EUROMOD WORKING PAPER SERIES

EM 7/18

Drivers of participation elasticities across Europe: gender or earner role within the household?

Charlotte Bartels and Cortnie Shupe

March 2018

Drivers of participation elasticities across Europe: gender or earner role within the household?*

Charlotte Bartels[a,b,c]

Cortnie Shupe[a,d]

[a] DIW, Berlin

[b] UCFS

[c] IZA, Bonn

[d] Economics Department, Free University Berlin

Abstract

We compute participation tax rates across the EU and find that work disincentives inherent in tax-benefit systems largely depend on household composition and the individual's earner role within the household. We then estimate participation elasticities using an IV Group estimator that enables us to investigate the responsiveness of individuals to work incentives. We contribute to the literature on heterogeneous elasticities by providing estimates for different socioeconomic groups by country, gender and earner role within the household. Our results show an average elasticity of 0.08 for men and of 0.14 for women as well as a high degree of heterogeneity across countries. The commonly cited difference in elasticities between men and women stems predominantly from the earner role of the individual within the household and nearly disappears once we control for this factor.

JEL: H24, H31, J22, J65

Keywords: participation elasticities, labor supply, taxation, cross-country comparisons

Corresponding author:

Cortnie Shupe

cshupe@diw.de

* The authors would like to thank Carsten Schröder, Emanuel Hansen, Peter Haan, Amelie Schiprowski and Julia Schmieder as well as participants at the UC Irvine Applied Micro seminar, the annual conference of the EEA 2016, the EUROMOD 20th Anniversary Conference, the IAB PhD Workshop Perspectives on (Un-)Employment 2017, the IAAE 2017 in Sapporo, IIPF 2017 in Tokyo and Berlin Public Finance workshop for helpful comments. The results presented here are based on EUROMOD version G4.0+. EUROMOD is maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex, in collaboration with national teams from the EU member states. We are indebted to the many people who have contributed to the development of EUROMOD. The process of extending and updating EUROMOD is financially supported by the European Union Programme for Employment and Social Innovation 'Easi' (2014-2020). We make use of microdata from the EU Statistics on Incomes and Living Conditions (EU-SILC) made available by Eurostat (59/2013-EU-SILC-LFS). The results and their interpretation are the authors' responsibility.

1 Introduction

Labor market participation rates diverge greatly across countries of the European Union (EU). The extent to which incentives inherent in the various tax-benefit systems drive these differences remains a topic of contention throughout many member states. Of particular concern are low participation rates among low-skilled individuals and secondary earners with weak labor market attachment. At the same time, these groups traditionally exhibit high responsiveness to monetary employment incentives. Thus, tax-benefit distortions at the extensive margin for these types of potential workers may contribute to low participation rates and create high efficiency costs. The resulting, substantial fiscal costs of inactivity include expenses for out-of-work benefits, foregone taxes and social security contributions. These costs render understanding the responsiveness of these groups to tax-benefit incentives highly relevant.

At the extensive margin, the participation tax rate (PTR) measures tax-benefit distortions to work. Since the 1980s, a wide range of empirical studies estimate the participation elasticity at the micro level, measuring the behavioral response to monetary incentives for work at the extensive margin. These studies exploit exogenous shocks to a particular group's work incentives through a tax or benefit reform in a quasi-experimental setting.[1] A general result is that the behavioral response is higher at the extensive margin than at the intensive margin, particularly for low-skilled, secondary earners (married women) or single mothers. However, it is unclear whether results obtained in a very particular quasi-experimental study of a specific reform yield externally valid results for general application (Goolsbee; 1999; Meghir and Phillips; 2010). Much smaller within-period micro-elasticities are found in two studies using an instrumental variables (IV) approach to estimate participation elasticities across countries (Jäntti et al.; 2015; Kalísková; 2015). Building upon these studies, we establish exogeneity through a Group IV that instruments the individual-

[1] An early and often cited example is Eissa and Liebman (1996), who exploit the 1986 introduction of the Earned Income Tax Credit (EITC) in the US in to estimate the labor market response of lone mothers at the intensive and extensive margin. Chetty et al. (2013) and Meghir and Phillips (2010) provide overviews on the estimated elasticities of these quasi-experimental studies. The participation elasticities of the studies reviewed by Chetty et al. (2013) average 0.28 and range from 0.13 to 0.43.

level net-of-PTR earnings with the group average such that common biasing factors in the labor supply equation cancel out. This strategy enables us to investigate participation elasticities across European countries and sociodemographic groups, such as gender and earner roles within the household. We use the same instrument as Jäntti et al. (2015), but different from Kalísková (2015), who employs a simulated IV approach for a pooled EU-wide sample of women. In contrast to Jäntti et al. (2015), who use averages from similar household types to approximate PTRs on the basis of the Luxembourg Income Study data, we use the microsimulation model EUROMOD in order to calculate taxes, social security contributions and benefits for every individual in both potential working states, in work and out of work.

Our contribution is threefold. First, we update the empirical literature on the size and distribution of work disincentives, as measured by Participation Tax Rates (PTRs), across EU countries between 2008-2014, using EUROMOD harmonized data and the accompanying tax and benefit calculator.[2] We provide an in-depth analysis of the PTR and its main drivers including taxes, social insurance contributions and benefits across countries by earnings quintile, earner role, and household context. Secondly, we exploit both the institutional variation across EU countries and changes in the tax-benefit systems between 2008 and 2014 to identify the causal impact of tax-benefit work incentives for employment across the EU, controlling for country and skill-level heterogeneity, including cultural norms or tastes for work and leisure. In doing so, we are able to not only account for how a specific reform in isolation affects a certain target group, but also how different changes in the tax-benefit system interact with each other to influence work incentives throughout the entire distribution. Thirdly, we use our estimated parameters to compute more heterogeneous participation elasticities according to the individual earner's position within the household as well as by gender. Further, we provide a decomposition of the driving components of labor supply disincentives and how individuals react differentially to taxes, benefits, and social security contributions.

[2]EU cross-country studies estimating PTRs based on the tax-benefit simulation model EUROMOD for the year 1998 include Immervoll et al. (2007), Immervoll et al. (2011) and O'Donoghue (2011). Kalísková (2015) uses EUROMOD data covering 2005-2010 to estimate PTRs for women. Several country studies evaluate PTRs over time: Dockery et al. (2011) for Australia, Adam et al. (2006) and Brewer et al. (2008) for UK, Pirttillä and Selin (2011) and Bastani et al. (2017) for Sweden, as well as Bartels and Pestel (2016) for Germany.

Our main results are the following. First, disentangling the drivers of the PTRs, we find that the relative importance of taxes, social insurance contributions and benefits largely depends on household composition and the individual's earner role within the household. In line with optimal tax theory which shows negative PTRs can be optimal at the bottom of the earnings distribution (Saez; 2002; Immervoll et al.; 2011; Choné and Laroque; 2011; Jacquet et al.; 2013; Hansen; 2017), we document negative PTRs in several countries for low-income working families with children. Secondly, we find an average elasticity of 0.08 for men and 0.14 for women, as well as a high degree of heterogeneity across countries. Elasticities in half of the countries in our sample are not statistically different from zero, while relatively high elasticities ranging from 0.1 to 0.3 can be found in Belgium, Germany, Greece, Spain, Italy, and Sweden. Thirdly, however, this commonly cited difference in elasticities between men and women stems predominantly from the earner role of the individual within the household; the difference nearly disappears once we control for this factor. Both male and female secondary earners are the most responsive earner groups with elasticities between 0.1 and 0.2 for male and between 0.1 and 0.3 for female secondary earners. Our results demonstrate the importance of calculating labor supply responses according to earner roles rather than gender, as differences between female and male labor force participation continue to decrease over time (Blau and Kahn; 2006). The finding that other earner types in most countries do not respond to work incentives limits the case for policymakers to further reduce PTRs for these groups.

This paper is structured as follows. In Section 2, we derive our structural equation of interest from a static household labor supply model. Section 3 provides a description of how we compute PTRs, our estimation strategy, and the data employed. In Section 4, we take a closer look at the variation of PTRs across countries by household and earner types. We discuss in detail, how the varying degrees of work incentives are related to the specific features of the tax-benefit system in a given country. Section 5 presents our regression results and discusses our estimated participation elasticities. Section 6 concludes.

2 A Static Household Labor Supply Model

Our analysis is embedded into the economic framework of a unitary, static family labor supply model with fixed costs, in which an individual i maximizes a quasi-concave household utility function,

$$u(c_{ht}, l_{ht})$$

that is increasing in consumption c_{ht} and leisure l_{ht} of the household h, within one period t, dependent on household characteristics and subject to a household budget constraint,

$$c_{ht} = y_{ht} - T(y_{ht}).$$

$T(y_{ht})$ are taxes and social security contributions paid net of any public transfers (benefits) received and

$$y_{ht} = z_{ht} + e_{-it} + e_{it}$$

is gross household income. z_{ht} expresses household non-labor income such as asset income while $e_{-it} + e_{it}$ denote the labor supply choices of each household member in the form of gross income.[3]

The individual will choose her/his optimal labor supply such that it is equal to her/his after-tax wage. In the household context, the net-of-tax earnings will depend on taxes and benefits calculated at the household level. Therefore, at the extensive margin, an individual facing no fixed costs enters the labor market if the household gain from individual employment is positive. However, fix costs such as search costs, additional transportation costs and commuting time, alternative child care, the opportunity cost of home production, or general disutility from work can play a significant role in participation decisions (cf. Piketty and Saez (2013); Cogan (1981)). Following Immervoll et al. (2007), we therefore denote fixed costs as q and the condition for taking up a job becomes

$$q_{it} \leq e_{it} - [T(e_{it}, e_{-it}, z_{ht}) - T(0, e_{-it}, z_{ht})]$$

[3] e_{it} can also be expressed as the product of wages and hours worked. We use the composite term, gross monthly earnings.

From this inequality, we arrive at the definition of the net-of-PTR earnings, which constitutes the measure of extensive margin work incentives in our analysis:

$$q_{it} \leq 1 - \underbrace{\frac{T(e_{it}, e_{-it}, z_{ht}) - T(0, e_{-it}, z_{ht})}{e_{it}}}_{PTR_{it}} \cdot e_{it}$$

Net-of-PTR earnings, $(1 - PTR_{it}) \cdot e_{it}$, summarizes the decision of an individual i facing the binary choice between the two labor market states of being employed w or not working nw. Due to the static, one period nature of our model, we do not consider second order effects, such as possible labor supply adjustments from the partner (i.e. added worker effects) as a result of the individual changing her/his work status. Our structural equation of interest can be formulated as follows:

$$P(w_{it}) = \alpha + \beta(1 - PTR_{it}) \cdot e_{it} + \eta_{it} \tag{1}$$

where $P(w_{it})$ represents the participation decision and takes the value of 1 when the individual works and 0 otherwise. We expect a negative effect of the PTR on employment probability, as distortions to work incentives should make work less probable. Accordingly, we expect the effect of (1-PTR) to be positive. We are interested in the structural parameter β, which, if estimated consistently, permits us to quantify the participation elasticity. We then add a country interaction term to the parameter of interest, expanding this term to $\beta(1 - PTR_{it}) \cdot e_{it} \cdot \lambda_c$ in order to allow for heterogeneous effects in the reaction to tax and benefit incentives across the EU. As a result, it is possible to calculate the country-specific elasticity based on the definition of Saez (2002) and adjusted to the PTR context:

$$PE = (\hat{\beta} + \lambda_c) \cdot \frac{\overline{(1 - PTR_c)}}{\overline{P(w)}_c} \tag{2}$$

where $\overline{PTR_c}$ is the average PTR by country and $\overline{P(w)}_c$ is the sample employment rate in each country. In the above equation of interest, the structural error term η_{it} is likely correlated with the PTR, thus causing an endogeneity problem which we address in Section 3.3.

3 Methodology and Data

3.1 Measuring Participation Tax Rates

The PTR measures the net difference in household taxes and benefits when an individual works, w, versus when (s)he does not work, nw, as a proportion of individual earnings in labor market state w and can be formulated as follows, suppressing the time index t

$$PTR_i \equiv \frac{T(y_h^w) - T(y_h^{nw})}{e_i} \tag{3}$$

where y_h^w is gross household income, $T(y_h^w)$ is household net taxes, and e_i is individual gross monthly labor earnings if the given individual is in the labor market state w. Gross household income can be calculated as the sum of labor earnings, asset income, private transfers, private pensions, and social security pensions of all household members. y_h^{nw} is gross household income and $T(y_h^{nw})$ is household net taxes, if the given individual is in labor market state nw, i.e. when (s)he has no individual labor earnings. We refer to net taxes T paid by the household h as income taxes t_h including social security contributions reduced by benefits b_h.

