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ORIGINAL ARTICLE

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

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Abstract

In this paper, we analyse the impact of the implementation of a child tax credit in Austria in 2018. We combine microsimulation techniques, labour supply modelling and dynamic general equilibrium modelling to make an *ex ante* evaluation of the reform, accounting also for behavioural responses of individuals. We show that although the macroeconomic effect of the Austrian reform is expected to be relatively small, accounting for feedback effects on a micro-level is very important, especially when analysing socioeconomic and policy-relevant indicators, such as poverty and inequality. When focusing on the distributional implications and the impact on poverty, our analysis highlights that the first-round effects of the child tax credit substantially underestimate the increase in household income for households with children. Additionally, we find that when accounting for second-round effects, the loss in tax revenues is partly offset. The estimated self-financing effect of the reform is estimated to be about 13 per cent. Our results also indicate that part of the associated tax decrease can be potentially captured by the employer, meaning that gross wages are expected to fall slightly. Therefore, in the medium term, some households without children might suffer a small reduction in their disposable income. Overall, our analysis highlights the importance of accounting for second-round effects when analysing tax reforms *ex ante*.

KEYWORDS
discrete choice, DSGE, EUROMOD, labour supply, microsimulation, tax credit

JEL CLASSIFICATION
H24, H31, I38

1 | INTRODUCTION

In 2018, the Austrian government decided to enforce a new law designed 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 since 2019. The goal of this reform was to reduce the tax burden of in-work families with children, which is one of the highest in the European Union (EU).[1] The tax credit is granted almost exclusively to in-work families, with variations according to the number of children in the household. While hard data are not yet available, the expected fiscal impact of the Austrian reform is substantial. The goal of our paper is first to analyse first-round effects of the reform (budgetary effects, the effects on the income distribution, inequality and poverty, as well as the effects on labour supply). In a second step, we model the behavioural responses to the reform in order to analyse the second-round effects, taking into account the changes in employment, as well as in consumption, investment, wages and prices, using a general equilibrium framework.

Initial simulations by Fink and Rocha-Akis (2018) show that the reform will lower the tax burden by about 1.6 billion euros. This amounts to almost 5 per cent of the total income tax revenues in Austria and, therefore, represents a significant decrease in the tax burden of households with dependent children. So far, these simulations have not accounted for the behavioural responses of households. However, the sizeable decrease in the tax burden potentially leads to a strong impact on labour supply. Therefore, the second-round effects can be potentially very strong, leading to a large bias in studies that only consider first-round effects. This makes the Austrian reform a perfect case study for such an *ex ante* evaluation.

Other studies, such as Blundell (2000) and Brewer et al. (2006), found substantial positive effects on labour supply as a result of in-work benefits for families with children. For Austria, as well as for other European countries, this is of special interest, as many countries are still facing high rates of women working part-time and a generally low participation in the labour market among women, especially those with dependent children.

The literature on the implications of such tax reforms is divided into two strands: one that analyses the distributional effect and another that focuses on the impact on labour supply. However, the literature on macroeconomic effects of tax-credit reforms is scant. As argued by Gottlieb et al. (2015), 'the existing literature on the effect of tax credits, abstract from behavioural responses to policy changes and are silent on potential general equilibrium effects'. However, these feedback effects can have a substantial impact and are essential for a comprehensive evaluation of tax reforms.

In this paper, we contribute to the literature in three ways. First, we provide a complete *ex ante* analysis of the introduction of a tax credit that is specifically focused towards families with children. In contrast to similar reforms in other countries, the Austrian reform is mainly targeted to middle-income earners. We show that although the macroeconomic effects of the reform are relatively small, accounting for feedback effects at a micro-level is important not only for the analysis of the potential self-financing effects of a tax reform, but also in order to analyse its distributional implications and the impact on poverty in more detail. We estimate that the self-financing effect of the reform will be about 13 per cent, meaning that government tax revenue losses will be lower because employment is expected to increase and additional tax revenues can be realised. When focusing on the distributional implications and the impact on poverty, we show that first-round effects substantially underestimate the increase in household income for households with children, which also leads to a substantial underestimation of the decrease in the poverty rate of these households.

Second, following Barrios et al. (2019), we link microsimulation and labour supply modelling with a dynamic general equilibrium model. The microsimulation and labour supply model used are based on the EUROMOD 2018 tax-benefit system, and use individual and household data from the European

[1] See, for example, OECD (2018).

Union Survey of Income and Living Conditions (EU-SILC) 2016. 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, we use a novel methodology. In contrast to the current literature, we do not use a re-weighting approach to introduce feedback effects at the micro-level. As argued by Rastrigina et al. (2016) and Figari, Salvatori and Sutherland (2011), re-weighting has several shortcomings. We try to overcome these by using microsimulation techniques that move individuals from unemployment to employment on a micro-level.

Third, we contribute to the extensive literature on the impact of tax credits on labour supply. We show that tax credits targeted at families with children can indeed increase labour supply incentives and that tax credit reform in Austria increased labour supply for both males and females. While, on the extensive margin, the effect is quite similar across genders, on the intensive margin we find a significant effect on women. These results are especially interesting, as the Austrian labour market is characterised by substantial gender differences. The participation rate of females (71.7 per cent in 2018) is substantially lower than that of males (80.7 per cent in 2018) and the gender gap in part-time employment in Austria is among the highest in the EU (37.7 per cent in 2018).

The paper is structured as follows. In Section 2, we briefly describe the literature on similar policies introduced in other countries. In Section 3, we describe the child tax credit reform in more detail. In Section 4, we introduce the methodology on which our analysis is based. In Section 5, we describe the results of our empirical analysis, where Sections 5.1–5.4 present the first-round effects, the labour supply effects, the macroeconomic consequences of the reform and the second-round effects, respectively. In Section 5.5, we discuss the robustness and limitations of our analysis. Lastly, in Section 6, we provide concluding remarks.

2 | LITERATURE OVERVIEW

The main component of the Austrian reform (*Familienbonus Plus*) is a tax credit for children, with its central objective being to lower the tax burden for families with children. Tax credits related to children often target low-income families, and therefore, according to Ochel (2001), usually consist of three phases: first, the tax credit increases as income increases (phase-in), then it remains constant, and then, beyond a certain income level, the tax credit starts to decrease and eventually stops (phase-out). This, however, is not the case in the Austrian reform, where the targeted group includes not only low-income families but families with children in general, regardless of their income.

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'. More specifically, the Austrian reform is not directly linked to employment but, as a result of the framing of the reform, more than 95 per cent of the recipients have employment or self-employment income as their primary income source. For these people, the difference between income when working or not working may change significantly due to the reform, indicating that it could incentivise certain groups to increase their participation on the labour market.[2] For this reason, we argue that the reform is positioned on the borderline between a family benefit and an in-work benefit. In this section, we focus on some in-work benefit (IWB) reforms, which are more closely linked to the Austrian reform than other family-benefit reforms.

In-work benefits, sometimes also called 'making work pay' policies, are generally meant to increase the disposable income of low-income earners. As already suggested by the name, these benefits are only for people who already have a job. IWB reforms typically aim to reduce the targeted subgroup's benefit dependency by increasing their net income from work. This means that the reforms intend to increase employment incentives and thus, potentially, the supply of labour. As a consequence, poverty and inequality could potentially decrease.

[2] Because the tax credit can be shared by couples, it is not straightforward to identify the labour supply effects.

Many papers use microsimulation models to analyse the fiscal and distributional effects of such tax credits for children, for example, Fink and Rocha-Akis (2018) for Austria, Blundell and Reed (2000) and Blundell et al. (2000) for the UK and Hoynes and Rothstein (2016) for the US. Regarding the distributional effects of such reforms, the results vary significantly depending on family structures in the given country. Families with children are generally over-represented in the lower and middle parts of the income distribution when considering equivalised disposable household income. Additionally, the eligibility conditions of the policy play an important role in the distributional effect. Many countries restrict such in-work benefits to a certain group of the population, or phase out the benefits after a certain income level has been reached. Additionally, the level of child tax credits varies substantially across countries.

With respect to poverty reduction, Meyer (2010) shows that the reform of the Earned Income Tax Credit (EITC) in 2009 in the US (American Recovery and Reinvestment Act of 2009) could help to decrease poverty. In the US, the EITC depends on the number of children per household. The reform aimed to increase the EITC for large families, which are typically low-income households.

The analysis of the labour supply effects of such reforms is widely covered in the literature. Recently, Ayala and Paniagua (2019) have measured the behavioural impacts of a hypothetical reform of in-work benefits in Spain. They replace the existing working mother tax credit (WMTC) by the US EITC and show that the introduction of such an IWB generates a substantial increase in labour supply at the extensive margin and also a non-negligible reduction at the intensive margin, highlighting also the importance of the design of such policies.

