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Reducing the income tax burden for households with children: An assessment of the child tax credit reform in Austria*

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December 11, 2019

Abstract

This paper analyses the impact of the implementation of a child tax credit in Austria in 2019, not only on micro, but also on macro level by using a dynamic scoring methodology. First, we assess the fiscal and distributional impact of this reform using the microsimulation model EUROMOD. Second, we estimate labour supply impacts of the reform based on a structural discrete choice framework. Third, we evaluate the macroeconomic impacts of the reform, by calibrating and shocking QUEST, the DSGE model of the European Commission, with the micro-based results for the implicit tax rate, the non-participation and the labour supply elasticities. We show that the child tax credit reform in Austria reduces inequality, lowers the poverty rate in general, but by definition only for households with children. Overall the reform has a positive impact on labour supply, both on the extensive and on the intensive margin, especially for women. On the macro-level (and in the long-run), our model suggests a positive impact on employment. Additionally, we find that parts of the tax decrease can be potentially captured by the employer, meaning that gross wages would fall slightly. However, we find small but positive effects on GDP, investment and consumption, although the long-run macroeconomic effects depend crucially on how the government compensates the missing tax revenues after the reform. Accounting for these effects at the micro level, we show that the second round effects are important to take into account, because they provide insights into the medium-term distributional impact of the reform.

Keywords: EUROMOD, tax credit, reform, DSGE, labour supply, microsimulation, discrete choice
JEL Classification: H24, H31, I38.
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1 Introduction

In 2018 the Austrian government decided to enforce a new law to lower the tax burden of families significantly through the implementation of a non-refundable tax credit for households with children - the so called *"Familienbonus Plus"*. The reform was confirmed by the parliament soon after and has been enforced in 2019. The goal of this reform was to reduce the tax burden of in-work families with children that is among the highest in the EU (see e.g. OECD (2018)). The tax credit was granted only to in-work families[1] and its amount he amount of the tax credit depends on the number of children. It can be split by family members but, by definition, it is only available for those family members that pay taxes.

After a long public debate, the government decided to introduce an additional refundable tax credit for lone parents and single-earner families - the so called "Kindermehrbetrag" - to support those family types that do not pay taxes due to part-time work, and are therefore not eligible for new tax credit. An additional goal of the government was to reduce the complexity of the tax system. Therefore, some old tax benefits for families that had overall small financial impact were abandoned. In this context, the deductibility of child care costs as well as the child tax allowance (the so called "Kinderfreibetrag") were abolished.

The overall expected fiscal impact of the Austrian reform is substantial. First simulations in Austria pointed out that the reform will lower the tax burden in Austria by about 1.6 billion Euro[2], which is almost 5 percent of the total income tax revenues in Austria. This reflects a strong decrease in the tax burden for households with dependent children, leading potentially to a strong distortion on the labour supply side. Other studies, such as Blundell (2000) and Brewer et al. (2006) already showed substantial impacts of in-work benefits for families with children on the labour supply. In Austria, this is of special interest due to a high rate of part-time working women in families, and a generally low labour market participation of women, especially with children.

We use a novel methodology analyzing tax reforms introduced by Barrios et al. (2017), linking a microsimulation and a dynamic general equilibrium model for Austria. This methodology allows to account for the feedback effects resulting from adjustments and behavioural responses in the labour market and the economy-wide reaction to the tax policy changes essential for a comprehensive evaluation of tax reforms. Based on EUROMOD, the European Union tax-benefit microsimulation model, this paper estimates in a first step the fiscal and distributional impact of the reform. In a second step, we estimate labour supply effects to analyse the implied changes in work incentives in more detail. In a third step, we use the results of both the microsimulation and the labour supply model to estimate second round macro effects with QUEST, the general equilibrium model of the European Commission. In the last step, we account on the micro level for the feedback effects that stem from behavioural responses, as well as the economy-wide reactions to the reform.

The international literature on macro-economic effects of in-work benefit reforms is scant. So far, there are to our best knowledge no studies that estimate the macro-effects of in-work benefit reforms that focus on families with children. Although the intended goal, to decrease poverty of households with children while increasing labour supply incentives for the target group, is typically met, the size of the macroeconomic effects is unclear. Our paper makes a first attempt to close this research gap. Additionally, we use a dynamic scoring approach to also account for second round effects on the micro level, which so far has not been analyzed in the literature.

The paper is structured as follows. In the next section, we briefly describe the literature on similar policies introduced in other countries. In Section 3 we present the family tax credit reform in more detail. In Section 4, we introduce the methodology our analysis is based on. Section 5 briefly describes the fiscal and distributional impacts of the reform, while Section 6 concentrates on the labour market impact. Section 7 then assesses the macro impact of the reform. Section 8 shows the micro impact using the dynamic scoring methodology and the last section concludes.

[1] We will show later, who is eligible for the non-refundable tax credit.

[2] See e.g. Fink and Rocha-Akis (2018).

2 Literature overview

The main part of the Austrian Reform (Familienbonus Plus) introduced a new tax credit for children. The main objective of this reform was to lower the tax burden for families with children. It is not a work-contingent tax-credit, but due to the way this child tax credit works, it is to a large extent conditional on employment. Immervoll and Pearson (2009) define in-work benefits as being "conditional on employment and that they create distinct incentives for some groups to increase working hours or work effort". While we can show later that the reform creates work incentives for the families concerned by the reform, the reform is not directly linked to employment. Still, by the framing of the reform, more than 95 percent of the recipients have employment or self-employment income as their primary income source. Additionally, for those people, the difference of working or not working (participation tax rate) may change significantly due to the reform, indicating that it could incentivise certain groups to increase participation[3]. For these reasons the reform is on the border line between family benefit and in-work benefit. We will discuss several reforms that are specifically in-work benefit (IWB) reforms, because they are more closely linked to the Austrian reform than other family benefit reforms.

Such policies, sometimes also called Making Work Pay policies, are meant to reduce poverty while boosting employment. As already suggested by the name, these benefits are only eligible for persons who have already taken up a job. Additionally, IWB typically aim to reduce benefit dependency of the targeted subgroup by increasing the net income from work, and therefore aim to increase the difference between in-work income and out-of-work benefits. This means that they intend to increase employment incentives and therefore, potentially, labour supply.

In-work benefits can vary quite substantially, especially regarding their design (e.g. tax credits, wage-related transfers or lump-sum payments) and their target groups (e.g.: recipients of unemployment benefits, recipients of social assistance, part-time workers, low-wage earners, families with children,...). Leppik (2006) gives an overview of typical IWBs around the world. Tax credits usually target low income working families and aim to improve the net income of these families, and thus contribute to reducing poverty, while at the same time creating work incentives. In the case of targeting families with children, the aim of those policies is not only to increase participation in the labour market, but also to increase the supplied working hours of the target group[4].

Tax credits related to children often target low-income families, therefore, according to Ochel (2001) they consists of three phases: first the tax credit increases as income increases (phase-in), then it remains constant, and beyond a certain income level the tax credit starts to decrease and eventually stops (phase-out). This is not the case of the Austrian reform, where the targeted group are not only low-income families but in general families with children, regardless of their income.

Similar policies to the Austrian child tax credit were introduced in other countries, such as the UK, the US, Canada and the Netherlands, with the intention to provide cash assistance to (low-income) families with children. These policies were often tax credits because they were meant to decrease poverty without creating adverse incentives to the labour market participation. Some of them focus only on low-income families. Brewer et al. (2009) give a brief overview of in-work benefit reforms in a cross-national perspective. Blundell (2000) additionally gives a general overview about those in-work benefit policies that exist in the US and Canada, and discusses potential impacts in the UK. Finally, Leppik (2006) discusses the legal framework of in-work benefits in several countries around the world (e.g. the child tax credit in the Netherlands).

Many papers use micro simulation models to analyze the fiscal impacts of such tax credits for children (see e.g. Fink and Rocha-Akis (2018) for Austria, Blundell and Reed (2000) and Blundell et al. (2000) for the UK, Hoynes and Rothstein (2016) for the US. Regarding the distributional impacts, the results strongly depend on the family structure. Families with children are generally overrepresented in the lower and middle part of the income distribution (when considering equivalized disposable household income).

[3]Since the tax credit can be shared within couples, it is not straight forward to identify the labour supply effects easily.

[4]see e.g. Leppik (2006)

Additionally, the eligibility conditions of the policy play an important role on the distributional impact. Many countries restricted such in-work benefits to a certain group of the population, or phase out the benefits after a certain income level. Additionally, the level of child tax credits varies substantially across countries.

Since the goal of such reforms is not only to reduce poverty of certain groups, but also to increase their labour supply, a detailed evaluation of their effectiveness focuses as well on labour supply effects. Only a few papers deal with the expected labour supply responses of child tax credit reforms, except for the UK reform which has generated numerous research. In the UK the government decided in 1999 to increase significantly the generosity of in-work benefits for families by introducing the so called Working Tax Families' Tax Credit (WFTC). According to Blundell et al. (2000) the WFTC was intended to improve work incentives and to encourage people to move into employment. The eligibility for the tax credit depended on hours of paid employment (a family needs to contain an adult who works 16 or more hours a week), the number of children, income, capital and formal childcare costs.

Overall, the literature on so called Working Tax Families' Tax Credit in the UK points out that participation of single mothers increased due to the reform, while the responses of married women is limited or even negative. The labour supply reaction of fathers in couples tends to be low, although positive.

Blundell et al. (2000) use a discrete-choice behavioural model of household labour supply to estimate labour supply responses of different household types to the WFTC. The estimation results suggest that the participation rates among single mothers increased, while married women tended to reduce their labour supply. A detailed analysis of the reform using micro data from before and after the reform by Brewer et al. (2006) showed a substantial impact on the labour supply of lone mothers, but a slight reduction in the labour supply of mothers in couples. For fathers in couples the labour supply increased slightly.

Brewer et al. (2009) argues that employment of married couples was largely unaffected, but for those couples with low income-partners, they found significant increases in employment as well as in hours worked, meaning that the reform was effective at increasing the labour supply of the targeted group.

Another interesting case study is the US child tax credit (CTC) which is in many respects similar to the policy implemented in Austria. The US CTC provides taxpayers up to 2000 Dollar of tax rebate for each dependent child under the age of 17. Additionally, the CTC also includes a refundable component for working families with low incomes[5]. The goal of this policy was, similar to the Austrian reform, to help families to offset the costs of raising children. The fact that the tax credit of the US was not only targeting low-income earners, but also has a refundable component, makes the policy probably the most similar to the Austrian one.

The child tax credit CTC has been analyzed by Hoynes and Rothstein (2016) with the intention to see whether the intended goals, to support low income groups and to encourage work, were met. The authors argue that the CTC was not well targeted, meaning that a large share of the expenditures are additionally going to above median income groups, although the refundable component of CTC that was introduced in 2009 made the CTC more targeted on low income groups.

Our paper contributes to the literature by not only analyzing a new child tax credit that was implemented in Austria, but by adding insights in the expected behavioural responses on labour supply. Compared to the literature on similar reforms, this is the first study that use the micro-economic effects of the reform to estimate macro-economic effects of the introduction of this in-work benefit (tax credit).

[5]see e.g. Greenstein et al. (2018) and Marr et al. (2015) for a detailed description of the child tax credit in the US

3 The Austrian reform of the family tax credit

The Austrian income tax system is in general quite complex. This complexity is driven by multiple tax reforms over previous years. Most of those tax reforms had the goal to offset the increasing tax burden that arises by not adjusting the tax brackets to inflation (bracket creep). This led to the introduction of several tax credits and allowances for certain groups of taxpayers within the tax system. Additionally, the fact that wages are usually paid 14 times in Austria, and that not all of those monthly wages are taxed in the same way, makes the system not easy to grasp. In fact, the tax system distinguishes two different types of wages that are taxed in a different way. While the recurrent wage income contains the regular monthly income paid 12 times a year is taxed on the usual tax scheme, the so-called special payments (holiday and Christmas bonuses) - that are typically paid twice a year - are taxed at a lower rate. For a detailed overview on the structure of the current Austrian tax system, but also on the latest structural tax reform in 2016, see e.g. Müllbacher and Nagl (2017) or Christl et al. (2017).

The new Austrian reform to reduce the tax burden for families with children consists of four parts. As already mentioned, a tax credit for families with children (*"Familienbonus Plus"*) as well as a benefit for lone-parents and single-earner households (*"Kindermehrbetrag"*) was introduced. To reduce the costs and to make the system less complex, in addition to the introduction of those new policies, the deductibility of child care costs (*"Absetzbarkeit von Kinderbetreuungskosten"*) as well as the current child tax allowance (the so called *"Kinderfreibetrag"*) were abolished. In the following the reform steps, the eligibility criteria of the reform and the impact on hypothetical households will be discussed in more detail.

