to social assistance benefits for singles
Source: Euromod country reports, own calculations

household appliances. Another series of criticism concerns the administrative cost and difficulty of controlling household structure and the invasion of privacy implied. Those elements have lead to some arguments in favour of universal systems where benefits are fully individualized (and does thus not depend on household composi-

tion).

Knowing to what extent cohabitation decisions are affected by social assistance benefit schemes is a crucial question for policy-makers. On one hand, from an economic point of view, as it will impact the government expenses and thus the overall efficiency of a policy. On the other hand from an ethical point of view, as important private decisions of households could be influenced by policy parameters.

The contribution of this paper is threefold. First, it provides an unprecedented descriptive analysis of the level social assistance benefits, and their relative generosity for cohabitants vs. singles, in Europe. Secondly, it is estimated statistically if and to what extent social assistance benefit schemes affect cohabitation, by using cross-country and time variation of social assistance schemes in Europe. It is found that when the ratio of cohabitant benefits to single benefits is low, socially assisted individuals indeed more often live alone, and that the effect of an increase in this ratio by 1 percentage point (following an increase in the cohabitant amount), increases the share of cohabiting socially assisted individuals by 0.621 to 0.667 percentage points. Thirdly, an estimation of the budgetary impact of marginally increasing the cohabitant amounts is provided. As will be seen, part of the direct cost is recovered by the fact some socially assisted singles will start cohabiting and hence receive lower benefits from the government.

In section 3.2, we go through related research. In section 3.3, we introduce a simple framework to understand the possible effects of social assistance scheme parameters on cohabitation decisions and government expenses. In section 3.4, we present the results of our statistical analysis, and section 3.5 discusses budgetary implications. Section 3.6 concludes. A more detailed analysis of Belgian social assistance benefits, that strongly disadvantage cohabitants (compared to other EU countries), is provided in Appendix B.1.

3.2 Literature review

The reasons to marry or cohabit that are identified in the economic literature could be split into 3 categories. The first one, and probably the most important one, directly relates to the well-being increases related to family life: companionship, love, children, ... (the non-marketable household-produced commodities in [Becker, 1973]). The second one relates to consumption aspects: when two individuals start

cohabiting, they not only benefit from economies of scales by the consumption of public (or family/collective) non-rival commodities, but also, they can specialize in the production of goods in which they have a comparative advantage. In this way, a partner could devote more time to labour supply, while the other could focus on household production and childcare. Partners could also coordinate investment activities, e.g. by investing in human capital of the most able one, to maximize lifetime earnings. Thirdly, marriage provides security as spouses insure each other against idiosyncratic risks through intra-household transfers.[4]

The importance of the second and third determinants of marriage, related to consumption and insurance, clearly can vary after a change in social security programmes. In [Becker, 1973] and [Becker, 1974] seminal analytical framework of marriage and divorce, divorce is predicted to increase with (expected) social security transfers to divorced individuals/families, as those transfers reduce the financial costs of divorce and thus the disutility of being single. Moreover, social security transfers reduce the incentive to cohabit as a means to smooth consumption shocks through income-pooling.

A line of research endeavoured to estimate to what extent social assistance programmes, by affecting the utility levels one could expect when being single versus married, impacted divorce rates of families with children. Many researches, to which T. Paul Schultz, Robert A. Moffitt and Anne E. Winkler contributed significantly[5], for example investigated the effect of the Aid To Families with Dependent Children (AFDC) programme, and more broadly of welfare programmes in the USA, on household structure. The AFDC programme, originally created in 1935 to support single mothers, was criticized for creating a disincentive for (re-)marriage because women who married faced the reduction or loss of their AFDC benefits. It is generally estimated that AFDC had a negative impact on marriage probabilities, however this result is relatively fragile. The Temporary Assistance for Needy Families (TANF) programme was created in 1997, out of the pre-existing AFDC programme, to end needy parents' dependence on governmental benefits, and with the frequently expressed goal to strengthen the institution of marriage in the United States. The impact of this reform on marriage has been studied among others by [Bitler et al., 2004], who concludes that the welfare reform is not "pro-marriage" on balance, as it may have actually decreased the incentives to be married by giving

[4] See for example [Rosenzweig and Stark, 1989] or [Hess, 2004].
[5] See [Grossbard-Shechtman, 2003] for a discussion of this literature.

women greater financial independence via the program's new emphasis on work. In Canada, a study by [Lefebvre and Merrigan, 1998] shows that more generous welfare policies intended for couples with children could push single mothers to marriage and cohabitation and thus decrease the amount of public transfers to single mothers on welfare.

A related line of research focused on how social security benefits affect the marriage market by being a substitute to income-insurance implicitly provided by marriage through intra-household transfers. [Kotlikoff and Spivak, 1981] showed that individuals have economic incentives to establish relationships which provide risk-mitigating opportunities, in a context of uncertain life duration. He suggested that the growth in pension and social security payments could explain to some extent the increased instability in marriage arrangements. [Anderberg, 2007] constructs a simple model to explore the interaction between partnership formation/dissolution and welfare-state policy. He shows that publicly provided earnings insurance can reduce the steady-state marriage rate and the financial cooperation (or intra-household transfers) between partners. Public insurance is also predicted to increase the "turnover" rate in the marriage market. [Potoms and Rosenberg, 2021] build on this model and estimate the effect of Affordable Care Act's Medicaid expansion on marital outcomes. They show both theoretically and empirically that while Medicaid expansion does decrease the marriage rate, it also reduces the divorce rate of new marriages. As individuals have lower incentives to marry to insure each other against shocks, the match quality has to increase to enter or stay in marriage. They moreover estimate that, even tough the expansion is mainly targeted at lower-income individuals, it may also affect the behavior of those individuals who have low absolute likelihoods of ever gaining coverage, by changing the perceived risk of marrying an individual of a particular income-group. Lastly, [Low et al., 2018] show that limitations in time of welfare receipt, introduced by the US welfare reform of 1996, could increase marriage stability by worsening the outside option associated with getting divorced.

In Europe, research is scarcer and has primarily focused on families with children. For example [Tjøtta and Vaage, 2008] analyze whether public transfers to divorced families induces marital instability, and finds that the level of transfers has a positive effect on the probability to divorce. Closely related, [Walker and Zhu, 2006] investigate the effect of child support liabilities on partnership dissolution in the UK and find that an increase in child support liabilities significantly

reduced the dissolution risk. Regarding insurance aspects, [Persson, 2020] shows that marital behavior is a component of couples' strategies to plan for financial security in old age, by analyzing a reform of the survivor's insurance in Sweden. The question of the impact of welfare on cohabitation of childless adults has to the best of our knowledge not been studied yet.

While the literature generally uses the term "marriage" to identify adults living together, it is progressively becoming obsolete due to the growing share of individuals living together outside a formal marital relationship. We will therefore use the term "cohabitation" to designate adults living together in a consensual union and being either in marital, registered or unregistered partnership. In a context of welfare policies, it seems particularily adequate as the factual situation of a household is usually taken in to account for the determination of the assistance that will be provided.

3.3 Theoretical perspective

As probably sensed in the previous section, economists like to see the marriage or cohabitation as a voluntary union of rational individuals, and use the same tools to analyze this phenomenon as they would to analyze processes on other markets. While some aspects of marriage as fertility and modes of family decision-making led to new streams of economic research (see for example [Weiss, 1997] for an overview), the processes of searching, matching, sharing surpluses, divorcing, ... present many analogies with the labour market, for example.

One of these similarities is the comparison of future streams of utility, reducing the marriage decision to a dynamic programming problem, in which individuals compare the expected utility stream of continuing or engaging in marriage until the next period with the stream that would result from dissolution or non-engagement, as in [Anderberg, 2007]. Letting U_t^C denote the discounted utility stream when married in period t (or cohabiting in our case) and U_t^S the discounted utility stream when being single, the decision consists of comparing both and opting for the highest value, possibly comparing more than 2 utilities when there is more than 1 potential partner. Those discounted utility streams are typically assumed to depend on own expected income stream, (potential) partner's expected income stream, sharing rules (which in turn possibly depend on other elements affecting negotiation power, as outside options and the degree of cooperation), individual traits, marriage/match

quality and it's expected evolution through time, children and family plans, etc. The marriage market conditions and search processes also influence the marriage/divorce decisions, by affecting the probability to find a suitable partner in case of divorce or non-engagement, and hence the utility stream of remaining single. For the purpose of our exercise, let's focus on the the income aspects of those expected utility streams and denote their discounted value for an individual i, and his potential partner j, by functions $U_{it}^C(I_i, I_j)$ and $U_{it}^S(I_i)$, which are assumed increasing in their arguments. Two singles that met will start cohabiting if they managed to agree on a sharing rule such that, for each of them:

$$U_{it}^C(I_i, I_j) > U_{it}^S(I_i) \tag{3.1}$$

We now make some assumptions regarding the income distribution and the government support provided to poor individuals, that will lead to a simple equation representing the net cost of marginally increasing benefits for cohabitants. Suppose there is a means-tested social assistance scheme that is such that if the income of a single is strictly lower than B_s or if the per capita household income of cohabitants is strictly lower than B_c, benefits are given to them by the government to make up for the difference: a single receives benefits amounting to $B_s - I_i$ and cohabitants jointly receive benefits amounting to $2.B_c - I_i - I_j$. Suppose also that the level of those social assistance benefits is such that $0 \leq B_c \leq B_s \leq 2B_c << w_{min}$, where w_{min} is the minimum wage. Such a scheme is comparable to most social assistance schemes in Europe, as those usually include a means-test and take the income of the cohabiting partner into account in the means-test (such that someone not working but having a partner earning a full-time salary will not be eligible to social assistance, for example). Moreover, it has the feature that cohabitants receive a lower per capita benefit than singles, and that those benefits are significantly lower than minimum wages.[6]

Given our assumptions about the utility functions, the probability to cohabit for poor individuals should increase with ρ, defined as the ratio of B_c over B_s, as this increases the expected income stream when cohabiting. This can be written (assuming B_s does not change):

[6]See Table B4 in Appendix B.2 for actual figures comparing social assistance benefits and minimum wages.

$$\frac{\partial P(U_{it}^{C}(B_c, B_c) > U_{it}^{S}(B_s))}{\partial \rho} = \frac{\partial P(U_{it}^{C}(\rho B_s, \rho B_s) > U_{it}^{S}(B_s))}{\partial \rho} \geq 0 \qquad (3.2)$$

When increasing the cohabitant amount, the government expenses will be impacted in two ways: on one hand the government will have to pay more to all currently socially assisted cohabitants, and on the other hand, as some socially assisted singles will start cohabiting (and thus receive only B_c instead of B_s), the government transfers towards those will be lower. Let A denote the number of socially assisted individuals. Suppose A_s and A_c (with $A_s + A_c = A$) respectively denote the number of single and cohabiting socially assisted individuals, receiving benefits such that their per capita incomes respectively reach B_s and B_c. We furthermore assume, neglecting part-time workers and jobless individuals with other sources of income for simplicity, that incomes (before social assistance transfers) are either 0 when individuals are jobless, either $\in [w_{min}, +\infty[$. Poor individuals therefore receive the maximum amount of the benefits (i.e. B_c or B_s) when jobless, and no benefits when at least someone in the household is working. This approximation also implies that a marginal increase in benefits will not increase the total number of socially assisted individuals, as no individual has an income in the interval $]0, w_{min}[$, in which the eligibility thresholds are. In other words, $\frac{\partial A}{\partial \rho} = 0$, and the number of new socially assisted cohabitants following an increase in ρ corresponds to the decrease in the number of socially assisted singles: $\frac{\partial A_s}{\partial \rho} = -\frac{\partial A_c}{\partial \rho}$. Expressing government social assistance expenses in terms of payments to singles and cohabitants gives:

$$G = A_s.B_s + A_c.B_c = A_s.B_s + \rho.A_c.B_s \qquad (3.3)$$

Deriving equation 3.3 by ρ (keeping B_s constant) allows to split the marginal cost of increasing ρ into two components: a positive 'direct cost' component representing the additional benefits to be paid to socially assisted cohabitants, equal to $A_c B_s$, and a negative component, representing the cost recovered due to the fact some single socially assisted individuals move in together, equal to $(B_c - B_s)A\frac{\partial R}{\partial \rho}$, where $R = \frac{A_c}{A}$ denotes the share of socially assisted individuals that are cohabiting:

$$\begin{aligned}\frac{\partial G}{\partial \rho} &= \frac{\partial A_s}{\partial \rho}.B_s + \frac{\partial A_c}{\partial \rho}.B_c + A_c.B_s \\ &= (B_s - B_c).\frac{\partial A_s}{\partial \rho} + A_c.B_s \quad (\text{given } \frac{\partial A_s}{\partial \rho} = -\frac{\partial A_c}{\partial \rho}) \\ &= (B_c - B_s).A.\frac{\partial R}{\partial \rho} + A_c.B_s \quad (\text{given } \frac{\partial A}{\partial \rho} = 0)\end{aligned} \tag{3.4}$$

The cost recovery rate (defined as the share of direct costs that are recovered thanks to the fact some single socially assisted individuals will move in together) of increasing ρ is hence computed as:

$$\phi = \frac{(B_s - B_c)A\frac{\partial R}{\partial \rho}}{A_c B_s} = \frac{1-\rho}{R}.\frac{\partial R}{\partial \rho} \tag{3.5}$$

and only depends on the current ρ, the share of cohabiting socially assisted individuals R and the degree at which singles will react to changing financial incentives to cohabit $\frac{\partial R}{\partial \rho}$.

The goal of our statistical analysis in next section is to estimate the value of $\frac{\partial R}{\partial \rho}$, which, as can be derived from Equation 3.2, is expected to be positive as the utility of cohabiting increases. While there are some theoretical reasons to believe that benefit levels also influence the decision of cohabitation for individuals that are not eligible to those benefits (by changing the perceived risk of cohabiting with someone unemployed or in a precarious job situation for example), the effect of increasing ρ should especially be visible for poor individuals resorting to social assistance. The second part of our statistical analysis consists of estimating the cost recovery rate, i.e. equation 3.5, for the different countries in the sample.

3.4 Statistical analysis

3.4.1 Data

We use the databases of the European Union Statistics on Income and Living Conditions survey (EU-SILC) for our statistical analysis. Those databases are representative for the national populations and contain among others information on income, socio-demographic situation and the reception of social assistance benefits. The fact we use the same survey for all European countries providing non-contributory means-tested social assistance benefits increases the likelihood that comparability

is high. We use all the databases available since 2006 (and until 2018) and thus use the distribution of household structures at different places and times.

We filter the databases to keep only households with one or two adults that are less than 64 years old, not disabled, and do not live with children. We moreover construct a dummy variable, δ^a, equal to 1 for households that are eligible to general-purpose cash social assistance transfers and indeed declare to receive such benefits. For the first condition we test if disposable income excluding social assistance benefits is lower than the relevant (country, time and household size specific) guaranteed minimum income. For the second condition we check whether the variable containing "periodic payments to people with insufficient resource" is strictly positive. When those two conditions are satisfied, we set $\delta^a = 1$.[7] Some descriptive statistics of the resulting subsample are provided in Table 3.1. One can for example see that slightly more than 2% of the sample is socially assisted, and that the probability to be socially assisted decreases with education. Moreover, women are slightly less likely to rely on social assistance benefits.

	Total	δ^a	
	(*thousands*)	0	1
Number of observations	818.8	97.88%	2.12%
Household size			
- adults living alone	218.5	95.56%	4.44%
- adults cohabiting	600.3	98.72%	1.28%
Level of education			
- Primary or no education	72.2	94.38%	5.62%
- Secondary education	625.3	98.03%	1.97%
- High education	121.3	99.20%	0.80%
Gender			
- Man	396.7	97.69%	2.31%
- Woman	422.0	98.06%	1.94%

Note: δ^a is the dummy indicating whether an individual is eligible to and receives social assistance benefits.

Table 3.1: Descriptive statistics - estimation sample

For the year- and country-specific per capita guaranteed minimum income levels singles and couples are eligible to, denoted B_s and B_c, EUROMOD country reports[8] are used. In those reports, social assistance schemes are detailed and maximum

[7] The details of the construction and country-comparability of this dummy are given in Appendix B.2

[8] Publicly available at `https://euromod-web.jrc.ec.europa.eu/resources/country-reports` (Retrieved in December 2020)

general-purpose social assistance benefit levels provided. Tables B1 and B2, in appendix B.2, give an overview of those values, which are used to compute the ratio of the cohabitant amount to the single amount, $\rho = \frac{B_c}{B_s}$, used in the regression.

3.4.2 Estimation strategy

We estimate the determinants of cohabitation, using an OLS regression.[9] 3 specifications of the model are detailed and compared below. Robustness checks are provided and discussed in subsection 3.4.4.

In the first specification, we assume the parameters of the social assistance scheme, B_s and ρ, only affect cohabitation decisions of those who are eligible to social assistance and declare to receive social assistance. A dummy also captures the effect of being socially assisted on propensity to cohabit. This reduces possible endogeneity issues by allowing to capture the fact some individual characteristics likely influence both the probability to be socially assisted and single. For example bad temper can decrease the likelihood to find a cohabitant as well as a job. Low productivity too reduces the probability to find a work and, by having lower expected earnings, could reduce the probability to find a suitable cohabitation partner. Moreover, we add geographical- and year-dummies capturing variation of socio-cultural influences on the propensity to cohabit. The geographical dummies[10] capture socio-cultural influences that are likely correlated amongst countries having a related historical or cultural background due to geographical proximity. This results in the following expression:

$$Cohab_{ict} = \alpha_0 + \delta^a_{ict}.(\beta_0 + \beta_1.B_{s,ct} + \beta_2.\rho_{ct}) + \delta_c + \delta_t \tag{3.6}$$

where δ_c and δ_t are the geographical dummies and year dummies. In the second specification of the model we add some control variables related to age and education.[11] In the third specification, we allow the parameters of the social assistance scheme to influence cohabitation of individuals that are not socially assisted.

If there are measurement errors and biases in the data due to a different interpretation of (or compliance to) Eurostat guidelines, those are likely to be correlated amongst individuals from the same country, as data is collected by the national

[9] A probit model was also estimated and yielded similar results. OLS was kept here as it does not require a normality assumption on the error terms.

[10] The geographical dummies are based on a division of Europe according the the CIA World Factbook. A robustness test where country-dummies are used instead is provided in Appendix B.4.

[11] age, age^2 and education level (low: no or primary, middle: secondary, high: tertiary).

	Model 1	Model 2	Model 3
(Intercept)	0.70277***	1.30683***	1.44275***
	(0.02318)	(0.05398)	(0.15344)
δ^a	-0.78590***	-0.75318***	-0.86745***
	(0.12982)	(0.11837)	(0.13920)
$\delta^a B_s$	-0.00013**	-0.00014***	-0.00019***
	(0.00004)	(0.00004)	(0.00005)
$\delta^a \rho$	0.66739***	0.62128***	0.63981***
	(0.14961)	(0.13976)	(0.16348)
age		-0.03345***	-0.03377***
		(0.00258)	(0.00268)
age^2		0.00042***	0.00042***
		(0.00003)	(0.00003)
educL		0.01307	0.01148
		(0.00854)	(0.00908)
educH		-0.02418**	-0.02441**
		(0.00938)	(0.00853)
$(1-\delta^a)B_s$			-0.00020**
			(0.00007)
$(1-\delta^a)\rho$			-0.05261
			(0.17778)
R^2	0.01864	0.03476	0.03917
R^2 (soc. assist.)	0.03288	0.04310	0.03847
Num. obs.	817741	817741	817741

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$. Geographical and year dummies coefficients in appendix. δ^a is the dummy indicating whether a person is eligible to and receives social assistance benefits. B_s is the maximum benefit a single person is eligible to, and ρ is the ratio of the maximum per capita benefits eligible cohabitants can receive and B_s.