Only a few papers, however, deal with the expected labour supply responses to child tax credit reforms. The 1999 UK reform, in which the government decided to substantially increase in-work benefits for families by introducing the working families' tax credit (WFTC), is one example that has been analysed extensively. According to Blundell et al. (2000), the WFTC was intended to improve work incentives and encourage people to move into employment. Eligibility for the tax credit depends on hours of paid employment, the number of children, income, capital and formal childcare costs. Overall, the literature on the WFTC in the UK[3] points to the increased participation of single mothers as a result of the reform, while the response of married women was limited or even negative. The labour supply reaction of fathers in couples tended to be low, although positive.

Similar policies to the Austrian child tax credit have been introduced in other countries, such as Canada, the Netherlands, the UK and the US, with the intention of providing cash assistance to families with children.[4] These policies are often in the form of tax credits, as their aim is to decrease poverty without creating deterrents to labour market participation. Most of these policies focus only on low-income families.

The US child tax credit (CTC) is similar in many respects to the policy implemented in Austria (with a refundable component, and not only targeting low-income earners).[5] The goal of this policy was to help families offset the cost of raising children. Hoynes and Rothstein (2016) show that the CTC was not well targeted, meaning that a large share of the expenditures were going to above median income groups, although the refundable component of CTC that was introduced in 2009 resulted in it being more directly targeted to low-income groups.

Our paper contributes to the literature not only by analysing the new child tax credit implemented in Austria but also by adding insights to the expected behavioural responses on labour supply. Additionally, compared with studies on similar reforms, this is the first study that uses the microeconomic effects of the reform to estimate the macroeconomic consequences of the introduction of this type of tax credit.

[3] Blundell et al., 2000; Brewer et al., 2009.

[4] Brewer et al. (2009) give a brief overview of in-work benefit reforms in a cross-national perspective. 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).

[5] See, for example, 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 generally quite complex. This complexity is driven by multiple tax reforms over previous years. The goal of most of these tax reforms has been 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. For a detailed overview of the structure of the current Austrian tax system and the latest structural tax reform in 2016, see, for example, Müllbacher and Nagl (2017) or Christl, Köppl-Turyna and Kucsera (2017).

The new Austrian reform to reduce the tax burden for families with children consists of four parts. As mentioned earlier, it consists of a tax credit for families with children (*Familienbonus Plus*) and a benefit for lone parents and single-earner households (*Kindermehrbetrag*). To reduce costs and make the system less complex, the deductibility of childcare costs (*Absetzbarkeit von Kinderbetreuungskosten*) and the current child tax allowance (*Kinderfreibetrag*) were abolished. The eligibility criteria of the reform and the impact on hypothetical households are discussed in more detail later. Additionally, Table A.1 in the online Appendix provides a detailed overview on the implementation of the Austrian tax reform in EUROMOD and the underlying assumptions.

3.1 | Description of the 2019 implemented policies

3.1.1 | Non-refundable tax credit for families with children (*Familienbonus plus*)

The tax credit for families lowers tax liabilities of a family member, but it is non-refundable. The eligibility condition for the tax credit is that the child is eligible for the family allowance (*Familienbeihilfe*). This means that 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. In general, the 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 euros per month until the age of 18. Note that families with children who are above 18 and younger than 25, and in post-secondary education, are eligible for the family allowance, but the amount of the tax credit is then reduced to 41.68 euros per month.

Households with children living outside the EU are not eligible for the family tax credit. Additionally, for households with children living in the EU 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 50–50 or to give it to the full extent to one of the partners.

3.1.2 | Refundable tax credit for lone-parent or single-earner households

Single-earner or lone-parent households whose tax liability lies below 250 euros (before considering any tax credits) will obtain, in addition to the family tax credit, a tax refund (*Kindermehrbetrag*) if the child is eligible for the family allowance (*Familienbeihilfe*). This refund is calculated as the difference between 250 euros per eligible child and the household's tax liabilities. This means that for each child, a single-earner or lone-parent household receives at least 250 euros, even if the household has no or low tax liabilities. Again, children who live outside the EU are not eligible for this tax refund. Additionally, for children who live in the EU or Switzerland, it is adjusted by the living costs of the respective country.

3.2 | Description of policies abolished in 2019

3.2.1 | Deductibility of childcare costs

The tax deductibility of childcare costs (*Absetzbarkeit von Kinderbetreuungskosten*) was a way for parents with children up to age 10 to deduct up to 2,300 euros 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, for example, when an employer contributes a subsidy for childcare costs, only the costs incurred by the taxpayer can be claimed. To be tax deductible, 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 are estimated to have been 105 million euros. This policy has been abolished within the overall reform framework.

3.2.2 | Child tax allowance

The *Kinderfreibetrag* is a child tax allowance that reduces the taxable income of households with children. If only one person in the family is liable to tax claims, the child tax allowance amounts to 440 euros per child per year. In the case that both partners claim the child tax allowance for the same child, it amounts to 300 euros 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.

Based on the legal framework of the reform, households with children where both parents do not work or both parents do not pay taxes will be not be eligible for the tax credit or for the benefit for lone-parent and single-earner households.

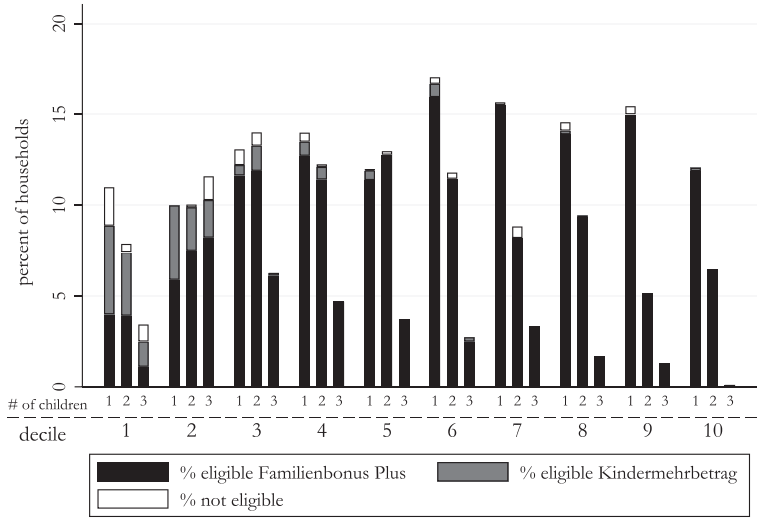
3.3 | Eligibility for the new policies

The OECD identifies tax credits as in-work benefits. However, strictly speaking, the child tax credit reform is not an in-work benefit reform in the traditional way because the benefit is not conditional on working. Even though the tax credit is designed in a way that almost only employees can profit from, there are some exceptions (e.g., the case where a household member is exclusively living on a pension or property income).

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

The reform clearly targets household with children. Figure 1 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 one, two, and three or more children, and whether they are eligible or not for the tax credit (*Familienbonus Plus*) and 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 per cent) and third (20.3 per cent) deciles. This share is quite high also in the fourth and fifth deciles (17 per cent), but then it starts to decrease until the end of the income distribution (6 per cent), where we find mainly families with one child.

FIGURE 1 Distribution of households with one, two, and three or more children by income decile



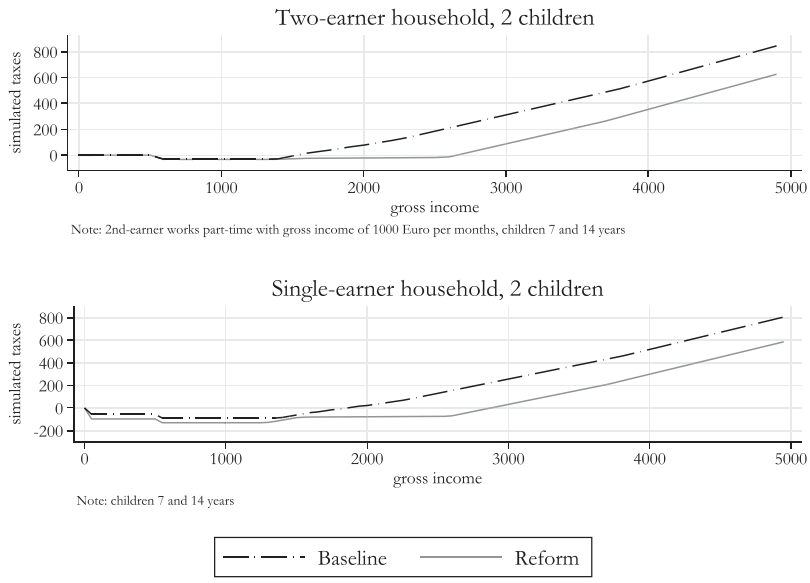
We also observe that most of the non-eligible households are concentrated in the lowest part of the income distribution. This is not surprising because those households typically have no tax liabilities, and therefore they are not eligible for the tax credit. Some of them are single parents or single-earner households and could benefit from the *Kindermehrbetrag*, especially in the first decile (9.7 per cent) and in the second decile (8.5 per cent). This means that they still benefit from the reform, but the impact on their disposable income is lower than in the case of eligibility for *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 | Impact of the new policies on the income taxes paid

To visualise the two policies in an intuitive way, we use the hypothetical household tool from EUROMOD, where we set up a variety of different household types. Figure 2 shows two specific households: household 1 is a two-earner household with two children, aged 7 and 14, where the income of the household head varies between 0 and 5,000 euros per month, and the partner works part-time and has a fixed income of 1,000 euros per month. Household 2 is a single-earner household (or lone-parent household) with two children aged 7 and 14, with an income varying from 0 to 5,000 euros monthly.

