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Drivers of Participation Elasticities across Europe: Gender or Earner Role within the Household?*

CHARLOTTE BARTELS[†] CORTNIE SHUPE[‡]

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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 breadwinners and secondary earners separately, according to their potential earnings rather than gender. Our results show an average participation elasticity of 0.0-0.1 among breadwinners and 0.1-0.4 among secondary earners in the EU as well as a high degree of heterogeneity across countries.

JEL Classification: H24, H31, J22, J65

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

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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, because these distortions may create high efficiency costs.¹ Of particular concern are low participation rates among low-skilled individuals and secondary earners with weak labor market attachment, as these groups traditionally exhibit high responsiveness to monetary employment incentives. While the literature has emphasized the need to consider the heterogeneity in response, studies tend to equate secondary earners with women despite the growing share of two-earner and female breadwinning households (see, for example, Goldin; 2006; Alesina et al.; 2011; US Bureau of Labor Statistics; 2017). In this paper, we show that heterogeneity by earner role is a more appropriate economic measure than heterogeneity by gender.

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.² 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.³

This paper is the first to show that, across countries, differences in male and female participation elasticities dissipate once the earner role within the household is consid-

¹The resulting, substantial fiscal costs of inactivity include expenses for out-of-work benefits, foregone taxes and social security contributions. For an early and a recent contribution to this debate, see Prescott (2004) and Bick and Fuchs-Schündeln (2018).

²An 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.

³It 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). Bargain et al. (2014) estimate a structural discrete choice model using numeric simulation to calculate labor supply elasticities for several European countries and the United States and obtain results in line with the magnitude found in quasi-experimental studies. Much smaller within-period micro-elasticities are found in two reduced form studies that exploit incremental changes in the tax-benefit system.

ered. The traditional distinction between male and female participation elasticities overestimates the response of female breadwinners and underestimates the response of male secondary earners. We argue that considering the earner role as the main characteristic is of increasing relevance given the rising importance of female breadwinners. The marginal worker in a couple is the lower earning spouse and not necessarily the woman, as demonstrated for the US by McClelland et al. (2014). We thereby add an important dimension to existing cross-country studies estimating participation elasticities for socioeconomic groups. For example, Bargain et al. (2014) restrict their analysis to women and men by marital status, Kalíšková (2018) exclusively studies female labor supply, and Jäntti et al. (2015) conduct a subanalysis between men and women. 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; McClelland et al.; 2018). The finding that other earner roles in most countries do not respond to work incentives limits the case for policymakers to further reduce PTRs for these groups, if the motivation is to increase labor force participation.

Our study also contributes to the literature estimating PTRs using tax-benefit simulation models and analyzing incremental changes. We document the size and distribution of work disincentives, as measured by Participation Tax Rates (PTRs), across twelve EU countries between 2008-2014, using EUROMOD data and the accompanying tax and benefit calculator.⁴ 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.

Using an instrumental variable (IV) approach to estimate participation elasticities across European countries, we build on Jäntti et al. (2015) and Kalíšková (2018). We establish exogeneity through a group IV that instruments the individual-level net-of-PTR earnings with the group average such that common biasing factors in the labor supply

⁴EU cross-country studies estimating PTRs based on the tax-benefit simulation model EUROMOD from earlier time periods include Immervoll et al. (2007), Immervoll et al. (2011) and O'Donoghue (2011). Kalíšková (2018) uses EUROMOD data covering 2005-2010 to estimate PTRs for women. Several country studies evaluate PTRs over time: Dockery et al. (2011) for Australia, Collado (2018) for Belgium, 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.

equation cancel out. We use the same instrument as Jäntti et al. (2015), but different from Kalíšková (2018), who employs a simulated IV approach for a pooled EU-wide sample of women. Extending work from 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. In contrast to Jäntti et al. (2015) and Bargain et al. (2014), our methodology overcomes the limitation of defining earner status according to gender and allows us to consider participation elasticities through the lens of different earner roles within the household, irrespective of gender.⁵

Our main results are the following. First, disentangling the components of the PTRs, we find that the relative importance of taxes, social insurance contributions and benefits largely depends on the individual's earner role within the household and the presence of children. In line with optimal tax theory, which shows that 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; 2021), we document negative PTRs in several countries for low-income workers in families with children. Secondly, participation elasticities between breadwinners (0.02) and secondary earners (0.05) among married or cohabiting couples with children differ almost three fold. Country-specific participation elasticities for breadwinners range between near zero to 0.13 and for secondary earners between 0.08 and 0.39 and are statistically significant in most countries. Finally, by comparing elasticities within the same earner role, i.e., breadwinners or secondary earners, the well-established difference between male and female participation elasticities dissipates.

This paper is structured as follows. In Section 2, we derive our 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 earner role and the presence of children. 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

⁵Due to the focus in this paper on comparing participation responses between different earner roles rather than countries, we use a pooled sample in our main specification rather than running separate regressions for each country. Separate estimation results for each country are available from the authors upon request.

our regression results and discusses our estimated participation elasticities. Section 6 concludes.

2 Empirical Approach

2.1 Basic Model

Our analysis is embedded into the economic framework of a static labor supply model, in which an individual i maximizes household utility $u(y_{ht} - T(e_{it}, e_{-it}, z_{ht}), q)$, where e_{it} denotes individual earnings, e_{-it} spouse's earnings, and y_{ht} denotes household income defined as $y_{ht} = e_{it} + e_{-it} + z_{ht}$. z_{ht} expresses household non-labor income such as asset income in year t . e_{it} can also be expressed as the product of wages and hours worked. We use the composite term, gross monthly earnings. $T(e_{it}, e_{-it}, z_{ht})$ are taxes and social security contributions paid net of any public transfers (benefits) received. Changes in household taxes and transfers between working and non-working not only depend on household income as a whole, but on individual earnings, the earner role in the household (e.g., primary vs. secondary earner) and individual as well as household characteristics (e.g., single vs. couple), in particular. At the extensive margin, fix costs, denoted as q , 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 (see, e.g., Piketty and Saez; 2013; Cogan; 1981).

Following Immervoll et al. (2007), we assume that individual i enters employment if the financial gain from working is positive considering all resulting changes in taxes and transfers that the household faces as a whole. This condition for taking up a job can be formulated as

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

which can be reformulated into a net-of-tax expression as

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

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 equation of interest can be formulated as follows:

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

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 parameter β , which, if estimated consistently, permits us to quantify the participation elasticity. In the above equation of interest, the error term η_{it} is likely correlated with the PTR, thus causing an endogeneity problem that we address in Section 2.4. We add an interaction term in order to allow for heterogeneous effects in the reaction to tax and benefit incentives across countries c .

$$P(w_{it}) = \alpha + \beta(1 - PTR_{it}) \cdot e_{it} + \gamma(1 - PTR_{it}) \cdot e_{it} \cdot \lambda_c + \eta_{it} \quad (2)$$

Estimating this equation separately by gender s and earner role r , it is possible to calculate the gender- or earner-role-specific elasticity in each country based on the definition of Saez (2002) and adjusted to the PTR context:

$$PE_{csr} = (\widehat{\beta}_{sr} + \widehat{\lambda}_{csr}) \cdot \frac{\overline{(1 - PTR_{csr})}}{\overline{P(w)_{csr}}} \quad (3)$$

where $\overline{PTR_{csr}}$ is the average PTR by gender s or earner role r in each country c and $\overline{P(w)_{csr}}$ is the respective sample employment rate in each country. We differentiate be-

tween breadwinners and secondary earners. Breadwinners can be either single-person households, sole earners in a joint household or the higher earning individual in a household.