If household net taxes are equal for both labor market states, then the PTR amounts to zero, indicating that incentives to take up work are not distorted. However, in reality, a welfare state providing income support in the state nw usually leads to $t_h^{nw} < b_h^{nw}$ resulting in $T(y_h^{nw}) < 0$ as social benefits will surpass taxes paid for the reduced household income y_h^{nw}. As such, the change in net taxes when switching from w to nw will be positive in the presence of a welfare state and the PTR will be higher than zero for most individuals. The higher the PTR, the more generous income support programs in the state of nw and/or high income taxes and social insurance contributions in the state of w reduce the financial gain from working. The PTR will equal one if the change in net taxes $T(y_h^w) - T(y_h^{nw})$ (numerator) is equal to individual earnings e_i (denominator). In this case, no financial gain arises from working. *Ceteris paribus*, lower spousal or other household earnings will lead to higher PTRs due to higher means-tested transfers, and additionally, in countries where spousal tax splitting exists, a higher spousal tax reduction in the labor status

nw. Therefore, in many countries the PTR will depend on household type and each potential worker's earner role within the household. Finally, if out-of-work income support exceeds earnings, then the PTR can be even greater than one; if benefits depend on in-work status such as the case with earned income tax credits (EITCs) or negative income taxes, the PTR could be negative for the affected workers.

In order to obtain a PTR for all individuals in the prime working-aged population, independent of their observed labor market status w or nw, we simulate the non-observed state. For this simulation, we abstract from possible secondary effects of labor status changes and concentrate our analysis on the decision of the individual potential worker, holding all other aspects of household composition fixed. As such, we assume that a change in one partner's labor supply behavior, i.e., giving up or taking up a job, does not simultaneously trigger a compensating labor supply reaction by other household members or changes in household income from other non-labor sources. This assumption reflects standard procedure in the PTR literature (see, e.g., Immervoll et al.; 2007; Jäntti et al.; 2015).

We start by predicting potential individual earnings $\widehat{e_i}$ using a standard Heckman regression (Heckman; 1979).[4] We assign individuals observed in w zero labor earnings in the counterfactual situation nw. We then obtain gross household income in both potential labor market states as $y_h = \widehat{e_i} + \sum_{j \neq i}^{N} e_j + z_h$, whereby $\widehat{e_i} = 0$ when the individual is in labor market state nw. [5]

Following the calculation of household gross income described above, we then use EUROMOD to apply the tax-benefit rules of the respective year and country to obtain household taxes t_h and public transfers b_h for both w and nw in a way that ensures consistent assumptions regarding deductions as well as other special tax and transfer rules across countries. For example, household taxes paid in state

[4]Potential earnings are calculated through a Heckman two-step regression by country, year and gender separately. Exclusion restrictions used to identify the selection term vary according to these groups. Variables include dummies for the presence of children in certain age groups, marital status, household non-labor income, household size, and the presence of an elderly person (older than 65 years) in the household. Predicted distributions closely match observed distributions of monthly income. Appendix Figure A.3 demonstrates that the difference in the estimated PTR calculated on the basis of predicted rather than observed earnings is negligible. Small deviations remain for Greece.

[5]Replacing observed earnings with predicted earnings for those observed in w allows us to isolate the identifying variation of interest discussed in further detail in Section 3.3.

nw are the sum of income tax assessed on the basis of y_h^{nw} and social security contributions from the partner's earnings e_j if the partner j is working. Household public transfers are the sum of social assistance, housing allowances, and child benefits. A potential increase in benefits when changing from w to nw will mostly occur for social assistance and housing allowances. In contrast, benefits may also increase when changing from nw to w in the case of in-work benefits.

3.2 Data

We draw on EUROMOD data from 2008-2014,[6] which is based on EU-SILC cross-sectional data that have been specifically prepared for use in the EUROMOD microsimulation model.[7] EU-SILC provides *ex-post* harmonized and internationally comparable household-level statistics on labor and income variables. To date, the EUROMOD microsimulation model functions exclusively using this cross-sectional input dataset. We refer to this data in the following as EUROMOD data. All simulations are based on EUROMOD version G4.0+.

The EUROMOD data cover a representative sample of private households in all investigated countries.[8] Our sample includes individuals in their prime working age, between 25 and 54 years of age. We restrict the sample to these ages because large groups of individuals younger than 25 likely face a decision between education and work rather than between employment and inactivity, which is the focus of this paper. Likewise, beginning approximately around age 55, individuals in many countries may choose between (early) retirement and employment rather than employment and inactivity. Furthermore, we exclude the self-employed, students, pensioners, permanently disabled persons, those in compulsory military service, and those on parental leave. We trim the earnings distribution by dropping the bottom

[6]The income reference period for all countries in our sample, except the UK, refers to the previous calendar year. For the UK, income refers to the previous twelve months. Furthermore, yearly income variables and the number of months employed are used to calculate monthly earnings.

[7]The EUROMOD microsimulation model is developed, maintained, and managed by the Institute for Social and Economic Research (ISER) at the University of Essex, in collaboration with national teams from the EU member states (See Sutherland and Figari (2013) for details).

[8]Countries include: Austria (AT), Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Germany (DE), Denmark (DK), Greece (EL), Spain (ES), France (FR), Italy (IT), Sweden (SE) and United Kingdom (UK). In the following, we use the included abbreviations.

1% in order to exclude unreasonably low earnings. Our final sample consists of approximately 350,000 individuals and four years of observations, namely 2008, 2010, 2012 and 2014.[9]

The EUROMOD micro-simulator currently offers an option to account for non-take-up of benefits as well as tax evasion for some countries. In order to ensure comparability, however, we do not model these for any country. Moreover, due to data limitations, neither contribution-based transitory benefits, such as unemployment insurance, nor in-kind benefits are accounted for. Not accounting for the former will underestimate the PTR level for countries with contribution-based SIC systems such as Austria, Belgium, and Germany. Lack of the latter could attenuate the participation elasticity, for example, in the case of publicly-provided childcare for individuals with small children, as such complementary goods reduce the fix costs of working.

We define the labor market status of employment, w, as having positive earnings and working at least 20 hours per week. We restrict our definition of w for two reasons. Firstly, working at least 20 hours allows workers to be employed either half- or full-time. Because part-time work is prevalent in many EU countries, this definition avoids the restrictive assumption that if non-workers transition into employment, they will always begin with a full-time job. Secondly, in order to avoid distortions in the PTR due to very low monthly earnings driven by workers in a transitional status between labor market attachment and occasional work, we exclude workers with less than 20 hours from our sample. Consequently, transition into employment is defined as taking up a job for at least 20 hours per week.

3.3 Estimation Strategy

In our regression analysis, we investigate the responsiveness of individuals to work incentives that are inherent in tax and benefit systems across the EU. We begin with a simple pooled OLS estimation of the structural labor supply equation, Equation 1, in the EUROMOD cross-sectional data and add demographic controls as well as

[9]We only include years for which EUROMOD provides input data in order to ensure that the determination of the PTR precedes the observed employment choice of the individual. For country-specific input years, refer to Table 1.

country and year fixed effects. The binary outcome variable is one if individual i is employed in period t (w_{it}).

$$P(w_{it}) = \alpha + \beta(1 - PTR_{it}) \cdot e_{it} + X'_{it}\gamma + \lambda_c + \mu_t + \epsilon_{it} \tag{4}$$

If uncorrelated with ϵ_{it}, the coefficient β would capture the effect of the net-of-PTR earnings on the likelihood of labor market participation. A vector of controls for each individual is denoted by X_{it} and includes age, education, experience, marital status, and the presence of a child in different age groups. Year fixed effects, μ_t, capture business cycle fluctuations affecting labor demand, while country fixed effects, λ_c, control for possible omitted policy variables and cultural preferences for work and leisure. The idiosyncratic error term is denoted by ϵ_{it}. Table 4 shows these results with and without controls for the EU sample as a whole.

We expect OLS to yield biased results due to an endogenous regressors problem in which the error term ϵ_{it} is likely correlated with the PTR. Endogeneity may arise through omitted variables, simultaneity or measurement error. The main concern in our setting stems from the omitted variable, which plausibly influences both an individual's probability to work $P(w_{it})$ and his or her net-of-PTR earnings $(1 - PTR_{it}) \cdot e_{it}$. For instance, highly motivated individuals might invest more in their human capital or choose more ambitious career paths, both of which are associated with higher earnings. At the same time, one would expect these same individuals to have a higher willingness to work compared to someone who is not motivated. Social norms present another omitted factor influencing both willingness to work and labor market income that individuals of particular social groups might expect. The correlation of these omitted variables with earnings e_{it} would bias the estimate of β in an upward direction. At the same time, for most individuals in the EU, higher labor market earnings will yield higher PTRs, as the PTR is a function of labor income. This mechanical correlation holds due to the progressive character of most taxation systems[10] and the means-tested nature of benefit receipt. The positive correlation between the omitted variable and the PTR creates a positive bias. Therefore, $1 - PTR_{it}$ yields a negative bias. In sum, the direction of the

[10]Bulgaria and the Czech Republic serve as exceptions, with proportional taxation systems.

overall bias for the composite term of net-of-PTR earnings $(1 - PTR_{it}) * e$ depends on which component dominates.

Due to these endogeneity concerns, we apply an instrumental grouping estimator (group IV), where group averages serve as instruments for the individual level net-of-PTR earnings. This instrument must be correlated with the individual level PTR (relevance condition) and exogenous to the observed labor supply choice (exclusion restriction). As discussed at length in Angrist (1991), Blundell et al. (1998), Blau and Kahn (2006) and Heckman and Robb (1985), instrumenting the individual-level endogenous explanatory variable in the labor supply equation with a group average drives the bias from omitted variables and measurement error toward zero as the cell size used to calculate group averages grows large. Specifically, identifying variation comes from cross-sectional differences across groups while common biasing factors are canceled out. Applications in the labor supply literature include Jäntti et al. (2015), Burns and Ziliak (2015) and Blau and Kahn (2006).

Optimal group partition will minimize heterogeneity within a group while allowing for enough variation beyond the group averages for identification. Minimizing heterogeneity involves a trade-off in which the group cells must remain sufficiently large for estimation. Since tax-benefit reforms differentially affected individuals in different birth cohorts and income groups, we split the sample into 5-year age groups and three educational attainment levels as a proxy for permanent income, resulting in 18 groups. This group definition follows Burns and Ziliak (2015).[11] Adapting the Wald estimator formulated in Blundell et al. (1998) to the extensive labor supply margin, we estimate the following equation by 2SLS:

$$1^{st} stage : (1 - PTR_{it}) \cdot e_{it} = \theta(1 - PTR_{gt}) \cdot e_{gt} + X'_{it}\gamma + \alpha_g + \lambda_c + \mu_t + u_{it} \quad (5)$$

[11] For our preferred group definition, group sizes range from 29 to 2,046 individual observations. We also provide results according to an alternative group definition according to 10-year age cohorts, three educational attainment groups, and gender for comparison with Jäntti et al. (2015). Our estimates are robust to this alternative definition. These results are presented in Table A.1.

$$2^{nd} stage : P(w_{it}) = \beta(1 - \widehat{PTR_{it}}) \cdot e_{it} + X'_{it}\gamma + \alpha_g + \lambda_c + \mu_t + \epsilon_{it} \qquad (6)$$

Having replaced the individual net-of-PTR earnings with the predicted value from the first stage, the correlation between the group mean and the idiosyncratic error term ϵ_{it} is assumed negligibly near zero. The necessary exclusion restriction for this instrument is that unobservable differences in net-of-PTR earnings across groups can be captured by permanent group α_g and country effects λ_c and an additive time effect μ_t. The second necessary condition corresponds to the rank condition and requires that, after subtracting the effect of the group, country, and time averages, some identifying variation in the PTR still remains, i.e. net-of-PTR earnings grow differentially across groups.