3.1 Description of the 2019 implemented policies

Non-refundable Tax-credit for families with children ("Familienbonus plus") The tax credit for families is the first to be subtracted from the tax liabilities, but is non-refundable. The eligibility condition for the tax credit is that the child is eligible to the family allowance (*Familienbeihilfe*). This means, the place of residence of the entitled person has to be in Austria and the child has to live in the same household with the entitled person. Basically, family allowance can be received for minor children below 18 years of age, and for children in full-time education below 24 years of age.

The tax credit is 125 Euro per month until the age of 18. Note that families with children above 18 and younger than 25 and in education are eligible for the family allowance, but the amount of the tax credit is then reduced to 41.68 Euro per month.

Households with children that live outside the European Union are not eligible for the family tax credit. Additionally, for households with children that live in the European Union or Switzerland, the family tax credit is adjusted by the living costs of the respective country. For each child, parents can choose to split the family tax credit either fifty-fifty or to give it to the full extent to one of the partner.

Refundable tax credit for lone-parents and single-earner households ("Kindermehrbetrag") If the tax liability of a single earner or a lone parent (before considering any tax credits) lies below 250 Euro, those household types will obtain additionally to the family tax credit a tax refund (*"Kindermehrbetrag"*) if the child is eligible to the family allowance (*Familienbeihilfe*). This refund is calculated as the difference between 250 Euro per child eligible and the tax liabilities. This means that for each child, a single-earner or lone-parent household receives at least 250 Euro, even if the household has no or low tax liabilities. Again, children that live outside the European Union are not eligible to this tax refund. Additionally, for children that live in the European Union or Switzerland, it will be adjusted by the living costs of the respective country.

3.2 Description of policies abolished in 2019

Deductibility of child care costs ("Absetzbarkeit von Kinderbetreuungskosten") The tax deductibility of child care cost was a way for parents with children up to the age 10 to deduct up to

2,300 Euro per year from their tax base. The cost can be freely shared between parents. According to the law, the childcare costs must be incurred expenses, meaning that whenever e.g. an employer contributes a subsidy for the childcare costs, only the costs incurred of the taxpayer can be claimed. The childcare service must be provided in private or public childcare facilities or by a person with pedagogical qualifications. According to the Austrian Ministry of Finance, around 220.000 households made use of this deductibility. The costs have been evaluated at a level of about 105 Million Euro. This policy has been abolished within the overall reform framework.

Child tax allowance ("Kinderfreibetrag") The *"Kinderfreibetrag"* is a child tax allowance that reduces the taxable income of persons that have maintenance obligations towards children. If only one person is liable to tax claims, the child tax allowance amounts to 440 Euro per child and year. In case both partners claim the child tax allowance for the same child, it amounts to 300 Euro per child and claiming person per year. The child tax allowance can only be claimed via the annual tax declaration. This allowance has also been abolished in the new system.

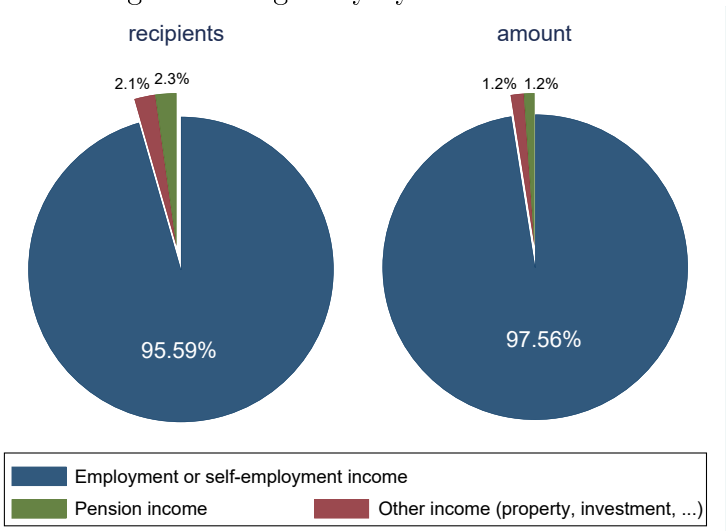
From the legal framework of the reform, we can already see that households with children, where both parents do not work at all, or both parents do not pay taxes, will be neither eligible for the tax credit, nor for the benefit for lone-parents and single-earner households.

3.3 Eligibility for the new policies

Strictly speaking, the child-tax credit reform is not an in-work benefit reform, since the benefit is not conditional on working. Even though the tax credit is designed in a way, that almost only employees can profit, there are some exceptions, in case a household member is only living from pension or property income.

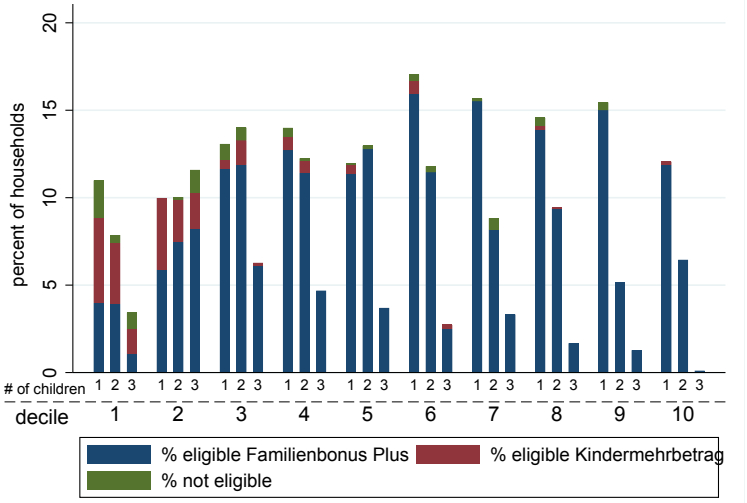
Figure 1 shows that 95.6% of the recipients of the benefits are people that are in work (receiving employment or self-employment income). Only about 4.4% of the receivers have another main income source. If we take a look on how the benefit amount is split across income sources, we can see that 97.6% of the total benefit amount goes to people with employment or self-employment income only about 2.4% of the amount is received by people whose main income source is not linked to employment.

Figure 1: Eligibility by income source



The reform clearly targets household with children. Figure 2 displays the distribution of families with children by income deciles of households equivalised disposable income. In each decile we can observe the percentage of households with 1, 2 and 3 or more children and whether they are eligible or not to the tax credit ("Familienbonus Plus") and to the subsidy for lone parents and single earners ("Kindermehrbetrag"). Interestingly, households with more than one child are located mostly in the lower part of the income distribution, especially in the second (21.6%) and third decile (20.3%). This share is quite high also in the fourth and fifth decile (17%), but then it starts to decrease until the end of the income distribution (6%), where we find mainly families with one child.

Figure 2: Distribution of households with 1, 2, 3 or more children by income decile



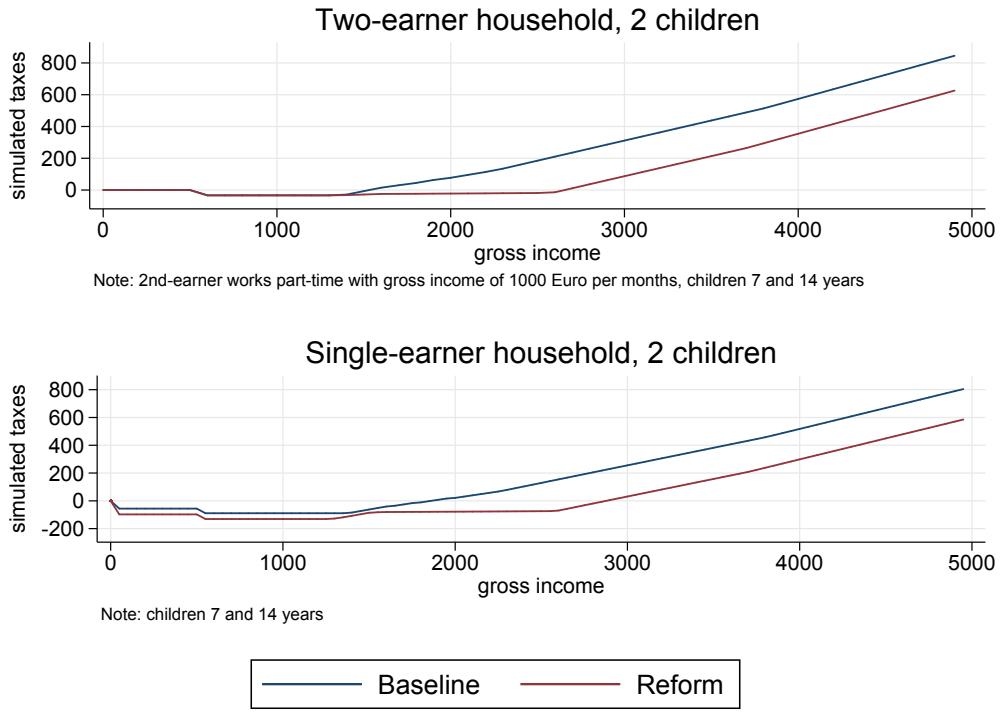
We also observe that most of the non-eligible households are concentrated in the lowest part of the income distribution. This is not surprising because those households typically have no tax liabilities and therefore they are not-eligible for the tax credit. Some of them are single parents or single earner households and could benefit of the "Kindermehrbetrag", especially in the first (9.7%) and in the second (8.5%) decile. This means that they still benefit from the reform, but the impact on their disposable income is lower than in the case of eligibility to "Familienbonus Plus". Households that are not eligible are generally households that rely only on transfers and are not working or have a low work intensity.

3.4 The impact of the new policies on the income taxes paid

To visualize the two policies in a intuitive way, we use the hypothetical household tool of EUROMOD, where we can set up a variety of different household types. Figure 3 shows two specific households: Household 1 is a two-earner household with two children, aged 7 and 14 where the household heads income varies between 0 and 5000 Euro, while the partner works part-time and has a fixed income of 1000 Euro. Household 2 is a single-earner household (or lone-parent household) with two children aged 7 and 14, with a income varying from 0 to 5000 Euro monthly.

We can see that in the case of a single earner household, the refundable tax credit ("Kindermehrbetrag") is reducing the tax-burden of this households even at really low incomes, while this is not the case in a two-earner household, which can only benefit from the non-refundable child tax credit. A two earner household will only profit from the reform if the income of one of the household members is above about 1500 Euro, as Figure 3 highlights. We can also see, that the income threshold where those households start to pay taxes is shifted substantially to the right, indicating that those households with a income below

Figure 3: The reform impact on income taxes of different households



about 2500 Euro, will not pay income taxes any more. In Austria almost all sectors of the economy are covered by collective bargaining agreements, and the negotiated wages are usually above 1500 Euro per month. This implies a substantial deduction of the tax burden for households with children where at least one household member works full time.

4 Data and Methodology

Our approach is based on Barrios et al. (2017), which combines the micro-simulation model with a macro model (QUEST) via the labour supply responses and the change in the implicit tax rate (from EUROMOD). This allows us to not only evaluate the overnight effects of the reform, but also to see long-run implication for the economy and public finances. This especially interesting since the literature on those long-term macro effects of tax-credit reforms is scant.

We first evaluate the distributional impact, as well as the impact on labour supply of the Austrian reform. Additionally, we use these results to calibrate the macro-model and to evaluate the impact of the reform on employment, investment, consumption and other relevant macro variables. In this section, we briefly discuss the three models we use to analyse the reform (EUROMOD, LS-model and QUEST) and how those models interact with each other.

4.1 EUROMOD

To evaluate the first-round fiscal and distributional effects of the reform within the Austrian tax-benefit systems we make use of EUROMOD, the tax-benefit microsimulation model for the European Union (see e.g. Sutherland and Figari (2013) or Sutherland (2007)). EUROMOD relies on micro-data representative of the household population of Austria and each other EU member state. EUROMOD is not only a unique tool for international comparative research on the effects of taxes and benefits, but also a tool to simulate fiscal and redistributional effects of certain reforms within a country.

Simulations are based on EUROMOD 2018 tax-benefit system, using individual and household data from the European Union Survey of Income and Living Conditions (EU-SILC) 2016. These data are uprated to the policy year 2018 to get a better intuition of the fiscal effects of the reform. Due to the lack of information, we cannot simulate the adjustment for living costs of the respective country for children that live abroad. This limitation is likely to have only a minor impact on our results, since the other parts of the overall reform are substantially bigger[6]. Additionally, we cannot identify parents with dependent children, if they are not living together (e.g. students living away from home).

The deductibility of child care costs is not implemented in EUROMOD. We use data from the Austrian national SILC where parents report the costs for child care. The variable K010004 in the national SILC data reports the monthly costs for child care for all children below 16. We use this information to improve the simulation in EUROMOD[7]. Since there is no valid information on the take up of this tax deduction, we assume that - in line with recent literature[8] - families with low child care costs are those that typically do not take up. We use this assumption to validate the costs of the tax deduction at macro level. The ministry of finance reported costs of about 105 Million Euros for 220 000 cases for the year 2015[9]. The costs as well as the number of people that make use of this deduction are quite stable over time. By assuming the non-take-up of those families that can only declare a small amount of child care costs, we get close to both, the reported recipients, as well as the total costs for the deductibility.