2.2 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 ,

$$PTR_i \equiv \frac{T(y_h^w) - T(y_h^{nw})}{e_i} \quad (4)$$

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 , i.e., $T = t_h - b_h$.

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 with means-tested social assistance 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 generally 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).

For individuals observed in w , we assign zero labor earnings in the counterfactual situation nw . We then obtain gross household income in both potential labor market states as $y_h = \hat{e}_i + \sum_{j \neq i}^N e_j + z_h$, whereby $\hat{e}_i = 0$ when the individual is in labor market state nw . For those observed out of work (nw), we must simulate and predict gross monthly earnings in the counterfactual labor status w . In order to treat workers and non-workers harmoniously and to test the accuracy of this prediction, we use simulated earnings for both workers and non-workers. We start by predicting potential individual monthly earnings \hat{e}_i using a standard two-step Heckman regression (Heckman; 1979), estimated 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 different age groups, marital status, household non-labor income, household size, and the presence of an elderly person (older than 65 years) in the household.⁶

Predicted earnings closely match observed earnings as demonstrated by Appendix

⁶Appendix Table A.9 lists the specific exclusion restrictions used to predict earnings. In the second stage of the Heckman estimation, the Inverse Mills Ratio is used to predict earnings for both workers and non-workers.

Table A.3, which compares observed and predicted earnings for the subsample of workers.⁷ We mostly predict slightly lower average incomes than observed for men and slightly higher average incomes than observed for women.⁸

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 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.

In the following analysis, we will focus on the net-of-PTR earnings $((1 - PTR_{it}) \cdot e_{it})$ in order to facilitate the interpretation of this measure as a work *incentive* rather than disincentive.

2.3 Data

We draw on EUROMOD data from 2008-2014,⁹ which is based on EU-SILC cross-sectional data that have been specifically prepared for use in the EUROMOD microsimulation model.¹⁰ 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

⁷While the analysis throughout the paper includes both workers and non-workers (estimation sample), we do not observe the wages of non-workers and thus exclude them from this particular exercise.

⁸Appendix 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.

⁹The income reference period for all countries in our sample, except the UK, refers to the previous calendar year. For the UK, EUROMOD is based on the Family Resources Survey (FRS) and income refers to the previous twelve months. Furthermore, yearly income variables and the number of months employed are used to calculate monthly earnings.

¹⁰The 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).

G4.0+.

The EUROMOD data cover a representative sample of private households in all investigated countries. We select twelve countries that cover different types of welfare state systems: 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. Table 1 highlights the variety of welfare state types as well as income tax and benefit systems covered by our selected countries.

Our sample includes individuals observed either non-working (*nw*) or working at least part-time according to the country-specific part-time norm (*w*). We restrict the sample to individuals in their prime working age between 25 and 54 years of age 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 and top 1% in order to exclude unreasonably low and very high earnings. Our final sample consists of approximately 350,000 individuals and four years of observations, namely 2008, 2010, 2012 and 2014, for which EUROMOD provides input data. France 2008 is based on input from 2007, UK 2010 is based on input from 2009 and UK 2014 is based on input from 2013.

The EUROMOD micro-simulator offers an option to account for non-take-up of benefits in 4 of 12 countries as well as tax evasion for 3 of 12 countries. In order to ensure comparability, however, we do not model these for any country. As a consequence, the net-of-tax earnings calculated in this paper should be interpreted as work incentives inherent in the tax-benefit system of each country under the assumption of full compliance with the law.¹¹ Moreover, due to data limitations, neither contribution-based transitory benefits,

¹¹The non-take-up of benefits may reflect a lower *perceived* level of benefits than what the state intends. For instance, this can be the case if search costs to sign up surpass the amount of the benefit for small benefit amounts. However, our focus is on the incentives inherent in the tax-benefit *system*. Data limitations prohibit the modelling of non-take-up at an individual level. Rather, non-take-up is modelled in EUROMOD using a random take-up simulation for each year and country (Belgium, France, Greece and the UK). Tax evasion is modelled for Bulgaria, Greece and Italy, but implemented differently across

such as unemployment insurance, nor in-kind benefits are accounted for.¹² 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 part-time, according to the country-specific part-time norm. We restrict our definition of w for two reasons. Firstly, 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 marginal workers from our sample. Consequently, transition into employment is defined as taking up a job for at least part-time.

2.4 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 Equation 1, in the EUROMOD cross-sectional data and add demographic controls as well as country and year fixed effects. The binary outcome variable is one if individual i is employed in period t (w_{it}).

$$P(w_{it}) = \alpha + \beta(1 - PTR_{it}) \cdot e_{it} + X'_{it}\gamma + \lambda_c + \mu_t + \epsilon_{it} \quad (5)$$

If the net-of-PTR is 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

these countries.

¹²While the most recent EUROMOD version does incorporate estimates of contribution-based unemployment benefits, these are still incompletely estimated for many countries due to the lack of information about social insurance contributions made. We therefore choose not to incorporate these until they are more precise in order to avoid additional and asymmetrical measurement error that is stronger for some countries than for others. We emphasize that our calculated PTRs should be interpreted as work disincentives after such transitory benefits expire.

of controls for each individual is denoted by X_{it} and includes household non-labor income, 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} .

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 systems¹³ 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 overall bias for the composite term of net-of-PTR earnings $(1 - PTR_{it}) \cdot e_{it}$ 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 net-of-PTR earnings (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

¹³Bulgaria and the Czech Republic serve as exceptions, with proportional taxation systems.

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 changes 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).¹⁴ Adapting the Wald estimator formulated in Blundell et al. (1998) to the extensive labor supply margin, we estimate the following equation by 2SLS:¹⁵

$$1^{st} stage : (1 - PTR_{it}) \cdot e_{it} = \theta(1 - PTR_{gt}) \cdot e_{gt} + X'_{it}\gamma + \alpha_g + \lambda_c + \mu_t + u_{it} \quad (6)$$

$$2^{nd} stage : P(w_{it}) = \beta(1 - \widehat{PTR}_{it}) \cdot e_{it} + X'_{it}\gamma + \alpha_g + \lambda_c + \mu_t + \epsilon_{it} \quad (7)$$

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 net-of-

¹⁴For our preferred group definition, group sizes range from 29 to 2,046 individual observations. We also provide results according to an alternative group definitions according to 10-year age cohorts, three educational attainment groups, and gender for comparison with Jäntti et al. (2015) as well as 10-year age cohorts and three educational attainment groups following Blundell et al. (1998). Our estimates are robust to these alternative definitions. These results are presented in Table A.4.

¹⁵The second stage is a linear probability model rather than a probit, as the latter would be inconsistent due to the generated variable.

PTR earnings still remains, i.e. net-of-PTR earnings grow differentially across groups. Appendix Figures B.1 to B.12 illustrate the variation of our grouping estimator for the entire set of countries and over time, i.e., PTRs by age group and education level.