We can see that in the case of a single-earner household, the refundable tax credit (*Kindermehrbetrag*) is reducing the tax burden of these households even at very 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 1,500 euros per month, as Figure 2 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 an income below about 2,500 euro per month will no longer pay income taxes. In Austria, almost all sectors of the economy are covered by collective bargaining agreements, and the negotiated wages are usually above 1,500 euro per month. This implies a substantial reduction in the tax burden for households with children when at least one household member works full time.

FIGURE 2 The impact of the reform on income taxes of different households



4 | DATA AND METHODOLOGY

4.1 | Model description

We use three different models to assess not only the overnight effects of the reform but also the long-run implications for the Austrian economy. First, 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 EU. Our baseline is the EUROMOD 2018 tax-benefit system. EUROMOD simulates direct taxes, social insurance contributions, and cash benefits for a representative sample of households from the EU-SILC 2016. Based on the 2018 tax-benefit system, we implement the reform of the child tax credit.[6] EUROMOD is a static model. Indeed, the first-round effects do not account for behavioural reactions to the policy change.

Second, we use a flexible, discrete choice labour supply model based on the methodology of Bargain, Orsini and Peichl (2014) to evaluate the impacts of the reform on the labour supply of households. Households maximise 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 optimisation errors of the household. As household characteristics enter the utility function, we allow heterogeneity in households' preferences. Labour supply decisions are therefore reduced to choosing between a discrete set of working hours. Our model distinguishes between three household types: single males, single females, and couples. The deterministic utility of a single household depends only on one's own wage, while a couple maximises utility, considering as well the participation and the wage of the partner. For each discrete choice of a household, disposable income is obtained by aggregating all sources of household income and simulating all benefits received as well as taxes and social security contributions paid using EUROMOD. The discrete choice framework allows us to estimate the structural parameters of the underlying utility function, the probability for each labour supply choice of the household, and finally the labour supply elasticities for each type of household.

[6] The details on the implementation of the reform scenario and the underlying assumptions are described in Table A.1.

Third, the results of both EUROMOD and the labour supply model are then used to calibrate QUEST, the European Commission's dynamic stochastic general equilibrium (DSGE) model, to evaluate the macroeconomic impact of the reform on employment, investment, consumption, and other relevant macroeconomic variables. The QUEST model is a workhorse model used by the European Commission to analyse the impact of fiscal policy scenarios and structural reforms in the EU member states.[7] As a fully forward-looking DSGE model, QUEST can trace the behavioural responses of major macroeconomic variables, going beyond the direct, static impact of specific tax reforms measured by EUROMOD.[8] The labour market modelling in QUEST follows microeconomic theory, and it distinguishes three skill groups earning different wages, which helps us to evaluate the distributional effect of policies.[9] The skill disaggregation allows us to calibrate the QUEST model using the skill-specific implicit tax rates, employment and non-participation rates, and gross wages from EUROMOD as well as the estimated labour supply elasticities from the labour supply model. After introducing the policy shocks on the implicit average tax rates, we run the model in order to obtain the impulse response on price level, employment, and gross wages in a five-year horizon. Note that the macroeconomic projections from QUEST account for the behavioural reaction of firms (i.e., labour demand), which is missing from standard analyses of tax reforms.

The methodological details of all three models, as well as the implementation of the reform scenario in EUROMOD, are described in detail in online Appendix A.

4.2 | Combining EUROMOD, the LS model and QUEST

We combine the three models described earlier to analyse the impact of the reform in Austria at the micro-level as well as the macro-level. There are several studies that try to estimate the macro-implication of policy reforms. Peichl and Siegloch (2012), for example, use information on firms' labour demand behaviour within their structural labour supply model to see the supply and demand impact at the micro-level. They make use of estimated labour demand elasticities and are able to calculate a partial labour market equilibrium. Another approach of linking micro- and macro-effects has been used by Franz et al. (2012), who combine microsimulation with a computable general equilibrium model of Germany to estimate the macro effects of the German labour market reform.

We are following an approach similar to Barrios et al. (2019), who combine the results of a microsimulation model and a labour supply model to calibrate and shock a DSGE model. The novelty of this approach is that it allows us to consider feedback effects of tax reforms (from the macro-model) on the microstructure.

EUROMOD provides us with the change in the implicit tax rate on labour income for employees and employers, that is, an aggregate indicator of the change in the tax burden resulting from the tax reform.[10] This information obtained at the micro-level is used to introduce the policy shock in the macro-model QUEST.

The results of the discrete choice labour supply model are used to calibrate the QUEST model. First, the non-participation rate by skill level is needed to obtain the number of people who do not participate on the labour market by skill level. Also by skill level, the estimated labour supply elasticities (i.e., the change in labour supply given a one percentage change in gross wages) are used to calibrate the model. Endogenous variables for calibration are obtained from the underlying micro-data, such as the number

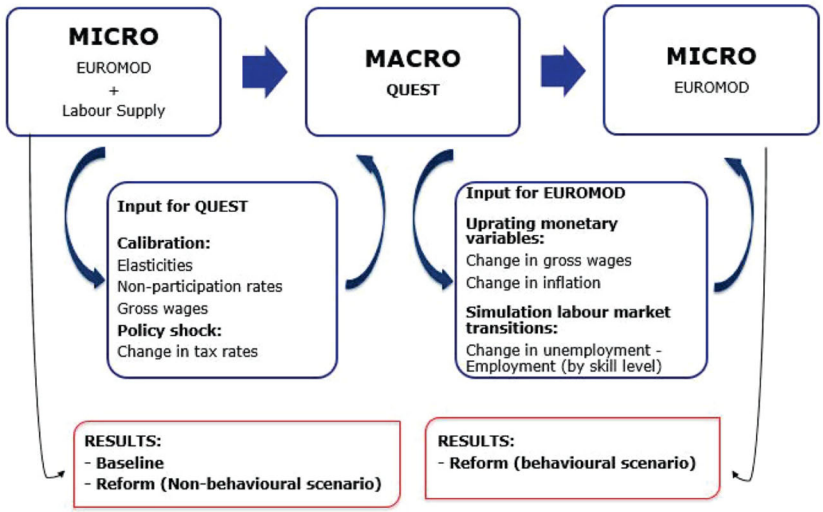
[7] See, for instance, in 't Veld (2013), Vogel (2017) and Roeger et al. (2021).

[8] QUEST is a member of the DSGE model family heavily used in policymaking institutions for fiscal policy assessment. The model has been part of the in-depth model evaluation exercise of Coenen et al. (2012), which compares some of the major structural DSGE models used in policy institutions. Its simulation properties are in line with those of other prominent models in the paper.

[9] See Burgert et al. (2020) for a detailed description of the model. Online Appendix A and Barrios et al. (2019) provide more details about how EUROMOD and QUEST can be interlinked in a dynamic scoring exercise.

[10] 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 3 Methodological steps of combining the three models



Note: Adapted from Barrios et al. (2019).

of employed and unemployed by skill level, as well as real wages by skill level. More details on the labour market calibration of the QUEST model can be found in Table A.2 in online Appendix A.

QUEST estimates the macroeconomic impact given the shock of the tax reform on the implicit tax rates of labour (by skill level) and the calibration of the labour supply elasticities (by skill level). The results 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 five years after the reform and to take behavioural responses into account. More precisely, we uprate monetary variables in EUROMOD based on the change in the consumer prices indices and gross wages estimated by QUEST. Gross wages are uprated according to skill level. Additionally, to take into account the employment effect, we randomly move individuals from unemployment to employment according to the change in the employment rate by skill level simulated in QUEST.