4 Participation Tax Rates across Europe

In this section, we take a closer look at variation across countries with respect to the dependent variable, employment, and the main explanatory variable of interest, net-of-PTR earnings. Table 1 depicts the observed employment rates in our sample across the EU when we define employment as having positive earnings and working at least 20 hours. Employment rates vary substantially between countries from 64 to 94 percent of the prime working-age population of women and between 80 and 96 percent of men.

Juxtaposed to these employment rates, Table 2 shows median PTRs for each country by year and gender. It is not only employment rates, but also PTRs that vary greatly across countries, with the highest extensive margin work incentives (lowest PTR) for women in Greece and Bulgaria; and for men in Greece, Italy, and Bulgaria. Several countries share relatively high PTRs and, thus, low work incentives for both women and men; in particular Belgium, Germany, and Denmark. Across all countries in the pooled sample, the average PTR is approximately 32% for women and 36% for men. Men tend to have a higher PTR than women due to higher earnings and, subsequently, higher tax and social security contributions,

Table 1: Employment rates in % and observations by country, 2008-2014

	Employment rates								Observations			
	Female				Male				All			
	2008	2010	2012	2014	2008	2010	2012	2014	2008	2010	2012	2014
AT	80	84	84	84	95	95	95	96	4751	4923	4726	4252
BE	75	79	80		91	91	89		5101	4764	4481	
BG	84	85	85	86	93	94	89	89	3923	5401	4798	4082
CZ	79	79	81		95	96	95		9167	7034	6553	
DE	79	79	83		92	92	93		9060	9076	8886	
DK	94		94		96		93		5014		4240	
EL	64	68	55	51	93	90	81	77	5616	5590	4233	6665
ES	72	71	65	72	93	83	80	85	12987	13212	11745	10912
FR	84[a]	88	89		93[a]	95	95		8473[a]	8180	8841	
IT	65	61	61	61	92	89	86	84	18491	16814	16364	15881
SE	73	72	81		93	89	85		4770	4325	3800	
UK	75	73[b]	73	74[c]	84	82[b]	82	83[c]	17126	17174[b]	13661	13756[c]

Note: The sample includes individuals aged 25-54 working at least 20 hours per week, excluding the self-employed, students, pensioners, the permanently disabled, those in compulsory military service, and those on parental leave. Rates describe weighted means per country using the EUROMOD sample weights. The sample only includes years for which EUROMOD input data exist. a. based on input 2007 b. based on input 2009 c. based on input 2013.
Source: EUROMOD data, own calculations.

especially in countries with progressive taxation. As such, the income tax wedge between employment and unemployment is lower for women than for men, yielding a lower PTR. We return to these gender differences in more detail in Figure 4 where we decompose the drivers of the median PTR by earner type. Section 5 discusses the extent to which these divergent tax and transfer incentives can explain the differences in employment rates.

Figure 1 shows varying degrees of dispersion in PTRs across countries by individual earnings quintile. On average, we expect PTRs to increase with earnings in progressive taxation systems as the tax wedge between working and not working increases with potential income. For most of the countries in our sample, we observe increasing median PTRs as we move from the lowest to highest individual potential earnings quintile. This observation lends credence to our concern about an endogenous regressors problem in our structural equation of interest. This effect becomes less pronounced in joint taxation countries like Belgium, France, and Germany because joint assessment of household income lessens the tax burden more

Table 2: Participation Tax Rates by Country and Gender in%, 2008-2014

	Male				Female			
	2008	2010	2012	2014	2008	2010	2012	2014
AT	48	46	52	53	37	42	37	40
BE	51	50	52		50	50	53	
BG	29	23	23	24	25	24	25	25
CZ	33	32	33		33	32	33	
DE	54	47	47		53	47	46	
DK	54		52		53		51	
EL	24	22	21	23	19	15	14	15
ES	25	28	30	30	25	29	31	30
FR	38[a]	38	39		35[a]	35	36	
IT	33	30	28	24	26	25	24	20
SE	36	35	32		32	31	29	
UK	47	46[b]	43	40[c]	40	37[b]	33	33[c]

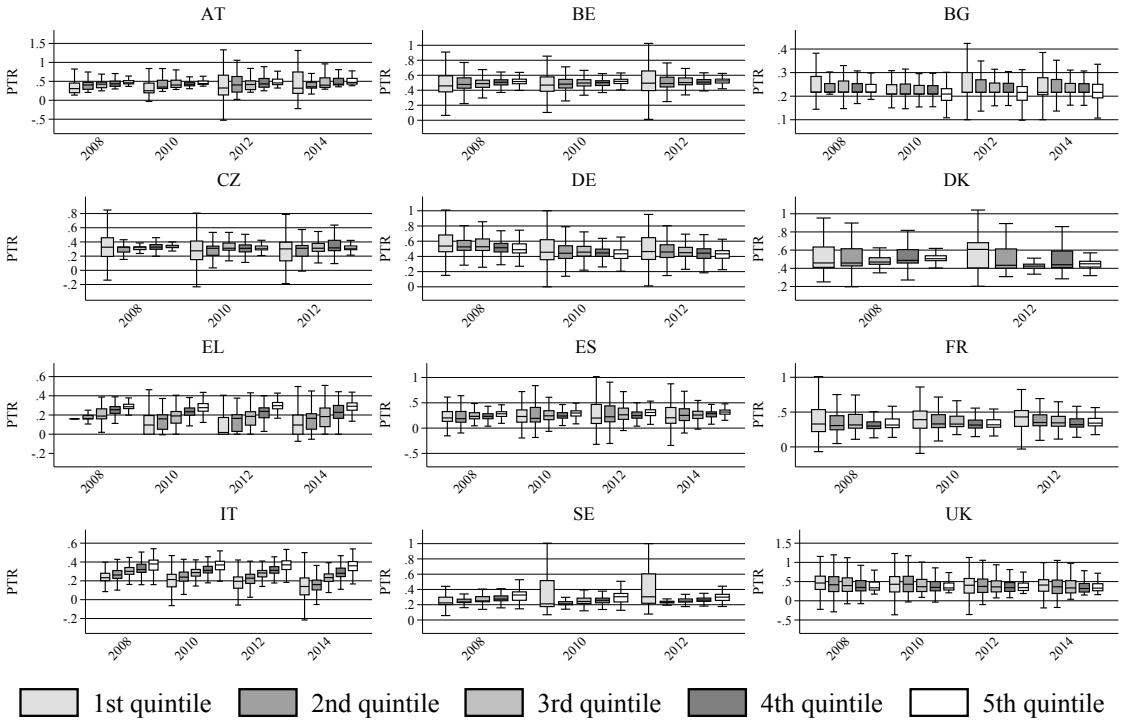
Note: Median values weighted using EUROMOD sample weights. a. based on input 2007 b. based on input 2009 c. based on input 2013. The sample includes individuals aged 25-54 working at least 20 hours per week, excluding the self-employed, students, pensioners, the permanently disabled, those in compulsory military service, and those on parental leave.
Source: EUROMOD data, own calculations.

on the upper end of the earnings distribution than on the lower end. While Bulgaria has very little variation in median PTRs across the earnings distribution due to a proportional tax rate and relatively insignificant out-of-work benefits, most other country systems show a great deal of dispersion in incentives throughout the earnings distribution.

PTRs are more dispersed in the bottom quintile, reflecting the fact that they consist primarily of single, sole, and secondary earners. While the former may be eligible for means-tested benefits when out of work, the latter most often do not pass the means test for benefit receipt. The highest quintile mostly consists of single and primary earners with high individual labor income, which leads to less dispersed PTRs. Given the significant influence that household structure appears to exert on the size of the individual PTR, in the following we decompose the driving components of the PTR according to household and earner types.

Negative PTRs arise from substantial in-work benefits or earned income tax credits (EITCs) and are especially found at the bottom of the earnings distribution. In most countries, these in-work benefits are either non-existent or small for individ-

Figure 1: PTR Distributions by Quintile



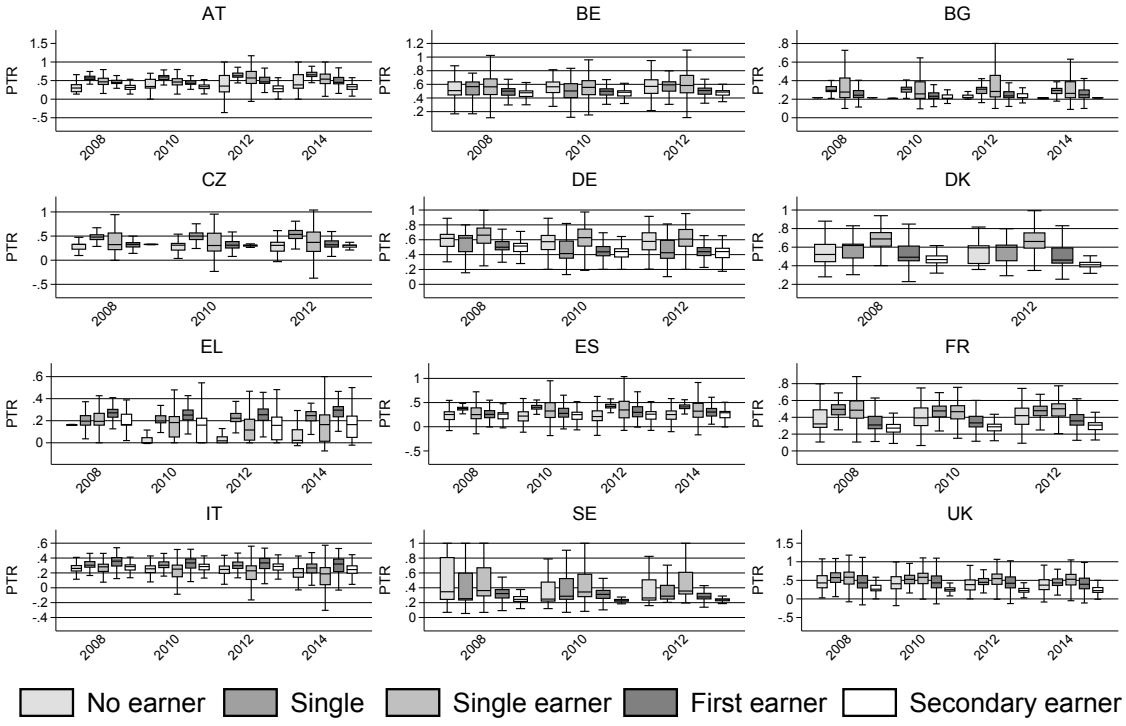
Source: EUROMOD data, own calculations.

uals without children, but generous for working families with children.[12] In Sweden, eligibility for the EITC is independent of the number of children in the household. Belgium, Bulgaria, and Denmark do not have substantial in-work benefits. This finding is of particular interest as some results from optimal tax theory call for a negative PTR at the bottom of the earnings distribution if the extensive elasticity is large (Saez; 2002; Choné and Laroque; 2011; Jacquet et al.; 2013; Hansen; 2017).

Figure 4 displays the dispersion in PTRs by earner type. We define five stylized earner roles within the household: 1) an individual in a household in which no member is observed working ("no earner"); 2) single earners in a one-person household ("single"); 3) sole earners in a multiple-person household ("sole earner"); 4) primary earners in households in which more than one person is employed ("first earner"); and 5) secondary earners in households in which more than one person is employed. The primary earner is the highest earning member of the household.

[12]This applies to Austria, the Czech Republic, Germany, Greece, France, Italy, Spain, and the United Kingdom. In Greece, the social dividend was paid in 2014 as a one-time lump-sum payment. In all other years, no substantial in-work credits existed.