3 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. Figure 1 juxtaposes the average PTR by earner role to the average employment rate in 2008 among the working-age population in each country. Employment rates vary greatly across countries ranging from 79% in Greece and Italy to 96% in Sweden.¹⁶ PTRs also greatly vary across countries ranging from about 20% in Bulgaria and Greece to more than 50% in Germany and Denmark. Across all countries, the average participation tax rate in the pooled sample from 2008-2014 is approximately 0.35.

In our analysis, we distinguish between breadwinners and secondary earners according to the relative potential earnings of individuals within the household. Breadwinners can be either single-person households, sole earners in a joint household or the higher earning individual in a household. While traditionally, many women did not participate in the labor market, Table 2 demonstrates that this is no longer the case; between 14 and 22 percent of the prime working-age population in the 12 countries investigated is comprised of female breadwinners and between 2 and 11 percent are male secondary earners. Appendix Table A.8 shows the breakdown of breadwinner earner types. In many countries, female primary and sole earners outnumber female singles indicating that female breadwinners are not necessarily single. In Denmark and Sweden, female primary earners represent more than 10 percent of the working-age population and 5 percent are female singles. In contrast, female breadwinners are mostly single in Austria, Germany, and the United Kingdom.

Figure 1 highlights the work incentive gap between breadwinners and secondary earners as well as substantial cross-country variation. For both breadwinners and secondary earners, extensive margin work incentives are highest (PTRs are the lowest) in

¹⁶Appendix Table A.1 further breaks down employment rates for each year, country and sex, revealing substantial differentials across countries, in particular with respect to female participation rates.

Greece, Bulgaria and Spain and lowest for Denmark, Germany and Belgium. At the same time, work incentives are systematically higher (PTRs are lower) for secondary earners than for breadwinners: The mean PTR for breadwinners amounts to 0.41 and for secondary earners to 0.31. Higher PTR for breadwinner result from two channels. First, breadwinners are more likely to be eligible for means-tested benefits in *nw* than are secondary earners. Secondly, breadwinners face a higher tax wedge between *w* and *nw* than secondary earners due to higher earnings and thus higher taxes and social insurance contributions in countries with progressive tax-benefit systems. This observation is further highlighted in Figure 2, which shows a positive correlation between the median PTR and earnings, albeit less pronounced in joint taxation or proportional taxation countries.¹⁷ This positive relationship between earnings and the PTR underlines the necessity of the instrumental variables approach to address endogeneity.

Taking a deeper look at the drivers of PTR, Figure 3 provides a decomposition of the PTR into taxes, social insurance contributions and benefits for breadwinners and secondary earners, with and without children.¹⁸ 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. The figure shows that 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. Furthermore, generous income support to the unemployed in Denmark, Germany, France, and the United Kingdom also lead to higher PTRs compared to Bulgaria and Greece, which only offer small or no benefits.

Children play an essential role in determining extensive margin tax rates.¹⁹ In-work

¹⁷Joint taxation is dominant in Belgium, France and Germany. Bulgaria has a proportional taxation system and insignificant out-of-work benefits, leading to very little dispersion in the PTR.

¹⁸PTR compositions across all observed country-years are provided in Appendix Figures B.13 through B.24

¹⁹Work-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 provide 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. 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.

benefits or earned income tax credits (EITCs) yield the most substantial reduction in PTRs for households with children. For some households with children, EITCs can lead to negative PTRs at the bottom of the earnings distribution. These in-work benefits are either non-existent or small for individuals without children, but generous for working families with children.²⁰ 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; 2021).

Finally, eligibility and exemption thresholds for benefits and tax contributions influence PTRs at the bottom of the income distribution. Table 3 therefore displays indicators of tax and benefit receipt for individuals in the bottom quintile of the earnings distribution in both possible labor states. In Austria, Belgium, Greece, Spain, France and Italy, individuals in the bottom quintile of earnings are more likely to receive benefits when working than when out of work. As displayed in Table 1, universal social assistance does not exist in Greece and Italy. The opposite is true for the remaining countries. Conditional on receiving benefits, Greece is the only country in which the benefit amount while working exceeds that received when not working. With respect to tax exemption thresholds, almost all workers in the bottom quintile of the earnings distribution pay taxes and social insurance contributions in most of the countries surveyed. Both Greece and Spain exempt a large share of their workforce, between 37-32%, from paying any taxes and the Czech Republic and Italy exempt between 10-15%.

4 Results

4.1 Pooled Marginal Effects

Table 4 shows marginal effects for the pooled sample of 12 European countries and provides an average effect for breadwinners and secondary earners separately. Results from the OLS estimation of Equation 5, treating the PTR as exogenous to the probability of employment

²⁰This 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. 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.

are shown in columns (1)-(2). Those from the 2SLS estimation using the group IV of Equation 7 are found in columns (3)-(6). For the group IV, groups are defined as 5-year age cohorts and three categories of educational attainment following the group definition of Burns and Ziliak (2015). Both estimators yield similar results and marginal effects are robust to controlling for gender. Adding control variables for demographic factors that potentially influence labor supply decisions has a stronger effect in the OLS estimation than in the group IV, as the latter implicitly controls for education and age groups already in the baseline specification.

Given a mean PTR of 0.41 and employment rate of 0.87, the average participation elasticity for breadwinners in the full sample is 0.04. Secondary earners have a mean PTR of 0.31, an employment rate of 0.71 and a participation elasticity of 0.05.²¹ While these elasticities are statistically different from one another, the magnitude of the difference is quite small. However, the pooled sample estimates mask a great deal of heterogeneity and breadwinners in the full sample are comprised of singles as well as sole and primary earners. Column (6) restricts the sample to married or cohabiting couples with children and finds that among these households, elasticities between breadwinners and secondary earners differ almost three fold (p-value <.001), with an average 0.02 for breadwinners and 0.05 for secondary earners.²² Notably, this difference is above and beyond gender differences in employment, as this specification additionally controls for gender.

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. The high first stage Kleibergen-Paap Wald statistic, which tests the null-hypothesis of weak instruments, lends credence to the use of the group IV as a strong instrument for individual net-of-PTR earnings.²³

Results for group IV prove rather robust to the definition of the group both in magnitude and direction of the effect. Appendix Table A.4 displays these results from the alternative definitions, which includes 10-year age cohorts, three educational attainment

²¹These elasticities are calculated following Eq. 3 as $\hat{\beta}_r \times \frac{1-PTR_r}{P(w)_r}$ for the subsample of breadwinners and secondary earners separately.

²²Average PTRs for primary earners with children is 0.38 and for secondary earners with children it is 0.29. Mean employment rates for these subgroups are 0.89 and 0.71, respectively.

²³We calculate this statistic from Baum et al. (2010), which allows for cluster robust inference.

levels, and gender.²⁴ Our preferred specification from Table 4 column (4) and (5) (with controls) is robust to alternative clustering strategies, as shown in Appendix Table A.5. Further, results prove robust to specifications that allow for country-specific, gender-specific and age-specific time trends, as shown in Appendix Table A.6 and to retaining individuals on parental leave²⁵, shown in Appendix Table A.7.