Table 3.2: Determinants of cohabitation - OLS regression

statistical offices. The consequence is that the error terms might be correlated with country-specific variables (the geographical dummies but also possibly the social assistance scheme parameters). To address this, we cluster the error terms at the country level. This reduces the risk of underestimating the confidence intervals.

3.4.3 Results

The results of the regression are summarized in table 3.2. First, it is clear from the regression that being socially assisted is strongly and negatively correlated with cohabitation. As explained above, this might be due to unobserved characteristics (for example unreliability, sluggishness, ...) that influence negatively both the probability to find a job as to find a partner. This negative relationship could be reinforced by the fact having no job and/or no income renders an individual less

attractive on the marriage/cohabitation market. In other words, a person that has some income might be reluctant to cohabit with a poor individual, knowing incomes are pooled to some extent and that his material comfort might therefore decrease.

Next, the regression shows that a higher ρ significantly increases the probability to cohabit, when socially assisted, in line with our theoretical expectations. This can be due to the higher number of couples that are eligible as to a number of socially assisted singles that start cohabiting. Increasing the overall level of benefits slightly decreases the probability to cohabit, which could suggest that the incentive to cohabit to insure against idiosyncratic income shocks decreases with the overall level of benefits, as expected theoretically.

In model 2 it is estimated that age has a small but significant effect on probability to cohabit for childless individuals: a minimum is reached around 40 years. Moreover, individuals with the highest education levels have the lowest probability to cohabit. One possible explanation for this result is higher labour mobility, resulting in less stable relationships. One could also think of longer studies and time investment in career paths that postpone transition into marriage. Also, lower purchasing powers of lowly educated individuals might render living alone hardly affordable.

Model 3 indicates that social assistance schemes also have a small but significant effect on cohabitation of individuals that are not socially assisted. This result is in line with the theoretical prediction that higher social benefits reduce the incentive to cohabit for risk-sharing purposes, mentioned in introduction. Note also that ρ has an insignificant effect on cohabitation of individuals that are not socially assisted.

The different models also reveal that in the last years individuals have more and more chosen to live alone, and that cohabitation rates are higher in Southern Europe. In all three models, the R^2 is quite low. This is easily understandable by the fact material aspects are not key factors when deciding to cohabit, nor are our control variables as age, education level, etc. Instead, factors as love, companionship, family and parental projects, social norms, ... are likely more determinant. Nonetheless, when measured only on the sub-sample of socially assisted individuals, the R^2 climbs stronly in model 1 and 2, indicating that social assistance scheme parameters are non-negligible determinants for this category of population. In model

3, the inclusion of explanatory variables to explain cohabitation behaviour of non-socially assisted slightly reduces the R squared of the sub-sample of socially assisted individuals.

Overall, the results are in line with the theoretical predictions and empirical observations found in the literature, as our model also implies that higher social assistance benefits for people living alone (which likely includes a significant share of the separated or divorced couples), as well as the relative generostiy of the benefits towards those single individuals (compared to cohabitants), have a negative impact on cohabitation rates.

3.4.4 Limitations and robustness

Identification of the causal effect of ρ on cohabitation requires that unobserved variables affecting cohabitation decisions are not correlated with ρ. One possible limitation of our analysis is that only cash benefits are considered. The provision of in-kind benefits, which could affect cohabitation decisions, are however difficult to include, as those can take many forms and be granted either through a direct provision of those goods and services (free or at reduced price), or through a reimbursement of proven expenses, and are therefore not systematically and comparably included in national surveys. The omission of in-kind benefits could bias the results if the ρ of those in-kind benefits (the relative generosity of those benefits for cohabitants compared to singles) is correlated with the ρ of general-purpose cash benefits. It is not clear in which direction the effect of ρ would be biased however: on one hand one could think that the ρ of in-kind benefits is correlated to the ρ of cash benefits, as the same intentions/assumptions could determine both (e.g. one could think that a particular country favours cohabitants, and thus sets high ρ both for cash as in-kind benefits). On the other hand, as cash benefits and in-kind benefits cover complementary needs, the ρ's could be negatively correlated.[12]

Note also that the estimation sample and analysis is limited to childless adults. Poor adults with children also face different financial incentives to cohabit depending on the country in which they live. Their inclusion is left for further research and is more complex given the heterogeneity of family and child benefits in EU coun-

[12]Suppose for example in country A only cash benefits are distributed to cover all needs, while country B distributes cash benefits to cover the rent, and food as an in-kind benefit. In country B the ρ of cash benefits is likely to be rather low (a rent does not increase fast with the size of a household), while the ρ of in-kind benefits is likely high (2 people would likely receive twice the food a single person would receive). In that example, the correlation of the ρ of cash benefits and the ρ of in-kind benefits would be negative.

tries, their possible interaction with social assistance benefits and their dependence on custodial agreements between separated parents.

We run a number of complementary robustness checks, of which the results are summarized in Appendix B.4. Our main result, that the ratio ρ significantly and positively affects cohabitation of socially assisted individuals, is robust to all the tests. The first test consists of iteratively removing all observations from a given country, in order to observe to what extent results depend on the inclusion of a specific country. The second test consists of replacing the geographical dummies by country dummies. The third test consists of keeping households composed of more than 2 childless adults in the dataset. While those are relatively infrequent, their cohabitation decisions are also affected by social assistance parameters and could therefore alter results.[13]

3.5 Marginal effects and cost-recovery

The average marginal effect of increasing ρ by 0.01 (in other words, increasing the cohabitant benefit level B_c by an amount of $0.01B_s$) is an increase of the share of individuals that cohabit of 0.621 to 0.667 (depending on the model) percentage points. The numerator of the cost recovery rate (defined in Eq. 3.5) is computed using our estimated marginal effect of increasing ρ on cohabitation rates, and the difference in the single and cohabitant amounts ($B_s - B_c$), which corresponds to the savings for the government when a socially assisted single starts cohabiting. For A and A_c, the number of socially assisted individuals and cohabitants, we use the information in the SILC surveys.[14]

The computed cost recovery rates ϕ are shown, by country, on Figure 3.3. Some countries have estimated cost recovery rates above 50%: Belgium, Malta, the Netherlands, Spain, Finland, Sweden, Croatia, France, Austria, and Luxembourg (in Model 1). This result is due to the fact that on one hand a relatively large share of socially assisted individuals in those countries live alone and/or that the savings achieved when two of them start cohabiting are considerable. In Belgium, the recovery rate is close to 100%, indicating that a Pareto improvement could be attained by increasing the cohabitant amount. In Denmark and Latvia, where

[13] Note however that using B_c as per capita benefit of households with more than 2 adult members is not always precise, as in some countries, the per capita benefits further decrease with household size.

[14] We use averages over the datasets of the different years, as in some countries few socially assisted individuals are observed each year. This reduces the risk that the number of socially assisted individuals are over- or underestimated if the surveys are not representative along that dimension.

socially assisted cohabitants receive the same benefits as singles, there is evidently no cost-recovery.

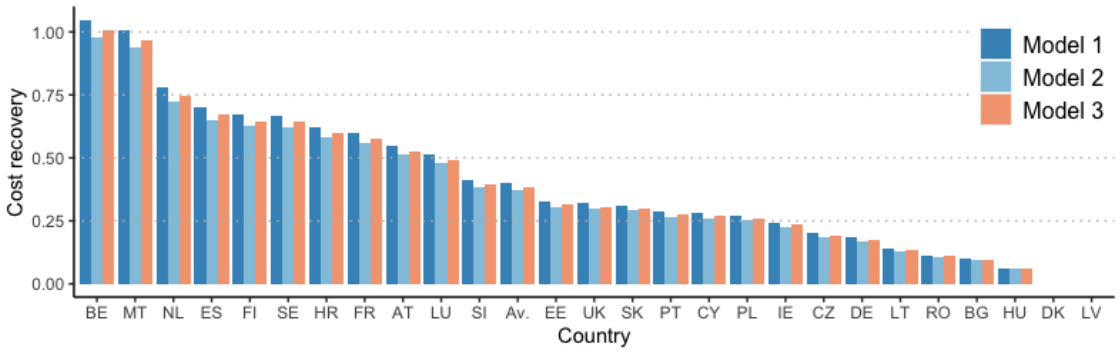


Figure 3.3: Cost recovery rate (ϕ) estimates based on Eq. 3.5

3.6 Conclusion

Our data collection shows that social assistance schemes vary significantly throughout Europe, both in absolute levels as in relative levels of assistance cohabitants receive. We calculated for example that the ratio of general-purpose per capita cash benefits when cohabiting to benefits when living alone varies from 0.52 to 1. In other words, two socially assisted individuals moving in together lose between 0 and 48% of their general-purpose cash benefits, depending on the country in which they live.

This country-variation is used in our statistical analysis to show that this ratio has a significant impact on cohabitation probability. Our research suggests that strongly differentiated rates as we observe in some countries (mainly Belgium, Spain, Croatia, Malta and Netherlands) are difficult to justify, as those hinder household formation and are unlikely to reflect actual economies of scale. Moreover, we estimate that increasing the cohabitant amount is much less costly than one might expect, as it will induce some single socially assisted individuals to move in together, resulting in lower per capita benefits to be distributed by the government. The cost recovery is estimated to average 37 to 39%, and to be higher than 50% for 9 to 10 countries, depending on the statistical model.

Exploration of market inefficiencies and externalities created by social assistance schemes disincentivizing cohabitation are important paths for further research, as well as calculating the administrative cost of controlling the household status of so-

cially assisted individuals. Another important path for further research is the question of whether social assistance benefit design affects the cohabitation of adults with children in the European Union, who likely also suffer from "loneliness traps" or "divorce traps".[15]

[15] and more specifically in Belgium, where rates are strongly differentiated. Field reports mention cases of households where parents have a financial advantage to live separately: [Schepers and Nicaise, 2014] for example mention a "divorce trap" created by social assistance benefits in Belgium, disincentivizing single parents to move in with another adult.

Universal Basic Income and Leisure Time Allocation

4.1 Introduction

Existing means-tested social security benefits are sometimes regarded as administratively burdensome, untransparent and failing to provide the right income security and work incentives to unemployed and inactive people. This led to a renewed debate about the advantages of universal basic income (UBI) schemes, in which all citizens are given a periodic and unconditional – with respect to means, work status and household structure – cash payment[1], in the last years.

One of the questions economists have focused on is the effects on labour supply incentives a UBI system could have. An often expressed worry is that, once people are given a generous obligation-free income, many may work much less or stop working altogether, reducing national production and income. In addition, as generous UBI schemes could require labour income tax increases to be financed, negative labour supply reactions could be even reinforced. On the contrary, the unconditionality of a UBI with respect to means, and thus earnings, usually reduces participation tax rates (PTR)[2] of people previously receiving means-tested benefits. In addition, UBI can offer a safety net reducing the risks associated with entrepreneurship. Labour supply could thus strongly be affected and the net impact of this (non-exhaustive) list of opposing mechanisms is of importance for the budgetary sustainability of the scheme.

Arithmetic microsimulation models, that consist of using individual-level economic and socio-demographic data and tax-benefit rules to simulate fiscal reforms, have been used to try to answer those questions. Those models allow to predict the

[1] A definition is given by the Basic Income Earth Network: "A Basic Income is a periodic cash payment unconditionally delivered to all on an individual basis, without means-test or work requirement." Note that a basic income thus is a set of possible tax-benefit policies, that can vary along different dimensions: level of the benefit, tax reforms financing it, benefits that are suppressed, modulation of the benefit with age, ...

[2] The participation tax rate is defined as the implicit tax rate a person would be subject to if she would move from unemployment to unemployment. The measure thus also takes into account the losses in benefits, which can be important. The term 'unemployment trap' is sometimes used to refer to a situation where the PTR is high (i.e. close to 1 or even higher).

effects on disposable income and work incentives (measured by participation and marginal effective tax rates for example) the introduction of a UBI reform would have on each individual. Behavioural microsimulation models go further and include the estimation of utility functions, allowing to predict labour supply changes that could occur after a change in individuals' opportunity sets. Those behavioural models all consider individuals that allocate their time between "labour" and "leisure", where leisure is an umbrella term designating all activities undertaken besides formal labour: personal care, household care, voluntary work, physical activities, social activities, ... While this is probably an understandable simplification, it only offers very limited insights on what schemes as UBI, that strongly alter opportunities, could induce in terms of time re-allocation. One of the aspects that deserve closer scrutiny, is how market and non-market activities (domestic work, voluntary work, family care ...) substitute each other after a tax-benefit reform affecting labour supply choices. A growing number of economists[3] recommend to take into account non-market activities when looking at wealth and social progress of a nation, as those contribute importantly even tough they are more difficult to measure and valuate.

This paper aims at, besides estimating the labour supply effects the introduction of a UBI scheme would induce, estimate how the freed up time would be spent, in order to give a more comprehensive evaluation of the scheme. The labour supply predictions are made using a Random Utility - Random Opportunity (RURO) labour supply model calibrated on EU-SILC data. Time allocations (outside formal labour) are then imputed, based on the disposable income, disposable time and socio-demographic characteristics of individuals, with a fractional multinomial logit (FML) model estimated on Harmonised European Time Use Surveys (HETUS).[4] The paper thus provides an ex-ante estimation of the consequences of the introduction of a UBI, both regarding labour market outcomes, as regarding leisure time allocations. The country considered in the simulation exercise is Belgium.

This article is organized as follows: in section 4.2, we review to literature related to the evaluation of UBI schemes, with a focus on labour market outcomes. In

[3]See for example the pioneering work of [Stiglitz et al., 2009].

[4]Note that an other explored possibility was to estimate a RURO model directly on the HETUS database, to circumvent the risk of endogeneity in the fractional multinomial logit, and thus biased imputations of time-allocations. However, the HETUS database contains very limited information on economic variables (only the income quintile, and no information on the income sources), and lacks some socio-demographic data (e.g. the region of residence), rendering it unusable to calculate opportunity sets (or at least, a lot of information would have to be imputed, bringing us back to the initial problem.)

section 4.3 a simulation of a benchmark UBI is presented, and the consequences on labour supply detailed. Section 4.4 presents the imputation of leisure time shares. Section 4.5 discusses the results and concludes.

4.2 Literature review

The first microsimulations of UBI schemes were run in the 90's and were purely arithmetic,[5] i.e. taking no behavioral changes into account. The goal was to calculate the income tax increases needed to finance a decent BI, and to estimate the redistributive effects of such schemes (see for example [Callan and Sutherland, 1997]). While still sometimes used nowadays to evaluate the effects of UBI schemes, arithmetic models suffer from the weakness of not providing estimates of the important labour supply changes that could occur under significantly different tax-benefit systems as UBI, but only changes in implicit participation tax rates and marginal effective tax rates.

In the late '90s labor supply models developped by [Van Soest, 1995] and [Aaberge et al., 1995][6] became increasingly popular. Those models allow to predict labour supply choices in contexts of complex budget sets. Their methodology consists of estimating a structural model of individuals' preferences, based on correlations in the data between individuals' supposed work opportunities and observed decisions. Having an estimation of those preferences, the second step consists of predicting individual and household behaviour when those are subject to different tax-benefit systems and thus different opportunity sets.

An overview of both arithmetic and behavioural studies on the introduction of UBI schemes is given in Appendix C.1. Those studies vary in terms of assumptions regarding the tax-benefit reforms accompanying the introduction of a UBI, as well as the level of the benefit. Moreover, reforms are simulated for different countries at different periods, implying different "initial conditions". Despite this, some conclusions are shared by most of those studies (see [Marx et al., 2019] for a discussion): first of all, secondary earners often face increases in participation tax rates, due to the fact they now have an out of labour income, resulting in labour supply decreases. In contrast, UBI schemes, by not being means-tested, generally decrease participation tax rates for singles and primary earners. This results in

[5] Note that [Bishop, 1979] or [de Jager et al., 1996] already simulated UBI schemes (or the comparable negative income tax mechanism) using general equilibrium models.

[6] Who relied on models initially developed by McFadden ([McFadden, 1974]) for transport choices.

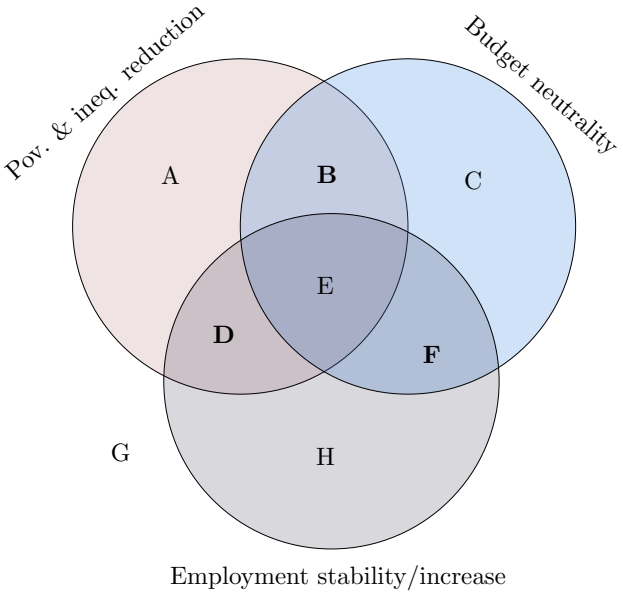
less negative or even slightly positive estimates of extensive labour supply reactions amongst singles and primary earners.

Regarding net effects, one can draw the conclusion that almost all simulated UBI schemes lead to an overall reduction of labour supply. Amongst the few simulated UBI schemes that increase overall labour supply, some are partial UBI, i.e. they do not allow people to live only from it, as in a scenario of [Scutella, 2004], and others are not budget neutral, as in one of the scenarios of [Horstschräer et al., 2010]. In the first case inequalities strongly increase while in the second case the scheme is not sustainable over time. More generally, the literature highlights that a UBI financed through income taxes struggles to combine those 3 elements: poverty reduction, net labour supply increase (or status quo) and budget neutrality. In other words, a UBI scheme will likely lead to at least one of those consequences: poverty increases, labour supply decreases (likely resulting in a production decrease) or a budgetary deficit. This trilemma, corresponding to the "iron triangle" of welfare reforms in [Blundell, 2002], is illustrated on Figure 4.1, where E represents a situation that seems difficult to attain: only [Colombino et al., 2010] and [Islam and Colombino, 2018], in an optimal taxation exercise, find budget-neutral UBI scenarios leading to poverty (or inequality) decreases and employment increases, for some countries considered. While this trilemma might lead to the conclusion that UBI could not easily become a socially and politically acceptable alternative, it is important to note, as do for example [Scutella, 2004] and [Colombino, 2015], that generous UBI schemes combined with higher income taxes could be socially optimal, even though labour supply might decrease, due on one hand to the value people give to leisure time, and on the other hand to inequality aversion.