Table 1 gives an overview on the implementation of the reform in EUROMOD. For children that are eligible for the family bonus but live outside the household, we do not assign a tax credit to the parents because we don't know the corresponding child.

[6]The Austrian ministry of finance estimates the effect of this part of the reform with approximately EUR 40 million while the total reform has an impact of almost EUR 1.5 milliard.

[7]We split the costs linearly between all children of the household below 16 years old, since only child care costs for children below 10 can be deducted.

[8]See Hernanz et al. (2004)

[9]See MoF (2017). Please note, that the year 2016 is not reliable, since people can still declare costs for that year.

Table 1: Implementation in EUROMOD

Benefits for children	**Baseline**	**Reform (TotRef)**	**Comments**
current child tax allowance ***Kinderfreibetrag***	- If one person claim: 440 Euro per child per year - If two parents claim: 330 Euro per child per claiming person per year	abolished	
deductibility of child care cost for children up to 10 years ***Absetzbarkeit von Kinderbetreuungskosten***	Child care cost can be deducted	abolished	We added information on Child care expenditures and assumed a non-take up of families with low child care costs to match with external statistics. This was not simulated in EUROMOD in the original baseline.
non-refundable child tax credit ***Familienbonus Plus***	not introduced	- 1500 Euro per year for each child 18 or younger and for which Main child benefit (Familienbeihilfe) is received - 500 Euro per year for each child in education above 18 and for which the Main child benefit (Familienbeihilfe) is received. - Family bonus can be split between parents (50:50 for each of the child).	We simulated the distribution of the tax credit within household as follows: We allocate the tax credit to one parent if the household is better off. In case the household is indifferent in splitting or not, we split the tax credit. We only allow to split the benefit 50:50. In case of more children e.g. a 25:75 distribution of the benefit would be possible, but we did not simulate this.
refundable child tax credit for lone parents or single earners ***Kindermehrbetrag***	not introduced	If eligible for tax credit for single earner (Alleinverdienerabsetzbetrag) or tax credit for lone parent (Alleinerzieherabsetzbetrag), but tax liability <(250 Euro*no. dependent children) the household should profit by at least (250 Euro per year*no. dependent children)	We simulate this as a negative tax. The costs are simulated as a decrease in the personal income tax. (Negative tax) The tax liability of a household can therefore be negative.

4.2 Labour Supply Model

We use a labour supply model based on the methodology of Bargain et al. (2014), which is a flexible discrete choice model as it was used by e.g. Brewer et al. (2006) and Blundell et al. (2000) to evaluate the impacts of a similar reform in the UK. This section will only briefly describe the model, we refer to Bargain et al. (2014) for a detailed overview. The discrete choice labour supply model has its roots in the Random Utility model (see McFadden et al. (1973)) and assumes that households maximize their utility function facing a trade off between consumption (income) and leisure. Consumption-leisure preferences are defined by a quadratic utility function with fixed costs. The utility of a household consists of a deterministic part and an error term that reflects optimization errors of the household. Since household characteristics enter the utility function, we allow heterogeneity in households preferences. Labour supply decisions are in the model reduced to choosing between a discrete set of working hours.

In order to estimate labour supply effects, we focus on the sample (hereinafter flexible sample) of people in working age and available for the labour market (employed or unemployed). We distinguish in our model between 3 household types: single males, single females and couples. While the deterministic utility of a single depends only on the own wage, the utility of a couple depends also on the labour market participation (hours worked) and the wage of the partner. Consumption varies across several taste-shifters (such as age, presence of children and region). Fixed costs to start working are also taken into account, which is in line with usual empirical findings that there are only few observation with low hours worked.

In the discrete choice setting[10], each individual faces a discrete number of alternatives in their choice of hours worked. In our model we use seven choices of hours worked, that are grouped in the following categories: 0, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60.

According to the number of hours, wage, other income sources and households characteristics, EUROMOD derives the disposable income for each of the seven choices. Since wages are not observed for non-workers, we estimate them according to a standard Heckman-correction wage equation. We report the results of the Heckman estimation in Table 11 in the Appendix. To minimize the division bias, we use the estimated wages both for non-workers as well as for workers.

The discrete choice framework allows us to estimate the structural parameters of the underlying utility function. As in Müllbacher and Nagl (2017) and Bargain et al. (2014), a multinominal logit model is used for the estimation of those parameters. Table 7 gives an overview over the results for single households (female and male) as well as for couples.

In a next step, we can estimate additionally to the labour supply elasticity, both the labour supply elasticity at the intensive as well as at the extensive margin. For further details on the methodology, see e.g. Bargain et al. (2014).

4.3 QUEST

As proposed by Barrios et al. (2017), we combine EUROMOD and the LS model with QUEST, the European Commissions dynamic stochastic general equilibrium (DSGE) model[11] that is used by the European Commission for the analysis of structural reforms. Therefore, we are able to model the macro economic impact of the reform.

The QUEST model is a fully forward-looking dynamic general equilibrium model which can capture the behavioural responses of major macroeconomic variables beyond the direct, static impact of specific tax reforms measured in EUROMOD. More specifically, the model-version used for this exercise is a three-region open economy model, calibrated for Austria, the rest of the Euro area, and the rest of the world. For each region, the model economy is populated by households and final goods-producing firms. There is a monetary and a fiscal authority, both following rule-based stabilization policies. The domestic and foreign firms produce a continuum of differentiated goods under monopolistic competition. The product and labour market set-up of the model is based on standard microeconomic theory.

[10] see e. g. Van Soest (1995)

[11] See Ratto et al. (2009), Roeger and Varga (2008) and D'Auria et al. (2009).

In order to measure the distributional consequences of policies, the QUEST model has three skill groups - high, medium, and low - skilled which are classified according to the ISCED education categories (ISCED 0-2, 3-4 and 5-8 groups respectively). These skill groups differ in their earnings and their labour market activity. Barrios et al. (2017) explains in detail the main blocks of the macro model. The next section explains how we link EUROMOD and QUEST through the labour market.

4.4 Combining EUROMOD, the LS model and QUEST

We combine the three models described before to not only analyse the impact of the reform in Austria on a micro-level, but also on the macro level.

First, we run our analysis in EUROMOD for the actual 2018 tax-benefit system and the reform scenario, using the household micro-data. EUROMOD provides us with the change in the implicit tax rate on labour income for employees and employers, i.e., an aggregate indicator of the change in the tax burden resulting from the tax reform[12].

Second, the discrete choice labour supply model estimates the non-participation rate and the labour supply elasticities (by skill level), that is the percentage change in labour supply, given a one percentage change in gross wages.

Third, we calibrate the QUEST labour market parameters in order to match the underlying baseline data and estimates from EUROMOD and the labour supply model respectively. We use the skill-specific population shares, employment rates and wages from EUROMOD and we calibrate the corresponding non-participation rates and labour supply (Frisch) elasticities as estimated in the labour supply model.

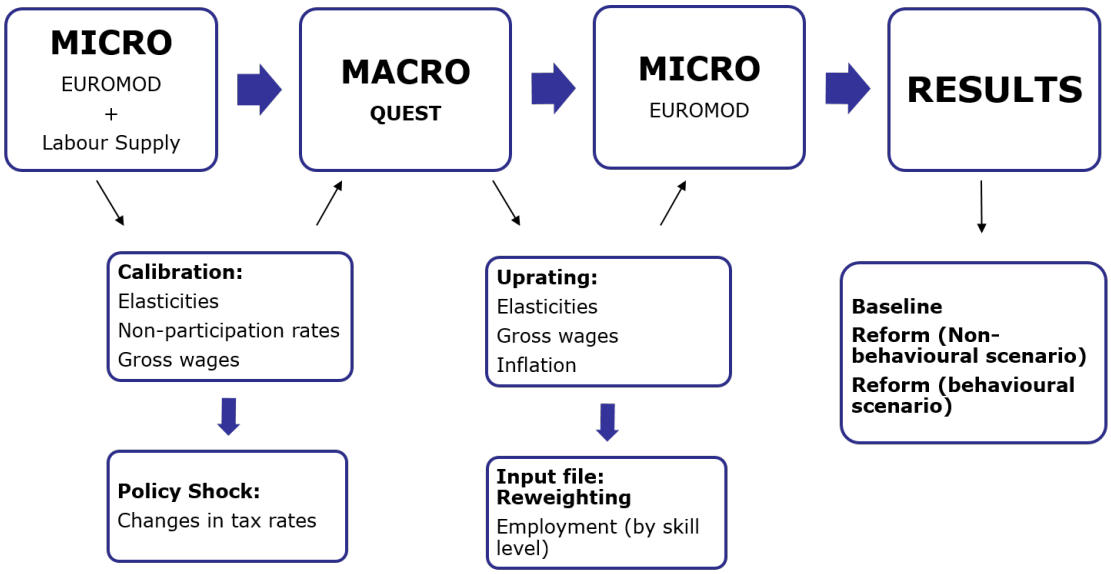
Then, we calculate the change in the implicit tax rates due to the reform in EUROMOD. We use these changes as shocks in the QUEST model in order to obtain the macroeconomic impact of the reform. These macroeconomic impacts include the full behavioural/general equilibrium effects of the reform.

In the final step, we introduce the QUEST output to EUROMOD to assess the impact on disposable income and poverty in 5 years after the reform. More precisely, we uprate monetary variables in EUROMOD based on the change in consumer prices indexes and gross wages simulated by QUEST. Gross wages are uprated according to the skills levels. Additionally, to take into account the employment effect, we randomly move individuals from unemployment to employment according to the change in employment rate by skills levels simulated in QUEST.

Figure 4 describes the interaction between all three models in an intuitive way. Additional information can also be found in Barrios et al. (2017).

[12]The implicit tax rate is calculated as the ratio of taxes and social insurance contributions on labour income to the total compensation of employees and payroll taxes.

Figure 4: Methodological steps of combining the three models



Source: Barrios et al. (2017).

5 The fiscal and distributional impact of the reform

5.1 The fiscal impact

The reform was intended to decrease the tax burden for households with children. This should be reached by an introduction of a tax credit that depends on the number of children. Hence, from the fiscal perspective of the government, the reform reduces the total income tax revenues. Table 2 summarizes the effect of the reform on the governments budget.

As a consequence of the reform, the income tax revenues are reduced by 1.55 billion Euro (or 4.7 percent). The biggest part of this decrease in tax revenue is due to the introduction of the "Familienbonus", while only about 38 Millions are due to the "Kindermehrbetrag" for lone parents and single earners.

On the other hand, some of the beneficiaries of the reform lose some benefits due to the increase in disposable income. The expenditures for means-tested benefits are reduced by 45 million Euro. This is mainly driven by a reduction in social assistance (36 million Euro), because some household might not be eligible for social assistance, or the social assistance is lowered due to the higher income (so called "Aufstocker"). The latter means that the government is expected to spend less on means-tested benefits. Therefore, the overall reform is expected to have a net budgetary effect of approximately -1.51 billion Euro.

Table 2: The fiscal impact of the reform (in million Euro)

			Total	Difference
Concept	Baseline	Reform	(in Euro)	(in %)
Total taxes	33 057	31 504	-1 553	-4.7
Total SSC	57 877	57 877	0	0.0
Social assistance	2 259	2 223	-36	-1.6
Family bonus Vienna	25	24	-1	-3.9
Unemployment assistance	1 025	1 019	-7	-0.7
Family supplement	82	81	-2	-2.1
Total means tested benefits	5 266	5 221	-45	-0.9
Total non-means tested benefits	10 860	10 860	0	0.0
Net budgetary effect	25 194	23 686	-1 508	-6.0

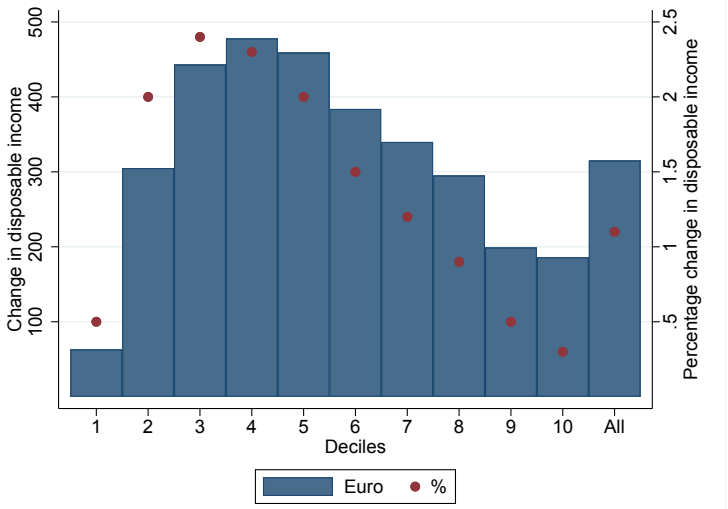
5.2 The distributional impact

This section presents the effects of the reform on income distribution, inequality and poverty, without accounting for possibly behavioural responses. The tax credit is addressed to families with children, hence, as already mentioned in section 2, the distributional impact strictly depends on where those types of households are located in the income distribution before the reform.