4.2 Participation Elasticities across Europe

Given the different institutional settings, social norms and tastes for work and leisure across European countries, it is reasonable to expect participation elasticities to vary across countries, gender and earner roles. From the marginal effects of the regression in Equation 7, we calculate the static, within-period participation elasticity according to Equation 3.

Figure 4 captures these country-specific elasticities estimated in Equation 7 by country for breadwinners and secondary earners separately. Country-specific elasticities for breadwinners range between near zero to 0.13 and for secondary earners between 0.08 and 0.39 and are statistically significant in most countries. Participation elasticities among secondary earners are high in Belgium, the Czech Republic, Germany, Greece, Spain and Italy, while they are low and not statistically different from zero in Denmark. This latter observation can likely be attributed to a very high labor market participation rate among secondary earners, leaving few individuals on the margin between participating and not participating in the labor force.

Our average estimates corroborate the smaller participation elasticities found by other studies that likewise compute reduced-form participation elasticities across countries based on incremental changes to tax-benefit incentives, namely Jäntti et al. (2015) and Kalíšková (2018). Jäntti et al. (2015) find a range of elasticities, mostly between 0-0.2, with statistically insignificant results in many countries. Kalíšková (2018) estimates an average female participation elasticity of 0.08 between 2005-2010 for an EU-wide sample of women from 26 countries.

²⁴Our three 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 as well as Blundell et al. (1998), who applied a group IV to estimate hours elasticities.

²⁵We likely under-identify individuals on parental leave, as we can only observe whether someone is in receipt of some form of parental leave benefit.

Beyond identifying average participation elasticities for breadwinners and secondary earners, in the second step of our analysis, we further disaggregate the impact of these disperse PTRs by gender among individuals of the same earner roles. Figures 5 and 6 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. In particular, Figure 6 shows that both female and male secondary earners respond the most to extensive margin tax rates. While the participation elasticities of male secondary earners are measured with less precision than female secondary earners due to the smaller number of observations (see Table 2)²⁶, results are statistically significant at the 95% confidence level in 9 out of 12 countries. Similarly, standard errors are large among female breadwinners and these elasticities cannot be distinguished from zero. However, in this case, large standard errors are more likely due to the fact that these estimates mask more heterogeneity, as breadwinners can be single-person households, sole earners in a joint household, or primary earners.

The further breakdown of breadwinners into these categories is displayed in Appendix Table A.8. While the majority of male breadwinners are primary earners in two-person households, a majority of female breadwinners is single, followed by roughly one quarter primary and sole earners, respectively. Unfortunately, the sample size prevents a further split of participation elasticities by these sub-categories of female breadwinners.

Despite this limitation, overall, results speak to 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. Our results offer first reduced-form evidence that this closing gap also can be observed in the European context in many but not all countries. Further, by estimating elasticities according to earner roles, our analysis directly leverages the important role of opportunity costs for participation decisions.

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 net-of-PTR earnings:

²⁶Observations can be calculated by multiplying the share in each category by the total number of annual observations.

taxes, social insurance contributions, and benefits. Just as we defined the net-of-PTR earnings 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: $(1 - \frac{t_h}{e_i}) * e_i$ for taxes, $(1 - \frac{SIC_h}{e_i}) * e_i$ for SIC, and $(1 - \frac{b_h}{e_i}) * e_i$ 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.²⁷

Following results from the previous section, which demonstrate significant elasticities almost exclusively for secondary earners, Table 5 displays average elasticities for this earner role in each country with respect to these separate components. Social insurance contributions systematically generate the highest response for this group. We interpret this as suggestive evidence that social insurance contributions are more salient than income taxes and benefits. The change in social insurance contributions becomes effective for the individual immediately after changing the work status, while income taxes are assessed annually. Further, social insurance contributions are computed on the level of the individual, while income taxes and benefits often take the household context into account, which complicates the assessment for the individual. Benefits comparably exert the smallest effect in eight out of 12 countries, despite the common focus on benefits in the public debate.

Testing for equivalence between the components' coefficients reveals that the component participation elasticities are statistically different from each other (see Table 5 columns 4 to 6). The only exceptions are taxes and benefits in Austria as well as taxes and SIC in Belgium, Sweden and United Kingdom (p-value > .1).

²⁷The tax and SIC wedges are defined as $\frac{t_h^w - t_h^{nw}}{e_i}$ and $\frac{SIC_h^w - SIC_h^{nw}}{e_i}$, respectively, whereas the benefit wedge, generally larger in the state of nw than in w , is defined as $\frac{b_h^{nw} - b_h^w}{e_i}$.

5 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. Disentangling the drivers of the PTRs, we find that the relative importance of taxes, social insurance contributions and benefits largely depends on the individual’s earner role within the household. Tax-benefit systems create the highest disincentives for breadwinners, which systematically exceed disincentives for secondary earners across Europe. High PTRs for breadwinners 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 Belgium, Denmark, and Germany, are the result of a high tax and social insurance contribution wedge between participation and non-participation.

We also document the widespread existence of negative PTRs as a result of means-tested in-work benefits for some countries and earner roles. 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; 2021).

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. Gender turns out not to be the characteristic that best predicts individual responses to monetary incentives for work. Our 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 and female secondary earners are mostly between 0.1 and 0.4. Countries with high extensive margin responses of secondary earners include: Belgium, Germany, Greece, Italy, Spain, and Sweden. In a final step, we show that among the three components of the PTR – taxes, social security contributions, and benefits – social security contributions elicit the strongest response among secondary

earners. Taken together, reducing social security contributions for secondary earners in the above countries might represent an efficiency enhancing reform.

Our average estimates corroborate the smaller participation elasticities found by other studies that likewise compute reduced-form participation elasticities across countries based on incremental changes to tax-benefit incentives, namely Jäntti et al. (2015) and Kalíšková (2018). On average, quasi-experimental studies reviewed by Chetty et al. (2013) find a participation elasticity of 0.28 and estimates range from 0.13 to 0.43, which corresponds to the magnitude of our estimates found only for the most responsive group of secondary earners. The discrepancy compared to these studies is likely attributable to their 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 demonstrate the importance of using more heterogeneous participation elasticities when calibrating structural labor supply models and/or predicting welfare effects from simulating tax-benefit reforms. Elasticities calculated on the basis of country-specific case studies may not broadly apply across socioeconomic groups and the entire working-aged population. In particular, our analysis shows the central role of the individual's earner position within the household context. The marginal worker in a couple is the lower earning spouse and not necessarily the woman (McClelland et al.; 2014). Secondly, larger estimates of quasi-experimental studies are likely more relevant for large, salient reforms, while smaller estimates, such as those found in this study, prove more accurate for incremental changes to the tax-benefit system in the short run.