Besides microsimulation models, some researchers exploited experiments to evaluate the effect UBI could have on labour supply. The most notables are probably the four Negative Income Tax (NIT) experiments[8], sponsored by the United States federal government between 1968 and 1982. It is found quite consistently across studies that NIT slightly reduce employment. [Robins, 1985] for example finds that husbands reduced their labor supply by about the equivalent of two weeks

[7]Note that only behavioural models are taken into account as static models are unable to estimate net effects on labour supply. Note also that sometimes information on overall effect on inequalities, poverty or labour supply are not explicitly given. In those cases we did not classify the papers, or classified them according to our best interpretation to build this illustrative figure if sufficient information was available. Lastly, note that employment stability refers to FTE equivalents (and not employment rate).

[8]The NIT, popularized by Milton Friedman, is an extension of the personal income tax system into negative territory. NIT and UBI engender similar budget constraints.



B: Scutella (2004) - System 1, Müller (2004) - all scenarios, Hortschräer et al. (2010) - Alternative 1, Colombino (2014), Jongen (2015), Jongen (2020)
C: Jessen et al. (2015)
D: Hortschräer et al. (2010) - Base scenario
E: Colombino et al. (2010) - DK, Islam and Colombino (2018) - BE,FR scenario
F: Scutella (2004) - System 2, Jacobs et al. (2006), Hortschräer et al. (2010) - Alternative 2
G: Clavet et al. (2013)

Figure 4.1: Basic income trilemma[7]

of full-time employment per year on average. Wives and single female heads are estimated to have reduced labor supply by about the equivalent of three weeks of full-time employment per year. The more recent Finnish experiment on UBI came to the conclusion that replacing existing unemployment benefits with a UBI did not significantly reduce labour supply, and might even have increased employment shares [Verho et al., 2022]. Other famous natural (quasi-)experiments exploited to search for evidence on labour supply reactions following the introduction of a UBI include for example win-for-life type of lotteries (studied for example by [Marx and Peeters, 2008]), unconditional transfers of casino profits to Cherokee Indian community members (studied among others by [Akee et al., 2010]) or unconditional transfers to Alaskan citizens, distributed yearly from the Alaska Permanent Fund ([Jones and Marinescu, 2022]). [Marx and Peeters, 2008] find no signficant effect of winning the lottery on labour supply. [Akee et al., 2010] find that neither mothers nor fathers are leaving the labor force because of the additional household income. Finally, [Jones and Marinescu, 2022] find, in their preferred statistical model specification, no effect on participation rates, but slight increases in part-time work, when people receive unconditional transfers.[9]

The question of how UBI affects leisure time allocation has not been studied yet using microsimulation models. Some insights are however available from a few past

[9] A more complete list and detailed discussion of experiments that give insights on the topic of UBI can for example be found in [Gentilini et al., 2019].

or ongoing natural or randomized experiments that report behavioural changes regarding time devoted to activities as education, community life or child and family care (see e.g. [Ferdosi et al., 2020], [Suplicy and Dallari, 2020]), but the question of what individuals would do with time freed up after a labour supply decrease, or what they would give up when increasing their labour supply remains largely unsolved.[10]

As is done in the literature, we will use the term "leisure" throughout the paper to denote the remaining time of working time, or said differently, the time endowment minus labour supply. It is noteworthy to point out that this term can be misleading, as it often refers to free time with dimensions of (perceived) freedom and choice in everyday language, while in its economic use it mostly also includes activities related to the fulfilment of physiological needs (sleeping, eating, ...) as well as activities that can resemble in their nature to labour (household chores, voluntary work, ...).

4.3 Simulation of a UBI in Belgium

4.3.1 Tax-benefit reform

The UBI reform we simulate consists of granting a UBI to all adult citizens aged 18 to 64, set at 25% of GDP per capita (a benchmark level proposed in [Van Parijs and Vanderborght, 2017]), and a quarter of this amount to the children. That level of UBI, 770 euros monthly, lies in between maximum social assistance benefits for cohabitants (544.91) and individuals living alone (817.36), in our policy year 2017. The UBI is included in taxable income. Most existing benefits (social assistance, unemployment, early retirement, in-work, child and birth benefits) are suppressed, and benefits covering particular health needs (sickness benefits, disability benefits) are diminished by the amount of the UBI. In addition, the marital quotient is suppressed.[11] Retired people continue to receive their normal pensions.[12] The budget deficit resulting from these reforms amounts to 23.68 billion euros yearly[13], after labour supply changes. Different tax reforms are possible to bridge this remaining

[10] Note however that some authors studied the effect of other tax-ben reforms on time-use. This is the case for example of [Bastian and Lochner, 2020] who study (ex-post) the effect of the Earned Income Tax Credit on maternal time use, using the American Time Use Survey.

[11] This follows some proposals made in Belgium (see for example [Defeyt, 2017]). The rationale is that the marital quotient, that gives a tax advantage to households with one earning individual and one labour market inactive individual, becomes obsolete with a UBI as the UBI provides a revenue for the inactive.

[12] However, pre-retired that are still in working age receive a UBI but see their pension decreased by the same amount.

[13] Budget deficit refers here to a deficit compared to the base scenario.

gap. UBI proposals cover a wide range of financing mechanisms: personal incomes taxes, capital taxes, value added taxes, corporate income taxes, but also public natural resources, money creation, carbon taxes etc. The microsimulation model EUROMOD only allows to reform personal income taxes, and thus limits the possibilities of simulation.

In scenario 1, 50% of the gap is assumed to be filled by a PIT increase, and 50% by other sources which are not modeled. As PIT revenues account for about half of Belgian tax revenues, it seems not too unrealistic to assume half of the gap is filled by other income sources, even if this would induce economic effects that cannot be modelled with EUROMOD. In scenario 2, we assume that the net cost of the UBI scheme is fully financed through a PIT increase. In both scenarios, PIT increases are achieved by multiplying the PIT tax rates by a constant.[14] The resulting PIT in the base and reform scenarios are given in Table 4.1.

UBI scenarios			
System	**Base**	**Scenario 1**	**Scenario 2**
Basic Income (0 - 17 y.o.)	0	192.5	192.5
Basic Income (17 - 64 y.o.)	0	770	770
Bracket 1 (0-10860)	25 %	29.6 %	34.2 %
Bracket 2 (13250-12470)	30 %	35.5 %	41.1 %
Bracket 3 (23390-20780)	40 %	47.3 %	54.8 %
Bracket 4 (20780-38080)	45 %	53.2 %	61.6 %
Bracket 5 (38080 +)	50 %	59.1 %	68.5 %

Table 4.1: Adjsuted PIT rates

4.3.2 Model predictions

To model workers decisions, we estimate a RURO labour market model, where labour supply is seen as the outcome of agents choosing from a set of job offers. Our model builds on [Capéau et al., 2016], and is the same as the one developed in detail in Chapter 2. For a detailed derivation of the RURO model, see also [Dagsvik and Strøm, 1992]. The RURO model allows to make predictions about the choices that would be made by economic agents when facing a different job opportunity set. This kind of model faces a number of limitations. The main one is probably that the model is a partial equilibrium model, and does not take into account the

[14]This constant is found through an iterative process leading to a target budget deficit (respectively 11.84 in scenario 1, and 0 in scenario 2). Concretely, as long as the budget deficit is larger than the target deficit, PIT rates are increased by small steps, corresponding labour supply changes estimated, and new budget deficits calculated.

effect of aggregate labour supply changes on individual opportunity sets. An other limitation is the fact the model is static (in the sense that it has no time dimension), while labour supply and life choices in general more likely result from a dynamic optimisation problem. Related to this, the assumption that observed situations result from optimal choices, is particularly daring, as unemployment or inactivity for example often are a transitional and temporary state chosen or incurred in particular life or economic conditions.

The RURO model predicts overall net labour supply changes of -5.7% FTE and -1.4% participation in scenario 1. This corresponds to an average labour supply decrease of 1h54 per week per labour market available individual (as defined in chapter 2). Singles' average labour supply does not change much, as new entries compensate intensive and extensive margin labour supply reductions to some extent. Single females with children even increase their labour supply: this results from a high number of inactive and unemployed single mothers who see their out-of-labour income and participation tax rate decrease. Couples also reduce their labour supply at the intensive and extensive margin, but in their case it is almost not compensated by new entries, which are very low. This is explained by the increase in PTR for secondary earners, as well as a stronger income effect for couples, who see their equivalent income increase more. In scenario 2, the overall net labour supply changes amount to -10.7% FTE and -3.9% participation. This corresponds to an average labour supply decrease of 3h35 per week per labour market available individual. Again, the net change in labour supply is in a big part driven by intensive margin changes and by couples. These changes are shown on Figure 4.2. The direction of the results is in line with the literature: net labour supply decreases, mainly driven by secondary earners. The amplitude of the changes is however more difficult to compare with the literature: it crucially depends on the level of UBI distributed and the tax-benefit changes that accompany the introduction of the UBI. Moreover it depends on the "initial conditions" (e.g. the number of unemployed in the base scenario) which are country and time specific, and lastly, comparable labour supply change metrics are unfortunately not always available across studies.

Figures 4.3 and 4.4 show the share of winners and losers, in terms of equivalized disposable income[15], by decile and by household type. One can see that the reforms

[15]Equivalized disposable income is obtained by first calculating the total disposable household income, i.e. the sum (across household members and income sources) of incomes that members of a household have at their disposal. This total disposable household income is then equivalized to take into account scale effects in household consumption. The scale used is the OECD-modified scale. All individuals

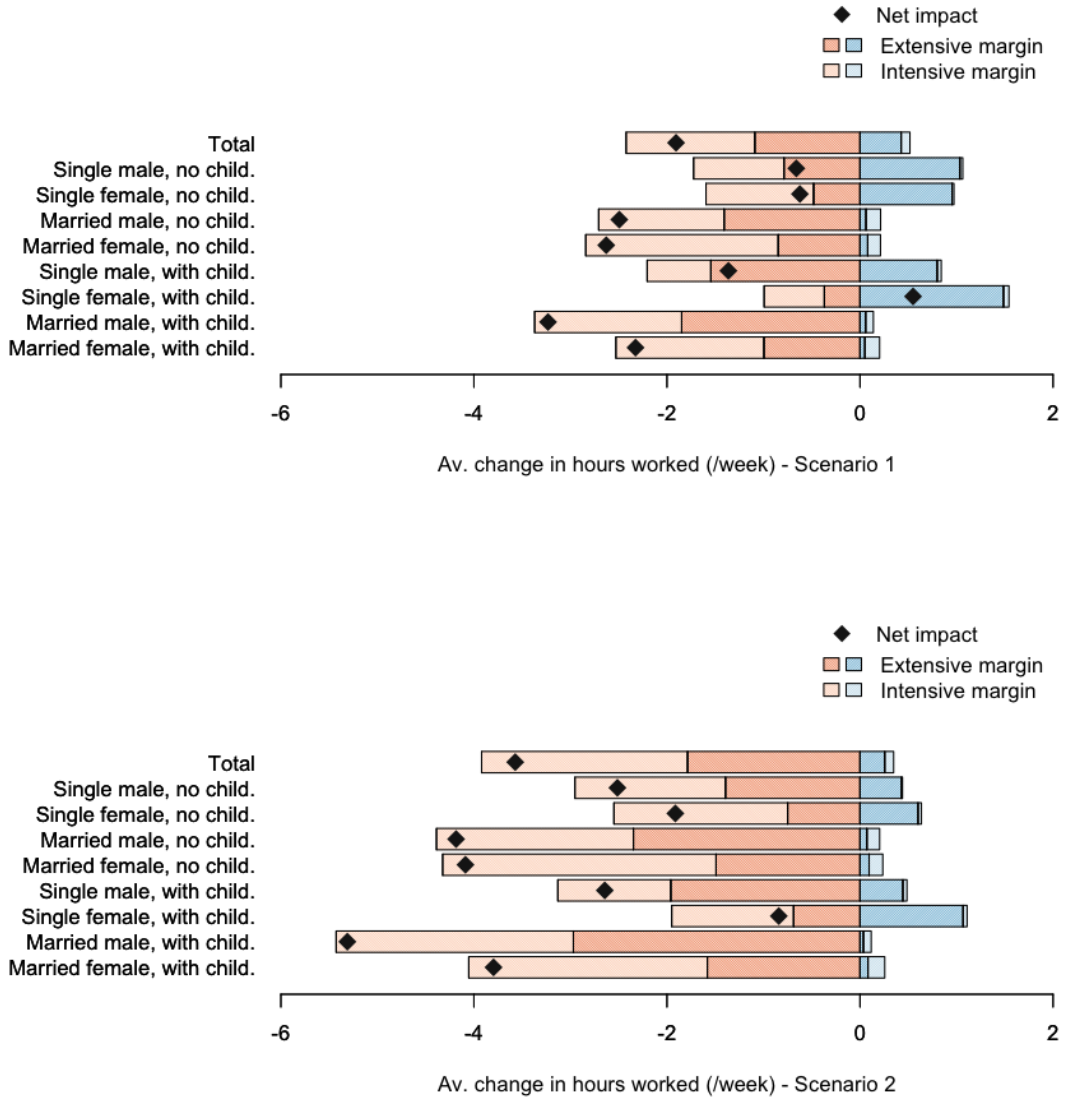


Figure 4.2: Labour supply responses

are strongly redistributive: a higher share of individuals see their income decrease in the highest deciles. This is explained by the fact high income earners will contribute more to the system through higher personal income taxes. One can also see that a non-negligible share of individuals in the lowest deciles will lose a big part of their income. This results from the suppression of existing benefits, which in many cases exceed the UBI distributed.

Among the different categories of individuals, those that will lose quite impor-

in a household have the same equivalized disposable income, and this measure thus does not look at intra-household apportionment of means.

tantly are the retired, especially the most wealthy. This comes from the fact they do not receive the UBI, but will pay higher personal income taxes. Jobless single parents will also lose more than the average, as they usually received important benefits before the reform. Among the big winners are childless couples that do not work, as the UBI they will receive is larger than social assistance benefits for cohabitants. Also, large households are rather well off, compared to other households. This results among others from the fact equivalent incomes take into account economies of scale in household expenses, and large household's equivalent income will increase by a higher percentage than a small household's equivalent income, if every household member receives 770 extra.

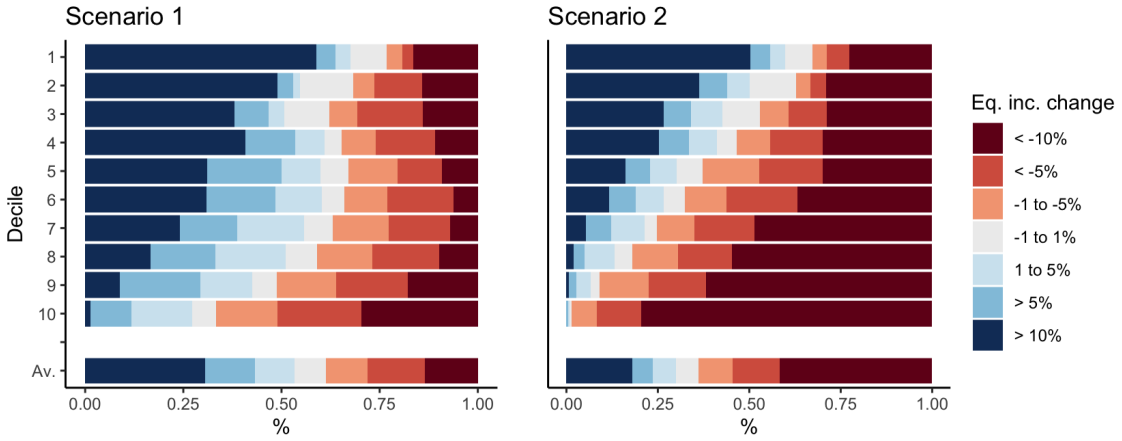


Figure 4.3: Winners and Losers by decile

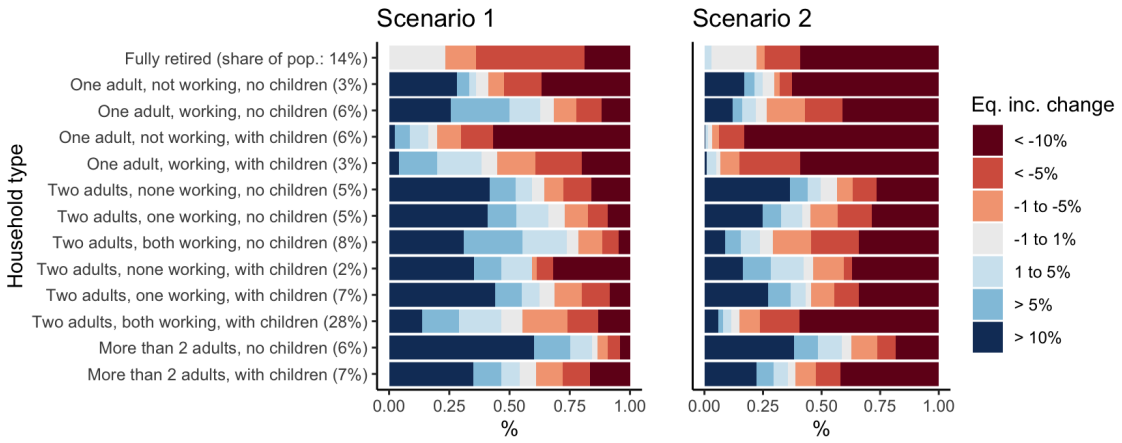


Figure 4.4: Winners and Losers by household type

Table 4.2 gives some statistics regarding poverty and inequality. The Gini-

coefficient, a measure of income inequality[16], decreases from 0.218 to 0.199 and 0.184 in scenarios 1 and 2 respectively. Poverty rates are given at fixed and floating (i.e. respectively calculated based on the median income of the base and reform disposable income distribution) poverty line. As can be seen, the simulated UBI reduces the number of poor below poverty lines set at 50% or 40% of the median income. When looking at higher poverty lines (60% of median income), the poverty rate also decreases except in the case of scenario 1, when the floating poverty line is used. The relatively low decreases in poverty rates can be explained by the fact universal benefits are less targeted towards the needy: by replacing most of existing benefits by a UBI, some poor households see their disposable incomes decrease. However, those not taking up social benefits or falling through the cracks of the system end up better off.

Category	**Base**	**Scenario 1**	**Scenario 2**
Basic Income (0 - 17 y.o.)	0	192.5	192.5
Basic Income (17 - 64 y.o.)	0	770	770
Gini	21.8%	19.9%	18.4%
Poverty line (0.6)	1086.8	1138.7	1100.2
Poverty rate (0.6) - fix./flo.	11.4%	9.6%/11.5%	10.3%/11.1%
Poverty line (0.5)	905.7	948.9	916.8
Poverty rate (0.5) - fix./flo.	6.1%	4.0%/5.1%	4.5%/4.7%
Poverty line (0.4)	724.5	759.1	733.5%
Poverty rate (0.4) - fix./flo.	1.9%	1.3%/1.7%	1.5%/1.7%

Table 4.2: Poverty and inequality

4.4 Leisure time

The allocation of "disposable" leisure time is estimated with a fractional multinomial logit (FML) model, on HETUS data. This specification guarantees that shares of total leisure time devoted to the different activity categories will sum up to 1. The estimated FML will allow to impute time-use shares to chosen job-opportunities in the RURO model, based on disposable income, disposable leisure time and socio-demographic characteristics. Comparing time allocations in the base (observed) case and the reform scenarios will allow to calculate expected changes.