Figure 5 shows absolute change (left axis) and relative change (right axis) of the equivalised disposable income by income deciles. Overall the reform would increase equivalised disposable income by 315 Euro per year. The effect is positive on all income deciles, especially in the third, fourth and fifth deciles, where the increase is larger than 400 Euro. From the fifth decile the effect starts to decrease until the end of the income distribution. This results is in line with the distribution of type of households described above. It is worthy to notice, that even if most of the households with two or more children are concentrated in the second decile, the absolute change in disposable income is lower than in other deciles, because many of them are only eligible to the "Kindermehrbetrag". If we focus on the relative change, the highest increase

in equivalised disposable income is found for the third (+2.4%) followed by the fourth (+2.3%) and the second and the fifth decile (+2.0%).

Figure 5: Change in disposable income by income decile due to the reform



Finally we assess the effect of the reform in terms of income inequality and poverty. Both the Gini coefficient and the income quintile share ratio (S80/S20) show that the reform slightly reduces inequality of equivalised disposable income (Table 3). The Gini coefficient of disposable income is reduced by 0.0029 from 0.2512 to 0.2483. This reduction is statistically significant. However, if we focus on the share of income received by the top decile divided by the share of income of the bottom decile, we find that the reform has almost no effect on this inequality measure.

Table 3: Inequality and redistributive effect of the tax-benefit system

Inequality measure	Baseline	Reform	Difference
Gini: disposable income	0.2512	0.2483	-0.0029
Income quintile share ratio s(80)/s(20)	3.4969	3.4724	-0.0322
Income quintile share ratio s(90)/s(10)	4.7492	4.7471	-0.0021

Table 4 shows the at-risk-of-poverty rate for different type of households, in the baseline, after the introduction of the "Familienbonus Plus"(FamB) and considering also the "Kindermehrbetrag" (TotRef). This index is measured as the people that have an income below 60% of the median equivalised annual disposable income (14,887.66 euro). Overall, the reform would decrease the at-risk-of-poverty rate significantly from 13.1 percent to 12.5 percent. Looking at the different type of households, we find that in the baseline families with children are those who experience a higher poverty rate. Obviously, only households with children are influenced by the reform. The simulation highlights that the reform decreases significantly the at-risk-of-poverty rate for households with two adults and children by 1.6 percentage points. Results for other households with children are not significant, also because the number of observations for these subgroups are low. It is worthy to note that the "Kindermehrbetrag" is the driving factor for the

at-risk-of-poverty rate reduction of single-parent households. However this reduction is not statistically significant at a 95% level.

Table 4: At-risk-of-poverty rates for different types of household (in percent)

	Level			Diff. wrt. baseline	
Household type	baseline	FamB	TotRef	FamB	TotRef
Total	13.1	12.5	12.5	-0.6	-0.6
One adult <65, no children	26.7	26.7	26.7	0	0
One adult over 65, no children	18.5	18.5	18.5	0	0
One adult with children	30.3	30	29	-0.3	-1.4
Two adults <65, no children	10.7	10.7	10.7	0	0
Two adults, at least one over 65, no children	8.5	8.5	8.5	0	0
Two adults with children	11.9	10.3	10.3	-1.6	-1.6
Three or more adults, no children	4.8	4.8	4.8	0	0
Three or more adults with children	15.9	14.6	14.6	-1.3	-1.3

Note: FamB refers to the reform of the child tax credit (without Kindemehrbetrag). TotRef refers to the whole reform, that consists of all 4 steps explained before. Poverty line is anchored at the baseline and it is EUR 14,887.66 (60% of median equivalised annual disposable income)

6 Labour market and work incentive impact of the 2019 reform

Work incentives can be split into incentives to start working (extensive margin) and incentives to increase working hours (intensive margin). The distinction between the extensive and intensive margins has long been recognized by the literature on the labour supply (see, e.g., Heckman (1993) Blundell et al. (2013)). The labour supply responses at the intensive and extensive margin depend crucially on the tax design of any income-tax system, as it has been shown for example by Choné and Laroque (2005) and Gruber and Saez (2002). Participation tax rates, the implicit tax rate on labour, as well as the marginal tax rate for low incomes remain high in many current tax systems (see, e.g., Jara and Tumino (2013) and Brewer et al. (2010)), indicating that there is room for policies that aim to increase incentives on both the extensive and the intensive margin.

This section will give a brief overview about the Austrian labour market, and will provide a detailed analysis on the implied first round effects of the reform on work incentives by analysing the changes in the implicit tax rate (on labour) as well as in the marginal tax rate due to the reform.

6.1 Implicit tax rates on labour

The Austrian labour market is characterized by a - in comparison with other European countries - low unemployment rate and a participation rate above the average. As expected, unemployed and inactive are more concentrated in the lower part of the income distribution.

We define the implicit tax rate on labour as the ratio of taxes and social insurance contributions on labour income to the total compensation of employees and payroll taxes. While the implicit tax rate on labour is about 23.3 percent in the first decile, it increases up to 36.6 percent in the 5th. For the top decile it is on average 44.5 percent, indicating the progressive tax structure of the Austrian income tax scheme.

Table 5: Labour market statistics and implicit tax rates by decile

Decile	Employed	Unemployed	Inactive	ITR (Baseline)	ITR (Reform)
1	186,866	151,891	95,288	23.3%	22.6%
2	201,328	59,872	83,005	29.2%	27.3%
3	238,568	42,400	71,394	33.3%	30.8%
4	277,326	34,486	61,295	34.7%	32.9%
5	330,652	29,017	54,652	36.6%	35.2%
6	348,762	18,050	42,188	37.3%	36.3%
7	400,930	21,074	34,140	38.3%	37.6%
8	417,350	12,774	29,934	40.2%	39.6%
9	476,783	10,603	26,254	41.8%	41.5%
10	477,258	5,812	19,807	44.5%	44.3%
All	3,355,824	385,979	517,958	37.9%	36.9%

Note: The ITR is calculated only for employees.

Taking a closer look at the impact of the reform on the implicit tax rate on labour, we can see that the reform affects the implicit tax rates on labour significantly. By construction, the reform (tax credit for employees) reduces the implicit tax rate for employees only, while the implicit tax rate (ITR) for employers stays the same.

Figure 14 in the Appendix shows, that especially the ITR for lower income deciles is reduced significantly. This is usually also the group that reacts most to changes in tax rates on the labour market. The

biggest impact can be found in the 3rd decile, where the ITR is reduced from 33.3% to 30.8%. This is a reduction of 2.5 percentage points. All of the reductions along the income distributions are statistically significant. Overall, the ITR on labour is reduced by almost one percentage point.

Now we take a closer look on the labour market by skill levels[13], which is the information used for the calibration of the QUEST model. Most of the unemployed and inactive are characterized as medium skilled, but this is also driven by the fact, that there are substantially less low-skilled people in general. Not surprisingly, the implicit tax rate on labour differs substantially by skill level. While high-skilled face an ITR of 41.3 percent, the ITR for low-skilled worker is 30.8 percent.

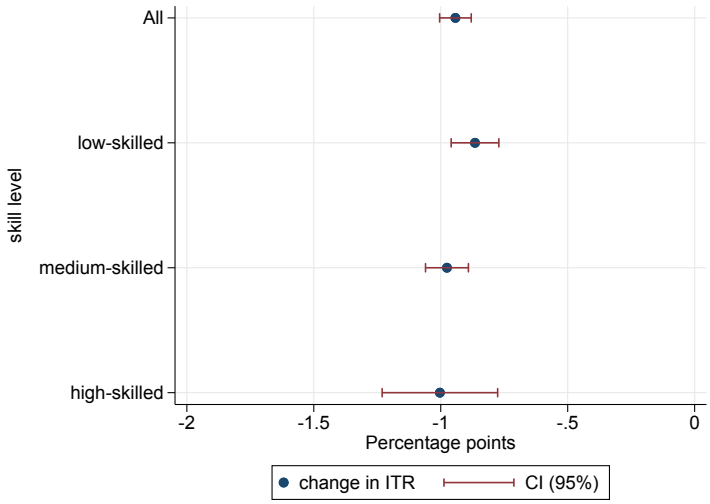
Table 6: Labour market statistics and implicit tax rates by skill level

Skill level	Employed	Unemployed	Inactive	ITR (Baseline)	ITR (Reform)
High	1,111,013	68,450	109,690	41.3%	40.5%
Medium	1,835,329	196,389	227,781	37.3%	36.3%
Low	409,482	121,141	180,487	30.8%	29.8%
All	3,355,824	385,979	517,958	37.9%	36.9%

Note: Numbers are based on EU-SILC 2016. Due to different definition of employment and unemployment, these number might be slightly different to external statistics.

Figure 6 takes a closer look at the effects on the implicit tax rate by skill level. Surprisingly, even though the change in the ITR differs substantially between income deciles, such a pattern can not be found when we distinguish by skill level. The implicit tax rate on labour is reduced by quite the same magnitude for all skill levels. A reduction by 0.9 percentage points (from 41.3% to 40.5%) is observed for high-skill workers. Similarly, the reform reduces the ITR for the low skilled by 1.0 percentage point (from 30.8% to 29.8%).

Figure 6: Change in the implicit tax rate by skill level (in percentage points)



[13]As already mentioned previously, skill levels are defined according to ISCED education category.

The analysis of the implicit tax rates implies that there is an increase in incentives to start working, because the disposable income is on average significantly higher in case of working in the reform scenario. We could expect that the reform therefore increases the labour supply on the extensive margin, because more people are willing to work for those higher disposable income (substitution effect). On the other hand, this higher disposable income could lead to a decrease of the hours worked. Some people might prefer to reduce their working time instead of earning more (income effect). Therefore, we use a labour supply model to analyze the expected behavioural effects of the reform on the labour market. Note that a labour supply model typically only covers the supply side factors, meaning that an increase in labour supply will not be translated in a one-to-one increase in employment, since labour demand is typically neglected. Therefore, we will additionally use a macro-model, to estimate the expected impact on overall employment considering labour demand too.

6.2 Labour supply responses

This section reports the labour supply responses to the reduction in tax burden. To get a first idea of the possible reaction to the reform, we show the estimates of wage elasticities for males and females. We report both, the labour supply elasticities on the intensive and extensive margin. Intensive margin refers to the expected change in the number of hours worked for people already working in the original dataset, while the extensive margin refers to the expected change from people not participating in the labour market.

The discrete choice framework allows us to estimate the structural parameters of the underlying utility function. Results of the wage equation estimation can be found in Table 11 in the Appendix. The results of the multinominal logit model that is used for the estimation of the elasticities can be seen in Table 7. All three columns show the expected signs for the main parameters and most are highly significant. As previously discussed, we control for several of taste-shifting parameters like age and children. Furthermore, we control for the age of the children.

For couple household, consumption (income) as well as the male and female leisure increase the household's utility with a decreasing effect as the level of leisure or consumption increases (squared term). Both for males and females, the value of leisure decreases with age. As indicated by the interaction term of leisure and children, married males have different preferences compared with married women. For males, the assessment of leisure in case of children is insignificant and sometimes even negative, while for married women the effect is positive and especially strong in case of young children.

The individual models suggests similar estimates, but substantial differences can be found in the presence of children. The interaction effect between having children and leisure for males is negative even in the presence of very young children, where also females show no differences in the assessment of leisure.

Our main interest is in the elasticities by skill level, since we need this information for our macro model. Due to the use of EUROMOD in our discrete choice model, we can distinguish between the labour supply elasticities based on a change in gross income, but also based on a change in net income. Figure 7 shows, that there are substantial differences in both measures. Additionally, we can see that the elasticities vary substantially (and in a statistically significant way) across skill levels.

While a one percent increase in gross income increases the hours offered by low skilled by about 0.36 percent, the effect on high skilled is only about 0.28 percent. On the other hand, an increase in 1 percent of net income increases the hours offered of low-skilled by 0.57 percent, while for high skilled it is only about 0.46 percent. Confidence intervals are especially high for low skilled workers, but still the results for low-skilled are significantly different from those of medium-skilled and high-skilled, meaning that low skilled respond stronger to a wage increase than higher-skilled.