Figure 2: PTR Distributions by Earner Type

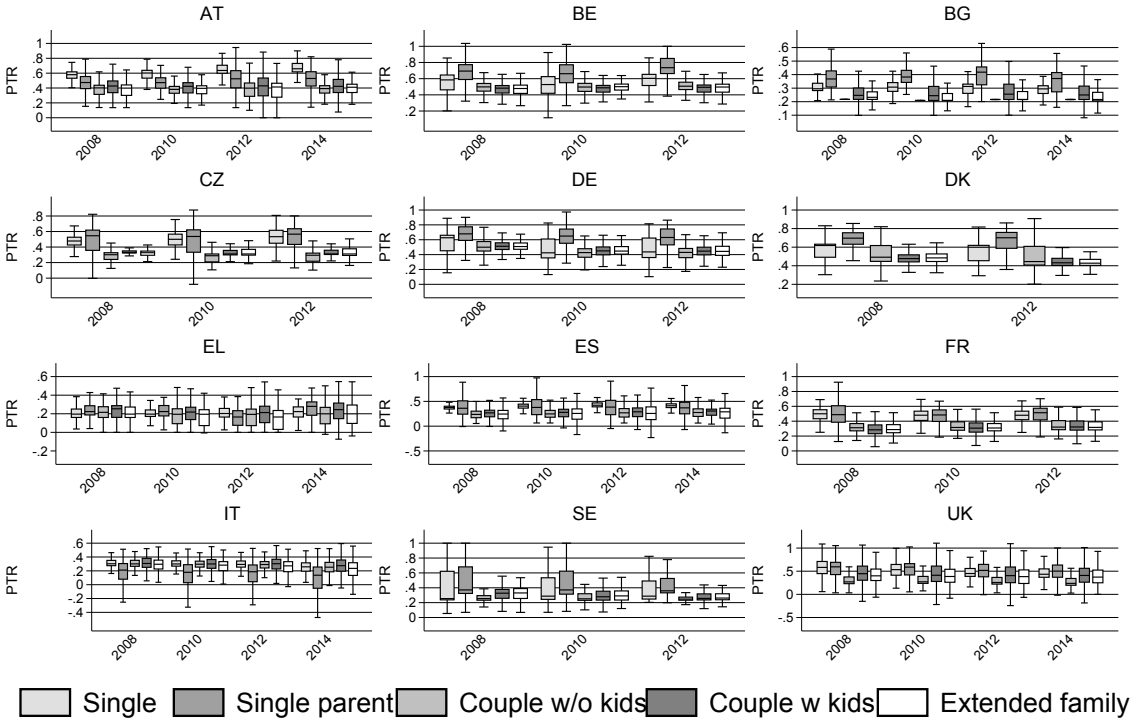


Source: EUROMOD data, own calculations.

Individual PTRs depend on other household member's earnings through two channels. First, singles or single earners are more likely to be eligible for means-tested benefits in nw than secondary earners. Secondly, single and primary earners face a higher tax wedge between w and nw than secondary earners. As a result, PTRs are lowest for secondary earners in all countries. We find larger PTRs for primary earners than for secondary earners in all countries, thus corroborating the results of Immervoll et al. (2011). Tax-benefit systems create the highest disincentives for singles in Austria, Bulgaria, the Czech Republic and Spain; for single earners in Belgium, Germany, Denmark, France and Sweden; and for first earners in Greece and Italy.

Figure 3 shows that the presence of children in the household has a large effect on the PTR. We distinguish between five stylized household types: 1) single; 2) single parent; 3) couple without children; 4) couple with children; and 5) extended families. Greater variation can be seen in the PTRs among parents and particularly for single parents in Austria, the Czech Republic, Germany, Spain, France, Italy, and the United Kingdom. This is the effect of two opposing factors. On the one hand,

Figure 3: PTR Distributions by Household Type



Source: EUROMOD data, own calculations.

means-tested benefits in nw increase with the number of children in the household, which in turn increases the PTR. On the other hand, many countries offer in-work family benefits that increase work incentives and reduce the PTR. The PTR becomes negative for single parents in the Czech Republic and Italy, as well as for couples with children in Austria and the United Kingdom. We comment further on these in-work family benefits below.

The composition of the PTR by household and earner type for the latest observed year is displayed in Figure 4. PTR compositions across all observed country-years are provided in Appendix Figures A.1 and A.2. The upper part of the figure displays the PTR composition by the five household types and the bottom part displays the PTR composition by the five earner types. The rationale for showing both distinctions lies in the fact that benefits most often depend on household composition and taxes for the household can vary greatly for different earner types across countries. Income taxes as well as social security contributions and benefits are displayed as a share of individual earnings, such that adding up the components results in the individual PTR. Household income taxes and social security contribu-

tions when the individual is not working, nw, as well as benefits when employed, w, negatively enter the PTR. Accordingly, this share is denoted below the horizontal axis.

With respect to the household type, three findings are worth discussing. First, out-of-work benefits are high for families, most noticeably for single parents. Second, in-work-benefits are also high for families. Work-related child benefits are granted in Austria (*Kinderbetreuungsgeld*), Belgium (*Basiskinderbijslag*), Italy (*assegni familiari*), Greece (*koinonikó mérisma*), Germany (*Kinderzuschlag*) and Spain (*mínimo por descendientes*), which can create negative PTRs for low-income earners. Similarly, working tax credits and child tax credits that include a partial childcare cost compensation for working parents exist in the United Kingdom and comprise a substantial incentive to work. In France, low-income workers receive in-work payments in addition to the social assistance received by non-workers (*Revenue de solidarité active, RSA*). This benefit is more generous for families than for households without children, as the lump-sum depends on the number of dependent children.[13] EITCs for single earners, on the other hand, while prevalent in some countries, are often negligible compared to the in-work benefits for families. Third, the tax wedge between working and not working is lower for couples than for singles regardless of the presence of children. This tax wedge, however, varies according to the individual's earner role within the household, as demonstrated in the bottom half of Figure 4.

In the context of earner types within the household, three findings with regard to individual incentives merit discussion. First, household income taxes and social security contributions as a share of individual earnings are particularly high for secondary earners in Austria, Belgium, Denmark, Germany, and Italy. If the labor income of secondary earners represents only a small portion of overall household income, a small tax wedge results between working and not working for this earner type. In contrast, single earners face a high tax wedge between working and not working. Second, only single, sole-earner and no-earner households receive substantial out-of-work transfers, while individuals in two-earner households are mostly

[13]Additionally in France, the means test for receipt of the family complement benefit (*Complément familial*) is measured against a higher eligibility threshold for households in which two earners, rather than one, are working. In 2016, a separate in-work benefit, *Prime d'activité*, was introduced to replace this system for low income earners.

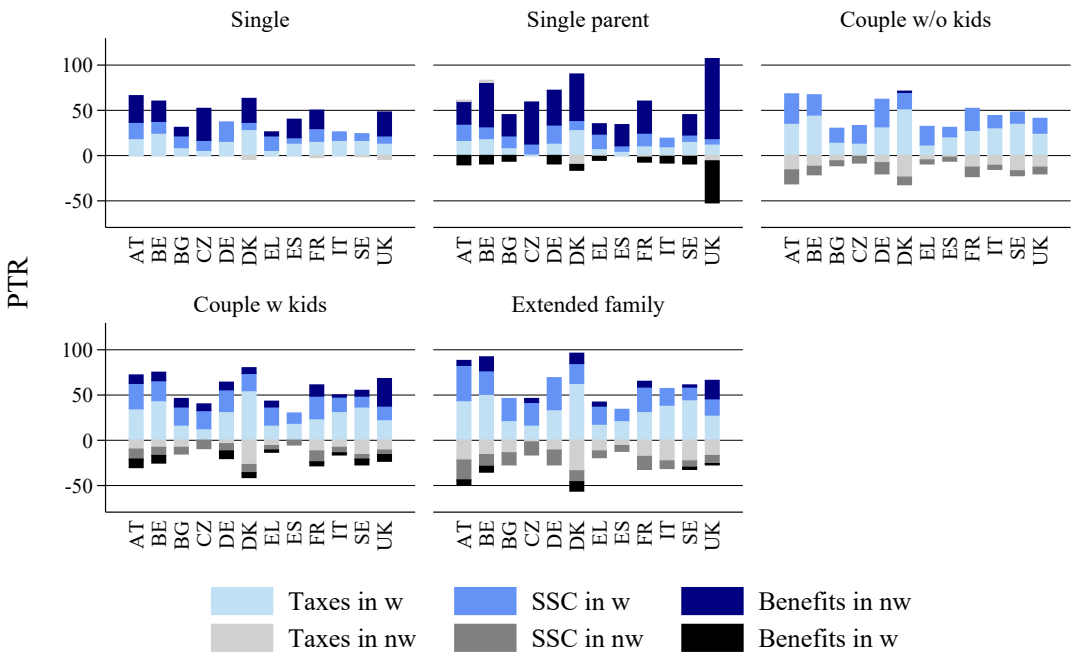
not eligible. Third, large differences result from the variation of tax-benefit systems across countries. While countries like Denmark, Germany, France, and the United Kingdom provide generous income support to the unemployed, countries like Bulgaria and Greece only offer small or no benefits.

Beyond the household context, tax-benefit systems differentially affect individual incentives depending on the level of their earnings. Because individuals with a weak attachment to the labor force on average exhibit low potential earnings and high extensive margin responses to incentives, Table 3 displays indicators of tax and benefit incidence for individuals in the bottom quintile of the earnings distribution in both possible labor states: 1) the share of benefit receipt and tax payment (% receiving/paying in w/nw); and 2) the level of taxes paid and benefits received, proportional to the bottom quintile's earnings threshold (Ratio in w/nw).

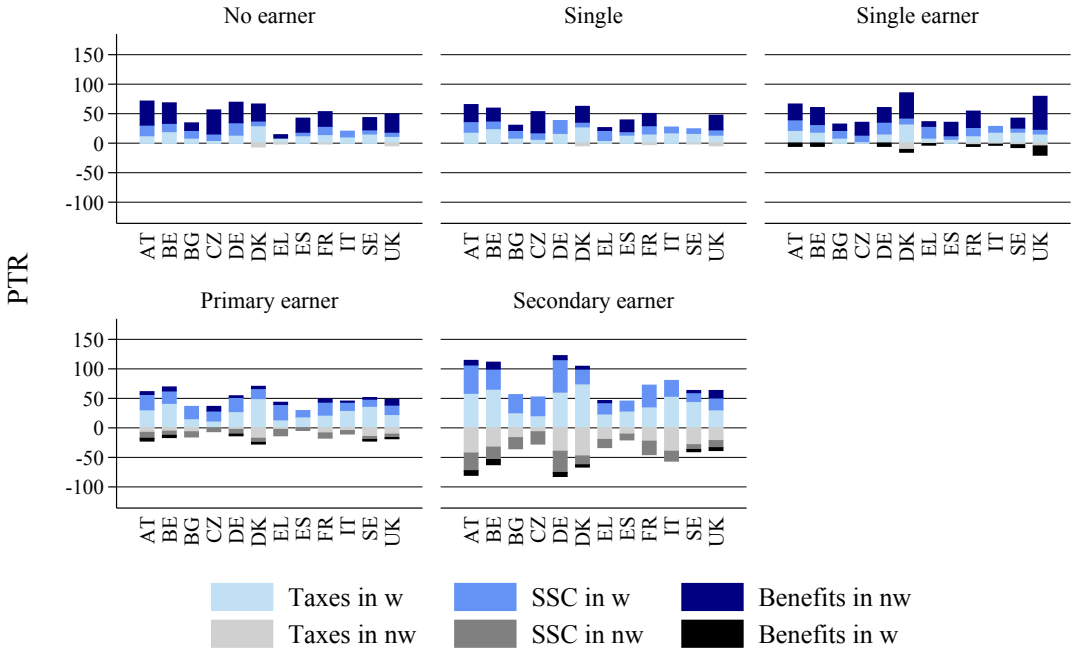
The share of benefit receipt in w and nw varies greatly across countries. In contrast, the ratio of benefits received in w, conditional on receipt, does not exceed one-fifth of the bottom quintile's earnings threshold in most countries. When these individuals do not work, the ratio of benefits to the bottom quintile's earnings threshold increases to 40-50% in Austria, Germany, Spain, and the United Kingdom; to almost 30% in France, Belgium and Denmark; and 20% or less in Bulgaria, Czech Republic, Greece, Italy, and Sweden. The difference in generosity of benefits in w and nw is highest in Austria, Belgium, Germany, Denmark, Spain, and France, indicating lower work incentives for low-income workers in comparison to countries with a small differential.

In most of the countries in our sample, almost all workers in the bottom quintile of the earnings distribution pay taxes. Only in Greece, Spain and the Czech Republic, do high tax allowances lead to roughly 12-22% of low income workers being exempt from paying taxes on their earnings. The ratio of the tax (including SIC) burden to the bottom quintile's earnings threshold, conditional on being positive, is lower than 10% in Spain, the Czech Republic and Italy, slightly higher than 10% in Austria, Belgium and Greece and between ca. 15-30% in Germany, Denmark, France, Sweden and the United Kingdom.