In general, the change in employment could be simulated using two different approaches: re-weighting the sample (static approach), as is done by Barrios et al. (2019), or simulating labour market transitions (dynamic approach).[11] The first method has some limitations because it is based on the assumption that new employed people have the same characteristics as those observed as employed in the baseline year. Given that the reform might have incentivised different types of people to enter the labour market, this assumption seems to be questionable. Additionally, in the EU-SILC data there is not enough information on the variables used to construct the weights. We cannot reconstruct them without the risk of introducing unknown distortions into the new weighted sample, as argued by Figari et al. (2011). For this reason, differently from Barrios et al. (2019), we chose to use the labour market transition approach, which consists of moving a specific amount of individuals from unemployment to employment (as we observe an employment increase), reflecting the change in the employment rate by skill level from the QUEST model. For these observations, we adjusted labour market characteristics using the EUROMOD LMA Add-on, and we estimated their employment income. Figure 3 describes the interaction between all three models in an intuitive way.

[11] The first method consists of increasing the weight of some employed people and reducing the weight of some similar households with unemployed persons. For an overview, see, for example, Rastrigina et al. (2016).

TABLE 1 The fiscal impact of the reform (in million euros)

Concept	Total		Difference w.r.t. baseline			
	Baseline	Reform	in euros	(SE)	in %	(SE)
Total taxes	33,057	31,504	**−1,553**	(46)	**−4.7**	(0.2)
Total SSC	57,877	57,877	0	(–)	0.0	(–)
Social assistance	2,259	2,223	**−36**	(4.9)	**−1.6**	(0.2)
Unemployment assistance	1,025	1,019	**−7**	(3)	**−0.7**	(0.3)
Total means-tested benefits	5,266	5,221	**−45**	(6.4)	**−0.9**	(0.1)
Total non-means-tested benefits	10,860	10,860	0	(–)	0.0	(–)
Net budgetary effect	25,194	23,686	−1,508	(46.2)	−6.0	(0.5)

Note: Budgetary effects are first-round effects and do not account for behavioural responses of households. The second-round effects can be seen in Figure 4. Cells highlighted in bold indicate that the estimates are statistically significant (95 per cent confidence interval). Confidence intervals are calculated following the approach of Picos and Schmitz (2016).

5 | EMPIRICAL RESULTS

5.1 | The fiscal and distributional impact of the reform

The reform of the Austrian tax system 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 1 summarises the first-round effects of the reform on the government's budget. Potential behavioural effects of households are not considered in these results.

As a consequence of the reform, the income tax revenues are estimated to be reduced by 1.55 billion euros (or 4.7 per cent). The biggest part of this decrease in tax revenue is due to the introduction of the *Familienbonus*, while only about 38 million euros are due to the *Kindermehrbetrag* for lone parents and single earners.

However, some of the beneficiaries of the reform lose some benefits due to the increase in disposable income. According to our estimates, the expenditures for means-tested benefits are reduced by 45 million euros. This is mainly driven by a reduction in social assistance (36 million euros) because some households might not be eligible for social assistance or the social assistance is lowered because of the higher income (called *Aufstocker*). Overall, the reform is expected to have a net budgetary effect of approximately −1.51 billion euros (overnight effect).

Focusing on the estimated effects of the reform on income distribution, inequality and poverty without accounting for possible behavioural responses, the results depend crucially on the design of the reform. The new Austrian tax credit is targeted to families with children, and hence the distributional impact depends especially on where those types of households are located in the income distribution before the reform. Figure 4 shows that, on average, the reform would increase equivalised disposable income by 315 euros per year.

The effect is positive for all income deciles, especially in the third, fourth and fifth deciles, where the increase is larger than 400 euros. From the fifth decile, the effect starts to decrease until the end of the income distribution. This result is in line with the distribution of the type of households described above. It is worth noting 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 for the *Kindermehrbetrag*. If we focus on the relative change, the highest increase in equivalised disposable income is found in the third decile (+2.4 per cent) followed by the fourth decile (+2.3 per cent) and then the second and fifth deciles (+2.0 per cent).

FIGURE 4 Change in disposable income by income decile due to the reform

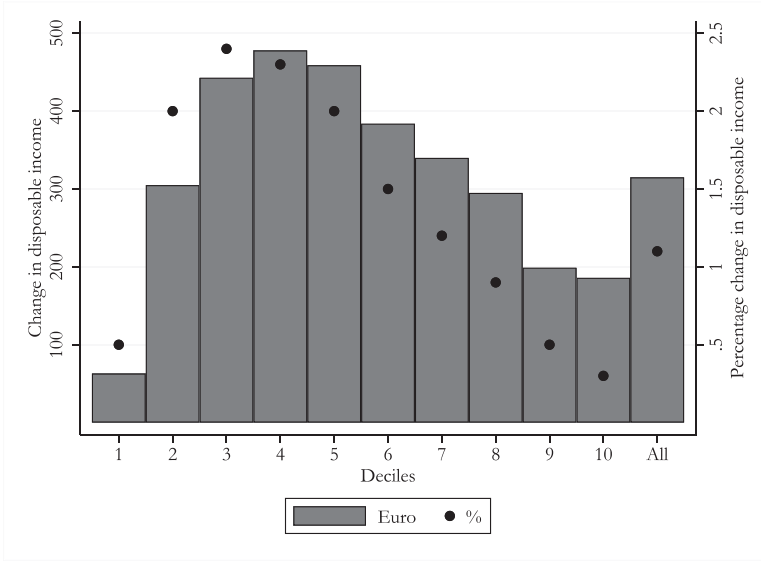


TABLE 2 Inequality and redistributive effect of the tax-benefit system

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

Note: Inequality measures are first-round effects and do not account for behavioural responses of households. Cells highlighted in bold indicate that the estimate is statistically significant (95 per cent confidence interval). Confidence intervals are calculated following the approach of Picos and Schmitz (2016).

When assessing the effect of the reform in terms of income inequality and poverty, Table 2 highlights that the reform reduces inequality measured by the Gini coefficient as well as by the income quintile share ratio (S80/S20). The Gini coefficient of disposable income is reduced by 0.0029 from 0.2512 to 0.2483, while the income quintile share ratio (S80/S20) declines from 3.4969 to 3.4724. The reduction in both inequality measures are statistically significant. However, if we focus on the share of income received by the top decile divided by the share of income received by the bottom decile, we find that the effect of the reform is not significant on this inequality measure.

Table 3 shows the at-risk-of-poverty rate for different types 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 who have an income below 60 per cent of the median equivalised annual disposable income (14,887.66 euros). Overall, the reform would decrease the at-risk-of-poverty rate significantly from 13.1 per cent to 12.5 per cent. Obviously, only households with children are influenced by the reform. The simulation highlights that the reform would decrease 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, possibly because the number of observations for these subgroups are low. The *Kindermehrbetrag* is the driving factor for the at-risk-of-poverty rate reduction in single-parent households. However, this reduction is not statistically significant at the 95 per cent level.

TABLE 3 At-risk-of-poverty rates for different types of household (in per cent)

Household type	Level			Difference w.r.t. baseline			
	Baseline	FamB	TotRef	FamB	(SE)	TotRef	(SE)
Total	13.1	12.5	12.5	**−0.6**	(0.2)	**−0.6**	(0.2)
One adult with children	30.3	30	29	−0.3	(0.3)	−1.4	(0.8)
Two adults with children	11.9	10.3	10.3	**−1.6**	(0.5)	**−1.6**	(0.5)
Three or more adults with children	15.9	14.6	14.6	−1.3	(0.9)	−1.3	(0.9)

Note: FamB refers to the reform of the child tax credit (without *Kindemehrbetrag*). TotRef refers to the whole reform that consists of all four steps explained earlier. Cells highlighted in bold indicate that the estimate is statistically significant (95 per cent confidence interval). Confidence intervals are calculated following the approach of Picos and Schmitz (2016). The poverty line is anchored at the baseline, and it is 14,887.66 euros (60 per cent of median equivalised annual disposable income).

5.2 | Impact of the 2019 reform on labour supply

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 recognised in the literature on labour supply.[12] The labour supply responses at the intensive and extensive margins depend crucially on the tax design of any income tax system, as shown for example by Choné and Laroque (2005) and Gruber and Saez (2002).[13]

This section reports the estimated labour supply responses to the reduction in tax burden due to the Austrian reform. 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 margins. The intensive margin refers to the expected change in the number of hours worked for people already working in the original data set, 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. The results of the multinominal logit model that is used for the estimation of the elasticities can be seen in Table C.2 in the online Appendix.[14] All coefficients in the three household models (single males, single females and couples) show the expected signs for the main parameters and most are highly significant. As previously discussed, we control for several of the taste-shifting parameters such as age and children. Furthermore, we control for the age of the children.