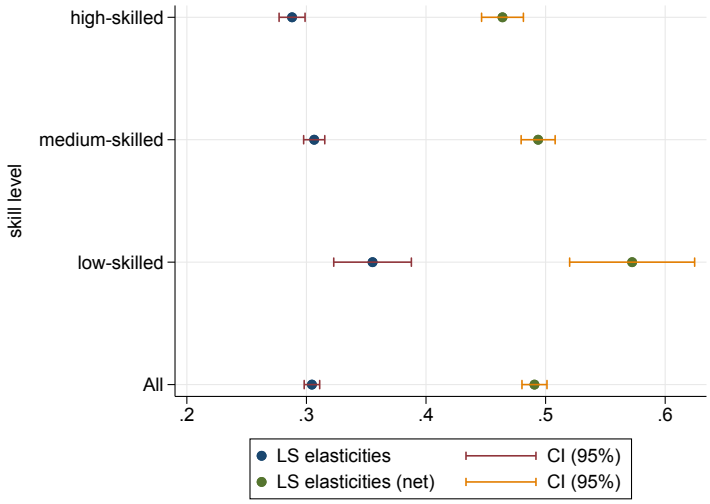
The labour supply elasticities are in line with the findings of Bargain et al. (2014) for Austria, but slightly higher than the results derived by Müllbacher and Nagl (2017)[14]. This might be driven by the use of different datasets to derive the elasticities. As these authors show in their paper, elasticities vary

[14]Please note, that Müllbacher and Nagl (2017) calculate the elasticities on the extensive margin for the whole sample, while we calculate them excluding people that are inactive.

Table 7: Estimates of the individual and household model

	single males	single females	couples
choice			
$In-work\ male$	-2.98083***		-3.08958***
	(-6.09)		(-5.45)
$Part-time\ male$	0.18430		0.50558
	(0.62)		(1.57)
$Full-time\ male$	0.97565**		1.77848***
	(2.40)		(3.99)
$Over-time\ male$	0.40826		1.20122**
	(0.82)		(2.25)
$Leisure\ male$	0.50180***		0.60937***
	(6.45)		(5.32)
$Leisure\ male^2$	-0.00423***		-0.00397***
	(-7.66)		(-6.95)
$Leisure\ male * Age$	-0.00001		-0.01064***
	(-0.00)		(-3.62)
$Leisure\ male * age^2$	0.00176		0.01430***
	(0.67)		(4.15)
$Leisure\ male * Children$	0.00386		-0.00757
	(0.65)		(-0.85)
$Leisure\ male * Children\ between\ 0\ and\ 2$	-0.00403		-0.00558
	(-0.54)		(-0.47)
$Leisure\ male * Children\ between\ 3\ and\ 6$	-0.00235		0.00519
	(-0.31)		(0.69)
$Consumption$	0.01446***	0.00982**	0.00540
	(2.91)	(2.26)	(0.70)
$Consumption^2$	-0.00000*	0.00000	0.00000
	(-1.79)	(0.63)	(0.96)
$Consumption * HH\ size$	0.00085***	-0.00128***	-0.00069
	(2.60)	(-2.72)	(-1.12)
$Consumption * Leisure\ male$	-0.00010**		0.00000
	(-1.97)		(0.04)
$In-work\ female$		-0.47599	0.57993**
		(-1.64)	(2.07)
$Part-time\ female$		0.38609**	-0.06038
		(2.01)	(-0.43)
$Full-time\ female$		1.31449***	0.34019
		(4.64)	(1.45)
$Over-time\ female$		0.62888	-0.31304
		(1.48)	(-0.78)
$Leisure\ female$		0.31087***	0.58995***
		(4.35)	(5.97)
$Leisure\ female^2$		-0.00280***	-0.00430***
		(-6.42)	(-10.12)
$Leisure\ female * Age$		0.00114	-0.00798***
		(0.48)	(-2.73)
$Leisure\ female * Age^2$		0.00125	0.01371***
		(0.45)	(3.83)
$Leisure\ female * Children$		0.00020	0.02782***
		(0.03)	(3.85)
$Leisure\ female * Children\ between\ 0\ and\ 2$		-0.01520	0.05621***
		(-0.92)	(5.02)
$Leisure\ female * Children\ between\ 3\ and\ 6$		0.01318	0.03392***
		(1.34)	(4.87)
$Consumption * Leisure\ female$		0.00003	-0.00002
		(0.73)	(-0.62)
$Leisure\ male * Leisure\ female$			-0.00009
			(-0.16)
$Observations$	7602	7147	61985

Figure 7: Labour supply elasticities by skill level



Note: High-skilled, medium-skilled and low-skilled are classified according to the ISCED education categories (ISCED 0-2, 3-4 and 5-8 groups respectively). CIs are derived by bootstrapping.

substantial depending on the year of the data used to derive labour supply elasticities. But most likely those differences are driven by the differences in the flexible sample used. While Müllbacher and Nagl (2017) uses the whole population in the flexible sample, we follow the method of Bargain et al. (2014), where only employees and unemployed are entering the flexible sample and inactive people are not taken into account.

Looking at labour elasticities by gender, we find significant differences (see Figure 8). An increase by 1% in gross income corresponds to an increase in working hours of males and females respectively by 0.285% and 0.334%. These results are in line with other findings for Austria [15], who report higher labour supply elasticities for women than for men.

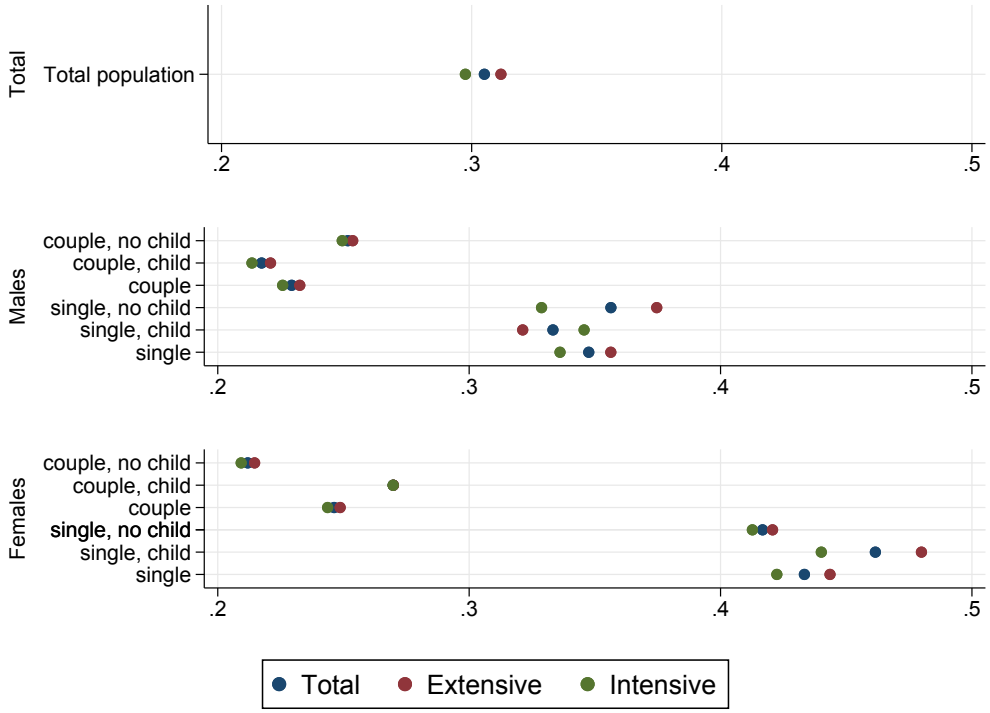
Labour supply elasticity are, according to our estimates, higher for singles than for couples, as it is shown in Figure 8. While, for example, single women have a labour supply elasticity of 0.43, the elasticity for married women is 0.25. The same holds true for males. While single men have an elasticity of 0.35, the one for married man is about 0.23. This is in line with the findings of Müllbacher and Nagl (2017), who find for the EU-SILC datasets from 2004 till 2012, that the labour supply elasticities tend to be higher for singles than for couples in Austria.

Additionally, we can see that males with at least one child (no matter whether living with a spouse) have a lower labour supply elasticity than males without children, and the differences are almost 5 percentage points. For women, this seems to be exactly the opposite. Women with children have a higher labour supply elasticity than women without children (no whether whether they live with a spouse or not). Additionally, we can see that gender differences in labour supply are less pronounced in couple households, while they are quite strong for single households.

Using the labour supply model presented in Section 4.2, we analyse the labour supply responses that can be attributed to the reform. Figure 9 reports the percentage changes in the full-time equivalent (i.e. number of hours equivalent to a full time position), labour market participation and the share of people working short part-time (1-15 hours), long part-time (16-32 hours), full-time (33-42 hours) and over time (43-60 hours).

[15] see e.g. Müllbacher and Nagl (2017) and Bargain et al. (2014)

Figure 8: Labour supply elasticities by household type



Note: We define as couples those households where both parents are flexible in labour supply. Flexible means individuals being head or partner of household head, in working age, who are employee or unemployed. On the other hand, we define as singles, adults living alone and also individuals who are in couple, but whose partner is not flexible in labour supply.

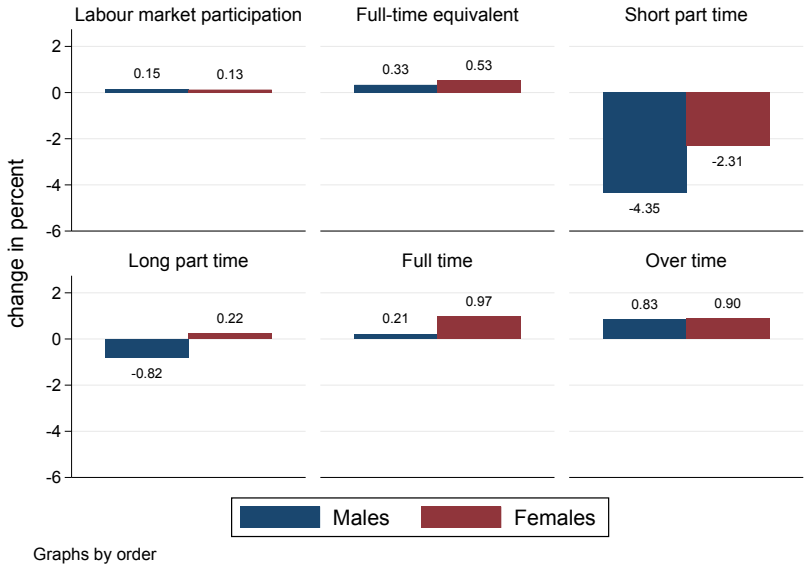
Overall the reform seems to have a positive effect both on females and males. The full time equivalent for females would increase by 0.53 percent, while for males we expect an increase by 0.33 percent. This effect seems positive both at the intensive (number of hours worked) and extensive (labour market participation) margins. Females would increase their labour market participation rate by 0.13 percent and males by 0.15 percent. On the intensive margin side, males would switch from part time to full time (+0.21%) and over time (+0.83%). The effect for females is even larger, where we observe a reduction in short part time (-2.31%) and an increase in long part time (+0.22%), full time (+0.97%) and over time (+0.90%) labour supply. This result seems to be especially of interest, since Austria's labour market is characterised by high female part-time employment which is one of the reason for Austria's high gender pay gap, which later translates in a high gender pension gap.

Looking at the effects separately for singles and couples, we find substantial differences in the labour supply responses by household type (see figure 10 and 11). On the one hand, we would expect a larger impact of the reform on couples since around half of the couple with flexible labour supply have children and benefit from the reform, while in the case of singles, this percentage is only close to 15%.

However, the reform seems to have a larger impact on singles. This is particularly true, when we look at the extensive margins. Single women (men) would increase their labour market participation by 0.21% (0.24%), while if we focus on couples both women and men, the reform would increase their participation by only 0.07%.

This effect could be potentially explained by the differences in the eligibility to the reform, but also by the fact that couples where only one parent is in the flexible sample, are supposed to be a single household.

Figure 9: Changes in the labour supply by gender

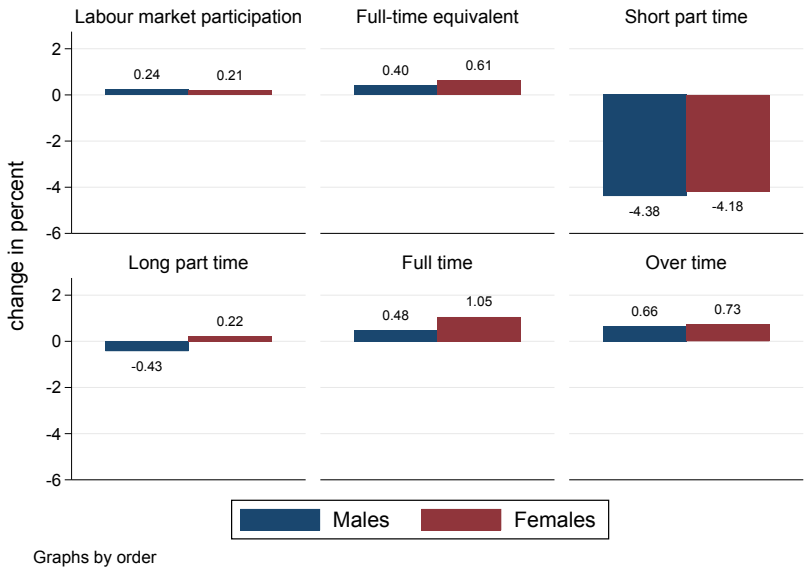


Note: Average values are calculated for all households subject to behavioural changes.