[16]The Gini-coefficient [Gini, 1912] is calculated using equivalized disposable incomes. The Gini goes from 0 (perfect equality: all individuals have the same income) to 1 (perfect inequality: 1 household receives all income).

4.4.1 HETUS data

The HETUS are surveys conducted to quantify how much time people spend on various activities. Those activities were categorized as employment, voluntary work, household chores, household member care, personal care (includes eating), study, sports and outdoor, other leisure (includes social life, entertainment, mass media, hobbies and computing), travel (or unspecified) and sleep.[17] A representative sample of respondents were asked to fill in all their activities undertaken during two days, of which one weekend day. The last available Belgian dataset, containing 5,559 respondents aged 10 or older from 2,744 households, was collected in 2013. We filter these households according to the same criteria as the SILC dataset (see subsection 2.4.1), to keep only singles and couples available to the labour market. In addition, we remove individuals that declared being sick on at least one of the registered days, or those that are only observed on holidays and weekend days. Descriptive statistics of the obtained sample are given in Table 4.3.

	Single		Couple	
	Male	Female	Male	Female
Number of observations	249	489	318	
Av. working time - Workers (h/w)	37.2	31.9	37.3	30.9
Participation (%)	63.2	56.6	77.8	63.1
Highest level of education (%)				
- Primary education	10.5	8.4	7.5	8.4
- Lower secondary education	20.3	22.7	17.4	12.4
- Upper secondary education	29.9	36.1	38.1	37.2
- High education	49.3	35.3	37.0	42.0
Household composition				
Average household size	1.6	1.9	3.4	
- of which children	0.2	0.4	1.0	

Table 4.3: Descriptive statistics - households included in estimation sample

A first descriptive statistic of interest is the time devoted to employment versus household chores and household member care. We show this in Figure 4.5, where employment corresponds to the red share and household chores and household member care correspond to the blue shares[18]. One can among others observe that male adults spend on average significantly more time on employment, and less time on household chores and household member care than female adults. This is

[17] see Appendix C.2 for more information of what each category includes.

[18] This split corresponds to the paid work and unpaid care work categorization of [Gálvez-Muñoz et al., 2011].

the case for singles and married individuals[19], having children or not, even tough the difference is the strongest for couples with children. In this latter case, one can also note that the sum of time devoted to employment, household chores and household memeber care is on average almost equal for male and female adults.

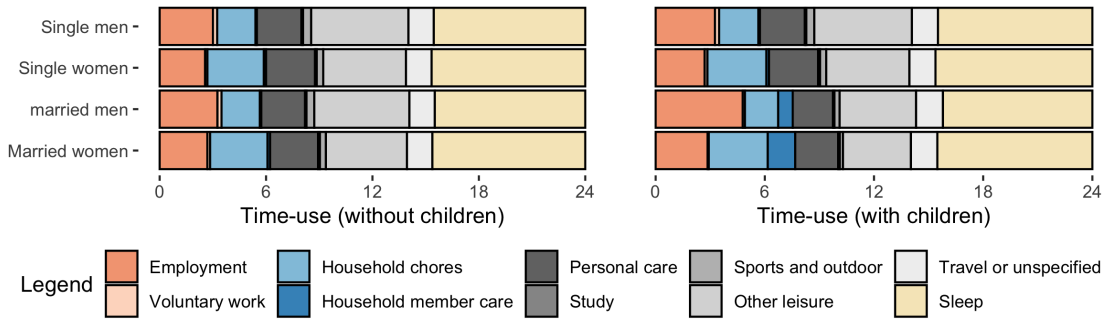


Figure 4.5: Av. time-use shares in function of gender, presence of children and marital status

Figure 4.6 shows how time-use relates to labour supply. The categories "Unemployed", "Part time 1", "Part time 2", "Full time", and "Overtime", designate individuals estimated[20] to work respectively 0, 1 to 17, 18 to 34, 35 to 44 and more than 45 hours weekly. Individuals working full-time spend on average around 5.8 hours working and 8.1 hours sleeping daily, and this does not significantly change with the presence of children. The remaining time is allocated to the other leisure activities as social life, entertainment, hobbies, computing and mass media (4 hours when no children are present, vs. 3.4 hours with children), eating and washing (resp. 2.3 and 2.2 hours), household chores (resp. 1.6 and 2 hours), travel (resp. 1.6 hours and 1.5 hours), household member care (resp. 0.1 hours and 0.8 hours), and other smaller activities. The most significant positive absolute difference in leisure time allocation between individuals having children or not thus concerns, as one might expect, household member care (+0.7 hours daily), and the most important negative difference concerns social life, entertainment, hobbies, computing and mass media (-0.6 hours daily).

The graph also shows that full-time workers spend on average about 2 hours less on household chores, and 2 hours less on "other leisure", than inactive/unemployed individuals. In addition, they sleep on average 0.9 hours less per night.

[19]Note that we use the term married in a broad way, to designate all adults in a formal or informal partnership (that are observed in the same household in the data).

[20]To estimate this, their labour supply during the observed week day and weekend day are respectively multiplied by 5 and 2, and then summed.

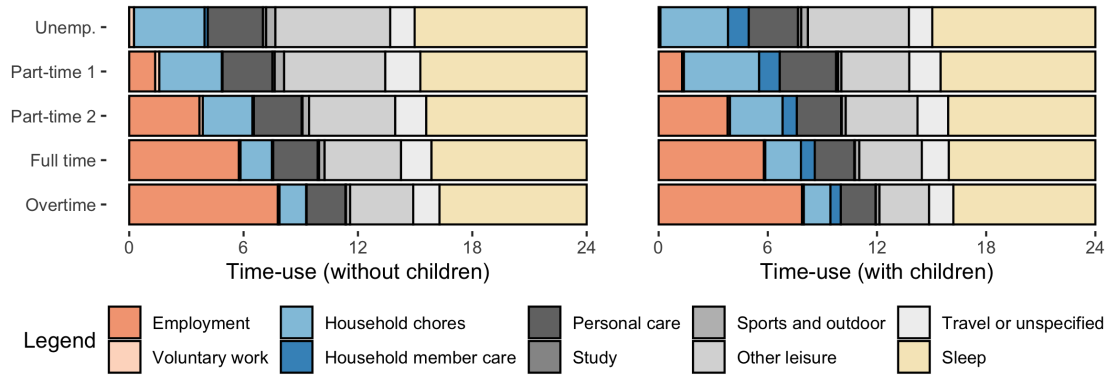


Figure 4.6: Av. time-use shares in function of labour regime and presence of children

4.4.2 Estimation

The following multinomial fractional logit is estimated using a quasi-maximum likelihood estimator (see [Mullahy, 2015] for a description of the estimation technique used):

$$E(\ell_k|C,L,\mathbf{X}) = \frac{exp(\beta_k^o + C.\beta_k^C + L.\beta_k^L + X_\ell.\beta_k^{x_\ell})}{\Sigma_{m=1}^{M} exp(\beta_m^o + C.\beta_m^C + L.\beta_m^L + X_\ell.\beta_m^{x_\ell})}, k = 1, ..., M \qquad (4.1)$$

where ℓ_k denotes the fraction of total disposable leisure time (L) spent on activity k, C the income level (quintile) and X is a vector of covariates including gender, education (7 levels), age (10 age-groups), number of children aged 0 to 6, number of children aged 7 to 17, number of adults and cross-effects of gender with respect to the presence of children and disposable leisure time. For couple members, total leisure time of the other individual is added as explanatory variable in X. This allows to capture the fact that an individual whose partner has a lot of leisure time (and thus time to take care of household chores and children for example) will likely have a different leisure time allocation than an individual with a busy partner. For the rest of this section, we assume that all those variables are exogenous to the leisure time allocation choice. This assumption will be discussed in 4.4.4.

The estimated parameters and marginal effects can be found in Tables D3 to D5 in appendix C.3. Tables D6 to D8 give the parameters when the model is estimated not only on Belgian data but also when neighbour countries observations are included.[21] Leisure activities are fostered when leisure time increases (with the exception of 'travel and unspecified'). Total leisure time of one's partner is negatively

[21] This is done as a robustness check. While it has the disadvantage of including individuals from other countries, who not necessarily have the same preferences in terms of time allocation, it allows to have more observations in the sample and thus possibly more accurate parameter estimates.

related with own time devoted to household chores and care of family members. This can be easily explained by the fact a partner with more leisure time is likely to take care of a bigger proportion of domestic tasks. As expected too, having children, especially aged 0 to 6, strongly increases time devoted to household chores and care of family members. Figures 4.7, 4.8 and 4.9 illustrate the number of hours devoted to household member care and household chores in function of labour supply, and household chores in function of the labour supply of the partner respectively.

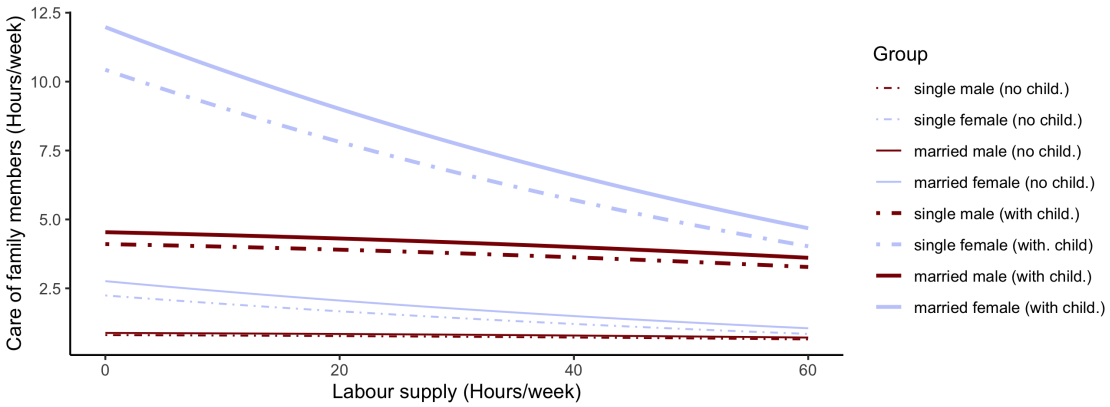


Figure 4.7: Time devoted to household member care in function of labour supply

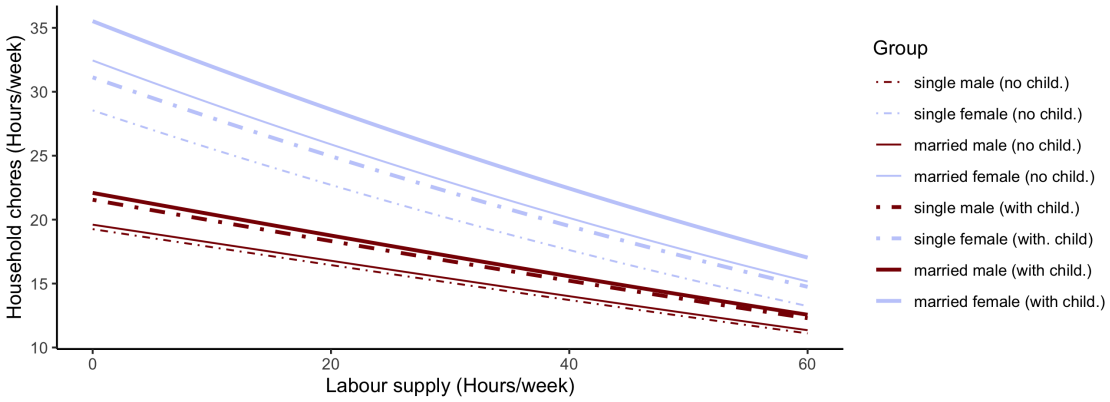


Figure 4.8: Time devoted to household chores in function of labour supply

The estimated time allocations after a switch from full-time to inactivity/unemployment are given in Figure 4.10 for different demographic groups. One can for example see that women are predicted to spend a higher share of time freed up to household chores and household member care, especially when having children. Note that those shares are calculated assuming the partner's labour supply (and thus leisure time) remains constant. As in the simulated UBI scenarios, some couple

[21] These estimations can also be interpreted as activities given up by someone entering the labour force.

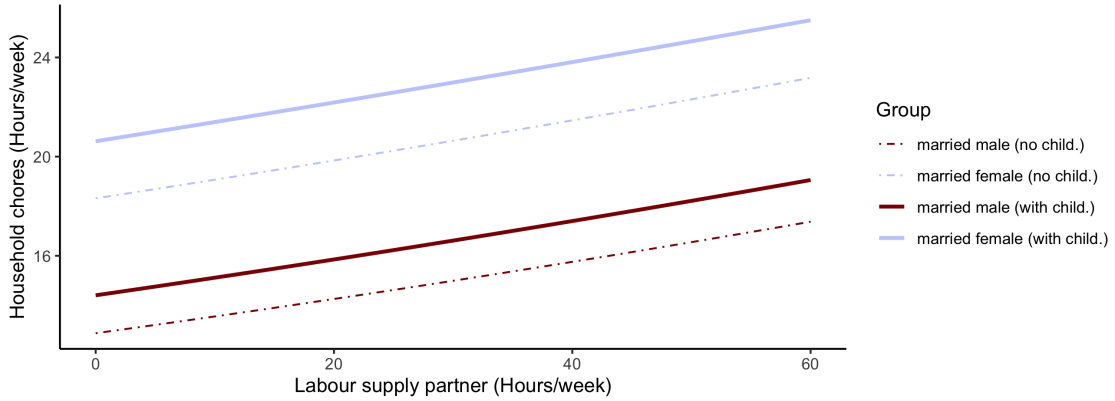


Figure 4.9: Time devoted to household chores in function of partner's labour supply

members both reduce their labour supply, they will both be predicted to contribute more to domestic tasks, and the share of freed up time devoted to those will thus be lower than what is depicted on Figure 4.10.

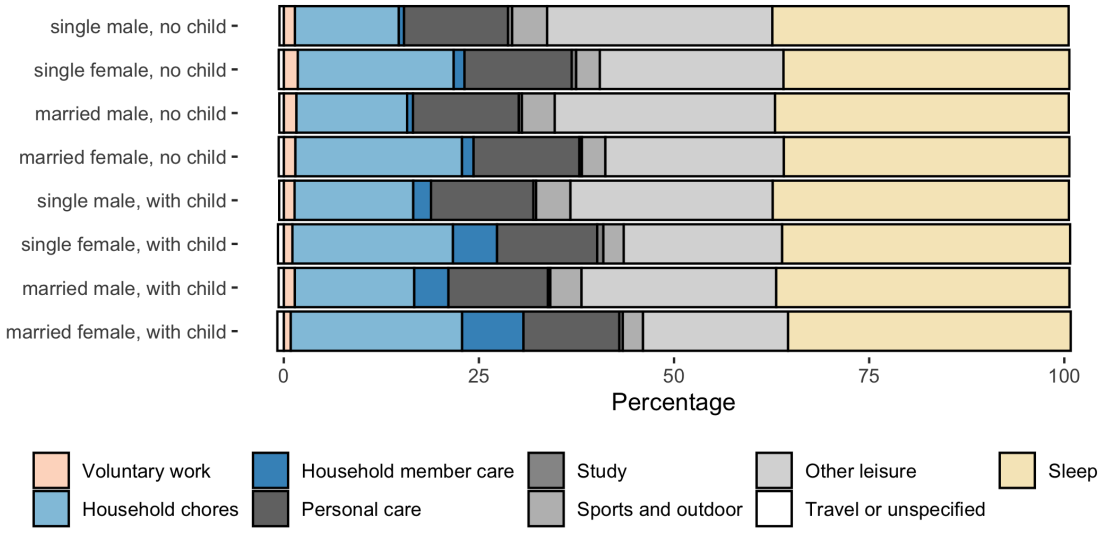


Figure 4.10: Estimated allocation of extra leisure time following exit of labour market

4.4.3 Imputation of leisure shares

Leisure time allocation shares are imputed to each individual in the RURO model, at the observed and predicted job opportunities, based on the estimated FML.[22] Figures 4.11 and 4.12 show how the time freed up would be spent: for each average

[22]In some cases, some variable categories do not correspond exactly, and it is necessary to create new variables for the imputation. For example in SILC, exact ages are known, while in HETUS, only 5-year age-categories are provided. A new categorical age-variable is thus created in SILC that corresponds to the HETUS variable.

labour supply change (in red), average leisure time changes are depicted symmetrically. The population is decomposed by gender, marital status and child presence. In scenario 1, individuals work on average 1h54 less per week. Their travel (and unspecified) time decreases by 0h01 hours per week on average. The model predicts that about 38% of the time freed up will be dedicated to sleep and 26% to "other leisure". Next come household chores, personal care, sports and outdoor, household member care and voluntary work, to which respectively 13%, 12%, 5%, 2% and 2% of liberated time is allocated on average. In scenario 2, the labour supply decrease averages 3h35 per week. Transport (and unspecified) time will also decrease by 0h13 on average. Time freed up will be dedicated at 32% to sleep, 32% to "other leisure", 12% to household chores, 10% to personal care, 7% to sports and outdoor, and the rest to voluntary work (2%) and study (2%).

Single females with children is the only category of individuals who slightly (0h33 per week on average) increase their labour supply following the introduction of the UBI in scenario 1. For them, household chores and care to family members are predicted to decrease by an average 0h11 and 0h06 weekly. Sleep is predicted to decrease by 0h09 and other activities by the remaining 0h07 weekly. [Bastian and Lochner, 2020], who looked at time-use of activated women with children following EITC implementation in the US, find the strongest reduction for home production, followed by leisure. They find however no significant effect on sleep.[23]

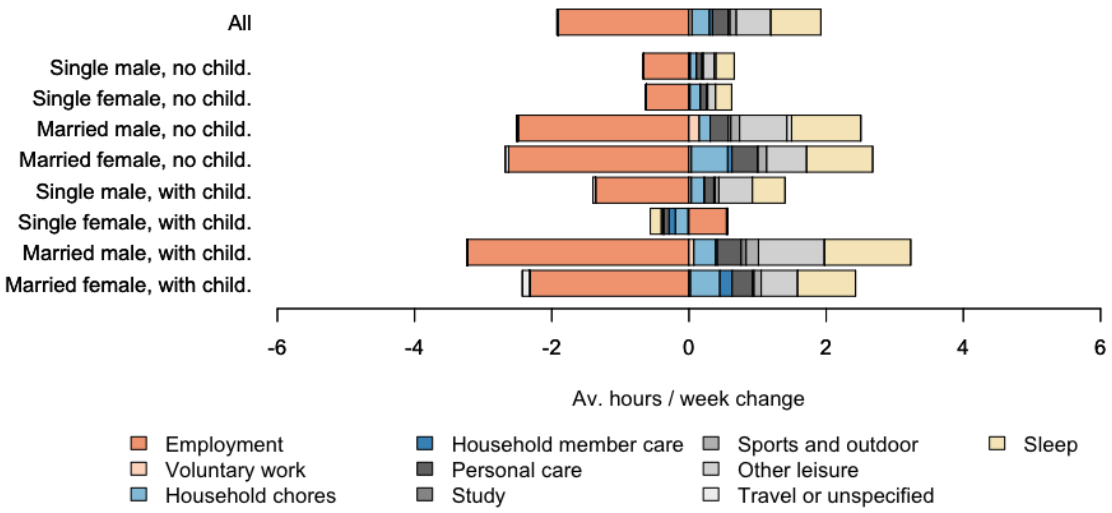


Figure 4.11: Estimated average time-use changes following reform scenario 1

[23]In [Bastian and Lochner, 2020], home production corresponds to our Household chores, household member care and personal care categories, while their leisure category corresponds to our sports and outdoor and other leisure categories.