For households of couples, consumption (income) as well as male and female leisure increase household utility with a decreasing effect as the level of leisure or consumption increases (squared term). For both 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 the case of young children.[15]

The model for households of single individuals suggests similar estimates, but substantial differences can be found in the presence of children. The interaction effect between having children

[12] See, for example, Heckman (1993) and Blundell, Bozio and Laroque (2013).

[13] Participation tax rates and 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; Brewer, Saez and Shephard, 2010), indicating that there is room for policies that aim to increase incentives on both the extensive and intensive margins. Details on the impact of the reform on the implicit tax rate on labour can be found in online Appendix B.

[14] Results of the wage equation estimation can be found in Table C.1 in the online Appendix.

[15] This finding is in line with the findings of Gong and Breunig (2017) who showed that tax credits (for childcare in their paper) are better than subsidies in terms of increasing labour supply. However, they also show that wealthier, more-educated women profit more from such reforms.

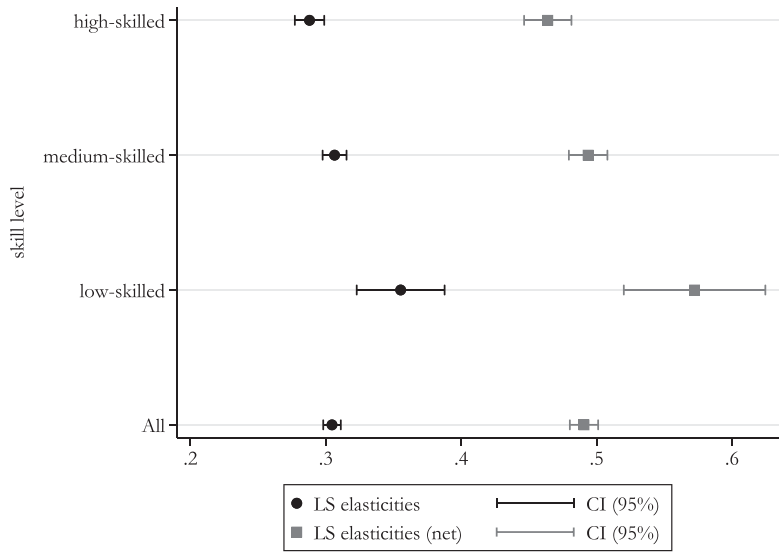
and leisure for males is negative even in the presence of very young children, whereas females show no differences in the assessment of leisure.

Our main interest lies in estimating the elasticities by skill level to calibrate our macro-model. Because we use EUROMOD in our discrete choice model, we can distinguish between the labour supply elasticities based on a change in gross income and a change in net income. Figure 5 shows that there are substantial differences in the two measures. Additionally, we can see that the elasticities vary substantially (and in a statistically significant way) across skill level.

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

Given the importance of the labour supply elasticities, we compare our results with the literature. In general, the labour supply elasticities are in line with the findings of Bargain et al. (2014) and Hanappi and Müllbacher (2016) for Austria, and are slightly higher than the results derived by Müllbacher and Nagl (2017). This might be driven by the use of different data sets to derive the elasticities. As Müllbacher and Nagl (2017) show in their paper, elasticities vary substantially depending on the year of the data used to derive the labour supply elasticities. Most likely, those differences are driven by the differences in the flexible sample used. While Müllbacher and Nagl (2017) use the whole population in the flexible sample, we follow the method of Bargain et al. (2014), where only employees and the unemployed are included in the flexible sample, and inactive people are not taken into account. Our results are also very close to what was argued by Chetty et al. (2011), who state the following. 'Based on our reading of the micro-evidence, we recommend calibrating macro-models to match Hicksian elasticities of 0.3 on the intensive and 0.25 on the extensive margin and Frisch elasticities of 0.5 on the intensive and 0.25 on the extensive margin.'

FIGURE 5 Labour supply elasticities by skill level



Note: High-skilled, medium-skilled and low-skilled workers are classified according to the ISCED education categories (ISCED 0–2, 3–4 and 5–8 groups, respectively). The confidence interval (CI) is derived by bootstrapping with 50 replications, following the method of Bargain et al. (2014).

Looking at labour elasticities by gender, we find that, in line with the literature, significant differences exist (see Figure 6). An increase of 1 per cent in gross income corresponds to an increase in working hours of males and females by 0.285 per cent and 0.334 per cent, respectively. These results are in line with other findings for Austria by, for example, Hanappi and Müllbacher (2016), Müllbacher and Nagl (2017) and Bargain et al. (2014), who all report higher labour supply elasticities for women than men.

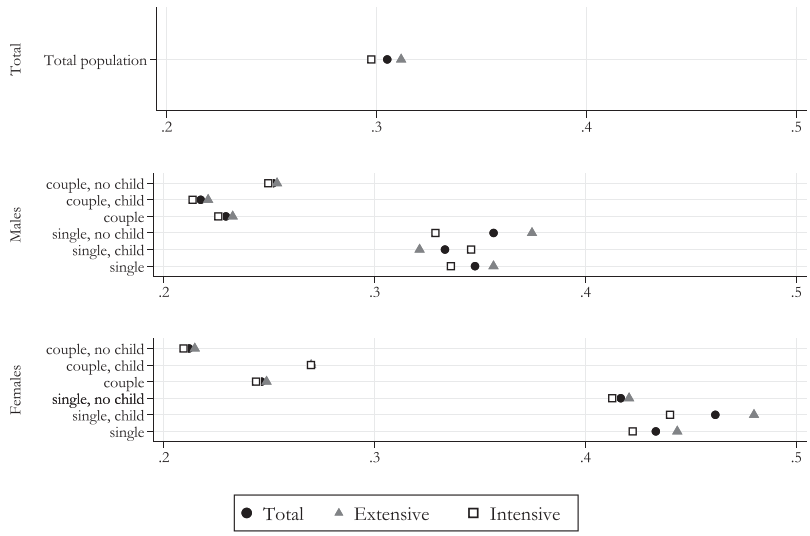
Labour supply elasticities are, according to our estimates, higher for singles than for couples, as is shown in Figure 6. While, for example, single women have a labour supply elasticity of 0.43, the elasticity for married women is 0.25. The same holds true for males. While single men have an elasticity of 0.35, the one for a married man is about 0.23. This is in line with the findings of Müllbacher and Nagl (2017), who find that, for the EU-SILC data sets from 2004 to 2012, 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 they live with a spouse) have a lower labour supply elasticity than males without children, and the difference is 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 matter 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 online Appendix B, we analyse the labour supply responses that can be attributed to the reform. Figure 7 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 (1–10 hours), long part-time (11–30 hours), full-time (31–40 hours) and over-time (41–60 hours).

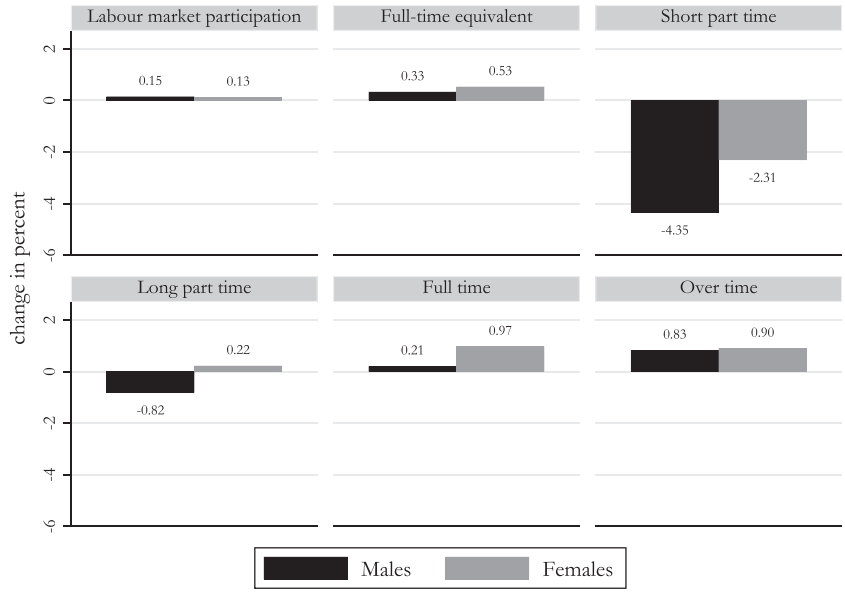
Overall, the reform has a positive effect on the labour supply of both females and males. The full-time equivalent for females would increase by 0.53 per cent, while for males we expect an increase of 0.33 per cent. In absolute values, this would reflect an increase of 10,967 in full-time equivalents: 5,827 females and 5,140 males. Compared with the tax reform of 2016, which was in magnitude

FIGURE 6 Labour supply elasticities by household type



Note: We define a couple as a household where both parents are flexible in labour supply. Flexible means an individual is the household head or the partner of the household head, of working age, and employed or unemployed. We define single as an adult living alone and also as an individual in a couple but whose partner is not flexible in labour supply.