Figure 4: PTR Compositions by Household and Earner Type



Graphs by hhtype



Graphs by earner

Source: EUROMOD data, own calculations.
Note: Latest observed year per country, i.e. 2012, 2013 or 2014.

Table 3: Tax and Benefit Incentives for Bottom Quintile

	Benefits				Taxes	
	% receiving in w	Ratio in w	% receiving in nw	Ratio in nw	% paying in w	Ratio in w
AT	18.5	23.0	17.0	47.8	99.3	11.1
BE	16.6	10.0	41.1	26.0	99.5	11.9
BG	23.1	19.5	16.0	20.9	100.0	13.6
CZ	23.8	11.6	31.3	20.3	88.3	9.9
DE	17.1	19.5	19.3	41.2	99.2	20.7
DK	55.1	1.4	78.2	32.1	100.0	31.6
EL	8.9	21.9	7.1	20.4	78.8	11.3
ES	20.1	10.9	15.3	44.8	79.8	5.4
FR	66.1	9.4	62.6	26.9	100.0	18.5
IT	13.8	13.4	0.5	19.5	91.9	8.1
SE	37.9	11.4	57.9	17.7	99.1	15.7
UK	42.9	40.1	45.7	55.6	98.6	13.0

Note: Median values weighted using EU–SILC sample weights. Ratio refers to median benefits or taxes (including social security contributions), respectively, as a share of bottom quintile's earnings. a. based on input 2007 b. based on input 2009 c. based on input. The sample includes individuals aged 25-54 working at least 20 hours per week, excluding students, pensioners, the permanently disabled, those in compulsory military service, and those on parental leave.
Source: EUROMOD data, own calculations.

5 Results

Results include data for 12 European countries that represent a variety of welfare state systems. Regression results for Equation 4 are presented in Table 4. This table shows the naive estimates resulting from treating the PTR as exogenous to the probability of employment. Without accounting for demographic factors that potentially influence labor supply decisions, the OLS baseline regression suggests a much larger, statistically significant effect of the net-of-PTR earnings on the probability of work for women than for men. However, after controlling for heterogeneity in the sample, the coefficient for women becomes slightly negative and loses significance. For men, a positive and significant effect remains after adding controls, but the size of the coefficient is only half as large. Because one would expect the female response to be larger than the male response, the OLS estimates are likely biased toward zero, more so for women than for men. Moreover, the substantial impact of the demographic controls indicates a great deal of heterogeneity, which we exploit

in the instrumental variables approach. Further results exhibit the expected signs: higher education is associated with a higher employment probability, more strongly for women than for men, and the presence of children have opposite effects for men than for women: men with young children are more likely to work while women are less likely. Finally, the relationship between experience and the probability of working takes on a inverse u-shape and household non-labor income is shown to have a significant, but economically small, effect that is positive for men and negative for women. However, as discussed above, we expect OLS to yield biased results in an ambiguous direction due to the endogeneity of earnings to the labor supply decision as well as the PTR being a function of earnings.

Table 5 presents results for Equation 6, in which we implement the Group IV using 2SLS, instrumenting individual-level net-of-PTR earnings with the group average per year and country. Groups are defined as 5-year age cohorts and three categories of educational attainment. In the second stage, the individually observed employment dummy taking the value of one for work and zero for not working is regressed on this Group IV. Column 1 displays results with only group, country and year fixed effects as control variables. Column 2 adds demographic controls and column 3 presents results of the regression incorporating an additional country interaction term, $\beta(1-\widehat{PTR}_{it}) \cdot e_{it} \cdot \lambda_c$, to the regression. Columns 4 and 5 show results further disaggregated by gender. From these last three regressions, we calculate the country-specific and country- and gender-specific elasticities. For columns 3-5, the country-specific effect can be found by adding the overall effect captured by the coefficient in the first line of the table to the country-specific effect, whereby Austria represents the omitted country.

In accordance with economic theory that suggests an increase in work incentives yields an increased probability of gainful employment, we find a strong, positive effect of net-of-PTR earnings on employment probability. As expected, the estimates of Group IV yield higher participation responses to changes in the net-of-PTR earnings than the OLS regressions, thus indicating a downward OLS bias. The high first stage F-statistic lends credence to the use of the Group IV as a strong

Table 4: OLS Regression Results for Equation 4

	Men		Women	
	baseline	controls	baseline	controls
	(1)	(2)	(3)	(4)
(1-PTR)*earnings	0.093***	0.047**	0.243***	-0.001
	(0.000)	(0.038)	(0.000)	(0.973)
Lower secondary		-0.061**		-0.246***
		(0.029)		(0.000)
Upper secondary		-0.005		-0.114***
		(0.742)		(0.000)
Experience		0.017***		0.044***
		(0.000)		(0.000)
Experience squared		-0.000***		-0.001***
		(0.000)		(0.000)
Married		0.017		-0.094***
		(0.104)		(0.000)
Hh. non-labor income		0.014**		0.008***
		(0.019)		(0.006)
Presence of child aged 1-3		0.026***		-0.106*
		(0.000)		(0.057)
Presence of child aged 4-6		0.006		-0.038
		(0.109)		(0.101)
Presence of child aged 7-17		-0.012**		-0.056***
		(0.000)		(0.000)
Constant	0.863***	0.794***	0.816***	0.599***
	(0.000)	(0.000)	(0.000)	(0.000)
Adj. r-squared	0.039	0.094	0.076	0.281
N	172,200	172,200	176,648	176,648

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The sample includes prime working-aged individuals aged 25-54, excluding students, pensioners, the permanently disabled, and those in compulsory military service. All equations are clustered at the country level and include both year and country fixed effects. The omitted education category is post-secondary education.
Source: EUROMOD data, own calculations.

instrument for individual net-of-PTR earnings.[14] Given the different institutional settings, social norms and tastes for work and leisure across European countries,

[14]For columns 3-5, in which we have more than one instrument through the country term interactions, we calculate the F-statistic derived from the Godfrey r-squared statistic as described in Greene (2014). This procedure yields an F-statistic for each of the 12 country interaction IVs, all lying well above the critical value. See table notes for the individual country F-statistics.

it is reasonable to expect participation elasticities to vary across countries. While we find a larger response for women, on average, this difference only persists at the country-specific level for Austria, Belgium, the Czech Republic, Germany, Italy, and Sweden. The presence of children significantly reduces employment probabilities for women, while it increases employment probabilities for men, with this impact diminishing as children get older.

Results for Group IV prove rather robust to the definition of the group both in magnitude and direction of the effect. Appendix Table A.1 displays these results from the alternative definition, which includes 10-year age cohorts, three educational attainment levels, and gender.[15]

[15]Our two alternative group definitions follow the two studies of Burns and Ziliak (2015) and Jäntti et al. (2015), which both applied a Group IV in order to estimate hours and participation elasticities. Small remaining differences of the Group IV between the two group definitions are likely explained by two factors: small group cells and remaining heterogeneity within the defined groups. In particular, for small countries these cells can be quite small (below 30 observations) and yet some heterogeneity may remain. The additional demographic controls in columns (2)-(5) likely absorb most of this heterogeneity.

Table 5: Group IV Regression Results for Equation 5

	baseline	full controls	with country interaction	women	men
	(1)	(2)	(3)	(4)	(5)
(1-PTR)*earnings	0.071***	0.058***	0.095***	0.061***	0.103***
Country*(1-PTR)*earnings	no	no	yes	yes	yes
AT			0.000	0.000	0.000
BE			0.078***	0.140***	0.069***
BG			-0.044***	0.014	-0.059***
CZ			0.024**	0.122***	-0.029***
DE			0.101***	0.285***	0.049***
DK			0.039**	0.043	0.017
EL			0.028***	0.043***	0.035***
ES			0.031***	0.060***	0.023**
FR			-0.038***	-0.024	-0.034***
IT			0.088***	0.149***	0.045***
SE			0.120***	0.273***	0.013
UK			-0.024***	-0.015	-0.013
Experience		0.044***	0.042***	0.048***	0.025***
Experience sq.		-0.001***	-0.001***	-0.001***	-0.000***
HH. non-labor inc.		-0.001	0.006***	0.007***	0.007***
Presence of child aged 1-3		-0.068***	-0.070***	-0.141***	0.008***
Presence of child aged 4-6		-0.039***	-0.039***	-0.073***	0.002
Presence of child aged 7-17		-0.025***	-0.027***	-0.039***	0.003
Adj. r-squared	0.090	0.274	0.277	0.347	0.127
N	348,848	348,848	348,848	176,648	172,200

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Dependent variable: employment probability. The usual sample restrictions apply. Groups are defined as 5-year age cohorts and three educational attainment groups, following Burns and Ziliak (2015). We define groups within each European country. All regressions are estimated with 2SLS, instrumenting the individual-specific net-of-PTR earnings with the group average in each year and country. Standard errors are heteroskedasticity robust and are corrected for generated variables bias. The country-specific F-statistic for the main specification in column 3 is 299 in AT, 81 in BE, 74 in BG, 167 in CZ, 266 in DE, 102 in DK, 226 in EL, 326 in ES, 73 in FR, 407 in IT, 142 in SE and 183 in UK.
Source: EUROMOD data, own calculations.

From the marginal effects of the regression in Equation 6, we calculate the static, within-period participation elasticity. Our findings indicate an EU-average elasticity of 0.08 for men and of 0.14 for women.[16] Figure 5 captures these country-specific elasticities estimated in Equation 6 for men and women separately by adding a country interaction, as shown in columns 3-5 in Table 5.

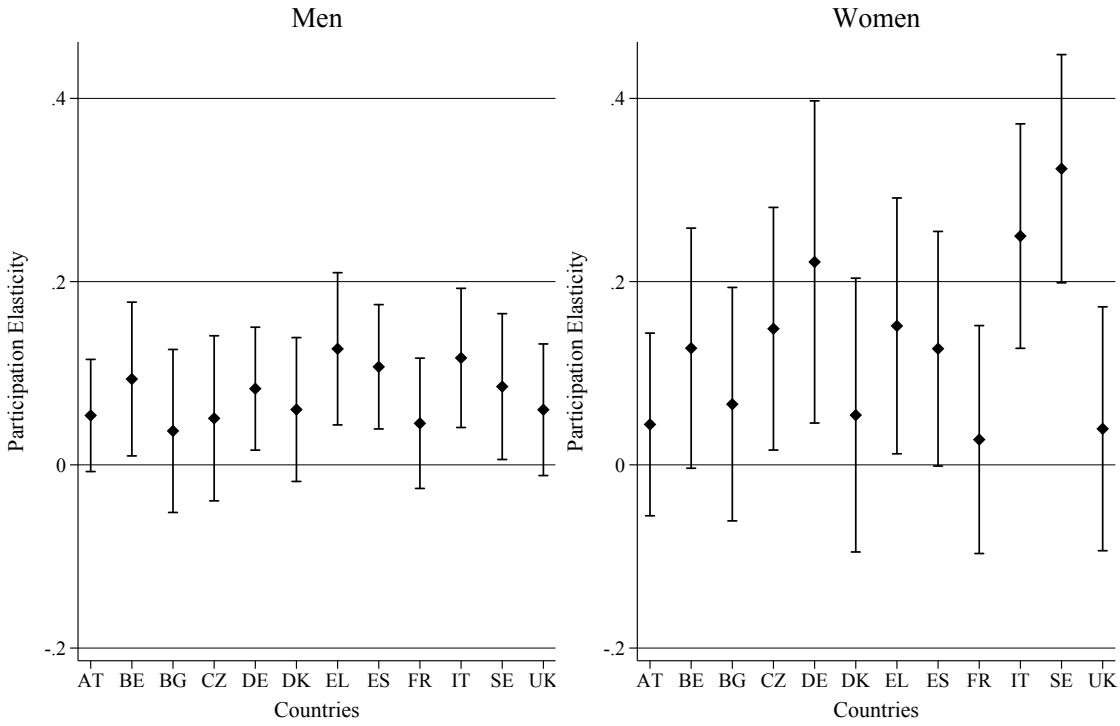
An overall country-specific pattern is observable across gender, in which higher elasticities for men in one country compared to another generally translate into higher relative female elasticities as well. Participation elasticities are high in Belgium, Germany, Greece, Spain, Italy, and Sweden, while they are low and not statistically different from zero in Bulgaria, France, and the United Kingdom. In these countries, especially Bulgaria and France, labor market participation is already high (see Table 1), leaving few individuals on the margin between participating and not participating in the labor force. Perhaps even more striking than the difference in the size of the estimates for men and women is the large dispersion in the elasticities among women, indicating substantial heterogeneity that is not captured by gender alone.[17]

Beyond identifying average male and female responses to work incentives, in the second step of our analysis, we further disaggregate the impact of these disperse PTRs by earner roles within the household. Figures 6 and 7 display elasticities for men and women, respectively, according to their potential earner role within the household when in labor state w. These figures reveal that men and women respond similarly if compared within the same household earner role. This result corroborates Blau and Kahn (2006) who find that women's labor supply elasticities approached men's in the US from 1980 to 2000 as the traditional division of labor broke down. Male and female primary earners in almost all countries exhibit elasticities indistinguishable from zero with very little variance. Only men in Greece, Spain, and Sweden, as well as women in Italy and Sweden show statistically significant and small responses. Likewise for singles, gender appears to matter little: only women in

[16]These averages are weighted using the individual EUROMOD sample weights.