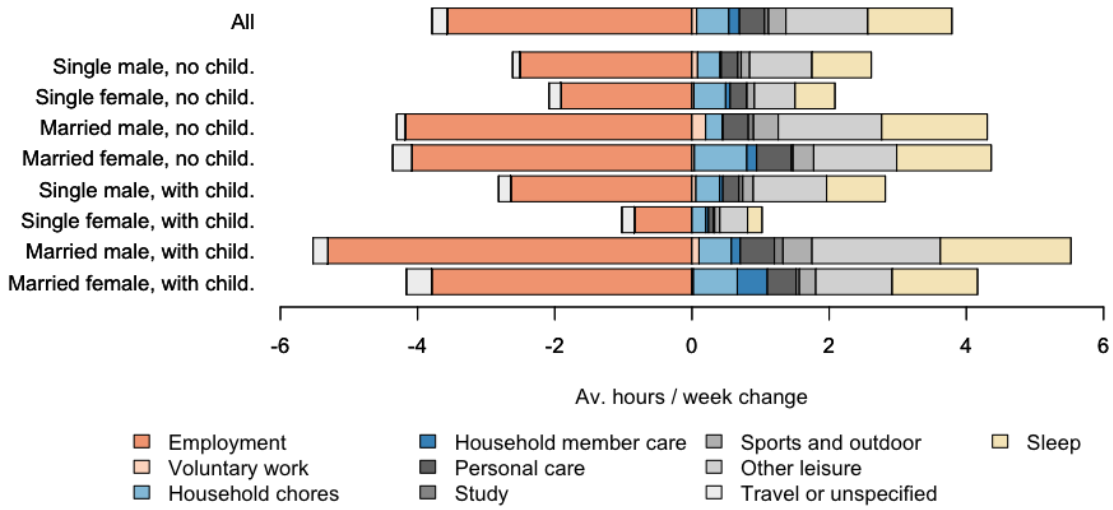


Figure 4.12: Estimated average time-use changes following reform scenario 2

4.4.4 Endogeneity

A crucial assumption for a valid imputation of leisure time allocations is that explanatory variables in the FML model, defined in Eq. 4.1, are exogenous to the leisure time allocation choice. This would for example be the case if people first choose their ideal job opportunity, and then, given the disposable income and disposable time obtained at that opportunity, decide on how to allocate their remaining time on leisure activities.

This assumption might however not always hold there might for example be a correlation between the explanatory variables C and L and the error term, due to unobserved variables that are confounding both those explanatory variables and the leisure time allocation shares. Suppose for example some part of the population has a pronounced taste for spending a lot of time on TV series and movies. Knowing that this activity is relatively cheap and time-consuming, they might, in the trade-off between disposable income and total leisure time, decide to work few hours. In this way, they are able to spend a lot of time on mass media and their low income is not a problem since their favourite leisure activity is cheap. As a second example, suppose there are also some individuals that like playing polo, an expensive outdoor leisure activity. They might decide to opt for the best-paying job opportunity to afford their hobby.

The consequence is that in Eq. 4.1, the coefficient of total leisure time associated with mass media ("other leisure"), β_O^L, will be upward biased. In other words, due

to many movie lovers that chose to work few or no hours, the effect of total leisure time on the fraction of it spent on mass media is overestimated. Similarly, the parameter β_{SO}^{C}, capturing the effect of income on the share of leisure time devoted to sports and outdoor activities, would be upward biased, due to the polo players. In other words, some omitted variables can be correlated with C or L in the FML due to the fact they affect the labour supply decision by increasing the probability of taking jobs compatible with those leisure activities.

These potential biases are not easy to prevent, and no variable meeting the criteria to be used as an instrument was found. The positive point however is that one of the likely most important determinants of labour supply and leisure time allocation, the presence of children in the household, is observed both in SILC and HETUS, and thus controlled for.

4.5 Discussion and conclusion

In this paper, we simulated the effect of introducing a UBI in Belgium on income distribution and labour supply, using a RURO model estimated on SILC data. We then used time-use data to predict how time devoted to different leisure activities as household and family care, personal care, voluntary work, sports and outdoor, ... would change after the tax-benefit reform. We argue that this extension can be of great use to give a more comprehensive and insightful understanding of behavioural changes tax-benefit reforms might induce.

Two UBI schemes were estimated, that differ in the way they are financed. Our results first of all show that overall labour supply will decrease, by an average of 1h54 to 3h35 per week (or 5.7% to 10.7%), depending on the scenario. Time spent travelling will also slightly decrease in both scenarios. 38 and 32% of this freed up time is predicted to be dedicated to sleeping, on average, in scenario 1 and 2 respectively. The next category of leisure activities that is the most fostered is "other leisure" (that includes hobbies, computing, social life, mass media, ...), to which 26 and 32% of freed up time is allocated respectively. Then comes household chores (13 and 12 %) and personal care (12 and 10 %). The remaining time is split among the other categories.

The time-use model extension is particularly interesting for simulations of reforms that are expected to induce important time reallocations. It opens the anal-

ysis of, among others, active labour market policies to new dimensions. It would for example be interesting to know, when looking at the objective of the Belgian government to raise the employment rate to more than 80% by 2030 (from 70.6% in 2021, in the 20-64 age category[National Bank of Belgium, 2022])[24], which categories of individuals might enter the labour market, and what activities would be dropped consequently. A related option for further research is to estimate how the demand for childcare facilities would evolve, following the activation of individuals that devote time to childcare, and possibly imagine complementary policies to address those changes. Time-use surveys are particularly helpful as, besides containing the main activities undertaken during a day, they also contain information about whom this activity is spent with.

[24] Accord de gouvernement pour une Belgique prospère, solidaire et durable - 30/09/2020. `https://www.belgium.be/sites/default/files/Accord_de_gouvernement_2020.pdf`, retrieved 30/11/2021.

General conclusion

Although there are still grey areas that need to be further investigated and validated with new datasets and methods, the policy implications of this research as well as the possibilities to push the different topics further are diverse.

In Chapter 2, it is concluded that an additional reduction in taxes and social security contributions for low hourly earners creates a large deficit and only slightly increases employment rates. While increasing the purchasing power of low-wage workers is certainly a positive aspect of an extension of the work-bonus policy, it is probably far from paying for itself, as some politicians like to think on the basis of very optimistic expectations of increased employment rates. I believe it is therefore crucial to understand more in depth how the alternative active labour market policies, as those listed in the introduction of Chapter 2, perform compared to an increased work-bonus. Reducing social security contributions is indeed a threat to the sustainability of our social security system and is always more popular than increasing them, and thus could lead to an inefficient situation that is difficult to reverse politically. Regarding the tool used, the RURO model, additional robustness checks and improvements are possible to. Some assumptions (about the structural form of the utility and opportunity functions, the out-of-labour income, ...) can be challenged more strongly, and different combinations of assumptions could be made to give more prudent confidence intervals. Improvements are also possible by completing the database with more recent SILC-waves and by adding general equilibrium conditions as in [Colombino, 2013].

Chapter 3 also has important policy implications, as it shows that poor cohabitants in Belgium are strongly disadvantaged compared to those living in most of other European countries. It is estimated that making the system more favourable for them would be a very cheap policy and would allow many individuals to choose their cohabitation status without fearing large losses in purchasing power. This gives new arguments to the many organizations that fight for better living conditions for cohabiting individuals. While I have no strong conclusions about the adequancy of fully individualized social rights, I am quite convinced that increasing cohabitant amounts, to at least 75%-80% of benefits singles are entitled to, is an equitable and cost-effective measure, and would bring Belgium closer to the Eu-

ropean average. Other natural experiments might bring insightful complementary results and possibly reinforce the conclusions of my research. I am thinking for example of the recent reform of disability benefits in Belgium, which strongly reduces the financial disincentives for disabled individuals to cohabit.[1] Estimating to which extent this reform allowed disabled individuals to move in together, and how their purchasing power evolved, could give hints about the population-wide effect an increase in social assistance benefits for cohabitants would have. Looking more in detail at countries where the relative generosity of the cohabitation amount significantly changed over time (which happened a few times, in foreign countries, as depicted in Table B3), could be an opportunity to obtain complementary results through an event study.

Chapter 4 is more exploratory, and, although many politicians or political parties have expressed interest in the UBI idea, their visions of the scheme are far apart, if not incompatible, and it is therefore unlikely that a UBI scheme will be implemented in Belgium any time soon. One of the goals of this research is however to take a step back from usual simulations of reforms on the labour market. By explicitly considering activities undertaken outside formal labour, one realizes more easily that any reform aiming at increasing employment rates will result in a decrease in some activities that had a positive impact on different aspects of our lives. The extension I propose allows to anticipate possible changes in terms of time spent on household chores (and its sharing), time with children, voluntary work, sleep, etc. This opens new possibilities, especially for research related to labour market activation of specific groups of the population. The UBI scenario simulated in this chapter is to some extent arbitrary, and trying to find more 'realistic' schemes (in the sense, for example, to have less people experiencing drastic changes in their disposable income) is an interesting path for further research. In the same vein, simulating UBI scenarios imagined by public figures could shed light on different grey areas in the debate, where discussed proposals often relies on rough assumptions and estimations.

[1] Arrêté royal du 2 mars 2021 modifiant l'arrête royal du 6 juillet 1987 relatif à l'allocation de remplacement de revenus et à l'allocation d'intégration portant limitation des effets du "prix de l'amour"

Appendix of Chapter 2

A.1 Parameter estimates

Below tables give an overview of parameter estimates. The Log-Likelihood at the maximum found is -29450.05. Note that for education covariates, "Middle education" is the reference, and for region covariates, "Flanders" is the reference, meaning that the effects of those covariates are measured comparatively to middle-educated Flemish people.

Preferences	Estimate	Standard Error	t-value
Single male			
Leisure			
Constant	8.380	2.074	4.041
Log(age)	-4.654	1.145	-4.065
Log(age)^2	0.665	0.158	4.208
Children 4-6	-0.117	0.073	-1.611
Children 7-9	0.002	0.072	0.034
Wallonia	0.125	0.035	3.578
Brussels	0.058	0.030	1.901
Low education	0.072	0.040	1.799
High education	-0.044	0.026	-1.670
Exponent	-9.217	0.414	-22.262
Income			
Constant	1.526	0.057	26.696
Exponent	0.721	0.036	20.250
Single female			
Leisure			
Constant	24.608	4.348	5.660
Log(age)	-13.548	2.392	-5.665
Log(age)^2	1.913	0.331	5.784
Children 0-3	0.297	0.104	2.864
Children 4-6	0.155	0.078	1.982
Children 7-9	0.116	0.064	1.824
Wallonia	0.145	0.047	3.093
Brussels	-0.025	0.040	-0.613
Low education	0.321	0.088	3.646
High education	-0.332	0.052	-6.400
Exponent	-9.005	0.351	-25.662
Income			
Constant	1.604	0.062	25.748
Exponent	0.681	0.037	18.356

Table A.1: Parameter estimates - Preferences singles

Preferences	Estimate	Standard Error	t-value
Couples			
Leisure			
Constant leisureM	5.637	0.110	51.210
Log(age)	-3.117	0.061	-51.380
Log(age)^2	0.443	0.011	41.785
Children 0-3	0.012	0.009	1.287
Children 4-6	0.003	0.010	0.326
Children 7-9	0.003	0.009	0.343
Wallonia	0.042	0.011	3.738
Brussels	0.036	0.015	2.347
Low education	0.053	0.018	2.885
High education	-0.003	0.010	-0.293
Constant leisureF	13.996	5.220	2.681
Log(age)	-7.480	2.900	-2.579
Log(age)^2	1.100	0.403	2.730
Children 0-3	0.137	0.049	2.821
Children 4-6	0.151	0.052	2.882
Children 7-9	0.031	0.046	0.676
Wallonia	0.123	0.053	2.303
Brussels	-0.159	0.064	-2.508
Low education	0.091	0.103	0.888
High education	-0.402	0.064	-6.275
Exponent leisureM	-10.872	0.243	-44.764
Exponent leisureF	-8.371	0.264	-31.751
Income			
Constant	3.016	0.122	24.687
Exponent	0.561	0.028	20.351
Cross-effect			
Cross-effect leisure	0.032	0.005	6.541

Table A.2: Parameter estimates - Preferences couples

Opportunities	Estimate	Standard Error	t-value
Male			
Intensity			
Working	-3.899	0.090	-43.151
Group specific unemp.	0.011	0.004	2.898
Wallonia	-0.626	0.088	-7.133
Brussels	-1.084	0.102	-10.655
Low education	-0.894	0.094	-9.477
High education	0.484	0.102	4.758
Offered time regimes			
Part-time dummy 1	0.618	0.092	6.725
Part-time dummy 2	0.909	0.082	11.106
Full-time dummy	2.543	0.031	80.733
Offered wages			
Constant	2.407	0.017	143.643
Low education	-0.121	0.011	-11.476
High education	0.247	0.007	33.057
Experience	2.290	0.140	16.404
Experience^2	-3.063	0.307	-9.969
Standard dev.	0.295	0.001	315.096
Female			
Intensity			
Working	-3.237	0.077	-42.108
Group specific unemp.	-0.021	0.003	-6.481
Wallonia	-0.540	0.077	-7.050
Brussels	-0.879	0.094	-9.383
Low education	-0.677	0.090	-7.522
High education	0.565	0.089	6.352
Offered time regimes			
Part-time dummy 1	1.496	0.050	30.180
Part-time dummy 2	1.731	0.055	31.664
Full-time dummy	2.055	0.033	61.666
Offered wages			
Constant	2.303	0.016	141.385
Low education	-0.079	0.012	-6.793
High education	0.273	0.008	33.886
Experience	2.650	0.131	20.200
Experience^2	-3.950	0.295	-13.400
Standard dev.	0.304	0.001	395.650

Table A.3: Parameter estimates - Opportunities

Opportunities	Estimate	Standard Error	t-value
Wage eq. year dummies			
2006 dummy	-0.212	0.010	-21.924
2007 dummy	-0.178	0.009	-19.012
2008 dummy	-0.179	0.009	-19.061
2010 dummy	-0.133	0.009	-14.050
2012 dummy	-0.078	0.010	-7.982
2015 dummy	-0.025	0.010	-2.580
2016 dummy	0.009	0.010	0.908

Table A.4: Parameter estimates - Wage eq. year dummies (Ref year: 2017)

A.2 Welfare changes

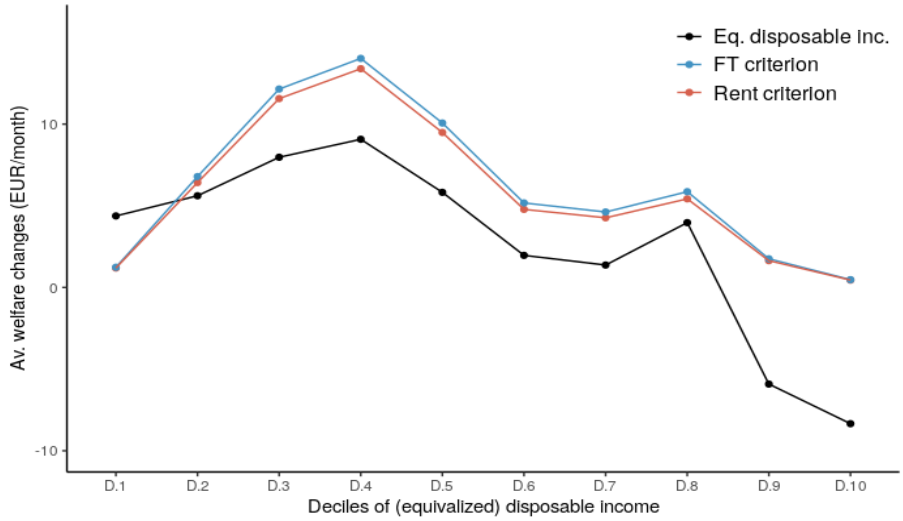


Figure A.1: Welfare changes following reform 2

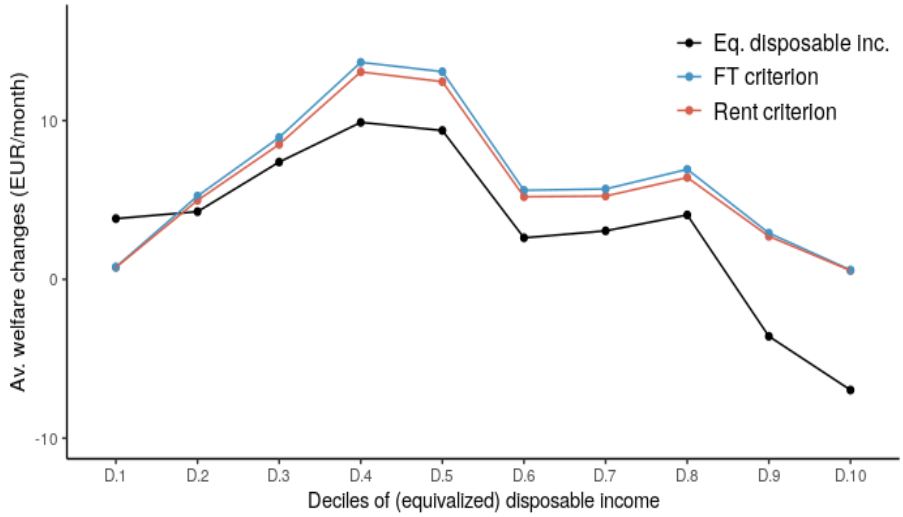
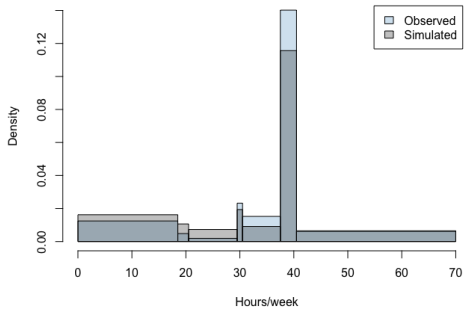


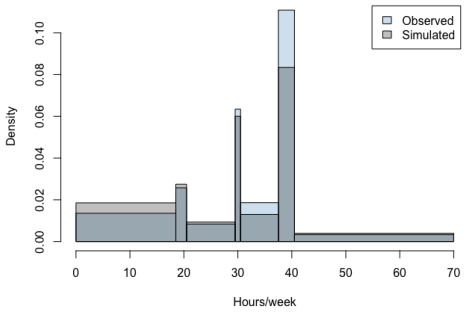
Figure A.2: Welfare changes following reform 3

A.3 Simulated distributions

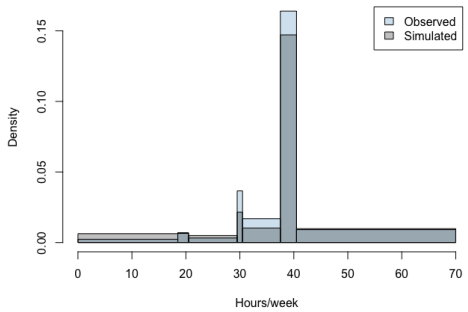
To test the fit of the model, we take a vector of random Gumbel draws and add them to the deterministic utilities of the different options in decision maker's choice sets. We then compare the simulated distribution and observed distribution of some key variables. Note that we estimate the model using 7 cross-section data sets of years ranging from 2005 to 2015, while we here simulate distributions for 2015.