In the case of couples, the incentive depends also on the tax liability of the partner, while singles probably are more incentivized to start working because otherwise they cannot benefit from the "Familienbonus Plus".

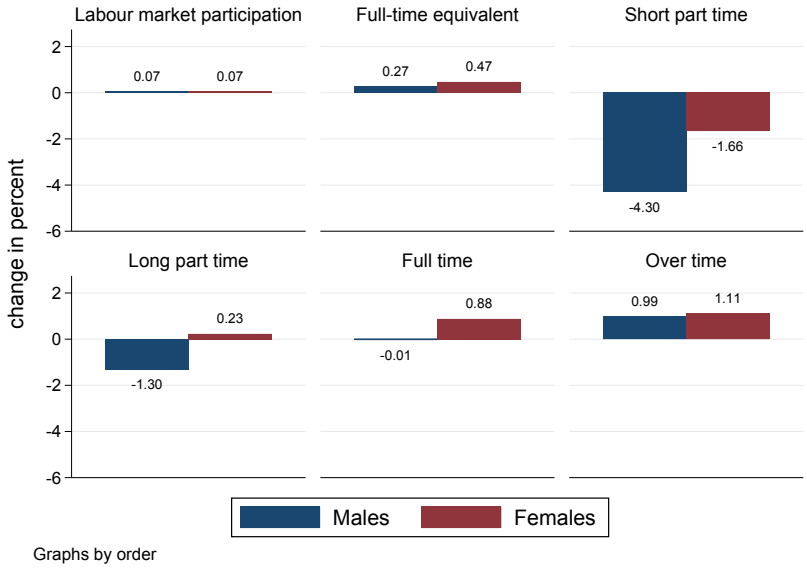
The labour supply effect is purely driven by the impact on households with children, since they are the only ones influenced by the reform. Figure 15 in the Appendix shows the impact on those households. We can see a strong shift in the intensive margin, especially for women. The impact on the labour market participation is slightly higher for males than for females. In general, our results suggest a positive impact of the reform on employment, however to take into account also labour demand restrictions, the QUEST needs to be used too.

Figure 10: Changes in the labour supply of singles by gender



Note: Average values are calculated for all households subject to behavioural changes.

Figure 11: Changes in the labour supply of couples by gender



Note: Average values are calculated for all households subject to behavioural changes.

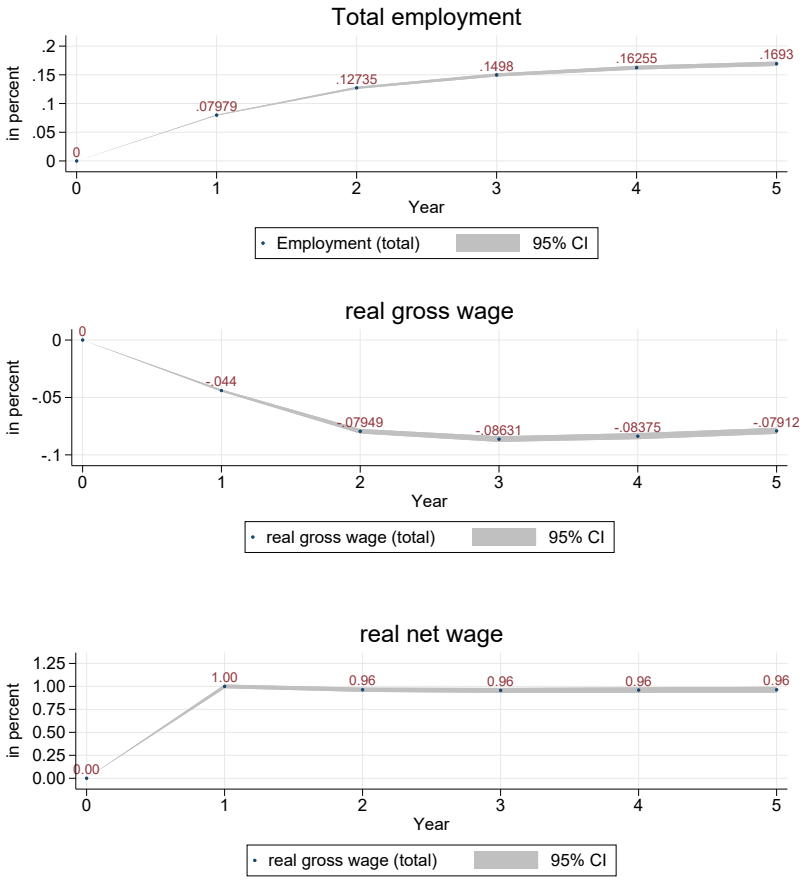
7 Macroeconomic impact of the reform

After calibrating the QUEST model for Austria based on the skill-specific labour market statistics from EUROMOD (see Table 6) and the estimated Frisch elasticities from the discrete-choice labour market model (Figure 7), we can introduce the tax-reform shocks into the QUEST model. As explained in Section 3.4, the shocks correspond to the changes in the implicit tax rate measured by EUROMOD (see Figure 6).

These shocks generate impulse responses in the QUEST model's endogenous variables as the economy converges to a new general equilibrium. This section will analyse these impulse response functions for the main endogenous variables, such as GDP, employment, wages, consumption and investment in more detail for a time period of 5 years after the implementation of the reform.[16]

As explained in Section 5.1, the tax credit for families with children lowers the average tax rate on employees. The lower tax rate stimulates labour supply as employees (with children) are willing to work more for higher net wages. The employment effect depends finally on the relative strength of the substitution and income effect and is ultimately derived in QUEST. Figure 12 depicts the total employment effect, as well as the wage effects of the reform for the first five years.

Figure 12: Employment and wage effects of the reform



Detailed information of the employment effects by skill levels can be found in the Appendix in Figure 16. The reform gradually raises total employment: five years after the reform employment is expected

[16] Note that we temporary offset the debt-stabilization rule to analyse the budgetary effects of the reform, creating a deficit in comparison to the baseline.

to increase by about 0.169% relative to the baseline. The positive employment effect is higher for low skilled-workers (+0.179%), while it is lower for high skilled workers (0.154%), mainly because they have a higher estimated labour supply elasticity than high-skilled workers.

Since workers have to pay lower taxes on their gross earnings, there is a downward pressure on gross wages: even if firms cut their gross employee compensations, net wages can still rise due to the tax-cut. Barrios et al. (2017) discuss this phenomenon of tax incidence in detail, basically pointing out that parts of the tax decrease can be potentially captured by the employer. They argue that tax incidence is crucial to explain why a tax reform might fail to deliver their expected impacts and identify the winners and losers of the reform. This highlights the importance of additionally analysing macro-economic implications of tax reforms.

The corresponding effects on gross and net wages are shown in Figure 12. Overall, the effect on gross wages is expected to be lowered by 0.079% compared to the baseline. This effect will be again stronger for the low-skilled, which is the skill group with the highest labour supply elasticity. Still, the differences are not really big across skill groups, reaching from -0.087% for low skilled to -0.068% for high-skilled. Detailed estimates by skill levels can be found in the Appendix in Figure 17 and 18.

Consequently, the positive effects of the reform on the disposable income for households will be lowered by the decrease in gross wages compared to a static analysis without considering the behavioural/general equilibrium effects. Overall, employees will receive higher net wage, because the decrease in gross wages is more than compensated by the introduction of the child tax credit. The effect on net wages is highest for medium-skilled, where we see an increase of about 1.00%, while the increase for low-skilled and high-skilled is expected to be 0.93% and 0.96% respectively five years after the reform. The impact is highest in the first year after the reform and slightly decreasing afterwards, due to the gradual decline in gross wages.

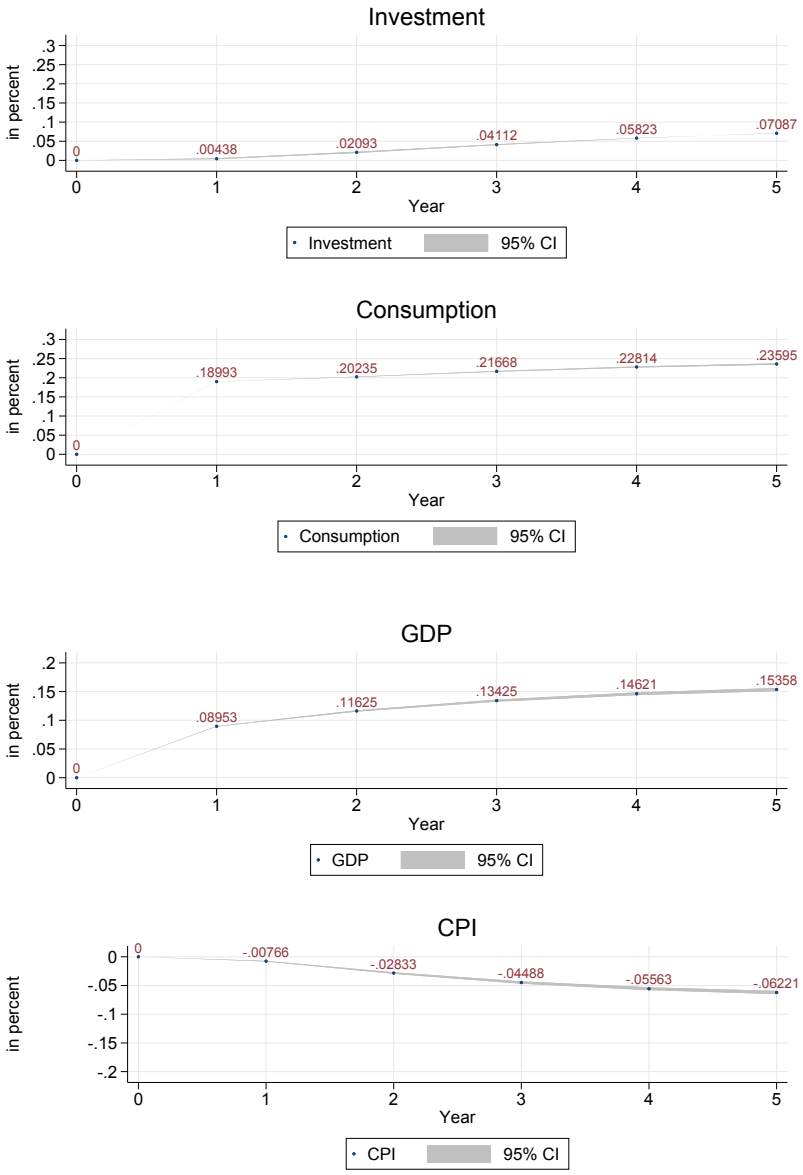
The overall impact on the main macroeconomic variables, such as GDP, consumption and investment are shown in Figure 13. The tax-credit stimulates the economy: due to the increase in net wages households increase consumption and firms increase investment afterwards.

Higher employment, investment and consumption leads to higher GDP. In the first year after the reform, the impulse response function suggests an increase in GDP by 0.090% relative to the baseline and a 0.154% increase after five years. The CPI is expected to decrease slightly due to the reform.

As expected, the tax reform weighs negatively on the government budget, as depicted by Figure 19 in the Appendix. The government balance deteriorates by around 0.3% of GDP on impact and close to 0.4% of GDP after five years. Note that this decline roughly corresponds to the - 6% net budgetary effect reported in Table 4.2 from the static EUROMOD analysis. Barrios et al. (2017) shows that in case of tax-cuts on employees the static and dynamic budgetary effects can be relatively close because gross wages and employment move in the opposite direction, i.e. gross wages fall while employment increases in our case. Since the tax-base does not deviate largely from the baseline after the reform, the corresponding change in tax-revenue will be similar to the one predicted by a static model without behavioural response. [17]

[17] Barrios et al. (2017) shows that this is not the case for employer paid taxes when both gross wages and employment would move in the same direction which leads to larger deviation of the tax-base from the baseline.

Figure 13: Effects of the reform on consumption, investment, GDP and prices



8 2nd round effects at micro-level

After running QUEST in order to obtain the five-year macroeconomic trajectories for all the endogenous variables of the model, we use the model prediction for employment, gross wages and the consumer prices to apply those result again on micro level data. In other words, we feed the macroeconomic projections into EUROMOD to analyse again the fiscal and distributional impacts. According to the employment effects by skill levels estimated by QUEST, we move unemployed people into work. Additionally, we uprate wages by the expected decrease in gross wages and prices with the expected changes in the consumer price index.