[17]This finding corroborates work by Bastani et al. (2017), who estimate PTRs by skill level and emphasize the importance of providing heterogeneous estimates to be used in the calibration of structural models.

Figure 5: Participation Elasticities by Country



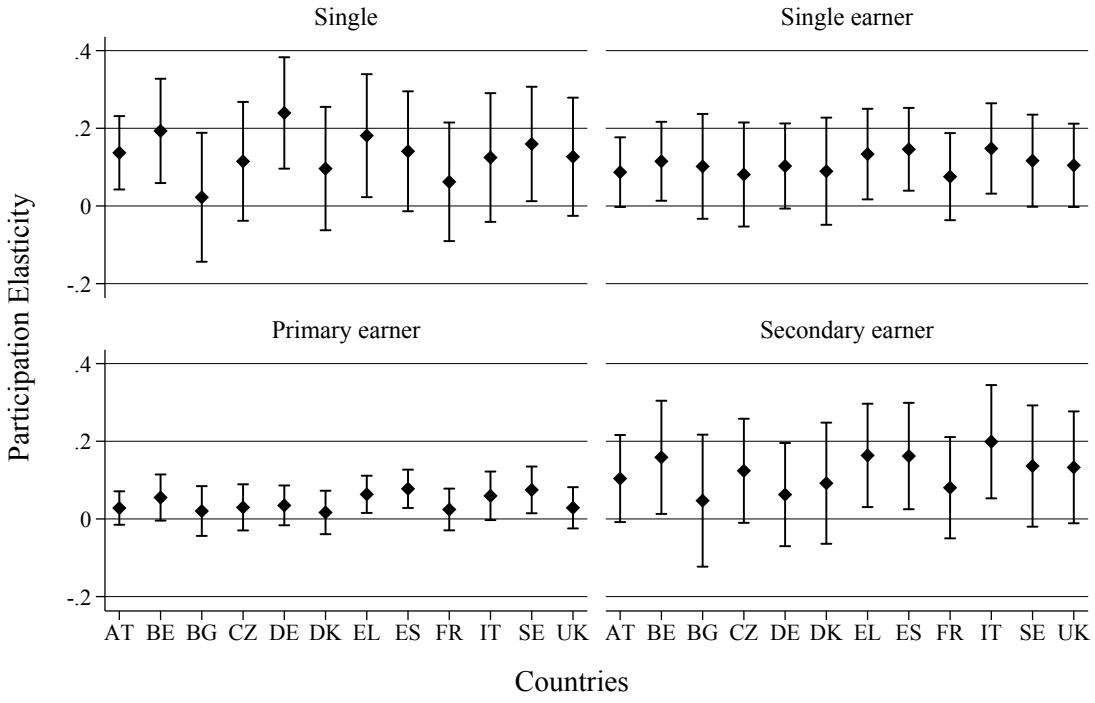
Source: EUROMOD data, own calculations.
Note: Vertical lines show cluster robust confidence intervals at the 95%-level.

Germany and Sweden and men in Austria, Belgium, Germany, Greece, and Sweden reacted significantly to monetary incentives to work. Where significant, elasticities for singles appear to be quite large with varying magnitudes across countries. With respect to sole earners, the size of the effects for men and women are similar, while the elasticity is only statistically different from zero for women in Sweden and for men in Belgium, Greece, Spain, and Italy. In contrast, both male and female secondary earners were the most responsive in terms of size and significance of their respective elasticities, although more variance exists among male secondary earners than for female secondary earners. These results demonstrate that elasticities vary much more according to earner type than by gender. The fact that women are secondary earners more frequently than men drives their average elasticity upward. A closer consideration of what drives this behavior uncovers the importance of the specific earner role that the individual plays within the household.

In a final disaggregated analysis, we tie our results into work by Aghion et al. (2017) and Abeler and Jäger (2015) on the importance of salience in determining

responses to changes in tax-benefit systems. In the following, we consider the extent to which individuals react differentially to the three main components of the PTR: taxes, social insurance contributions, and benefits. Just as we defined the PTR as the household's tax wedge between w and nw, it is possible to break this term down into the wedge for taxes, SIC, and benefits before formulating the net-of-tax earnings from each of these wedges: $(1 - \frac{tax}{e}) * e$ for taxes, $(1 - \frac{SIC}{e}) * e$ for SIC, and $(1 - \frac{ben}{e}) * e$ for benefits. The expected direction of the effect is the same as for the entire net-of-PTR earnings term, but the reaction of individuals to each of these components could vary according to differences in the salience of taxes, SICs or benefits.[18]

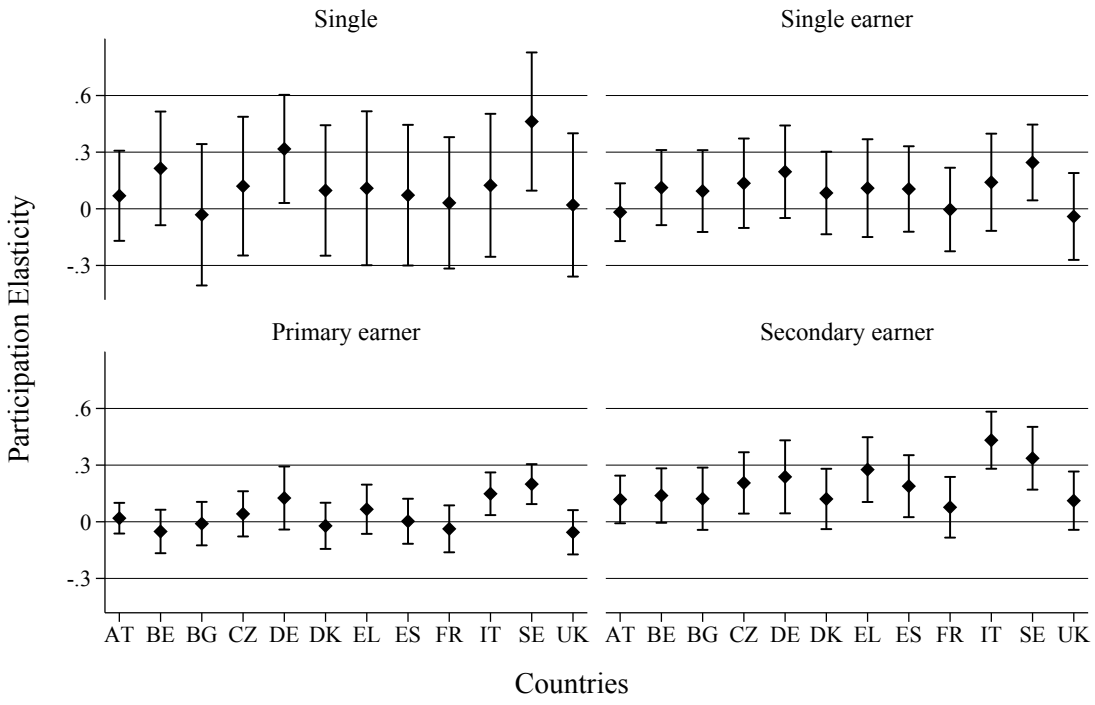
Figure 6: Participation Elasticities by Earner type, Men



Source: EUROMOD cross-sectional data and microsimulation, own calculations.
Note: Vertical lines show cluster robust confidence intervals at the 95%-level.

[18]The tax and SIC wedges are defined as $\frac{tax^w - tax^{nw}}{e}$ and $\frac{SIC^w - SIC^{nw}}{e}$, respectively, whereas the benefit wedge, generally larger in the state of nw than in w, is defined as $\frac{ben^{nw} - ben^w}{e}$.

Figure 7: Participation Elasticities by Earner type, Women



Source: EUROMOD data, own calculations.
Note: Vertical lines show cluster robust confidence intervals at the 95%-level.

Table 6 displays average elasticities for men and women by country with respect to these separate components. Two findings are noteworthy. First, for men and women across all countries, elasticities do not very substantially between types of tax wedges. While significance levels differ slightly, the size of the effect does not seem to be driven asymmetrically by one PTR component more than the other. Second, while elasticities for men, with respect to the overall net-of-PTR earnings, are only significant in half of the countries in the sample (compare Figure 5), reactions to the individual components are statistically more significant. With the exception of taxes in Denmark, all male elasticities for the individual components are statistically significant across all countries.

Table 6: Participation elasticity by PTR component

		Income tax		Soc. ins. contributions		Benefits	
		Elasticity	SE	Elasticity	SE	Elasticity	SE
AT	Women	0.05	0.04	0.05	0.05	0.06	0.02
BE	Women	0.07	0.04	0.08	0.06	0.08	0.04
BG	Women	0.06	0.04	0.06	0.06	0.07	0.03
CZ	Women	0.13	0.05	0.12	0.07	0.13	0.03
DE	Women	0.16	0.05	0.16	0.07	0.19	0.04
DK	Women	0.05	0.05	0.06	0.07	0.06	0.03
EL	Women	0.18	0.05	0.16	0.07	0.18	0.03
ES	Women	0.11	0.05	0.11	0.07	0.11	0.03
FR	Women	0.02	0.04	0.02	0.07	0.02	0.03
IT	Women	0.26	0.04	0.26	0.06	0.30	0.03
SE	Women	0.24	0.05	0.26	0.06	0.27	0.04
UK	Women	0.03	0.05	0.03	0.07	0.03	0.03
AT	Men	0.07	0.02	0.07	0.02	0.08	0.02
BE	Men	0.10	0.03	0.11	0.02	0.12	0.02
BG	Men	0.06	0.03	0.06	0.02	0.06	0.02
CZ	Men	0.07	0.03	0.07	0.02	0.07	0.02
DE	Men	0.09	0.02	0.09	0.02	0.11	0.02
DK	Men	0.05	0.03	0.07	0.02	0.07	0.02
EL	Men	0.13	0.02	0.12	0.02	0.14	0.02
ES	Men	0.13	0.03	0.13	0.02	0.13	0.02
FR	Men	0.07	0.02	0.06	0.02	0.07	0.02
IT	Men	0.12	0.03	0.13	0.03	0.15	0.02
SE	Men	0.11	0.03	0.12	0.03	0.13	0.02
UK	Men	0.08	0.02	0.09	0.02	0.09	0.02

Note: The sample includes prime working-aged individuals aged 25-54, excluding the self-employed, students, pensioners, the permanently disabled, and those in compulsory military service. Standard errors are clustered at the country level.
Source: EUROMOD data, own calculations.

6 Conclusion

In this paper, we compute Participation Tax Rates (PTRs) across the EU as a comprehensive measure of work disincentives inherent in tax-benefit systems. We find varying degrees of disincentives that were larger on average for men and that increase with gross individual earnings, which is related to the progressivity of most European tax-benefit systems. Throughout the period under investigation, large

disparities between countries persisted, but remained relatively constant across time despite several individual reforms.