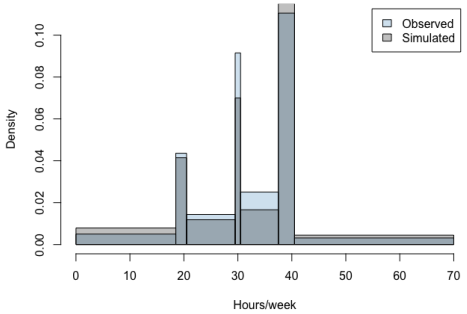
(a) Single male



(b) Single female

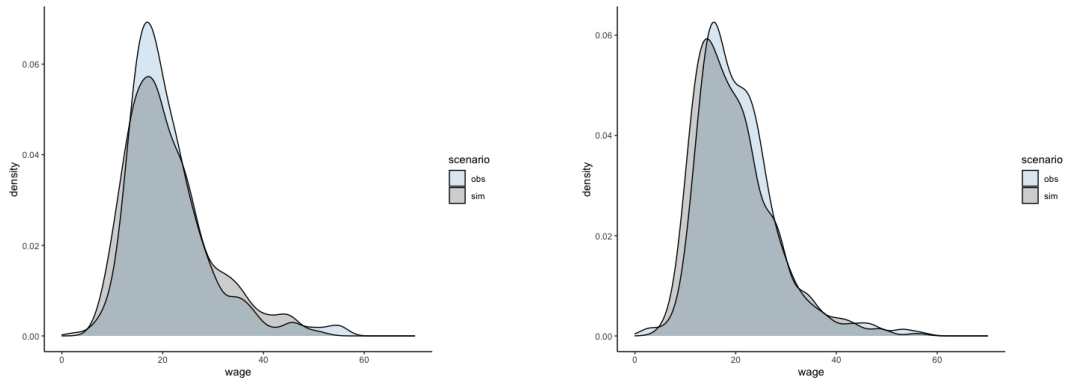


(c) Married male



(d) Married female

Figure A.3: Simulated and observed hours distributions



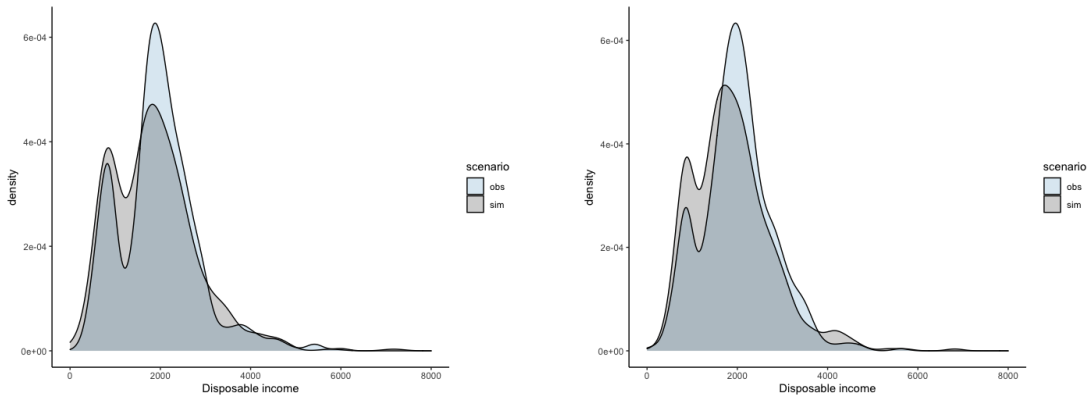
(a) Single male

(b) Single female

(c) Married male

(d) Married female

Figure A.4: Simulated and observed wage distributions



(a) Single male

(b) Single female

Figure A.5: Estimated disposable income distribution

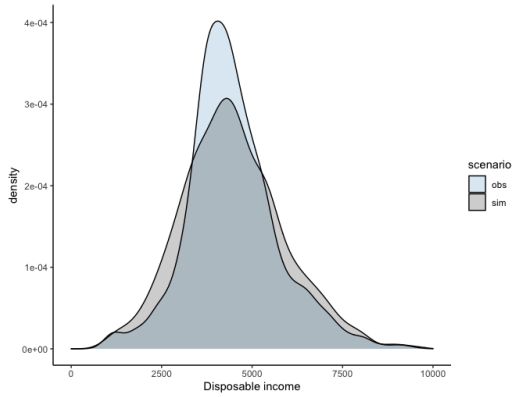


Figure A.6: Estimated disposable income distribution

Appendix of Chapter 3

B.1 Belgian case study

Belgium has introduced a minimum income guarantee in 1974[1]. Those benefits are granted by the Public Centres for Social Welfare[2] (hereafter PCSW), that are present in each of the 581 municipalities and are responsible to run the means-tests. Part of the benefits (at least 50%) are paid by the federal government. To benefit from this income, the applicant has to meet a number of criteria:

1. Citizenship: the applicant must have the Belgian citizenship or be a EU citizen family member having a residence permit of more than three months, a foreigner registered at the population register, a recognized refugee or a stateless person.

2. Residence: the applicant must reside in Belgium.

3. Age: the applicant must be at least eighteen years old. Exceptions are made for younger applicants if pregnant, in charge of children or emancipated by marriage.

4. Means: the applicant must have insufficient resources and be unable to obtain them by her- or himself. The PCSW has to run a means-test.

5. Labour market: the applicant must be available to the labour market, and do serious efforts to find a job (except in cases of serious health issues or other constraints[3]).

6. Exhaustion of social rights: the applicant must have applied for other aids (s)he might be eligible to.

7. Individual social integration project: since 2016, new applicants have to conclude an agreement with the PCSW, in which the necessary steps and the objectives towards social and/or socio-professional integration are established.[4]

[1] Loi du 7 août 1974 instituant le droit à un minimum de moyens d'existence.

[2] Centre public d'action sociale (CPAS) in French and Openbaar Centrum voor Maatschappelijk Welzijn (OCMW) in Dutch.

[3] Of which the validity is judged by the PCSW. Those can be for example being in training, having an handicapped child who needs special attention, be caring of young children, etc.

[4] Loi du 21 juillet 2016 modifiant la loi du 26 mai 2002 concernant le Droit à l'Intégration Sociale

The benefits depend on the household structure. The current categories were defined in 2002[5]: head of households (with children), isolated individuals and cohabitants. The benefits of a cohabitant person was established at 67 percent of the benefit of an isolated person. Moreover, the benefit is reduced by the amount own means, taking into account some exonerations.[6]

Compared to other countries, the level of cash social assistance is rather high. However, the level of per capita social assistance couples receive compared to a single person is rather low. In-kind assistance provided by PCSW and related organisms include subsidized housing, energy, medical aid and home help.

This low ratio has led to criticism and calls for change. [Saintes and Woelfle, 2018] (p.4), [Perdaens et al., 2010] (p.14) or [Schepers and Nicaise, 2014] (p.15) report destructive effects on poor couples and families, who prefer to live separately to not see their financial means decrease strongly[7]. Moreover, [Steenssens et al., 2016] report that 70% of PCSW observe increases in LAT-relations[8], who are in 90% of the cases granted full benefits. This same report as well as [Galand et al., 2013] mention cases of couples renting a cheap room at an other address, where one of the partners would be domiciled without actually living there, in order to receive the full benefits.

While different left-wing political parties have included individualisation of social rights and the suppression of the cohabitant status in their programme, it seems that the budgetary costs of such measures represent the main obstacle. Middle ground solutions proposed by field associations and academics include the creation of a label to specific solidary housing projects, that would guarantee to precarious households wishing to share living costs they would not lose their rights to full social assistance benefits ([Bernard, 2007], [Bernard, 2016]).

[5]Loi du 26 mai 2002 concernant le Droit à l'Intégration Sociale

[6]The details of what is included in own means and which exonerations are granted are detailed in: Arrêté royal portant règlement général en matière de droit à l'intégration sociale.

[7]For a more detailed overview of the legislation and the problem that the cohabitant status creates see also [Galand et al., 2013] (p.23-26).

[8]Living apart together (LAT) unions are intimate relationships between unmarried partners who live in separate households but identify themselves as part of a couple. These relationships are sometimes referred to as "non-residential partnerships" ([Strohm et al., 2009]).

B.2 Benefit levels, datasets included and cross-country comparability

In order to construct a dummy δ^a indicating as accurately as possible which households in the SILC datasets are potentially impacted by social assistance scheme parameters, there are two options. The first one would be to simply consider households who receive positive non-contributory means-tested social assistance cash benefits (HY063G), but from the data it seems that there is an important variation in the share of households who receive some form of social assistance (from 0 to 60 percent, depending on the country), and that many households with important incomes receive some small transfers.[9] We thus add the constraint that the household disposable income before social assistance benefits has to be lower than the relevant guaranteed minimum incomes. We can thus rewrite δ^a as the product of two dummies, indicating a low income (li), and the reception (rec) of social assistance benefits: $\delta^a = \delta^{li}.\delta^{rec}$.

For δ^{li}, we start from disposable income (HY020) and remove means-tested social assistance benefits. When the obtained income is lower than the year-, country- and household size-specific guaranteed minimum income level, we set $\delta^{li} = 1$. For δ^{rec} we could use the variable HY063G in the EU-SILC survey, which contains the values of "periodic payments to people with insufficient resource" that are "non-contributory and means-tested" and not considered as other types of benefits (as unemployment benefits, family benefits, disability benefits, ...) and seems the most appropriate. However, this variable is only reported for some countries (less than half of them). We thus prefer to use HY060G, which contains all types of "periodic payments to people with insufficient resources", and which is reported for all countries except Denmark.

[Trindade et al., 2019] report that this variable is mostly comparable across countries except in certain cases where other types of benefits might be wrongly included. This is the case for some parts of disability benefits (NL, SI, PO), education allowances (SK), family benefits (SE), survivor's benefits (LV), and scholarships for teachers in small rural area's (EE). As we conduct our analysis only on childless adult couples, and remove disabled individuals from the analysis[10], the biases

[9] This might be due to the fact benefits that are neither family, unemployment, disability or sickness benefits are included in HY063G, even tough not targeted at poor individuals.

[10] This is done by removing observations with PY130 > 0: as in NL, SI and PO the main components of disability benefits are correctly included in PY130, this allows to relatively precisely identify disabled

should be limited. For the survivor's benefits, there should be few incomparable observations due to the fact that we focus on working-age population, keeping thus a limited number of widows. Regarding scholarships for teachers in small rural area's, we assume it represents an insignificant share of the sample. For Denmark, means-tested non-contributory benefits for unemployed are collected at individual level and given in PY093. For some countries, no information was provided for the META analysis (FI, LT, IE, RO), rendering it difficult to assess the degree of comparability of the benefits categorization. For older SILC-versions, we keep the same variables, or take the more aggregate variable when the same level of detail is not available. No significant changes with respect to META SILC 2010 are mentioned for our variables of interest in [Trindade et al., 2019].

Below tables give the maximum general-purpose cash social assistance benefit levels in EURO when living alone and cohabiting (resp. B_s and B_c). The conversion from national currency to EUR is done with Eurostat nominal exchange rates. The cells highlighted in gray mean that the corresponding SILC dataset is available and included in the probit estimation. For the probit analysis, benefits are expressed in purchasing power parity. Below figures are thus converted using Eurostat data on average basket prices (with EU-27 average as reference basket), and average inflation figures for EU-27.

individuals.

SILC	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AT	NaN	NaN	427	439	454	461	752.94	773.26	794.91	813.99	827.82	837.76	844.46	863.04
BE	613.33	625.6	644.48	697.61	725.79	725.79	755.08	785.61	801.34	817.36	817.36	867.4	884.74	892.7
BG	NaN	NaN	20.53	20.53	20.53	24.26	24.26	24.26	24.26	24.26	24.26	24.26	24.26	27.99
CY	NaN	331.47	364.17	379.31	425	452	452	452	452	480	480	480	480	480
CZ	108.61	110.3	112.58	125.31	118.25	123.64	127.12	135.59	131.25	123.84	125	126.14	129.53	132.96
DE	NaN	NaN	345	347	351	359	364	374	382	391	399	404	409	416
DK	NaN	NaN	1202.45	1236.45	1276.49	1323.57	1348.08	1388.42	1407.9	1433.84	1454.54	1473.16	1498	1513.71
EE	47.93	47.93	57.52	63.91	63.91	63.91	76.7	76.7	76.7	90	90	130	130	140
ES	326.96	340.65	360.82	361.72	373.45	376.73	395.57	395.57	396.18	396.18	396.69	397.71	405.84	503.06
FI	NaN	NaN	381	399.1	417.45	417.45	419.11	461.05	477.26	480.2	485.5	485.5	487.89	491.21
FR	NaN	433.06	440.86	447.91	454.63	460.09	469.33	477.31	485.66	501.81	516.46	527.32	539.48	553.7
HR	NaN	NaN	NaN	NaN	NaN	NaN	80.66	79.77	79.17	104.79	105.07	106.2	107.19	107.84
HU	NaN	78.1	86.35	90.65	81.33	82.76	81.61	78.82	76.8	73.86	73.55	73.21	73.74	71.5
IE	NaN	717.91	804.51	856.47	884.62	848.68	814.04	814.04	814.04	814.04	814.04	814.04	835.69	857.34
LT	NaN	43.01	53.43	74.29	91.23	91.23	91.23	101.37	101.37	101.37	102	102	102	122
LU	NaN	NaN	1168.54	1201.5	1308.67	1308.67	1361.95	1393.24	1425.31	1458.18	1458.18	1458.18	1511.18	1511.18
LV	NaN	34.47	38.57	38.42	52.43	56.44	56.63	57.36	49.89	49.8	49.8	49.8	49.8	53
MT	NaN	NaN	357.76	367.83	379.61	396.41	399.75	413.21	424.99	435.08	436.77	441.83	446.9	451.97
NL	NaN	840.84	865.8	882.2	898.7	909.33	919.7	935.49	925.37	948.18	960.83	972.7	982.79	992.12
PL	NaN	55.79	65.55	70.62	57.32	62.09	60.2	59.27	67.14	67.36	67.36	71.98	73.78	73.7
PT	NaN	171.73	177.05	181.91	187.18	189.52	189.52	189.52	178.15	178.15	178.15	180.99	183.84	186.68
RO	NaN	NaN	28.78	27.15	25.47	29.68	29.49	28.03	28.29	31.84	31.83	31.51	30.97	30.4
SE	NaN	369.55	375.13	369.21	346.55	385.85	411.97	441.17	448.48	426.44	414.82	410.82	407.88	389.93
SI	NaN	200.56	205.57	212.97	221.7	226.8	229.52	260	261.56	265.22	269.2	288.81	292.56	385.05
SK	NaN	41.9	48.56	53.74	58.43	60.5	60.5	60.5	60.5	61.6	61.6	61.6	61.6	61.6
UK	NaN	364.89	374.26	328.99	312.5	330.36	336.77	379.14	365.57	388.89	436.08	386.25	361.05	357.77

Table B1: Amounts for singles over time (nominal EUR)
Source: Euromod country reports, own calculations

SILC	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AT	NaN	NaN	330	340	352	357	564.71	579.95	596.18	610.49	620.87	628.32	633.35	647.28
BE	408.89	417.07	429.66	465.07	483.86	483.86	503.39	523.74	534.23	544.91	544.91	578.27	589.82	595.13
BG	NaN	NaN	18.56	18.56	18.56	21.93	21.93	21.93	21.93	21.93	21.93	21.93	21.93	25.31
CY	NaN	248.6	273.13	284.48	318.75	339	339	339	339	360	360	360	360	360
CZ	95.2	96.68	98.68	109.84	103.65	108.37	111.43	118.69	114.9	108.4	109.42	110.42	113.39	116.39
DE	NaN	NaN	310	312	316	323	328	337	344	352	359	364	368	374
DK	NaN	NaN	1202.45	1236.45	1276.49	1323.57	1348.08	1388.42	1407.9	1433.84	1454.54	1473.16	1498	1513.71
EE	43.14	43.14	51.77	57.52	57.52	57.52	69.03	69.03	69.03	81	81	117	117	126
ES	188.82	196.51	207.55	209.59	216.82	218.66	229.05	229.05	229.4	229.4	229.68	230.26	281.68	305.39
ES	188.82	196.51	207.55	209.59	216.82	218.66	229.05	229.05	229.40	229.40	229.68	230.26	234.85	316.19
FI	NaN	NaN	323.85	339.24	354.83	354.83	356.24	391.89	405.67	408.17	412.68	412.68	414.71	417.53
FR	NaN	324.8	330.64	335.94	340.92	345.07	352	357.98	364.25	376.36	387.35	395.48	404.61	415.28
HR	NaN	NaN	NaN	NaN	NaN	NaN	53.77	53.18	52.78	62.87	63.04	63.72	64.31	64.71
HU	NaN	74.2	82.03	86.12	77.27	78.63	77.53	74.88	72.96	70.16	69.87	69.55	70.05	67.92
IE	NaN	597.11	669.2	712.5	735.88	706.01	677.21	677.21	677.21	677.21	677.21	677.21	695.18	713.15
LT	NaN	43.01	53.43	74.29	91.23	91.23	91.23	91.23	91.23	91.23	91.8	91.8	91.8	109.8
LU	NaN	NaN	870.16	894.25	967.75	967.75	1007.71	1031.18	1055.23	1079.88	1079.88	1079.88	1119.63	1119.63
LV	NaN	34.47	38.57	38.42	52.43	56.44	56.63	57.36	49.89	49.8	49.8	49.8	49.8	53
MT	NaN	NaN	186.46	201.56	207.45	215.85	217.52	224.25	230.14	235.18	236.03	238.56	241.09	243.63
NL	NaN	600.6	618.43	630.14	641.93	649.97	656.92	668.21	660.98	677.27	686.31	694.78	701.99	708.66
PL	NaN	42.18	48.24	51.97	42.18	45.69	44.29	43.62	56.49	56.67	56.67	61.26	62.79	62.72
PT	NaN	145.97	150.49	154.62	159.1	161.09	161.09	161.09	133.61	133.61	133.61	135.74	137.88	140.01
RO	NaN	NaN	25.93	24.58	23.11	26.71	26.54	25.23	25.46	28.69	28.68	28.39	27.91	27.4
SE	NaN	303.1	308.1	302.65	284.86	317.18	338.88	361.9	367.57	349.51	339.98	336.36	333.68	318.77
SI	NaN	170.48	174.73	181.02	188.44	192.78	195.09	195	196.17	212.18	215.36	226.72	229.66	302.26
SK	NaN	36.39	42.19	46.54	50.79	52.6	52.6	52.6	52.6	53.55	53.55	53.55	53.55	53.55
UK	NaN	286.13	293.59	258.16	245.31	259.32	264.3	297.57	286.92	305.36	342.57	303.42	283.63	281.05