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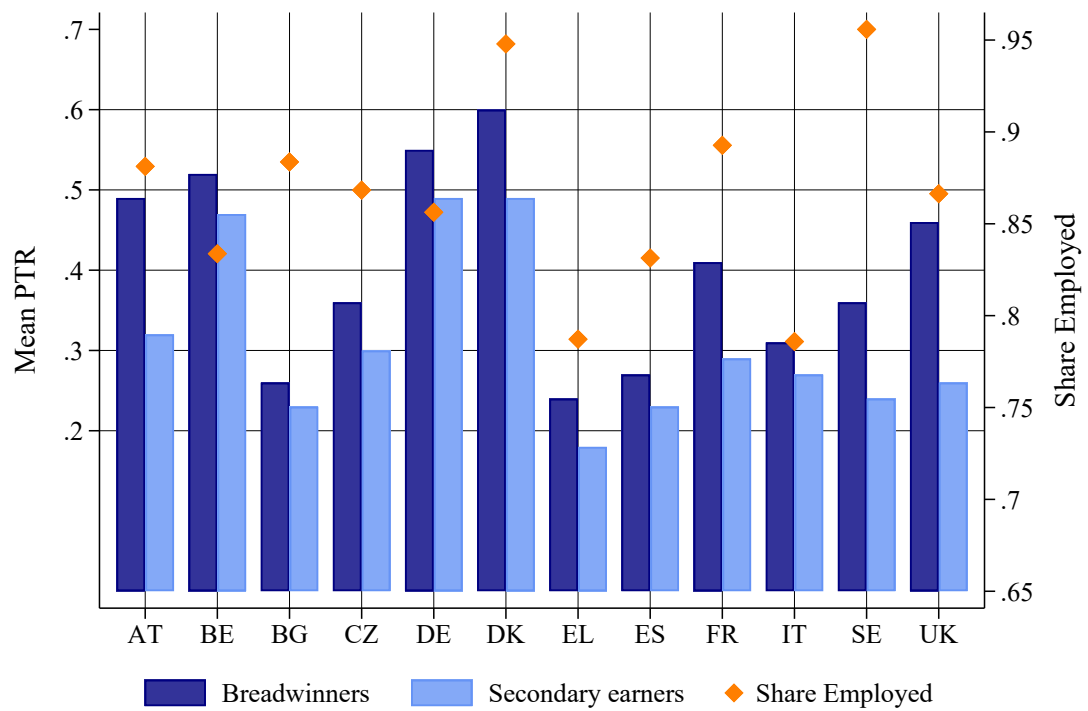
Main Tables and Figures

Table 1: Welfare State Systems

	Type I	Type II	Univ. Social Assistance	In-work Tax Credits	Income Taxation
Austria	-	Corporatist	✓	CTC	Individual
Belgium	Bismarck-hs	Corporatist	✓	CB	Joint filing
Bulgaria	-	-	✓	-	Individual
Czech Republic	-	-	✓	CTC	Individual
Germany	Bismarck-hs	Corporatist	✓	CB	Joint taxation
Denmark	Beveridge-hs	Social-democratic	✓	EITC	Individual
Greece	Bismarck-ls	Corporatist	-	CB	Joint filing
Spain	Bismarck-ls	Corporatist	✓	CTC	Joint filing
France	Bismarck-hs	Corporatist	✓	CB	Join taxation
Italy	Bismarck-ls	Corporatist	-	CTC	Individual
Sweden	Beveridge-hs	Social-democratic	✓	EITC	Individual
United Kingdom	Beveridge-ls	Liberal	✓	EITC, CTC	Individual

Note: Type I refers to the welfare state classifications of Bonoli (1997), where *hs* refers to high-spending and *ls* to low-spending; Type II refers to the welfare state classifications of Esping-Andersen (1990). CTC denotes Child Tax Credit, EITC denotes Earned Income Tax Credit and CB denotes in-work child benefits. Tax-benefit informations from EUROMOD country reports.

Figure 1: Mean PTR and Employment Shares by Country and Earner Role (2008)



Note: PTR and employment share calculations are based on the estimation sample including working and non-working individuals and weighted using individual sample weights. Estimates for France are based on information from 2007. Earner role is defined according to potential earnings in the state of work. PTR and employment share estimates for all countries and years can be found in Appendix Tables A.1 and A.2. Appendix Figure A.1 displays the full distribution of PTRs by country.

Source: EUROMOD data, own calculations.

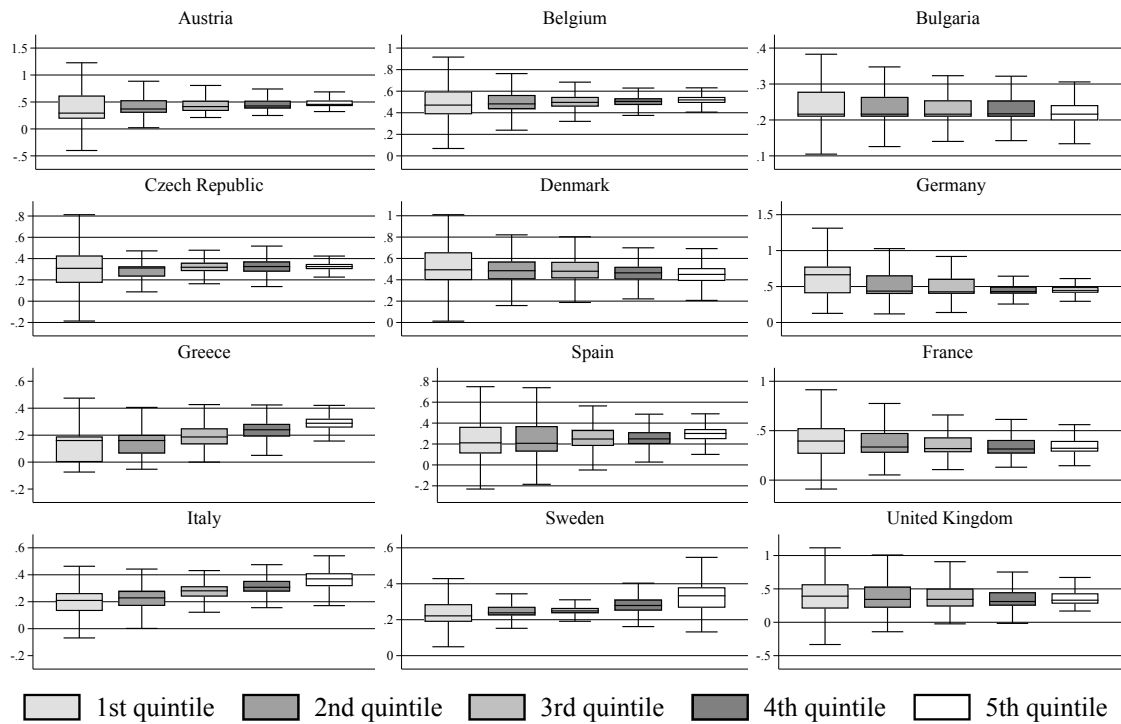
Table 2: Shares of Breadwinners and Secondary Earners by Gender

Country	Average yearly observations	Female secondary earners	Male secondary earners	Female breadwinners	Male breadwinners
Austria	4,676	0.31	0.05	0.19	0.45
Belgium	4,795	0.32	0.04	0.17	0.47
Bulgaria	4,628	0.36	0.09	0.14	0.40
Czech Republic	7,746	0.31	0.11	0.21	0.37
Germany	9,008	0.30	0.02	0.20	0.48
Denmark	4,703	0.31	0.12	0.21	0.37
Greece	5,661	0.34	0.08	0.17	0.41
Spain	12,286	0.33	0.07	0.18	0.42
France	8,800	0.33	0.06	0.18	0.43
Italy	16,945	0.33	0.06	0.18	0.43
Sweden	5,527	0.30	0.09	0.20	0.41
United Kingdom	16,209	0.30	0.05	0.22	0.43

Notes: Unweighted shares of breadwinners and secondary earners by country and gender using the analysis sample. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. Shares are pooled over all years for exposition purposes. These shares do not change substantially over the period of observation.