FIGURE 7 Changes in the labour supply by gender



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

substantially more costly, this effect is very similar in size to the one estimated by Müllbacher and Nagl (2017). They estimated a total labour supply increase related to the tax reform in 2016 in full-time equivalents of 12,675, with an increase of about 7,533 females and 5,142 males. Please note that the goal of the Austrian tax reform was not precisely the increase of labour supply, but a number of other goals, as also highlighted by Müllbacher and Nagl (2017).

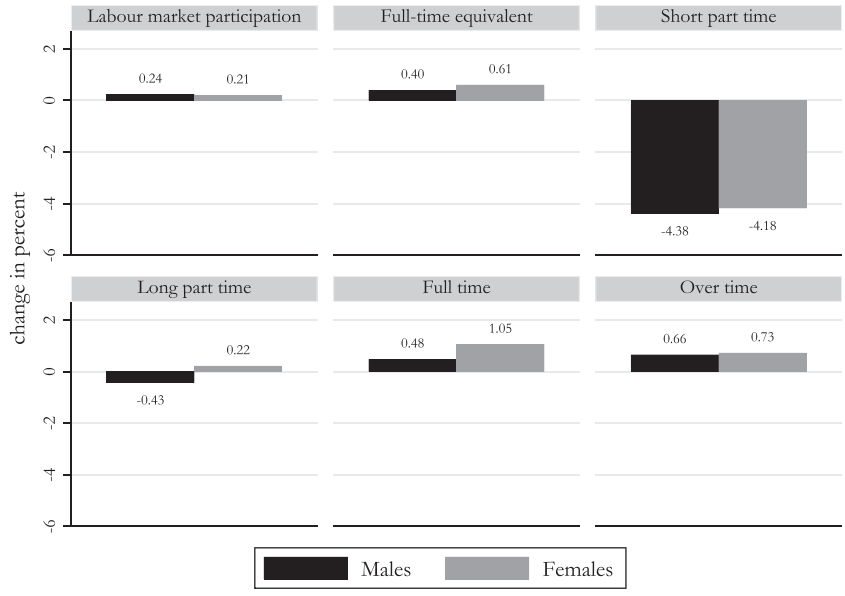
This effect results from a positive effect on both the intensive margin (number of hours worked) and the extensive margin (labour market participation). Females would increase their labour market participation rate by 0.13 per cent and males by 0.15 per cent. On the intensive margin, males would switch from part-time to full-time (+0.21 per cent) and over-time (+0.83 per cent). The effect for females is even larger, where we observe a reduction in short part-time (−2.31 per cent) and an increase in long part-time (+0.22 per cent), full-time (+0.97 per cent) and over-time (+0.90 per cent) labour supply. This result is of particular interest because Austria's labour market is characterised by high female part-time employment, which is one of the reasons for Austria's high gender pay gap, which later translates into 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 Figures 8 and 9). On the one hand, we would expect a larger impact of the reform on couples because around half of the couples with flexible labour supply have children and benefit from the reform, while in the case of singles, this percentage is only close to 15 per cent. On the other hand, the reform seems to have a larger impact on singles. This is particularly true when we look at the extensive margin. Single women (men) are expected to increase their labour market participation by 0.21 per cent (0.24 per cent), while if we focus on couples, the reform would increase their participation by only 0.07 per cent.

This effect could potentially be explained by differences in eligibility to the reform and also by the fact that couples where only one parent is in the flexible sample[16] are considered to be a single household. In the case of couples, the incentive depends additionally on the tax liability of the partner,

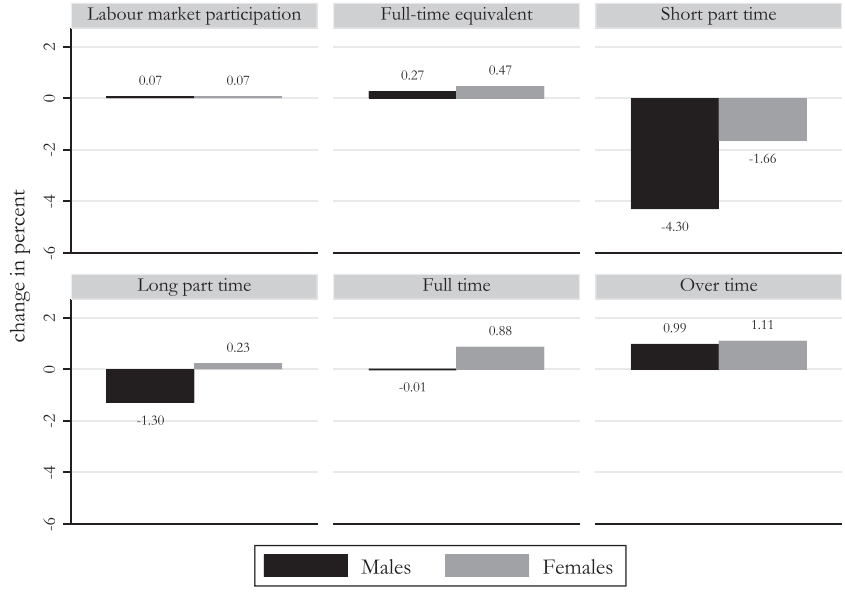
[16] In our approach, only employees and the unemployed are included in the flexible sample, and inactive people are not taken into account.

FIGURE 8 Changes in the labour supply of singles by gender



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

FIGURE 9 Changes in the labour supply of couples by gender



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

while singles probably are more incentivised 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 because they are the only ones influenced by the reform. Figure C.1 in the online Appendix shows the impact on those households. We can see a strong shift in the intensive margin, especially for women. The impact on labour market participation is slightly higher for males than females. In general, our results

suggest a positive impact of the reform on employment. However, to take into account labour demand restrictions, QUEST needs to be used too.

5.3 | Macroeconomic impact of the reform

After calibrating the QUEST model for Austria based on the skill-specific labour market statistics from EUROMOD and the estimated Frisch elasticities from the discrete-choice labour market model,[17] we introduce the tax-reform shock (corresponding to the expected changes in the implicit tax rate measured by EUROMOD). The shock generates impulse responses in the QUEST model's endogenous variables as the economy converges to a new steady state. In this subsection, we analyse in more detail these impulse response functions for the main endogenous variables (such as GDP, employment, wages, consumption and investment) for a time period of five years after the implementation of the reform.[18]

The tax credit for families with children lowers the average tax rate on employees and therefore stimulates their labour supply, as they are willing to work more for higher net wages. The employment effect depends finally on the relative strength of the substitution and income effects, and is ultimately derived in QUEST. Figure 10 depicts the total employment and the wage effects of the reform for the first five years. We estimate that the reform gradually raises total employment: five years after the reform, employment is expected to increase by about 0.169 per cent relative to the baseline. The positive employment effect is higher for low-skilled workers (+0.179 per cent), while it is lower for high-skilled workers (+0.154 per cent), mainly because the low-skilled workers have a higher estimated labour supply elasticity than the high-skilled workers. Detailed information on employment effects by skill level can be found in Figure C.2 in the online Appendix.

As workers pay lower taxes on their gross earnings, there is 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. (2019) discuss this phenomenon of tax incidence in detail, pointing out that part 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 its expected impacts and to identify winners and losers of the reform. This highlights the importance of additionally analysing the macroeconomic implications of tax reforms.