Disentangling the drivers of the PTRs, we find that the relative importance of taxes, social insurance contributions and benefits largely depends on household composition and the individual's earner role within the household. Tax-benefit systems create the highest disincentives for singles in Austria, Bulgaria, the Czech Republic, and Spain; for sole earners in Belgium, Germany, Denmark, France and Sweden; as well as for first earners in Greece and Italy. Across European countries, PTRs are lowest for secondary earners. High PTRs for singles, sole earners, and those observed not working are the result of substantial out-of-work benefits in Denmark, France, Germany, and the United Kingdom, while out-of-work benefits are very small or even non-existent in Bulgaria, Greece, and Italy. Comparably higher PTRs for secondary earners in Austria, Belgium, Denmark, Germany, and Italy are the result of a high tax and social insurance contribution wedge between participation and non-participation.

Negative PTRs arise in several countries for working families with children at the bottom of the earnings distribution from substantial in-work benefits or earned income tax credits (EITCs). More precisely, work incentives are upwardly distorted for single parents and single earners in the Czech Republic and Italy as well as for couples with children (single earner or first earner) in Austria and the United Kingdom. This finding is of particular interest as optimal tax theory shows negative PTRs can be optimal at the bottom of the earnings distribution for one-earner households as well as for families if the social weight placed on this group is sufficiently high (Saez; 2002; Immervoll et al.; 2011; Choné and Laroque; 2011; Jacquet et al.; 2013; Hansen; 2017). While two-earner households benefit from economies of scale, childcare costs for parents of small children create higher fixed costs associated with working, which may suggest a lower optimal PTR in comparison to childless households. The present paper empirically documents the widespread existence of negative PTRs as a result of means-tested in-work benefits for some countries and earner types. In contrast, in-work benefits for individuals without children are either non-existent or small in most European countries. Only in Sweden is eligibility for

the EITC independent of the number of children in the household, which could be rendered unnecessary due to the general availability of publicly provided childcare. Belgium, Bulgaria, and Denmark do not have substantial in-work benefits.

A reform reducing the PTR of a particular group only increases efficiency if participation elasticities of this group are sufficiently high. In the second step of our analysis, we identify the impact of the disperse PTRs on labor supply and estimated marginal effects on an aggregate level as well as by country, gender and earner roles within the household. We find an average participation elasticity of 0.08 for men and of 0.14 for women, as well as a high degree of heterogeneity across countries. Countries with high extensive margin responses include: Belgium, Germany, Greece, Italy, Spain, and Sweden. Bulgaria, France and the United Kingdom, in contrast, exhibit elasticities not statistically different from zero. In these countries, especially Bulgaria and France, labor market participation is already high, leaving few individuals on the margin between participation and non-participation.

Gender turns out not to be the characteristic that best predicts individual responses to monetary incentives for work. A further analysis reveals that men and women respond similarly if compared within the same household earner role. Typically, both male and female primary earners, sole earners, and singles show elasticities indistinguishable from zero. In contrast, both male and female secondary earners were the most responsive in terms of size and significance of their respective elasticities. Participation elasticities of male secondary earners are mostly between 0.1 and 0.2 and between 0.1 and 0.3 for female secondary earners. In a final step, we investigate whether individuals react differentially to separate components of the PTR, namely taxes, social security contributions, and benefits, in order to determine if one or more of these are driving the effect. However, we do not find asymmetric reactions to the different components that diverged from the overall country elasticity for men and women, which could be attributed to insufficient variation allowing for identification of such effects.

Our average estimates corroborate the smaller participation elasticities found by other studies that likewise compute reduced-form participation elasticities across countries, namely Jäntti et al. (2015) and Kalísková (2015). Jäntti et al. (2015)

find a range of elasticities, mostly between 0-0.2, with statistically insignificant results in many countries. Kalísková (2015) estimates an average female participation elasticity of 0.08 between 2005-2010 for an EU-wide sample of women from 26 countries. Our results – estimated on the basis of cross-country data, the full prime working-aged population and the tax-benefit system as a whole – demonstrate different participation elasticities when compared to existing studies using quasi-experimental settings. These studies, mainly using US and UK data, tend to find larger reactions: On average, studies reviewed by Chetty et al. (2013) find a participation elasticity of 0.28 and estimates range from 0.13 to 0.43. This discrepancy could be explained by the use of large and intensively discussed reforms such as the introduction of the EITC in the US which cause disproportionately high reactions in the target group. Smaller behavioral responses imply that government policies may have a less distortionary effect on labor supply in the short run than existing studies suggest.

Taken together, our findings caution against using participation elasticities calculated in the context of country-specific case studies as broadly valid across countries and socioeconomic groups when calibrating structural labor supply models and/or predicting welfare effects from simulating tax-benefit reforms for the entire working-aged population. Such estimates are likely to be upward biased.

References

Abeler, J. and Jäger, S. (2015). Complex Tax Incentives, *American Economic Journal: Economic Policy* **7**: 1–28.

Adam, S., Brewer, M. and Shephard, A. (2006). *The poverty trade-off. Work incentives and income redistribution in Britain*, Policy Press.

Aghion, P., Akcigit, U., Lequien, M. and Stantcheva, S. (2017). Tax Simplicity and Heterogeneous Learning, *NBER Working Paper No. 24049* .

Angrist, J. D. (1991). Grouped-data estimation and testing in simple labor-supply models, *Journal of Econometrics* **47**(2): 243 – 266.

Bartels, C. and Pestel, N. (2016). Short- and long-term participation tax rates and their impact on labor supply, *International Tax and Public Finance* **23**(6): 1126–1159.

Bastani, S., Moberg, Y. and Selin, H. (2017). The anatomy of the extensive margin labor supply response.

Blau, F. D. and Kahn, L. M. (2006). The u.s. gender pay gap in the 1990s: Slowing convergence, *Industrial and Labor Relations Review* **60**(1): 45–66.

Blundell, A., Duncan, A. and Meghir, C. (1998). Estimating Labor Supply Responses Using Tax Reforms, *Econometrica* **66**(4): 827–861.

Brewer, M., Saez, E. and Shephard, A. (2008). Means-testing and tax rates on earnings, Prepared for the Report of a Commission on Reforming the Tax System for the 21st Century, Chaired by Sir James Mirrlees, Institute for Fiscal Studies.

Burns, S. K. and Ziliak, J. P. (2015). Identifying the elasticity of taxable income, *The Economic Journal* **127**: 297–329.

Chetty, R., Guren, A., Manoli, D. and Weber, A. (2013). Does Indivisible Labor Explain the Difference between Micro and Macro Elasticities? A Meta-Analysis of Extensive Margin Elasticities, *NBER Macroeconomics Annual 2012* **27**: 1–56.

Choné, P. and Laroque, G. (2011). Optimal taxation in the extensive model, *Journal of Economic Theory* **146**(2): 425 – 453.

Cogan, J. F. (1981). Fixed costs and labor supply, *Econometrica* **49**(4): 945–963.

Dockery, A., Ong, R. and Wood, G. (2011). Welfare Traps in Australia: Do they bite?, *CLMR Discussion Paper Series No. 08/02* .

Eissa, N. and Liebman, J. (1996). Labor Supply Response to the Earned Income Tax Credit, *Quarterly Journal of Economics* **111**: 605–637.

Goolsbee, A. (1999). Evidence on the high-income laffer curve from six decades of tax reform, *Brookings Papers on Economic Activity* **1999**(2): 1–64.

Greene, W. H. (2014). *Econometric Analysis: International Edition: Global Edition*, Pearson series in economics, Pearson Education Limited.

Hansen, E. (2017). Optimal income taxation with labor supply responses at two margins: When is an Earned Income Tax Credit optimal?, *Discussion Paper Series of the Max Planck Institute for Research on Collective Goods* (2017/10).

Heckman, J. (1979). Sample Selection Bias as a Specification Error, *Econometrica* **47**: 153–161.

Heckman, J. and Robb, R. (1985). Alternative methods for evaluating the impact of interventions: An overview, *Journal of Econometrics* **30**(1-2): 239–267.

Immervoll, H., Kleven, H., Kreiner, C. and Saez, E. (2007). Welfare reform in European countries: a microsimulation analysis, *The Economic Journal* **117**: 1–44.

Immervoll, H., Kleven, H., Kreiner, C. and Verdelin, N. (2011). Optimal tax and transfer programs for couples with extensive labor supply responses, *Journal of Public Economics* **95**: 1485–1500.

Jacquet, L., Lehmann, E. and Van der Linden, B. (2013). Optimal redistributive taxation with both extensive and intensive responses, *Journal of Economic Theory* **148**(5): 1770–1805.

Jäntti, M., Pirttilä, J. and Selin, H. (2015). Estimating labour supply elasticities based on cross-country micro data: A bridge between micro and macro estimates?, *Journal of Public Economics* **127**: 87–99.

Kalísková, K. (2015). Tax and transfer policies and the female labor supply in the EU, *IZA DP No. 8949* .

Meghir, C. and Phillips, D. (2010). Labor Supply and Taxes, Chapter 3 for Mirrlees Review (2009), *in* J. Mirrlees, S. Adam, T. Besley, R. Blundell, S. Bond, R. Chote, M. Gammie, P. Johnson, G. Myles and J. Poterba (eds), *Dimensions of Tax Design: the Mirrlees Review*, Oxford University Press.

O'Donoghue, C. (2011). Do tax-benefit systems cause high replacement rates? A decompositional analysis using EUROMOD, *LABOUR* **25**: 126–151.

Piketty, T. and Saez, E. (2013). Optimal labor income taxation, *in* M. F. Alan J. Auerbach, Raj Chetty and E. Saez (eds), *Handbook of Public Economics 5*, pp. 391–474.

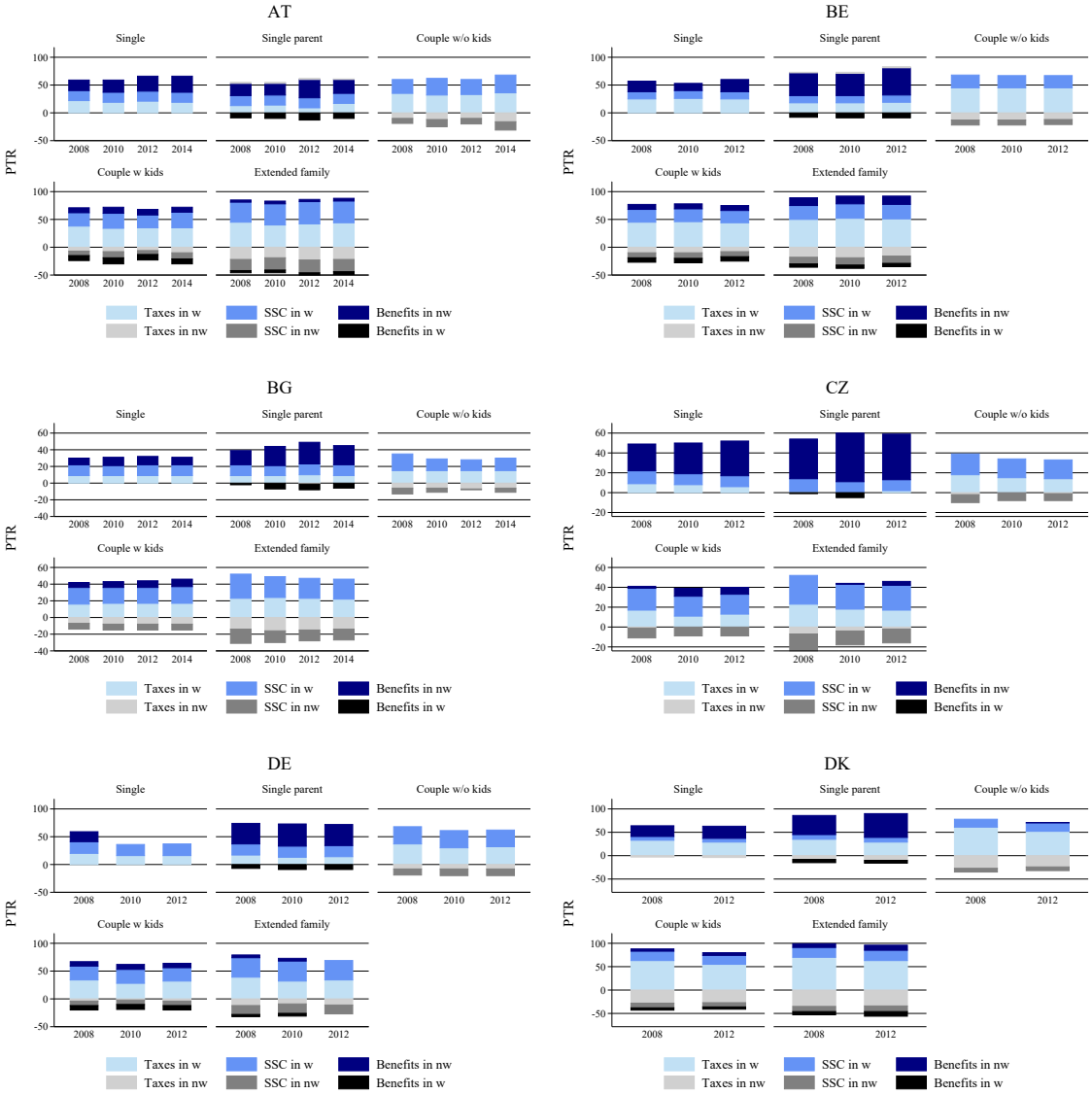
Pirttillä, J. and Selin, H. (2011). Tax Policy and Employment: How does the Swedish system fare, *CESifo Working Paper Series No. 3355* .