Source: EUROMOD data, own calculations.

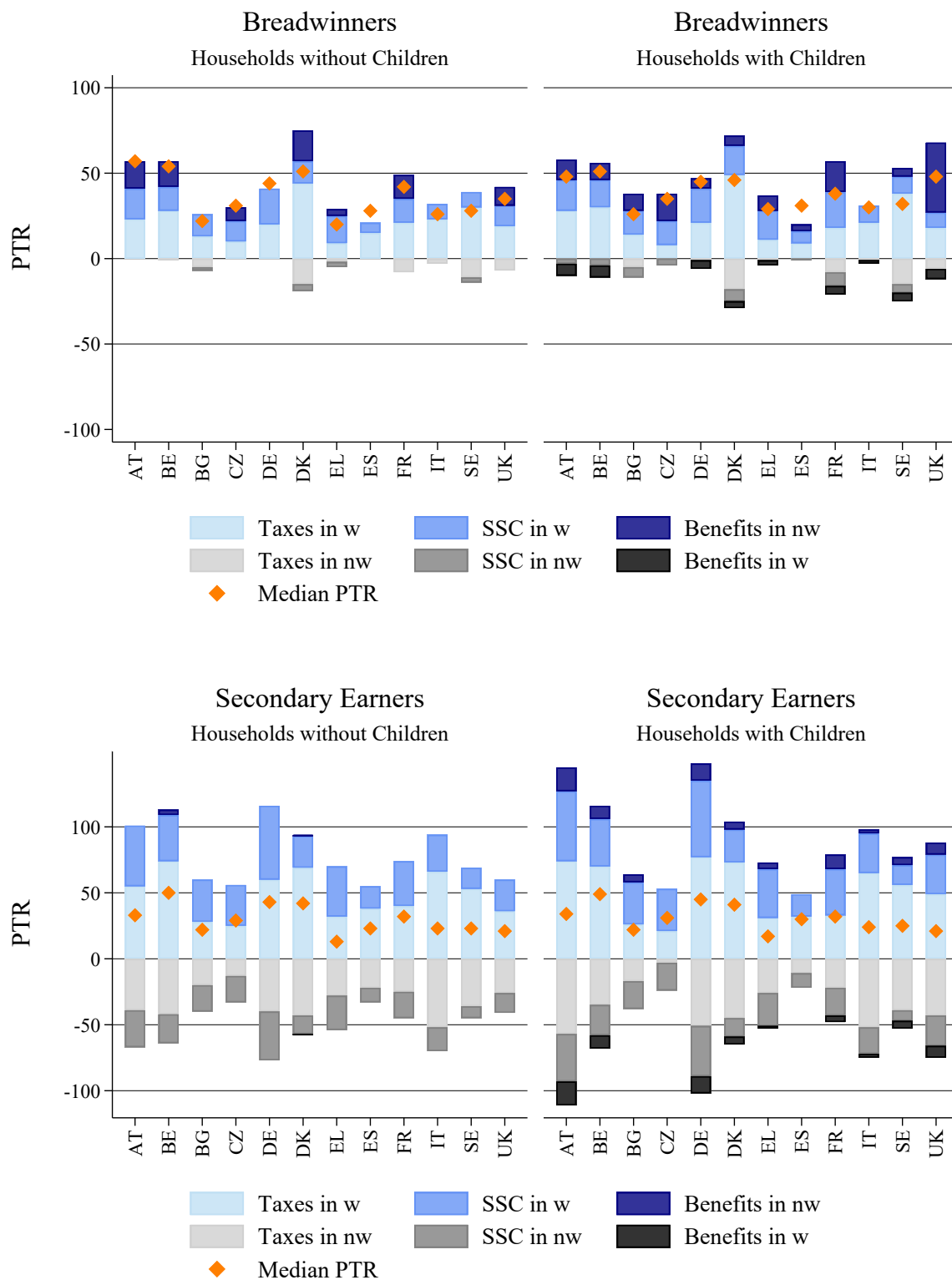
Figure 2: PTR Distributions by Individual Earnings Quintile



Note: Estimation sample including working and non-working individuals. The highest and lowest percentile of earnings are omitted from the sample. The figure pools together all years of the sample for exposition purposes. The boxplot shows the median, interquartile range as well as minimum and maximum PTRs excluding outliers.

Source: EUROMOD data, own calculations.

Figure 3: PTR Compositions by Earner Role, with and without Children



Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. Latest observed year per country, i.e. 2012, 2013 or 2014. Median PTR, taxes, ssc and benefits by subgroup.

Source: EUROMOD data, own calculations.

Table 3: Tax and Benefit Incentives in Individual Earnings Bottom Quintile

	Benefits				Taxes	
	% receiving in w	Ratio in w	% receiving in nw	Ratio in nw	% paying in w	Ratio in w
Austria	18.5	23.0	17.0	47.8	98.8	11.6
Belgium	16.6	10.0	41.1	26.0	98.3	17.4
Bulgaria	23.1	19.5	16.0	20.9	100.0	14.9
Czech Republic	23.8	11.6	31.3	20.3	84.5	10.3
Germany	17.1	19.5	19.3	41.2	98.8	28.1
Denmark	63.9	1.9	89.0	41.6	99.5	28.8
Greece	8.9	21.9	7.1	20.4	63.4	11.0
Spain	20.1	10.9	15.3	44.8	68.1	5.4
France	68.3	9.2	62.4	28.0	100.0	18.7
Italy	13.8	13.4	0.5	19.5	89.5	9.2
Sweden	28.7	13.9	50.1	28.0	98.6	17.0
United Kingdom	31.5	45.6	36.4	62.8	97.7	13.7

Note: Subgroup of estimation sample in the bottom quintile of the earnings distribution including working and non-working individuals weighted using EUROMOD sample weights. Ratio refers to median benefits or taxes (including social security contributions), respectively, as a share of bottom quintile's earnings.

Source: EUROMOD data, own calculations.