Table 8 shows that while the reform decreases the tax revenues of the state substantially in the first round (-1,553 Million Euro), the second round effects are substantially lower (-1,466 Million Euro) highlighting the importance of taking those effects into account when assessing tax reforms. The wage and price effect (uprating) decreases the income tax revenue in a first step, but the positive employment effect of the reform more than offsets this effect, leading to more income tax revenues for the government. We can also see that this changes in wages, prices and employment, have an impact on social benefits (especially on unemployment benefits) and social security contributions. Overall, the net budgetary effect is lowered from -1,508 Million Euro to -1,318 Million Euro.

Table 8: Fiscal impact of the reform, 2nd round effects (in Mio. Euros)

	baseline	**reform**			**difference to baseline**		
		1st round (overnight)	2nd round (uprating)	2nd round (up+emp)	1st round (overnight)	2nd round (uprating)	2nd round (up+emp)
Total taxes	33,057.7	31,504.2	31,474.4	31,591.8	- 1,553.5	- 1,583.3	- 1,466.0
Total SIC	57,876.8	57,876.8	57,842.3	57,920.4	0	34.4	43.6
Social assistance	2,259.1	2,223.2	2,223.9	2,215.2	36.0	35.2	44.0
Unemployment assistance	1,025.2	1,018.5	1,018.6	993.4	- 6.7	- 6.6	31.8
Total means tested benefits	5,266.1	5,220.7	5,220.9	5,185.2	45.3	45.1	80.9
Unemployment benefit	2,387.0	2,387.0	2,387.0	2,364.2	0	0	22.7
Total non-means tested benefits	10,860.2	10,860.2	10,860.0	10,837.3	0	-0.2	22.9
Net budgetary effect	25,193.8	23,685.6	23,621.3	23,875.2	- 1,508.2	- 1,572.5	- 1,318.6

Remark: Please note that all the monetary values are based on the price level of 2018. The reform scenarios for the 2nd round take into account the macro effects of 2023.

Table 9 highlights the impact of the dynamic scoring approach on the disposable household income. While the reform increases the disposable household income for singles with children on average by 486.5 Euro and 695.9 Euro for couples with children overnight, we can see that the impact on households without children is zero. The second round effects, however, highlight that all households (with employees) suffer a small wage loss. Once we consider also the employment effect, some individuals would benefit from a significant increase in disposable income. The results show a positive effect on household disposable income, in particular for single with children. It is worthy to mention that these results may be triggered by the random choice of individuals moved to employment[18].

Looking at poverty measures after performing the dynamic scoring exercise, we can again note the importance of accounting for second round effects on the micro level. The overnight effects suggest a decrease in poverty for all types of household with children while accounting for the second round effects leads to substantially lower poverty rate, especially for singles with children. The poverty rate for singles

[18]We move not only individuals affected by the reform, but also individuals without children because while the labour supply effects are only notable for households with children, the equilibrium effects can also impact other households. Therefore we consider the second round effect on households with children as a lower bound effect.

Table 9: Disposable household income, 2nd round effects (Euro)

	baseline	reform			difference to baseline		
		1st round (overnight)	2nd round (uprating)	2nd round (up+emp)	1st round (overnight)	2nd round (uprating)	2nd round (up+emp)
Single with children	21,126	21,613	21,606	21,686	486.5	480.1	559.4
Single w/o children	24,943	24,943	24,937	24,960	0.0	-6.0	17.0
Couple with children	25,832	26,528	26,516	26,533	695.9	683.9	701.5
Couple w/o children	31,076	31,076	31,065	31,069	0.0	-11.0	-7.0

Remark: Please note that all the monetary values are based on the price level of 2018. The reform scenarios for the 2nd round take into account the macro effects of 2023.

with children decreases from 30.3% to 29.0% overnight, and further to 27.8% after accounting for the second round effects. The same holds true for couples with children, even though the effect is not that sizeable. Overall, the poverty rate decreases by 0.8 percentage points when accounting for the impacts on wages, prices and employment in the long run, while the overnight effects suggested a reduction of 0.6 percentage points.

Table 10: Poverty impact of the reform, 2nd round effects

	baseline	reform			difference to baseline		
		1st round (overnight)	2nd round (uprating)	2nd round (up+emp)	1st round (overnight)	2nd round (uprating)	2nd round (up+emp)
Single with children	30.3	29.0	29.0	27.8	-1.4	-1.4	-2.6
Single w/o children	23.6	23.6	23.6	23.5	0.0	0.0	-0.1
Couple with children	13.1	11.5	11.5	11.3	-1.5	-1.5	-1.8
Couple w/o children	7.9	7.9	7.9	7.9	0.0	0.0	0.0
All	13.1	12.5	12.5	12.4	-0.6	-0.6	-0.8

Remark: Please note that all the monetary values are based on the price level of 2018. The reform scenarios for the 2nd round take into account the macro effects of 2023.

The dynamic scoring exercise highlights the importance of taking into account behavioural reactions, as well as macro-economic feedback when analyzing tax-reforms. The dynamic scoring approach used in this chapter enriches the evaluation of the tax reforms, not only on fiscal aspects, but also on distributional ones. As already argued by Barrios et al. (2017), "this approach leads to a very realistic assessment of the impact of tax reforms which cannot be obtained with macro-models alone". The behavioural impact in the case of the Austrian reform is not very large, but this can be explained by the fact that the changes in the taxes where not extremely strong and only for a subgroup of the population (households with children). However, we can see that the impact on the micro-structure (especially on the household income, as well as on poverty) is not negligible.

Barrios et al. (2017) in general argues that "the relatively small macro feedback effect does not invalidate the usefulness of the dynamic scoring approach, however. It rather confirms the accuracy of the direct fiscal impact assessment provided by the microsimulation model for most reforms considered and is in line with the evidence on dynamic scoring suggesting that the macroeconomic impact of most tax reforms is usually low."

9 Conclusion

This paper assesses the impact of the Austrian reform introduced in 2019, that aimed to reduce the tax burden of families with children, while providing sufficient work incentives, although indirectly. The reform contained two new policies, a non-refundable tax credit of 1500 Euro per child and year (the so-called "Familienbonus Plus") and a refundable tax credit of 250 Euro for lone parent household and single-earner households that are not affected by the "Familienbonus Plus" (the so-called "Kindermehrbetrag"). Additionally to this two new policies, within the reform process two policies were abolished, namely the deductibility for child care costs, as well as the child tax allowance ("Kinderfreibetrag").

To analyze the reform, following the methodology introduced by Barrios et al. (2017), linking a microsimulation and a dynamic general equilibrium model. Dynamic scoring allows us to account for the feedback effects resulting from behavioural responses on the labour market as well as for economy-wide reaction to the tax policy changes. Those reactions are essential for a comprehensive evaluation of tax reforms.

First, we use EUROMOD to analyse the fiscal and distributional effects (first-round effect) of the reform. Our results suggest that the size of the reform was substantial. Overall income the government budget was reduced by almost 6 percent. Focusing on the distributional effects and inequality indicators, we find an inequality-decreasing impact of the reform. Especially households in the lower part of the income distribution benefited strongly, with exception of the first deciles. This is the result of a lower concentration of families with children in the lowest decile and reflect also the fact that a bigger portion of families with children are not eligible for the non-refundable tax credit ("Familienbonus Plus") and the refundable tax credit ("Kindermehrbetrag") introduced by the reform.

Second, we combine EUROMOD with a labour supply model and a DSGE model in order to analyse the employment effects of the reform. Our labour supply model reveals that women, as well as low-skilled have higher labour supply elasticities or in other words are more responsive to changes in their own income. Computing labour supply responses based on this discrete choice labour supply model, we find that the reform increased labour supply for both male and female. While on the extensive margin, the effect is quite similar, we find a stronger effect on the intensive margin for women. The effect of the reform on the labour supply seems to be stronger also for singles compared to couples.

The general equilibrium model (QUEST) allows us to assess the macroeconomic impact of the reform. Therefore, we not only take into account labour supply behaviour, as is usually done in the literature, but we also focus on the macroeconomic impact of the reform. Our model estimates total employment to increases by about 0.17 percent after 5 years, due to a positive labour supply shock as a result of the reform of child tax credit and to the decrease in the implicit tax rates on labour. Additionally, the reform leads to a slight decrease in gross wages, that partly offsets the increase in net wages due to the reduction in the tax burden.

Overall the macroeconomic effects of the reform are small, but non negligible. An increase in consumption due to higher incomes, as well as a slight increase in investment, are expected in our model simulations. The reform also increases GDP and employment by around 0.15% and 0.17% respectively after five years. However, the loss in terms of tax-revenues would lead to the deficit increase by 0.4% of GDP, unless the government introduces additional balancing measures. It is important to stress that our analysis focuses on the short-run effects of the reform by temporarily increasing the debt. The long-run distributional and macroeconomic effects depend crucially on how the government compensates the missing tax-revenues after the reform.

In the last step, by using a dynamic scoring technique, we bring back the overall macroeconomic effects to the micro level, meaning that we account for behavioural responses in the labour market, as well as overall economic reactions on the micro level. Although the macro feedback effect of this reform is relatively small, we show that accounting for those second round effects on micro level is important. Second round effects of tax reforms are important not only to analyse potential self-financing effects of tax reforms, but also to analyse the distributional and poverty impact in more detail. First, we find a self-financing effect of the tax reform of about 190 Million Euro, which is about 13 percent of the total costs of the reform.

Second, when paying special attention to the distributional implications and the poverty impact of the reform, the second round effects indicate an increase in household income especially for households with children. This additionally lowers the poverty rates of these households substantially.

Second round effects of tax reforms in the European Union is important not only to analyse potential self-financing effects of tax reforms, but also to analyse the distributional and poverty impact in more detail. First, we find a self-financing effect of the tax reform of about 190 Million Euro, which is about 13 percent of the total costs of the reform. Second, when paying special attention to the distributional implications and the poverty impact of the reform, the second round effects indicates an increase in household income especially for households with children. This additionally lowers the poverty rates of these households substantially in the long run.

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Appendix

Figure 14: Change in the implicit tax rate by decile (in percentage points)

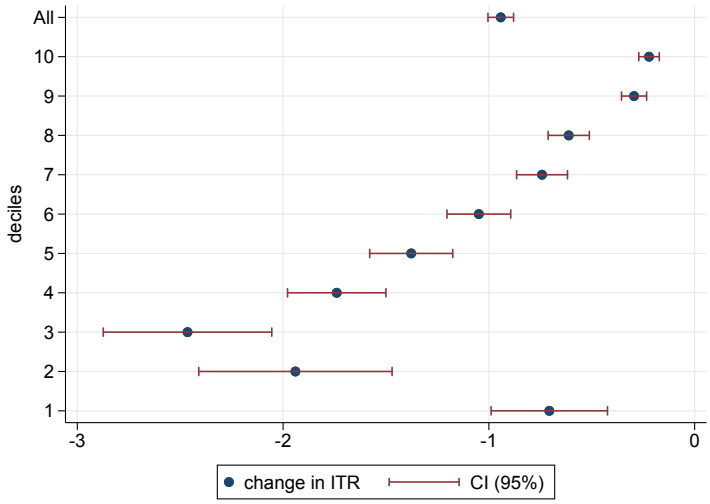
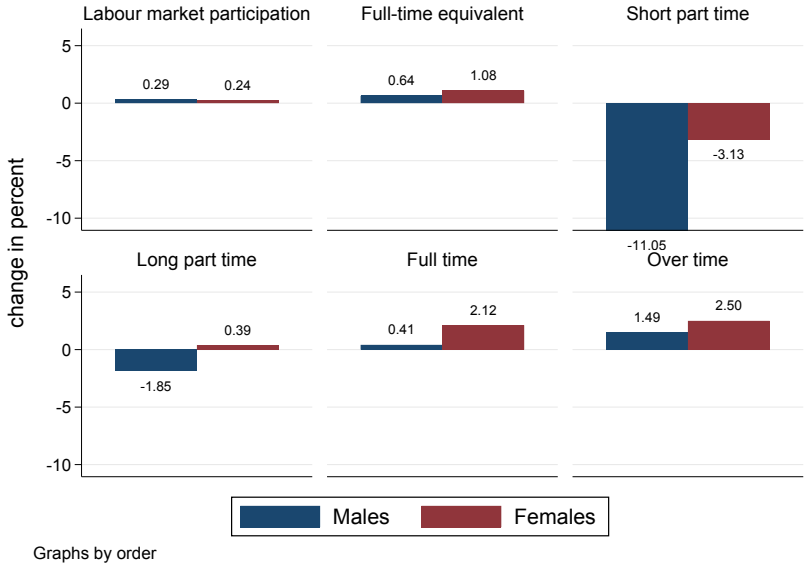


Figure 15: Changes in the labour supply of households with children by gender



Note: Average values are calculated for all households subject to behavioural changes.