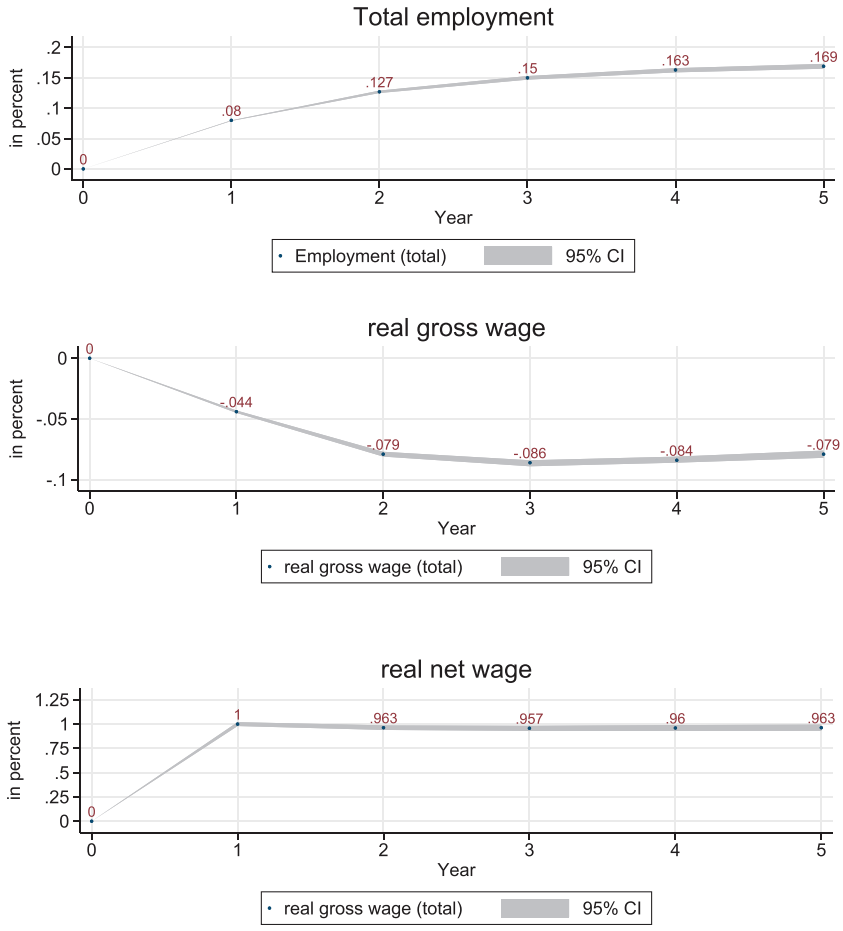
The corresponding effects on gross and net wages are also shown in Figure 10. Overall, the effect on gross wages is expected to be lowered by 0.079 per cent compared to the baseline after five years. This effect will again be stronger for the low-skilled workers, which is the skill group with the highest labour supply elasticity. Still, the differences are not large across skill groups, reaching from −0.087 per cent for the low-skilled workers to −0.068 per cent for the high-skilled workers. Detailed estimates by skill level can be found in Figure C.3 in the online Appendix.

Consequently, the positive effects of the reform on the disposable income of households will be lowered by the decrease in gross wages compared with a static analysis without considering the behavioural effects. Overall, employees will receive higher net wages because the decrease in gross wages is more than compensated by the introduction of the child tax credit. The effect on net wages five years after the reform is highest for medium-skilled workers, where we find an increase of about 1.00 per cent, while the increase for low-skilled and high-skilled workers is expected to be 0.93 per cent and 0.96 per cent, respectively. The impact is highest in the first year after the reform and decreases slightly afterwards due to the gradual decline in gross wages. Detailed estimates by skill level can be found in Figure C.4 in the online Appendix.

[17] For more details on the labour market calibration of the model, see Table A.2 in the online Appendix.

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

FIGURE 10 Employment and wage effects of the reform

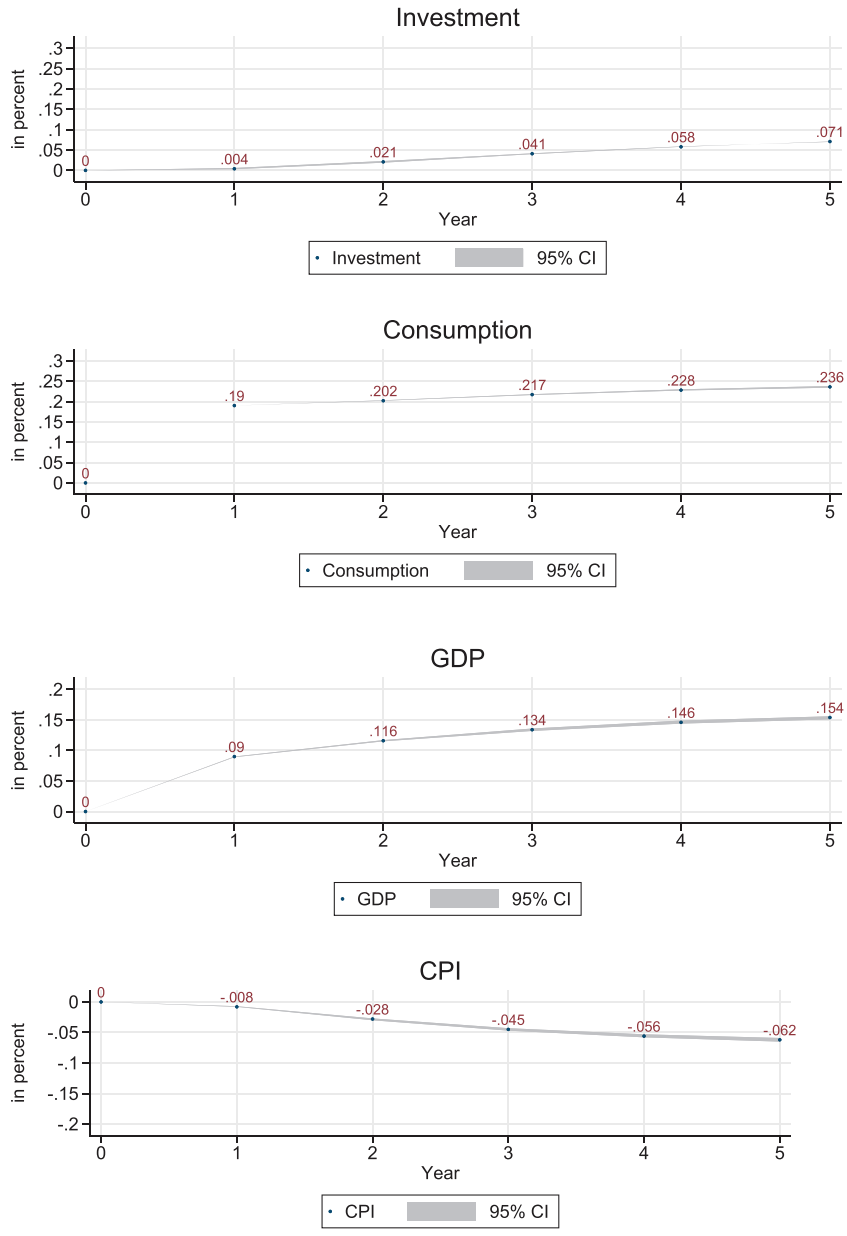


Note: Confidence intervals are calculated using the lower and upper bounds of the labour supply elasticity when calibrating the DGSE model (QUEST).

The overall impact on the main macroeconomic variables, such as GDP, consumption and investment, are shown in Figure 11. The tax credit stimulates the economy; because of the increase in net wages, households are expected to increase consumption and firms to 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 per cent relative to the baseline and a 0.154 per cent increase after five years. The consumer price index (CPI) is expected to decrease slightly due to the reform.

As expected, the reform weighs negatively on the government budget, as depicted by Figure C.5 in the online Appendix. The government balance deteriorates by around 0.3 per cent of GDP on impact and close to 0.4 per cent of GDP after five years. Note that this decline roughly corresponds to the −6 per cent net budgetary effect reported in Table 1 from the static EUROMOD analysis. The literature on this topic typically shows that in the 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). Because 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.

FIGURE 11 Effects of the reform on investment, consumption, GDP and prices



Note: Confidence intervals are calculated using the lower and upper bounds of the labour supply elasticity when calibrating the DGSE model (QUEST).

5.4 | Second-round effects at the 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 consumer prices to apply those results again on micro-level data. In other words, we feed the macroeconomic projections into EUROMOD to analyse the fiscal and distributional effects five

years after the reform. According to the employment effects by skill level obtained from QUEST (see Figure C.2), we move unemployed people into work. Additionally, we uprated wages by the expected decrease in gross wages by skill level (see Figure A.5) and prices with the expected changes in the CPI (see the bottom panel of Figure 11).

Table 4 shows that while the reform decreases the tax revenues of the state substantially in the first round (−1,553 million euros), the second-round effects are substantially lower (−1,466 million euros), highlighting the importance of taking those effects into account when assessing tax reforms. The wage and price effects (uprating) decrease 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 also observe that these 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 euros to −1,318 million euros.