Table B2: cohabitant amounts over time (nominal EUR)
Source: Euromod country reports, own calculations

SILC	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AT	NaN	NaN	0.773	0.774	0.775	0.774	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
BE	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667	0.667
BG	NaN	NaN	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904	0.904
CY	NaN	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
CZ	0.877	0.877	0.877	0.877	0.877	0.876	0.877	0.875	0.875	0.875	0.875	0.875	0.875	0.875
DE	NaN	NaN	0.899	0.899	0.9	0.9	0.901	0.901	0.901	0.9	0.9	0.901	0.9	0.899
DK	NaN	NaN	1	1	1	1	1	1	1	1	1	1	1	1
EE	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
ES	0.577	0.577	0.575	0.579	0.581	0.580	0.579	0.579	0.579	0.579	0.579	0.579	0.579	0.629
FI	NaN	NaN	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
FR	NaN	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
HR	NaN	NaN	NaN	NaN	NaN	NaN	0.667	0.667	0.667	0.6	0.6	0.6	0.6	0.6
HU	NaN	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
IE	NaN	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832	0.832
LT	NaN	1	1	1	1	1	1	0.9	0.9	0.9	0.9	0.9	0.9	0.9
LU	NaN	NaN	0.745	0.744	0.739	0.739	0.74	0.74	0.74	0.741	0.741	0.741	0.741	0.741
LV	NaN	1	1	1	1	1	1	1	1	1	1	1	1	1
MT	NaN	NaN	0.521	0.548	0.546	0.545	0.544	0.543	0.542	0.541	0.54	0.54	0.539	0.539
NL	NaN	0.714	0.714	0.714	0.714	0.715	0.714	0.714	0.714	0.714	0.714	0.714	0.714	0.714
PL	NaN	0.756	0.736	0.736	0.736	0.736	0.736	0.736	0.841	0.841	0.841	0.851	0.851	0.851
PT	NaN	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.75	0.75	0.75	0.75	0.75	0.75
RO	NaN	NaN	0.901	0.905	0.907	0.9	0.9	0.9	0.9	0.901	0.901	0.901	0.901	0.901
SE	NaN	0.82	0.821	0.82	0.822	0.822	0.823	0.82	0.82	0.82	0.82	0.819	0.818	0.818
SI	NaN	0.85	0.85	0.85	0.85	0.85	0.85	0.75	0.75	0.8	0.8	0.785	0.785	0.785
SK	NaN	0.868	0.869	0.866	0.869	0.869	0.869	0.869	0.869	0.869	0.869	0.869	0.869	0.869
UK	NaN	0.784	0.784	0.785	0.785	0.785	0.785	0.785	0.785	0.785	0.786	0.786	0.786	0.786
Av.	**0.755**	**0.820**	**0.820**	**0.822**	**0.822**	**0.821**	**0.814**	**0.807**	**0.807**	**0.806**	**0.806**	**0.806**	**0.806**	**0.808**

Table B3: Cohabitant / Single ratio's over time ($\geq 5\%$ changes in blue)
Source: Euromod country reports, own calculations

country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
AT	-	-	-	-	-	-	-	-	-	-	-	-	-
BE	0.66	0.65	0.64	0.67	0.7	0.67	0.68	0.7	0.71	0.73	0.71	0.74	0.75
BG	-	-	0.33	0.3	0.3	0.36	0.3	0.28	0.25	0.23	0.2	0.19	0.17
CY	-	-	-	-	-	-	-	-	-	-	-	-	-
CZ	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.75	0.7	0.65	0.6	0.54	0.49
DE	-	-	-	-	-	-	-	-	-	0.49	0.5	0.49	0.49
DK	-	-	-	-	-	-	-	-	-	-	-	-	-
EE	0.45	0.37	0.37	0.41	0.41	0.41	0.48	0.43	0.39	0.42	0.38	0.5	0.47
ES	0.6	0.59	0.59	0.58	0.59	0.58	0.61	0.61	0.61	0.61	0.6	0.56	0.55
FI	-	-	-	-	-	-	-	-	-	-	-	-	-
FR	-	0.51	0.5	0.5	0.51	0.51	0.49	0.5	0.5	0.52	0.53	0.53	0.54
HR	-	-	-	-	-	-	0.28	0.27	0.27	0.32	0.31	0.29	0.28
HU	-	0.6	0.6	0.61	0.59	0.56	0.47	0.44	0.43	0.41	0.39	0.34	0.31
IE	-	0.82	0.92	0.97	1.01	0.97	0.93	0.93	0.93	0.93	0.88	0.87	0.86
LT	-	0.42	0.46	0.64	0.79	0.79	0.79	0.63	0.63	0.56	0.48	0.48	0.46
LU	-	-	1.08	1.06	1.12	1.1	1.12	1.1	1.1	1.12	1.12	1.08	1.12
LV	-	0.28	0.24	0.21	0.29	0.28	0.28	0.28	0.22	0.28	0.27	0.26	0.23
MT	-	-	0.6	0.63	0.63	0.65	0.63	0.64	0.64	0.65	0.65	0.65	0.65
NL	-	0.91	0.91	0.9	0.91	0.91	0.9	0.9	0.88	0.9	0.89	0.89	0.88
PL	-	0.35	0.32	0.29	0.28	0.26	0.24	0.23	0.28	0.27	0.26	0.27	0.25
PT	-	0.62	0.61	0.59	0.57	0.57	0.57	0.57	0.47	0.45	0.43	0.42	0.41
RO	-	-	0.35	0.3	0.33	0.34	0.32	0.28	0.25	0.24	0.2	0.18	0.13
SE	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	-	0.65	0.62	0.61	0.51	0.52	0.51	0.5	0.5	0.54	0.54	0.56	0.54
SK	-	0.34	0.34	0.32	0.33	0.33	0.32	0.31	0.3	0.28	0.26	0.25	0.22
UK	-	0.44	0.44	0.43	0.46	0.45	0.46	0.47	0.47	0.46	0.42	0.4	0.38

Table B4: Total social assistance benefits for a couple / Minimum wage (if exists)
Source: Euromod country reports, Eurostat, own calculations

B.3 Year and Geographical dummies

	Model 1	Model 2	Model 3
year2008	-0.01287	-0.01172	-0.00407
	(0.01183)	(0.01189)	(0.00815)
year2009	-0.02187	-0.01942	-0.01423
	(0.01277)	(0.01341)	(0.00852)
year2010	-0.02180	-0.02027	-0.01530
	(0.01406)	(0.01474)	(0.01010)
year2011	-0.02429	-0.02402	-0.02015
	(0.01357)	(0.01446)	(0.01046)
year2012	-0.01856	-0.01884	-0.01512
	(0.01637)	(0.01715)	(0.01324)
year2013	-0.02034	-0.02141	-0.01863
	(0.01608)	(0.01681)	(0.01277)
year2014	-0.02895	-0.02535	-0.02238
	(0.01728)	(0.01526)	(0.01199)
year2015	-0.03194	-0.02870	-0.02478
	(0.01822)	(0.01608)	(0.01282)
year2016	-0.03151*	-0.02870*	-0.02413*
	(0.01524)	(0.01338)	(0.01069)
year2017	-0.04000***	-0.03880***	-0.03009**
	(0.01180)	(0.00994)	(0.00973)
year2018	-0.03814**	-0.03753**	-0.03075**
	(0.01461)	(0.01230)	(0.01006)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table C1: Year dummies (ref. 2007)

	Model 1	Model 2	Model 3
n_europe	-0.06915**	-0.08109**	-0.06883
	(0.02633)	(0.02951)	(0.04074)
e_europe	-0.01735	-0.01445	-0.07785
	(0.03020)	(0.03283)	(0.04579)
c_europe	-0.06133	-0.06080	-0.08636*
	(0.04038)	(0.04318)	(0.03914)
s_europe	0.07650**	0.07362*	0.07402**
	(0.02762)	(0.03107)	(0.02643)
sw_europe	0.05276	0.05647	0.03022
	(0.02812)	(0.02960)	(0.03667)
se_europe	0.07575**	0.07748**	-0.00003
	(0.02637)	(0.02817)	(0.03886)

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$

Table C2: Geographical dummies (ref. Western Europe)

B.4 Robustness checks

B.4.1 Jackknife resampling: parameter density

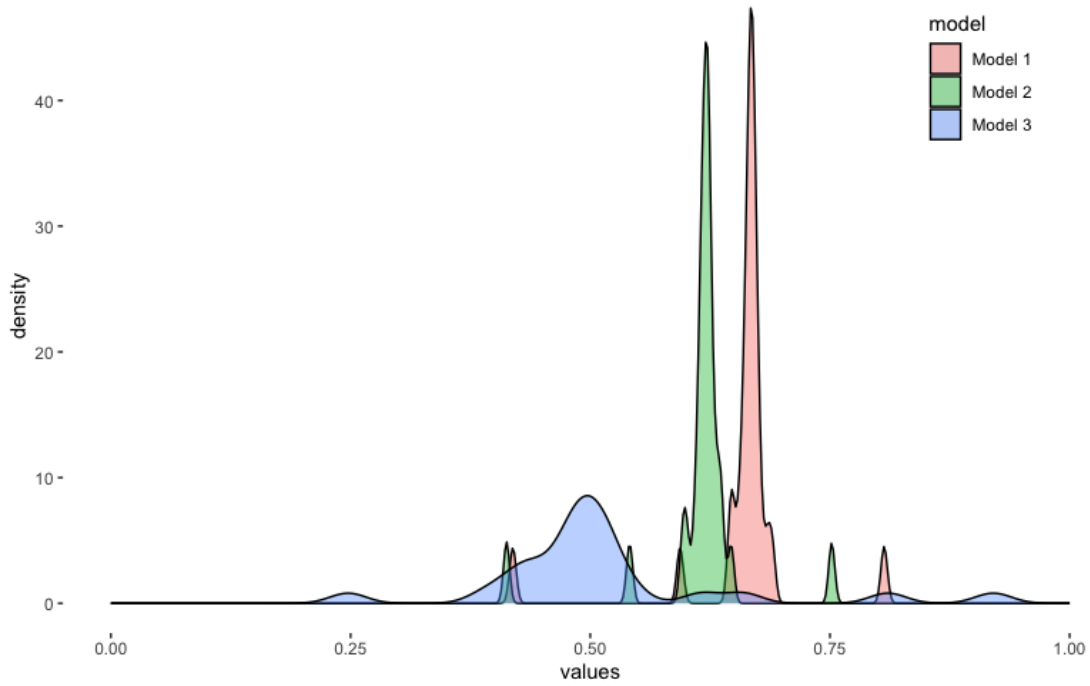


Figure B.1: Density of $\hat{\beta}_2$ when estimated on sub-samples of N-1 countries

B.4.2 Country dummies (instead of broader geographical dummies)

	Model 1	Model 2	Model 3
(Intercept)	0.60444***	1.23463***	1.24370***
	(0.00900)	(0.05319)	(0.13930)
δ^a	-0.79208***	-0.75110***	-0.75171***
	(0.11838)	(0.10777)	(0.10834)
$\delta^a B_s$	-0.00004	-0.00005	-0.00001
	(0.00003)	(0.00004)	(0.00008)
$\delta^a \rho$	0.62408***	0.56530***	0.51603**
	(0.13604)	(0.12325)	(0.17401)
age		-0.03459***	-0.03459***
		(0.00292)	(0.00292)
age^2		0.00043***	0.00043***
		(0.00004)	(0.00004)
$educ_L$		0.01049	0.01041
		(0.00757)	(0.00785)
$educ_H$		-0.02722**	-0.02714**
		(0.00828)	(0.00826)
$(1-\delta^a)B_s$			0.00004
			(0.00008)
$(1-\delta^a)\rho$			-0.05015
			(0.13789)
Country dummies		*See below*	
Year dummies		*See below*	
R^2	0.02905	0.04649	0.04650
Adj. R^2	0.02901	0.04644	0.04645
Num. obs.	817741	817741	817741

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D1: OLS regression with country dummies

	Model 1	Model 2	Model 3
year2008	0.00533	0.00706	0.00726
	(0.00537)	(0.00579)	(0.00560)
year2009	-0.00352	-0.00043	0.00042
	(0.00576)	(0.00628)	(0.00541)
year2010	-0.00383	-0.00173	-0.00082
	(0.00722)	(0.00781)	(0.00702)
year2011	-0.00718	-0.00643	-0.00549
	(0.00751)	(0.00842)	(0.00775)
year2012	-0.00256	-0.00242	-0.00157
	(0.01063)	(0.01114)	(0.01028)
year2013	-0.00537	-0.00615	-0.00528
	(0.01098)	(0.01115)	(0.01009)
year2014	-0.01369	-0.00828	-0.00717
	(0.01227)	(0.01171)	(0.01074)
year2015	-0.01624	-0.01115	-0.01022
	(0.01317)	(0.01262)	(0.01191)
year2016	-0.01649	-0.01197	-0.01122
	(0.01066)	(0.01049)	(0.01002)
year2017	-0.01910	-0.01528	-0.01467
	(0.01073)	(0.01052)	(0.01029)
year2018	-0.01968	-0.01701	-0.01633
	(0.01045)	(0.00979)	(0.00933)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D2: Year dummies (ref. 2007)

	Model 1	Model 2	Model 3
countryBE	0.02832***	0.01302***	0.00563
	(0.00115)	(0.00194)	(0.01266)
countryBG	0.16689***	0.15578***	0.18924***
	(0.00045)	(0.00226)	(0.04613)
countryCY	0.14745***	0.13485***	0.14120***
	(0.00044)	(0.00128)	(0.01180)
countryCZ	0.13405***	0.12810***	0.15429***
	(0.00076)	(0.00111)	(0.03614)
countryDE	-0.01736***	-0.02724***	-0.00792
	(0.00034)	(0.00216)	(0.02554)
countryDK	-0.01051**	-0.03141***	-0.03474
	(0.00382)	(0.00446)	(0.04739)
countryEE	0.02595***	0.02082***	0.05145
	(0.00091)	(0.00063)	(0.04262)
countryES	0.12478***	0.12309***	0.12435***
	(0.00079)	(0.00147)	(0.03236)
countryFI	0.03517***	0.01938***	0.03589
	(0.00036)	(0.00152)	(0.02263)
countryFR	0.04944***	0.03661***	0.04487**
	(0.00089)	(0.00104)	(0.01548)
countryHR	0.16836***	0.15088***	0.16665***
	(0.00210)	(0.00245)	(0.04585)
countryHU	0.12071***	0.11441***	0.14672***
	(0.00059)	(0.00176)	(0.04302)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D3: Country dummies (ref. AT) - Part 1

	Model 1	Model 2	Model 3
countryIE	0.16202***	0.14416***	0.14637***
	(0.00082)	(0.00235)	(0.01221)
countryLT	0.06026***	0.05502***	0.08647*
	(0.00151)	(0.00247)	(0.04209)
countryLU	0.02480***	0.02796***	0.00488
	(0.00068)	(0.00089)	(0.03931)
countryLV	0.10655***	0.10077***	0.13814**
	(0.00089)	(0.00205)	(0.04971)
countryMT	0.18484***	0.17759***	0.17235***
	(0.00206)	(0.00306)	(0.03308)
countryNL	0.05701***	0.04304***	0.03088
	(0.00168)	(0.00136)	(0.01792)
countryPL	0.13404***	0.13007***	0.15471***
	(0.00087)	(0.00135)	(0.04011)
countryPT	0.19859***	0.17989***	0.20092***
	(0.00069)	(0.00359)	(0.03058)
countryRO	0.15405***	0.15020***	0.18319***
	(0.00082)	(0.00173)	(0.04570)
countrySE	0.01193***	-0.01123***	0.00513
	(0.00081)	(0.00174)	(0.02371)
countrySI	0.05458***	0.05814***	0.07588**
	(0.00094)	(0.00122)	(0.02591)
countrySK	0.12233***	0.12107***	0.15125***
	(0.00092)	(0.00140)	(0.04283)
countryUK	0.13702***	0.13845***	0.15412***
	(0.00105)	(0.00100)	(0.02503)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D4: Country dummies (ref. AT) - Part 2

B.4.3 Including households with more than two childless adults

	Model 1	Model 2	Model 3
(Intercept)	0.73973***	1.48223***	1.70790***
	(0.02827)	(0.05390)	(0.18827)
δ^a	-0.75543***	-0.72338***	-0.89824***
	(0.12608)	(0.11643)	(0.15084)
$\delta^a B_s$	-0.00015**	-0.00016***	-0.00021***
	(0.00005)	(0.00005)	(0.00005)
$\delta^a \rho$	0.61926***	0.57345***	0.55136**
	(0.14729)	(0.13846)	(0.17510)
age		-0.03893***	-0.03909***
		(0.00242)	(0.00242)
age^2		0.00046***	0.00047***
		(0.00003)	(0.00003)
$educ_L$		0.01704*	0.01514
		(0.00816)	(0.00875)
$educ_H$		-0.03779***	-0.03794***
		(0.00980)	(0.00899)
$(1-\delta^a).B_s$			-0.00024**
			(0.00008)
$(1-\delta^a).\rho$			-0.15445
			(0.20266)
R^2	0.02386	0.04277	0.04959
Adj. R^2	0.02385	0.04276	0.04958
Num. obs.	2897830	2897830	2897830

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D5: OLS on dataset including households with > 2 childless adults

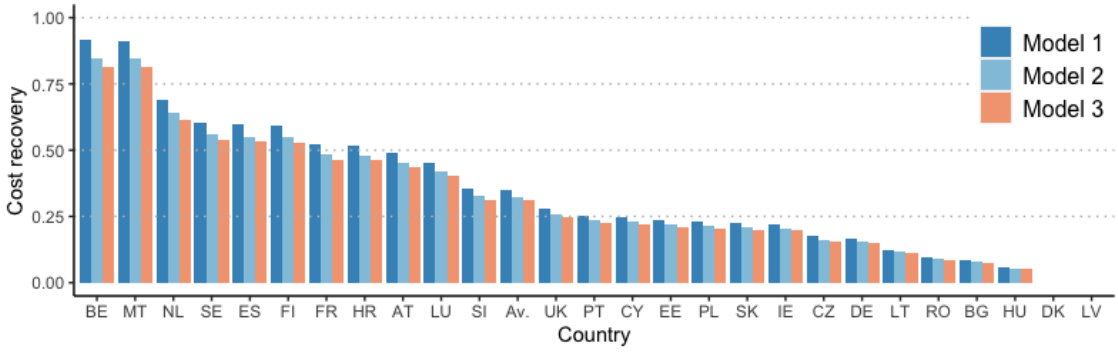


Figure B.2: Cost recovery (ϕ) estimates based on Eq. 3.5 and Table D5

	Model 1	Model 2	Model 3
year2008	-0.02023	-0.01777	-0.00743
	(0.01463)	(0.01419)	(0.00847)
year2009	-0.02871	-0.02524	-0.01772
	(0.01621)	(0.01621)	(0.00928)
year2010	-0.02804	-0.02533	-0.01804
	(0.01703)	(0.01715)	(0.01072)
year2011	-0.02992	-0.02822	-0.02237*
	(0.01591)	(0.01616)	(0.01089)
year2012	-0.02541	-0.02388	-0.01828
	(0.01858)	(0.01867)	(0.01330)
year2013	-0.02895	-0.02781	-0.02336
	(0.01807)	(0.01814)	(0.01264)
year2014	-0.03817*	-0.02874	-0.02336*
	(0.01912)	(0.01643)	(0.01155)
year2015	-0.04180*	-0.03301	-0.02640*
	(0.02022)	(0.01747)	(0.01254)
year2016	-0.04148*	-0.03273*	-0.02527*
	(0.01729)	(0.01489)	(0.01055)
year2017	-0.05165***	-0.04433***	-0.03210***
	(0.01400)	(0.01133)	(0.00929)
year2018	-0.04916**	-0.04236**	-0.03235**
	(0.01740)	(0.01451)	(0.01000)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D6: Year dummies (ref. 2007)

	Model 1	Model 2	Model 3
n_europe	-0.08538**	-0.09519**	-0.06934
	(0.02995)	(0.03225)	(0.04961)
e_europe	0.00397	0.00830	-0.04979
	(0.03396)	(0.03598)	(0.04933)
c_europe	-0.04583	-0.04302	-0.06466
	(0.05178)	(0.05347)	(0.04349)
s_europe	0.09787**	0.09283**	0.08787**
	(0.03185)	(0.03368)	(0.02770)
sw_europe	0.08087*	0.08575**	0.04179
	(0.03146)	(0.03248)	(0.04261)
se_europe	0.11594***	0.11916***	0.03732
	(0.03047)	(0.03182)	(0.04162)

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Table D7: Geographical dummies (ref. Western Europe)

Appendix of Chapter 4

C.1 Literature review: overview table

Below tables lists microsimulations of UBI schemes. The column Type refers to static models, where only changes in participation tax rates and marginal effective tax rates can be calculated, or behavioural models, where labour supply responses are estimated. Most of the simulated schemes (with the exception of a scenario in [Horstschräer et al., 2010] and [Martinelli, 2017], and in [Clavet et al., 2013]) are budget-neutral scenarios. In the majority of scenarios a reduced UBI is granted to children, whereas in some scenarios original child benefits are maintained. Some variation also exists regarding elderly: sometimes they keep their original pensions, in other cases they are included in the UBI scheme with possibly an augmented benefit. Finally, all budget-neutral scenarios use an increase of personal income tax combined with a reduction of existing benefits to attain neutrality, with the exception of a scenario in [Müller, 2004], where VAT increases is used.