Table 4: Regression Results for Pooled OLS and Group IV

	OLS		Group IV			
	(1)	(2)	(3)	(4)	(5)	(6)
a. $(1 - PTR) \times e$	0.133*** (0.002)	0.085*** (0.001)	0.087*** (0.008)	0.083*** (0.007)	0.084*** (0.007)	0.038*** (0.010)
b. $(1 - PTR) \times e \times secondary$	0.095*** (0.003)	0.048*** (0.002)	0.056*** (0.005)	0.027*** (0.005)	0.030*** (0.004)	0.077*** (0.006)
Sec. earner	0.009*** (0.002)	0.017*** (0.002)	-0.034*** (0.005)	0.010* (0.005)	0.022*** (0.003)	0.048*** (0.006)
Upper Secondary		-0.258*** (0.005)				
Tertiary		-0.271*** (0.005)				
Experience		0.041*** (0.000)		0.043*** (0.000)	0.043*** (0.000)	0.049*** (0.000)
Experience sq.		-0.001*** (0.000)		-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Child 1-3		-0.003*** (0.001)		-0.001 (0.001)	-0.002** (0.001)	-0.009*** (0.002)
Child 4-6		-0.071*** (0.002)		-0.065*** (0.002)	-0.065*** (0.002)	-0.056*** (0.004)
Child 7-17		-0.032*** (0.002)		-0.036*** (0.002)	-0.036*** (0.002)	-0.034*** (0.003)
Hh. non-labor income		-0.019*** (0.001)		-0.022*** (0.002)	-0.022*** (0.002)	-0.039*** (0.004)
Female					-0.016*** (0.004)	-0.096*** (0.008)
Constant	0.899*** (0.005)	0.601*** (0.005)	0.876*** (0.009)	0.196*** (0.007)	0.206*** (0.009)	0.292*** (0.015)
Avg. ME Breadwinners	0.133***	0.085***	0.087***	0.083***	0.084***	0.038***
(a)	(0.002)	(0.001)	(0.008)	(0.007)	(0.007)	(0.010)
Avg. ME Sec. Earners	0.227***	0.133***	0.143***	0.110***	0.114***	0.115***
(a+b)	(0.003)	(0.003)	(0.010)	(0.009)	(0.008)	(0.012)
Country, year & group FEs	✓	✓	✓	✓	✓	✓
Demographic controls		✓		✓	✓	✓
Additional gender control					✓	✓
Subsample couples w/children						✓
Adj. R-squared	0.12	0.28				
First stage F-Statistic			4892.17	4439.20	6361.81	2773.29
Observations	355,757	355,757	355,757	355,757	355,757	166,685

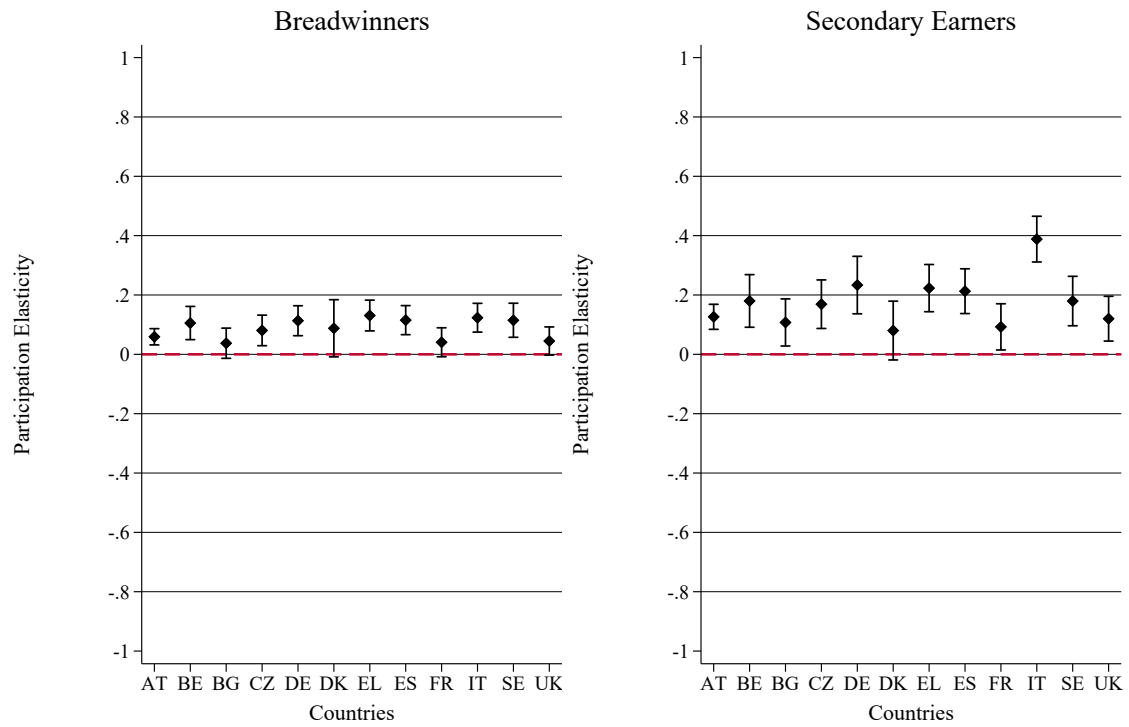
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household and is the omitted category in all regressions. All equations include group, year and country fixed effects as well as a constant and are weighted using EUROMOD individual sample weights. Columns (1)-(2) are estimated using OLS.

Columns (3)-(6) are estimated using 2SLS, instrumenting the individual-specific net-of-PTR earnings with the group average in each year and country. Groups are defined according to 5-year age cohorts and three educational attainment groups, following Burns and Ziliak (2015). We define groups within each European country. Earnings e are standardized. IV regressions implicitly control for education through the definition of the group. Columns (1) and (3) compare baseline specifications without demographic controls. Columns (2) and (4)-(6) include demographic controls. Columns (5) and (6) additionally control for gender. Column (6) restricts the sample to couples with at least one child. The first-stage F-statistic refers to the Kleibergen-Paap Wald statistic. Standard errors are heteroskedasticity robust and are corrected for generated variables bias.

Source: EUROMOD data, own calculations.

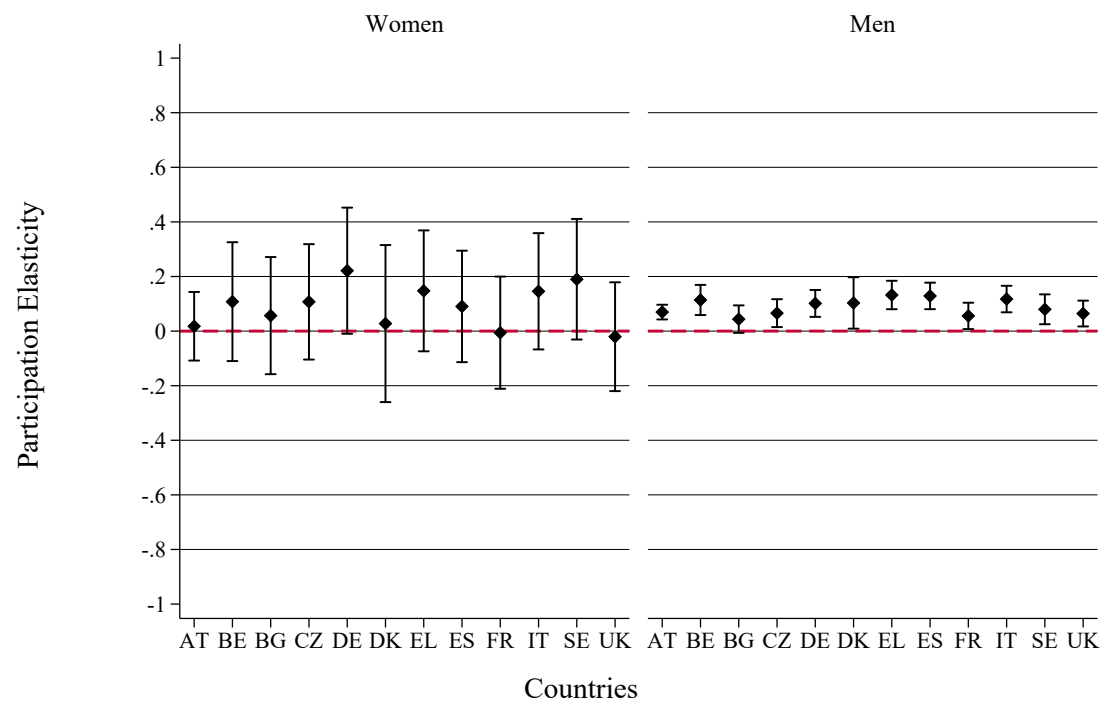
Figure 4: Participation Elasticities by Earner Role



Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. Vertical lines show cluster robust confidence intervals at the 95%-level.