Saez, E. (2002). Optimal Income Transfer Programs: Intensive versus Extensive Labor Supply Responses, *Quarterly Journal of Economics* **117**: 1039–1073.

Sutherland, H. and Figari, F. (2013). EUROMOD: The European Union Tax-Benefit Microsimulation Model, *International Journal of Microsimulation* **6**(1): 4–26.

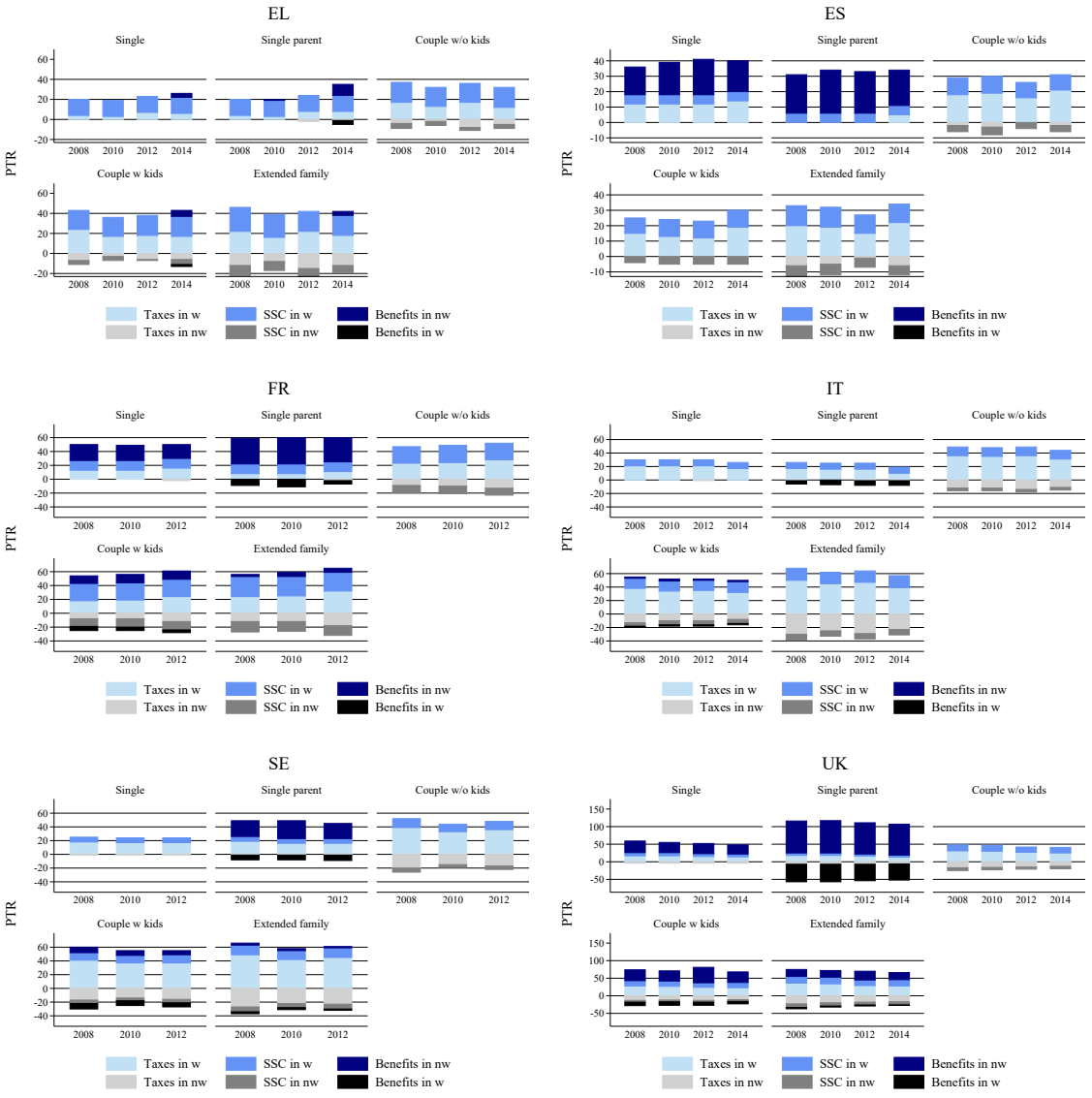
A Appendix

Figure A.1: PTR composition by country and year



Source: EUROMOD data, own calculations.

Figure A.2: PTR composition by country and year



Source: EUROMOD data, own calculations.

Table A.1: Group IV Regression Results with Alternative Group Definition

	baseline	full controls	with country interaction	women	men
	(1)	(2)	(3)	(4)	(5)
(1-PTR)*earnings	0.122***	0.069***	0.033***	0.054***	0.105***
Country*(1-PTR)*earnings	no	no	yes	yes	yes
AT			0.000	0.000	0.000
BE			0.074***	0.147***	0.076***
BG			-0.012*	0.012	-0.060***
CZ			0.073***	0.134***	-0.022**
DE			0.081***	0.279***	0.049***
DK			-0.001	0.045	0.019
EL			0.074***	0.048***	0.028**
ES			0.037***	0.063***	0.023**
FR			-0.019***	-0.017	-0.029***
IT			0.113***	0.153***	0.038***
SE			0.137***	0.257***	0.008
UK			-0.008	-0.016	-0.015
Experience		0.041***	0.040***	0.047***	0.023***
Experience sq.		-0.001***	-0.001***	-0.001***	-0.000***
HH. non-labor inc.		0.002***	0.003***	0.006***	0.009***
Presence of child aged 1-3		-0.064***	-0.067***	-0.137***	0.010***
Presence of child aged 4-6		-0.036***	-0.037***	-0.073***	0.004
Presence of child aged 7-17		-0.026***	-0.028***	-0.046***	-0.001
Adj. r-squared	0.121	0.267	0.271	0.336	0.117
N	348,848	348,848	348,848	176,648	172,200

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Dependent variable: employment probability. The sample includes prime working-aged individuals aged 25-54, excluding students, pensioners, the permanently disabled and those in compulsory military service. Groups are defined as 10-year age cohorts, three educational attainment groups and gender, following Jäntti et al. (2015). We define groups within each European country. All regressions are estimated with 2SLS, instrumenting the individual-specific net-of-PTR earnings with the group average in each year and country. Standard errors are heteroskedasticity robust and are corrected for generated variables bias. The country-specific F-statistic for the main specification in column 3 is 1419 in AT, 63 in BE, 599 in BG, 514 in CZ, 537 in DE, 1775 in DK, 592 in EL, 1981 in ES, 450 in FR, 2169 in IT, 473 in SE and 2741 in UK.

Source: EUROMOD data, own calculations.

Table A.2: Group IV Regression Results by Household Type - All

	single	single parent	couple w/kids	couple w/o kids	extended family
	(1)	(2)	(3)	(4)	(5)
(1-PTR)*earnings	0.269***	-0.066	0.127***	0.013	0.069**
Country*(1-PTR)*earnings	no	no	yes	yes	yes
AT	0.000	0.000	0.000	0.000	0.000
BE	0.077	0.346**	0.050**	0.008	0.030
BG	-0.262***	0.015	-0.049**	-0.021	-0.012
CZ	-0.064	0.315***	0.011	0.065***	0.076***
DE	0.188***	0.567***	0.050***	0.094***	0.067**
DK	-0.073	0.313*	0.077**	-0.020	0.011
EL	-0.119**	0.078	-0.008	0.044***	0.026
ES	-0.095*	0.147	0.012	0.051***	0.059***
FR	-0.176***	0.068	-0.049***	-0.023*	-0.026
IT	-0.115**	0.111	0.055***	0.133***	0.077***
SE	0.024	0.357**	0.136***	0.056**	0.013
UK	-0.148***	0.135	-0.064***	-0.002	-0.030
Experience	0.026***	0.051***	0.029***	0.054***	0.047***
Experience sq.	-0.000***	-0.001***	-0.000***	-0.001***	-0.001***
HH non-labor inc.	-0.015	-0.009	0.024***	-0.023***	0.013***
Presence of child aged 1-3	0.000	-0.121***	0.000	-0.057***	-0.068***
Presence of child aged 4-6	0.000	-0.069***	0.000	-0.038***	-0.025***
Presence of child aged 7-17	0.000	-0.026	0.000	-0.052***	-0.024**
Adj. R-squared	0.122	0.291	0.199	0.313	0.356
N	33,112	11,506	72,777	121,089	40,149

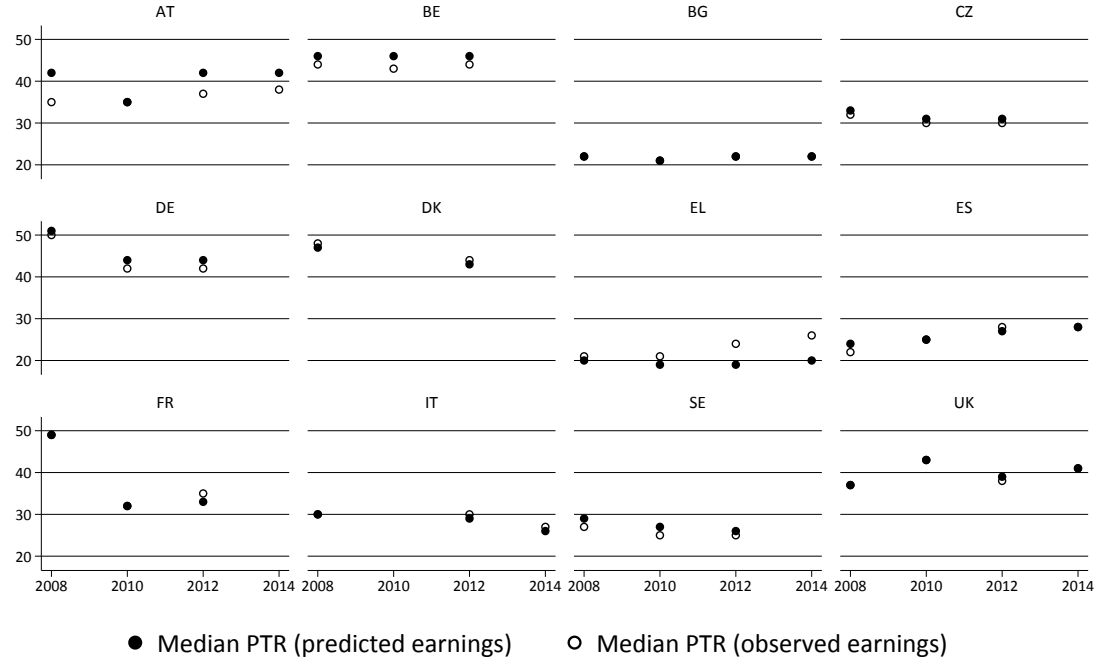
t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Dependent variable: employment probability. The sample includes prime working-aged individuals aged 25-54, excluding students, pensioners, the permanently disabled and those in compulsory military service. Groups are defined as 5-year age cohorts and three educational attainment groups. We define groups within each European country. All regressions are estimated with 2SLS, instrumenting the individual-specific net-of-PTR earnings with the group average in each year and country. Standard errors are heteroskedasticity robust and are corrected for generated variables bias.

Source: EUROMOD data, own calculations.

Figure A.3: Median PTR based on predicted vs. observed earnings



Source: EUROMOD data, own calculations.