Author(s)	Type	Country
[Callan and Sutherland, 1997]	Static	UK, IE
[Scutella, 2004]	Behav.	AU
[Müller, 2004]	Behav.	CH
[Jacobs et al., 2006]	Behav.	NL
[Colombo et al., 2008]	Behav.	DE
[Colombino et al., 2010]	Static	DK, IT, PT, UK
[Horstschräer et al., 2010]	Behav.	DE
[Clavet et al., 2013]	Behav.	CA
Colombino (2014)	Behav.	IT
[Jessen et al., 2015]	Behav.	DE
[Jongen et al., 2015]	Behav.	NL
[Sommer et al., 2016]	Behav.	DE
[Browne and Immervoll, 2017]	Static	FI, FR, IT, UK
[Martinelli, 2017]	Static	UK
[Pareliussen et al., 2018]	Static	FI
[Islam and Colombino, 2018]	Behav.	BE, FR, IE, IT, LU, UK
[de Boer and Jongen, 2020]	Behav.	NL

Table D1: Literature review - UBI microsimulations

C.2 activity coding list: level 1 and 2 categories

HETUS Category	HETUS sub-category	Model Category	Short name
0: Personal care	01 sleep	Sleep	S
	02 eating 03 other personal care	Personal care	P
1: Employment	11 main job and second job 12 acti. related to employment	Employment	E
2: Study	20 unspecified 21 school or university 22 free time study	Study	ST
3: HH and family care	30 unspec. HH and family care 31 food management 32 household upkeep 33 making and care for textiles 34 gardening and pet care 35 construction and repairs 36 shopping and services 37 household management	Household chores	HC
	38 childcare 39 help to adult fam. member	Care to fam. members	CF
4: Voluntary work and meetings	41 organisational work 42 informal help to other HH	Voluntary work	V
5: Social life and entertainment	51 social life 52 entertainment and culture 53 resting - time out	Other leisure	O
6: Sports and outdoor activities	61 physical exercise 62 productive exercise 63 sports related activities	Sports and outdoor	SO
7: Hobbies and computing	71 arts and hobbies 72 computing 73 games	Other leisure	O
8: Mass media	81 reading 82 tv, video and dvd 83 radio and recordings		
9: Travel and unspecified time-use		Travel and unspec.	T

Table D2: Recategorization of leisure activities for FML

C.3 Parameter estimates - FML model

Coefficients - FML model

Tables D3 and D4 give an overview of FML parameter estimates and Table D5 the marginal effects at the means. The marginal effects show how shares of leisure time devoted to a particular activity (and not absolute time spent!) vary with the explanatory variables. The log pseudo-likelihood at the maximum found is -22329.02. All information on activity categories can be found in Appendix C.2. Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05.

	P	ST	HC	CF
Variables				
Leisure	0.000372	0.0301*	0.00196	-0.00363
	(0.000934)	(0.0137)	(0.00178)	(0.00478)
Leisure partner	-0.000408	0.00543	-0.00547***	-0.00726*
	(0.000869)	(0.0125)	(0.00126)	(0.0034)
Education	0.00653	0.221	0.0118	-0.027
	(0.00879)	(0.123)	(0.0142)	(0.0338)
Age category	-0.0132	-0.704	0.15**	-0.0285
	(0.0401)	(0.61)	(0.0569)	(0.167)
(Age category)^2	0.00175	0.0381	-0.0061	-0.00361
	(0.00268)	(0.0417)	(0.00377)	(0.0123)
Children 0-6	0.0481	0.325	0.0659	1.13***
	(0.0272)	(0.455)	(0.0489)	(0.0871)
Children 7-17	0.0443	0.206	0.0583	0.513***
	(0.0231)	(0.302)	(0.0392)	(0.0938)
Number of adults	-0.0162	-1.02	0.799***	1.26**
	(0.128)	(1.87)	(0.183)	(0.488)
Income quintile	0.0045	-0.0472	-0.00047	-0.0602
	(0.01)	(0.152)	(0.0141)	(0.0391)
Female	-0.205	4.44	-0.383	-1.22
	(0.191)	(2.81)	(0.287)	(0.804)
Female X Children 0-6	-0.0823*	-0.102	-0.00703	-0.161
	(0.0374)	(0.481)	(0.0539)	(0.0995)
Female X Children 7-17	-0.0694*	0.4	0.0331	-0.0925
	(0.0294)	(0.376)	(0.0447)	(0.106)
Female X Leisure	0.00211	-0.0323	0.00464*	0.0136*
	(0.00129)	(0.0188)	(0.00199)	(0.00556)
Female X Leisure partner	8.12e-05	-0.00019	0.000666	-6.65e-05
	(0.000327)	(0.00496)	(0.000506)	(0.00143)
Constant	-1.34***	-5.92*	-3.12***	-4.35***
	(0.235)	(2.98)	(0.394)	(1.02)

Table D3: Fractional multinomial logit estimates, part 1 (Ref: S)

	V	SO	O	T
Variables				
Leisure	0.0233**	0.00238	0.000681	-0.00688***
	(0.00786)	(0.00424)	(0.00127)	(0.00158)
Leisure partner	0.00686	0.00601	-0.00034	0.00118
	(0.00791)	(0.00417)	(0.00111)	(0.0013)
Education	0.00688	0.143***	-0.0116	0.0826***
	(0.0919)	(0.043)	(0.0111)	(0.014)
Age category	0.781*	-0.151	0.0626	0.209***
	(0.379)	(0.165)	(0.0503)	(0.0549)
(Age category)^2	-0.0481	0.00887	-0.00324	-0.0156***
	(0.0248)	(0.0116)	(0.00337)	(0.00371)
Children 0-6	-1.06***	-0.0467	-0.0791*	0.0159
	(0.294)	(0.125)	(0.0386)	(0.042)
Children 7-17	-0.611**	-0.0445	0.00462	-0.0404
	(0.224)	(0.111)	(0.0299)	(0.0332)
Number of adults	-0.773	-0.445	0.0147	-0.191
	(1.26)	(0.616)	(0.166)	(0.195)
Income quintile	0.0772	-0.0961	-0.0251*	0.0289
	(0.0723)	(0.051)	(0.0126)	(0.0162)
Female	0.686	-1.46	-0.346	0.293
	(1.51)	(0.816)	(0.238)	(0.289)
Female X Children 0-6	0.219	-0.293	-0.0308	0.00774
	(0.404)	(0.166)	(0.0517)	(0.055)
Female X Children 7-17	0.562*	-0.15	-0.085*	0.01
	(0.264)	(0.147)	(0.0379)	(0.0419)
Female X Leisure	-0.00662	0.00827	0.00093	-0.00204
	(0.0104)	(0.00567)	(0.00161)	(0.00203)
Female X Leisure partner	-0.00546	-0.00152	-8.9e-05	-0.000941
	(0.00305)	(0.00161)	(0.000425)	(0.000487)
Constant	-9.31***	-2.68*	-0.62*	-1.28***
	(2.07)	(1.16)	(0.315)	(0.362)

Table D4: Fractional multinomial logit estimates, part 2 (Ref: S)

	S	P	ST	HC	CF	V	SO	O	T
Variables									
Leisure	-0.004	0.003	0.008	0.027	-0.005	0.015	0.003	0.013	-0.059
Leisure partner	0.031	0.004	0.002	-0.069	-0.009	0.005	0.01	0.01	0.017
Education	-0.359	-0.031	0.058	0.038	-0.053	-0.001	0.199	-0.472	0.621
Age category	-2.06	-0.754	-0.206	1.44	-0.118	0.458	-0.303	0.221	1.32
(Age category)^2	0.112	0.053	0.011	-0.048	-0.001	-0.028	0.017	-0.008	-0.108
Children 0-6	-0.333	0.451	0.086	0.845	1.63	-0.674	-0.082	-1.99	0.062
Children 7-17	-0.575	0.337	0.052	0.64	0.724	-0.394	-0.088	-0.23	-0.467
Number of adults	-4.16	-1.41	-0.306	10.2	1.67	-0.554	-0.821	-2.09	-2.52
Income quintile	0.185	0.106	-0.012	0.063	-0.081	0.052	-0.136	-0.462	0.285
Female	6.1	-0.557	1.25	-3.33	-1.55	0.53	-1.94	-4.29	3.8
Female X Children 0-6	0.87	-0.685	-0.021	0.226	-0.202	0.152	-0.403	-0.191	0.255
Female X Children 7-17	0.794	-0.559	0.114	0.787	-0.105	0.367	-0.193	-1.46	0.257
Female X Leisure	-0.045	0.011	-0.009	0.051	0.018	-0.005	0.011	-0.005	-0.027
Female X Leisure partner	0.002	0.002	0	0.011	0	-0.003	-0.002	-0.001	-0.008

Table D5: Marginal effects, in percentage of total leisure time

Coefficients - extended FML model

Tables D6 and D7 give an overview of FML parameter estimates and Table D8 the marginal effects at the means, when the model is estimated on HETUS data from Belgium and neighbour countries (FR, UK, DE, LU, NL).

	P	ST	HC	CF
Variables				
Leisure	0.000797*	0.00612	0.00183**	0.00494**
	(0.000344)	(0.00582)	(0.000603)	(0.00171)
Leisure partner	0.000903**	0.0119*	-0.00443***	-0.00318**
	(0.000316)	(0.00571)	(0.000468)	(0.00117)
Education	-0.00693*	0.21***	-0.00752	0.0942***
	(0.0033)	(0.053)	(0.00483)	(0.0146)
Age category	0.0391**	-0.818***	0.196***	0.358***
	(0.0125)	(0.147)	(0.0191)	(0.068)
(Age category)^2	-0.0016	0.0419***	-0.00828***	-0.0373***
	(0.000865)	(0.0108)	(0.00131)	(0.00525)
Children 0-6	-0.0292**	-0.48*	0.123***	1.11***
	(0.0104)	(0.226)	(0.0176)	(0.0324)
Children 7-17	-0.0198*	-0.129	0.0628***	0.42***
	(0.00855)	(0.134)	(0.0147)	(0.036)
Number of adults	-0.154**	-1.83*	0.652***	0.882***
	(0.0468)	(0.859)	(0.068)	(0.17)
Income quintile	0.023***	-0.0479	0.00222	-0.0146
	(0.00365)	(0.0521)	(0.00526)	(0.0156)
Female	-0.117	0.561	-0.263**	-0.367
	(0.0649)	(1.06)	(0.1)	(0.273)
Female X Children 0-6	-0.0129	0.0469	-0.0359	-0.115**
	(0.0135)	(0.254)	(0.0201)	(0.0383)
Female X Children 7-17	-0.00358	0.308	0.0479**	-0.0466
	(0.0106)	(0.164)	(0.0166)	(0.0419)
Female X Leisure	0.00112*	-0.00207	0.00421***	0.00905***
	(0.000453)	(0.00736)	(0.000706)	(0.002)
Female X Leisure partner	-0.000122	-0.00213	0.000128	-0.00248***
	(0.000119)	(0.00187)	(0.000185)	(0.000572)
Constant	-1.35***	-1.06	-3.15***	-6.9***
	(0.0832)	(1.31)	(0.132)	(0.359)

Table D6: Fractional multinomial logit estimates (with neighbour countries), part 1 (Ref: S)

	V	SO	O	T
Variables				
Leisure	0.00279	0.0045***	0.000783	-0.00713***
	(0.00246)	(0.00122)	(0.000468)	(0.000645)
Leisure partner	-0.00739***	0.00304*	-0.00111**	0.00178**
	(0.00223)	(0.00126)	(0.000424)	(0.000591)
Education	0.0871***	0.0675***	0.000363	0.0524***
	(0.0243)	(0.0134)	(0.00437)	(0.00626)
Age category	0.12	0.00576	-0.00818	0.0326
	(0.0974)	(0.0485)	(0.0162)	(0.0232)
(Age category)^2	-7.26e-05	-0.00159	0.00125	-0.0029
	(0.00644)	(0.0034)	(0.00111)	(0.00162)
Children 0-6	-0.0249	-0.124**	-0.118***	0.0358
	(0.0873)	(0.0412)	(0.0144)	(0.0186)
Children 7-17	0.0288	-0.0449	-0.00429	0.0103
	(0.0622)	(0.0321)	(0.011)	(0.0153)
Number of adults	1.15***	-0.55**	0.178**	-0.311***
	(0.323)	(0.187)	(0.0633)	(0.088)
Income quintile	-0.0396	0.0549***	-0.0352***	0.0129
	(0.0256)	(0.0143)	(0.00487)	(0.008)
Female	-1.15*	-0.539*	-0.281**	0.167
	(0.453)	(0.252)	(0.0861)	(0.122)
Female X Children 0-6	-0.302**	-0.0526	-0.0251	0.0235
	(0.113)	(0.0562)	(0.0186)	(0.024)
Female X Children 7-17	-0.0887	-0.0682	-0.0455**	0.0206
	(0.0762)	(0.0433)	(0.0139)	(0.0191)
Female X Leisure	0.00857**	0.00133	0.000647	-0.00158
	(0.00318)	(0.00174)	(0.000598)	(0.000855)
Female X Leisure partner	-0.00182*	0.000415	-8.22e-05	-0.000311
	(0.000838)	(0.000456)	(0.000157)	(0.00022)
Constant	-6.29***	-3.09***	-0.61***	-0.375*
	(0.621)	(0.321)	(0.111)	(0.155)

Table D7: Fractional multinomial logit estimates (with neighbour countries), part 2 (Ref: S)

	S	P	ST	HC	CF	V	SO	O	T
Variables									
Leisure	-0.003	0.009	0.001	0.025	0.006	0.003	0.009	0.015	-0.064
Leisure partner	0.024	0.019	0.003	-0.054	-0.003	-0.006	0.007	-0.011	0.021
Education	-0.261	-0.167	0.049	-0.203	0.112	0.077	0.123	-0.138	0.408
Age category	-1.45	0.018	-0.207	2.25	0.409	0.079	-0.064	-0.989	-0.045
(Age category)^2	0.068	0.002	0.01	-0.093	-0.045	0.002	0	0.065	-0.01
Children 0-6	-0.075	-0.379	-0.116	1.73	1.41	-0.026	-0.255	-2.59	0.303
Children 7-17	-0.422	-0.374	-0.034	0.738	0.523	0.017	-0.113	-0.329	-0.006
Number of adults	-3.53	-2.98	-0.464	7.97	1.01	1.01	-1.3	1.88	-3.6
Income quintile	0.112	0.315	-0.011	0.073	-0.015	-0.035	0.117	-0.697	0.141
Female	4.73	0.068	0.165	-1.99	-0.313	-0.989	-0.842	-3.42	2.59
Female X Children 0-6	0.59	0.029	0.015	-0.293	-0.127	-0.275	-0.076	-0.211	0.347
Female X Children 7-17	0.142	0.001	0.075	0.734	-0.055	-0.082	-0.131	-0.903	0.217
Female X Leisure	-0.037	0.002	-0.001	0.046	0.01	0.007	0.001	-0.007	-0.023
Female X Leisure partner	0.003	0	0	0.003	-0.003	-0.002	0.001	0	-0.002

Table D8: Marginal effects, in percentage of total leisure time

C.4 Euromod policy reform details

To simulate the reforms scenarios, changes are made upfront to the original SILC database and in the Euromod policies. While all changes could be realized in the Euromod programme direclty, it proved simpler to implement some of the changes upfront.

Upfront

The SILC-dataset (prepared for EUROMOD by the national teams) is adapted before running EUROMOD in the following ways:

- an UBI of 770 euros is distributed to all individuals aged 18 to 84
- an UBI of 192.5 euros per child is distributed to all heads of households (as defined in Euromod)
- Unemployment, early retirement and social assistance benefits are set at 0
- disability and sickness benefits are reduced by the amount of UBI (or set at 0 when those benefits are lower than the UBI level)

Changes in EUROMOD

- 6.3: UBI added to taxable income
- 15.1: work-bonus (in-work benefit) set to 0
- 27.1: marital quotient advantage set to 0
- 34: birth allowance switched off
- 35: child allowances switched off
- 36: income support switched off

Budget neutrality

Budget neutrality is obtained by iteratively multiplying the PIT tax rates by an increasing constant. When the weighted sum of all disposable incomes equals a target value, the loop stops. In scenario 2, this target value is the weighted sum of disposable incomes in the base case, while in scenario 1, this value is a bit higher, as we assume some part of the deficit is financed through non-simulated taxes.

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