Figure 16: Effects of the reform on employment

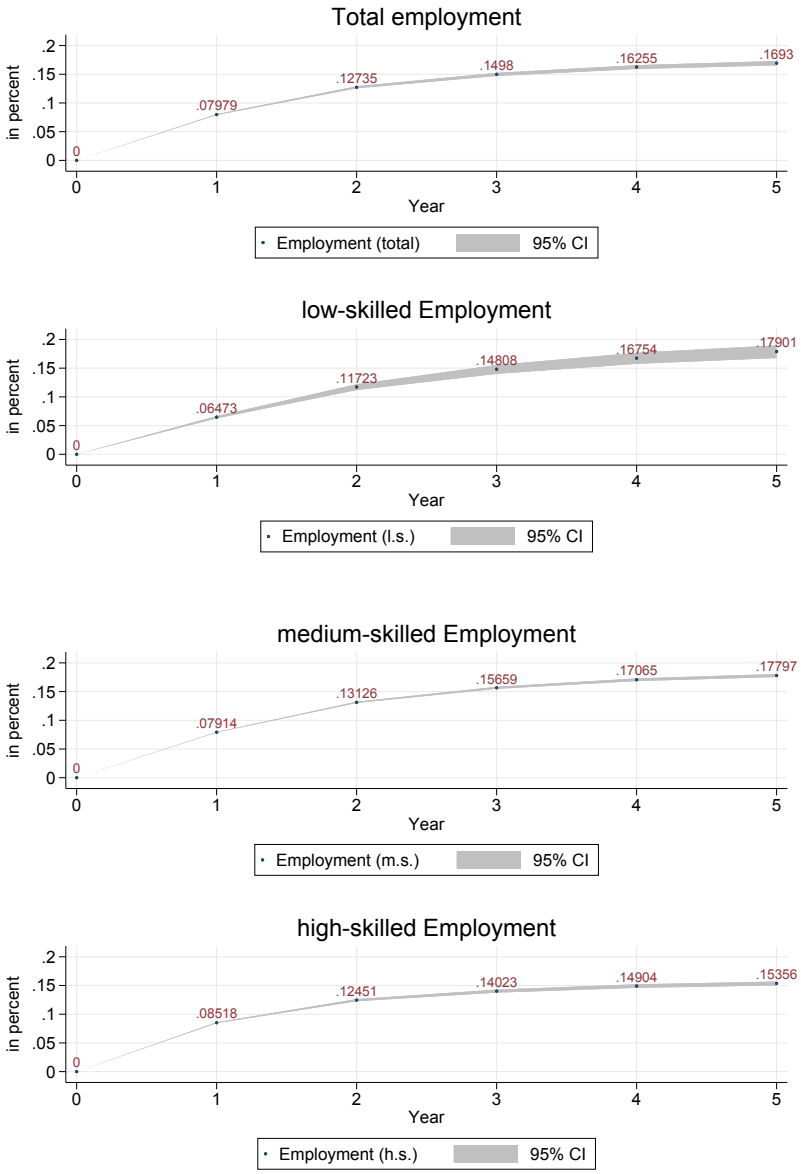


Figure 17: Effects of the reform on gross wages

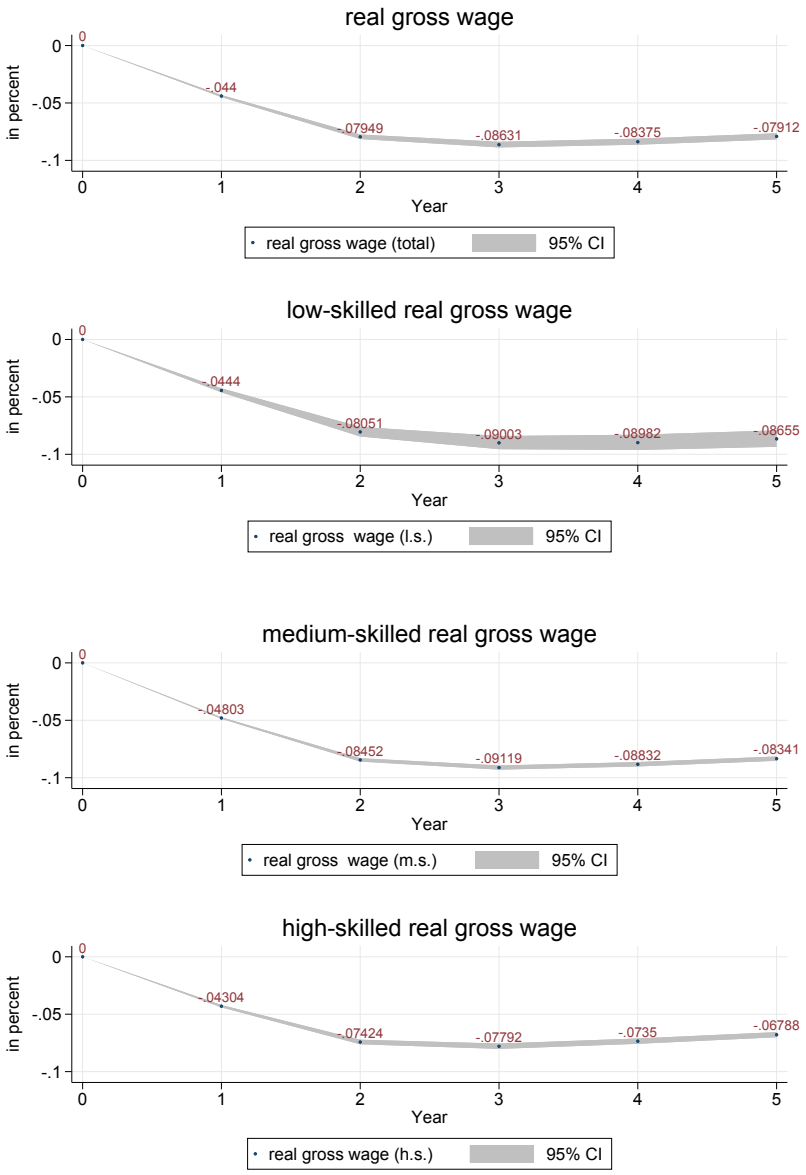


Figure 18: Effects on net wages of the reform

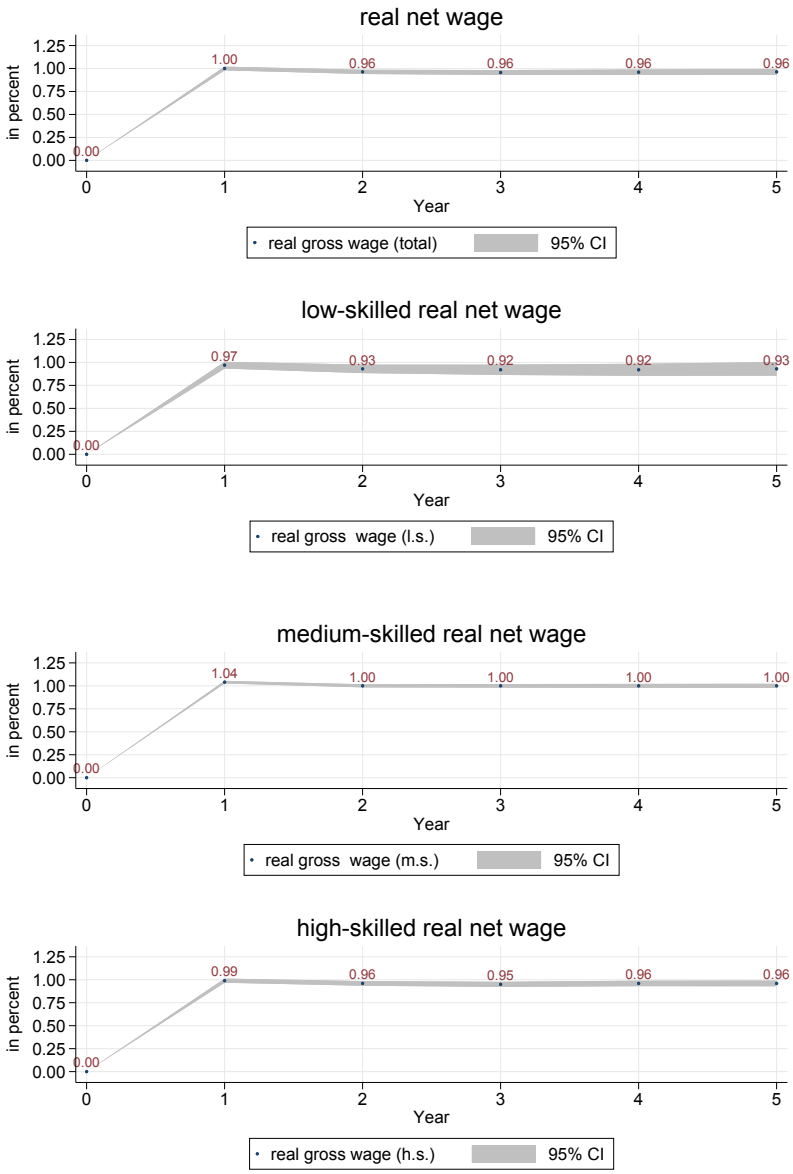
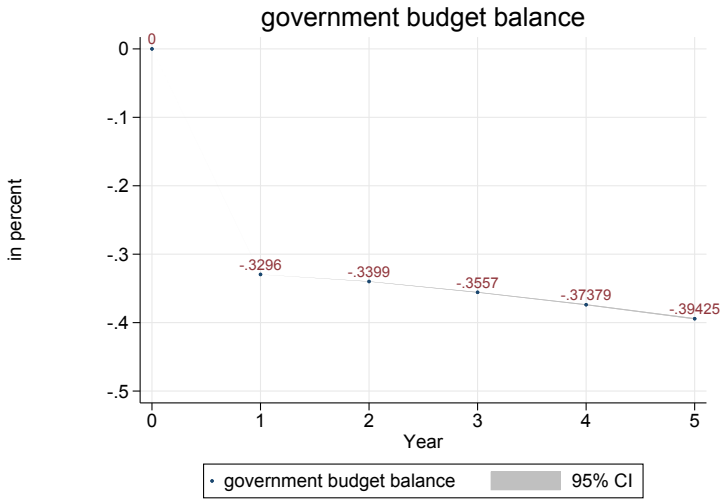


Table 11: Heckman model estimates for males and females

	(1) Males	(2) Females
ln(hourly wage)		
Age	0.04502***	0.04534***
	(5.48)	(4.39)
Age squared	-0.03359***	-0.03464***
	(-3.15)	(-2.58)
Secondary education	0.15767***	0.14711***
	(3.39)	(3.05)
Tertiary education	0.47434***	0.39791***
	(9.55)	(7.82)
Married	-0.06381**	0.00706
	(-2.01)	(0.23)
Constant	3.89566***	3.58870***
	(25.82)	(18.54)
selection		
Children 0-2	-0.29700	-0.12154
	(-1.45)	(-0.52)
Children 3-6	-0.23102	-0.12563
	(-1.55)	(-0.73)
Children 7-12	-0.18170	0.04030
	(-1.31)	(0.31)
Children 13-17	-0.06916	-0.11921
	(-0.62)	(-1.10)
Children above 17	0.23750	0.11556
	(1.49)	(0.66)
Age youngest child	-0.02421**	-0.00429
	(-2.07)	(-0.33)
Age	0.08477**	0.07972**
	(2.51)	(2.11)
Age squared	-0.10817**	-0.09966*
	(-2.47)	(-1.96)
Secondary education	0.49765***	0.59653***
	(3.67)	(4.60)
Tertiary education	0.51621***	0.86630***
	(3.23)	(5.63)
Older than 70 in HH	-0.36265***	-0.25716*
	(-2.62)	(-1.92)
Married	0.25134**	0.08112
	(2.24)	(0.76)
Other HH income	-0.03112*	0.02758
	(-1.66)	(1.63)
Wealth/(Eq. scale*1000)	0.00434***	0.00390*
	(3.67)	(1.77)
Constant	-0.30918	-0.84042
	(-0.50)	(-1.11)
/		
athrho	-1.26377***	-1.35153***
	(-10.62)	(-11.06)
lnsigma	-0.73417***	-0.67755***
	(-34.16)	(-30.32)
Observations	1493	1344

Figure 19: Effects on government budget balance of the reform



Remark: Please note that the long-run effect of the reform depends on how the government is going to finance the missing tax-revenues. Our analysis only focused on the short-run effects by temporarily increasing the debt. The analysis of various debt-stabilization schemes following the reform is beyond the scope of our paper.

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