Table 5 highlights the impact of the dynamic scoring approach on disposable household income. The reform increases disposable household income for singles with children on average by 486.5 euro and 695.9 euro for couples with children overnight, while 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 benefit from a significant increase in disposable income. The results show a positive effect on household disposable income, in particular for singles with children. It is worthy to mention that these results may be triggered by the random choice of individuals moved to employment.[19]

Looking at poverty measures after performing the dynamic scoring exercise, we can again note the importance of accounting for second-round effects at the micro-level. The overnight effects suggest a decrease in poverty for all types of households with children, while accounting for the second-round effects leads to substantially lower poverty rates, especially for singles with children. The poverty rate for singles with children decreases from 30.3 per cent to 29.0 per cent overnight and further to 27.8 per cent 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 suggests a reduction of 0.6 percentage points.

The dynamic scoring exercise highlights the importance of taking into account behavioural reactions as well as macroeconomic feedback when analysing tax reforms. The dynamic scoring approach used in this paper enriches the evaluation of the tax reforms in terms of both fiscal and distributional aspects. As already argued by Barrios et al. (2019), '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 taxes were not extremely strong and only for a subgroup of the population (households with children). However, we can see that the impact on the microstructure (especially on household income and poverty) is not negligible.

5.5 | Robustness and limitations of the analysis

In this subsection, we briefly discuss the robustness and caveats of our analysis. Our approach is an *ex ante* evaluation, and so a detailed discussion of the model assumptions is crucial to validate our results.

Our analysis is based on the interaction of several models. We predict first-round results with EUROMOD, and then estimate the potential behavioural responses based on a labour supply model

[19] 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 4 Fiscal impact of the reform, second-round effects (in million euros)

	Baseline	Reform			Difference w.r.t. baseline		
		First round (overnight)	Second round (uprating)	Second round (up+emp)	First round (overnight)	Second round (uprating)	Second 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	0.0	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**
Total non-means tested benefits	10,860.2	10,860.2	10,860.0	10,837.3	0.0	−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**

Note: All the monetary values are based on the price level in 2018. The reform scenarios for the second round take into account the macro-effects of 2023. Values highlighted in bold indicate that the estimates are statistically significant (95 per cent confidence interval). Confidence intervals are calculated following the approach of Picos and Schmitz (2016).

TABLE 5 Impact of the reform on disposable household income and poverty: second-round effects (in euros)

	Baseline	Reform			Difference w.r.t. baseline		
		First round (overnight)	Second round (uprating)	Second round (up+emp)	First round (overnight)	Second round (uprating)	Second round (up+emp)
Disposable household income							
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
Poverty							
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**

Note: All the monetary values are based on the price level in 2018. The reform scenarios for the second round take into account the macro-effects of 2023. Values highlighted in bold indicate that the estimates are statistically significant (95 per cent confidence interval). Confidence intervals are calculated using the approach of Picos and Schmitz (2016).

that we use to calibrate the DSGE model (QUEST). This implies several assumptions and calibration choices, and leads to uncertainty in our results that we discuss in detail below.

First, the uncertainty related to the results of the microsimulation model is more or less limited to the design of the underlying survey. When presenting the results of the analysis, we report the standard errors or confidence intervals that result from the EU-SILC survey design. In this respect, we follow the approach of Picos and Schmitz (2016). We find that, overall, the results on the bigger aggregates and on the indicators are mostly statistically significant.

Second, our labour supply model estimates labour supply elasticities that are then used to calibrate the macro-model QUEST. Our elasticities are similar to other estimates for Austria,[20] and are in line with the suggestions from Chetty et al. (2011). Using a bootstrapping methodology, which follows Bargain et al. (2014), we also report the confidence intervals of the labour supply elasticities.

Third, we use the estimated labour supply responses to calibrate QUEST. To ensure the robustness of the estimates on the macro-level, we show the impact of the calibration choice (upper and lower bounds of the 95 per cent confidence interval of the labour supply elasticities). This allows us to obtain an upper bound and a lower bound for the macroeconomic impact, which is also included in the impulse response of the estimated variables in QUEST. As can be seen in Figures 10 and 11, the macro-level impact of the uncertainty in the estimated labour supply elasticities is limited, but not negligible.

Fourth, there is uncertainty around the quantification of the implicit tax rate shock after the tax reform. Our estimates in the change of the implicit tax rate related to the reform are exposed to uncertainty introduced by our microsimulation model due to the underlying survey data. In online Appendix D, we additionally present the impact on the macroeconomic results when using the confidence intervals of the implicit tax rate by skill group. We can see that using the upper and lower bounds of the changes in the implicit tax rates (the key variable to introduce the shock of the tax reform in QUEST), our macroeconomic results are still significant, although the robustness checks highlight the importance of having precise estimates of the implicit tax rate changes due to the reform when calibrating the shock in the DSGE model.

Regarding the general limitations of our analysis, it is important to mention that we are not aiming to use the Austrian reform to identify behavioural responses to the reform. On the contrary, labour supply responses of individuals are based on a structural labour supply model, rather than on exogenous variation in labour supply.

6 | CONCLUSION

This paper provides an *ex ante* assessment of a specific Austrian reform introduced in 2019, which is aimed at reducing the tax burden of families with children while providing additional incentives to work. The key element of the reform is a non-refundable tax credit of 1,500 euros per child per year (*Familienbonus Plus*) and a refundable tax credit of 250 euros for lone-parent households and single-earner households that are not affected by the *Familienbonus Plus* (*Kindermehrbetrag*).

As demonstrated in the literature, a comprehensive evaluation of a tax reform needs to take into account feedback effects resulting from adjustments and behavioural responses in the labour market and the economy-wide reaction to the tax policy. We follow the methodology introduced by Barrios et al. (2019), linking microsimulation modelling and labour supply modelling to calibrate a DSGE model that allows us to assess the macroeconomic impact of the tax reform.

This paper contributes to the existing literature by using a different approach to account for the feedback effects resulting from behavioural responses on the labour market as well as the economy-wide reaction to the tax policy changes. Instead of using the re-weighting approach, we use a

[20] See, for example, Hanappi and Müllbacher (2016) or Müllbacher and Nagl (2017).

dynamic approach introduced by Rastrigina et al. (2016). We argue that this allows us to introduce the macroeconomic feedback effects of the tax reform in a more precise way at the micro-level.

First, we use EUROMOD to analyse the fiscal and distributional effects (first-round effect) of the reform. Our results suggest that the impact of the reform is substantial. Overall, total budget of the government was reduced by almost 6 per cent. Focusing on the distributional effects and inequality indicators, we find an inequality-decreasing impact of the reform. In particular, households in the lower part of the income distribution have benefitted strongly, with the exception of the first decile. This is the result of a lower concentration of families with children in the lowest decile, and it also reflects the fact that a bigger portion of families with children are not eligible for the tax credits introduced by the reform.

Second, we combine EUROMOD with a discrete choice labour supply model. Therefore, we also contribute to the rich labour supply literature related to tax credit reforms. Our labour supply model reveals that women, as well as low-skilled workers, have higher labour supply elasticities, or, in other words, they are more responsive to changes in their own income. We find that the reform increased labour supply for both males and females. On the extensive margin, the effect is quite similar, while on the intensive margin we find a stronger effect for women. The effect of the reform on the labour supply seems to be stronger also for singles compared with couples.

Third, we calibrate our DSGE model (QUEST) with the findings at the micro-level. This allows us to assess the macroeconomic impact of the reform. Therefore, we not only take into account labour supply responses of the reform, as is usually done in the literature, but we also focus on the macroeconomic impact. Our model estimates an increase in total employment of about 0.17 per cent after five years due to a positive labour supply shock that results from the child tax credit reform. 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 not negligible. We estimate an increase in consumption as a result of higher incomes, as well as a slight increase in investments, due to the fact that part of the associated tax decrease can be potentially captured by the employer. Overall, the reform is also expected to increase GDP by around 0.15 per cent after five years.

Finally, we bring back these overall macroeconomic effects to the micro-level, meaning that we account for behavioural responses in the labour market, as well as overall economic reactions at the micro-level. Although the macro-feedback effect of this reform is relatively small, we show that accounting for those second-round effects at the micro-level is very important, not only to analyse potential self-financing effects of tax reforms but also to analyse the distributional impact in more detail. We find a self-financing effect of the tax reform of about 190 million euros, which is about 13 per cent of the total cost of the reform. Additionally, when paying special attention to the distributional implications and the impact of the reform on poverty, the second-round effects indicate an additional increase in household income stemming from higher employment, especially for households with children. This further lowers the poverty rates of these households substantially. However, other households are suffering small wage losses due to the increases in labour supply and the implied decrease in wages, leaving some households worse off when accounting for second-round effects.

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