Source: EUROMOD data, own calculations.

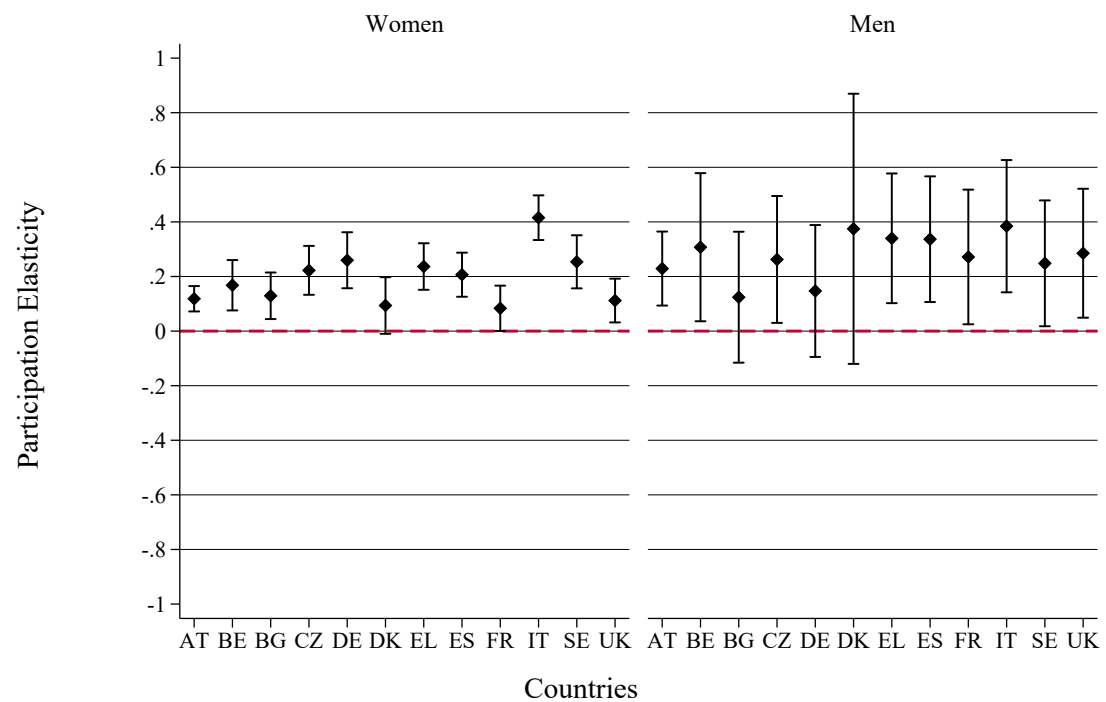
Figure 5: Participation Elasticities for Breadwinners by Gender



Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. Vertical lines show cluster robust confidence intervals at the 95%-level.

Source: EUROMOD data, own calculations.

Figure 6: Participation Elasticities for Secondary Earners by Gender



Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. Vertical lines show cluster robust confidence intervals at the 95%-level.

Source: EUROMOD data, own calculations.

Table 5: Participation elasticity for secondary earners by PTR component

	Inc. tax	SIC	Benefits	Equiv. Test P-value		
	(1)	(2)	(3)	(1)=(2)	(1)=(3)	(2)=(3)
Austria	0.135 (0.038)	0.170 (0.044)	0.107 (0.030)	0.000	0.160	0.016
Belgium	0.193 (0.081)	0.215 (0.087)	0.197 (0.076)	0.676	0.001	0.000
Bulgaria	0.131 (0.065)	0.138 (0.073)	0.122 (0.071)	0.000	0.002	0.000
Czech Republic	0.177 (0.061)	0.191 (0.070)	0.164 (0.057)	0.000	0.003	0.000
Germany	0.260 (0.077)	0.319 (0.082)	0.278 (0.067)	0.000	0.078	0.000
Denmark	0.123 (0.081)	0.134 (0.088)	0.104 (0.083)	0.008	0.001	0.007
Greece	0.211 (0.059)	0.229 (0.068)	0.206 (0.052)	0.000	0.051	0.000
Spain	0.216 (0.065)	0.233 (0.075)	0.204 (0.054)	0.000	0.047	0.000
France	0.108 (0.064)	0.120 (0.072)	0.100 (0.060)	0.000	0.060	0.000
Italy	0.336 (0.067)	0.399 (0.075)	0.363 (0.055)	0.000	0.004	0.000
Sweden	0.182 (0.104)	0.216 (0.105)	0.195 (0.097)	0.108	0.001	0.000
United Kingdom	0.153 (0.073)	0.165 (0.077)	0.136 (0.069)	0.205	0.005	0.001

Note: Estimation sample including working and non-working secondary earners. Columns (1)-(3) contain country-specific elasticities from separate regressions for each PTR component using Equation 7 with country interaction terms and a full set of demographic controls. Standard errors, in parentheses, are clustered at the group level. Columns (4)-(6) show results for testing the null hypothesis of equivalence of coefficients between each component.

Source: EUROMOD data, own calculations.

A Appendix A: Additional Tables and Figures

Table A.1: Employment Rates in % and Observations by Country, 2008-2014

	Employment rates										Observations			
	Female					Male					All			
	2008	2010	2012	2014	2014	2008	2010	2012	2014	2014	2008	2010	2012	2014
AT	81	84	84	85	85	97	97	95	97	97	4,990	5,232	4,997	4,511
BE	75	79	79			92	91	90			5,415	5,052	4,723	0
BG	84	86	85	85		92	93	90	89		4,222	5,683	5,032	4,254
CZ	81	80	83			97	97	97			9,903	7,778	7,225	0
DE	79	78	82			93	93	94			9,608	9,424	9,180	0
DK	96		97			97		97			5,481	0	4,520	0
EL	65	65	57	54		94	91	83	78		6,253	6,354	4,835	7,550
ES	70	69	64	71		93	84	81	85		13,786	14,034	12,519	11,586
FR	85 ^a	89	90			94 ^a	96	96			9,421 ^a	9,045	9,985	0
IT	67	64	64	65		92	89	87	86		20,316	18,631	18,296	17,751
SE	95	95	95			97	97	95			6,417	5,963	5,346	0
UK	80	78 ^b	79	80 ^c		91	89 ^b	90	91 ^c		19,319	19,167 ^b	15,402	15,498 ^c

Note: Estimation sample including working and non-working individuals weighted using the EUROMOD sample weights. a. based on input 2007 b. based on input 2009 c. based on input 2013.

Source: EUROMOD data, own calculations.

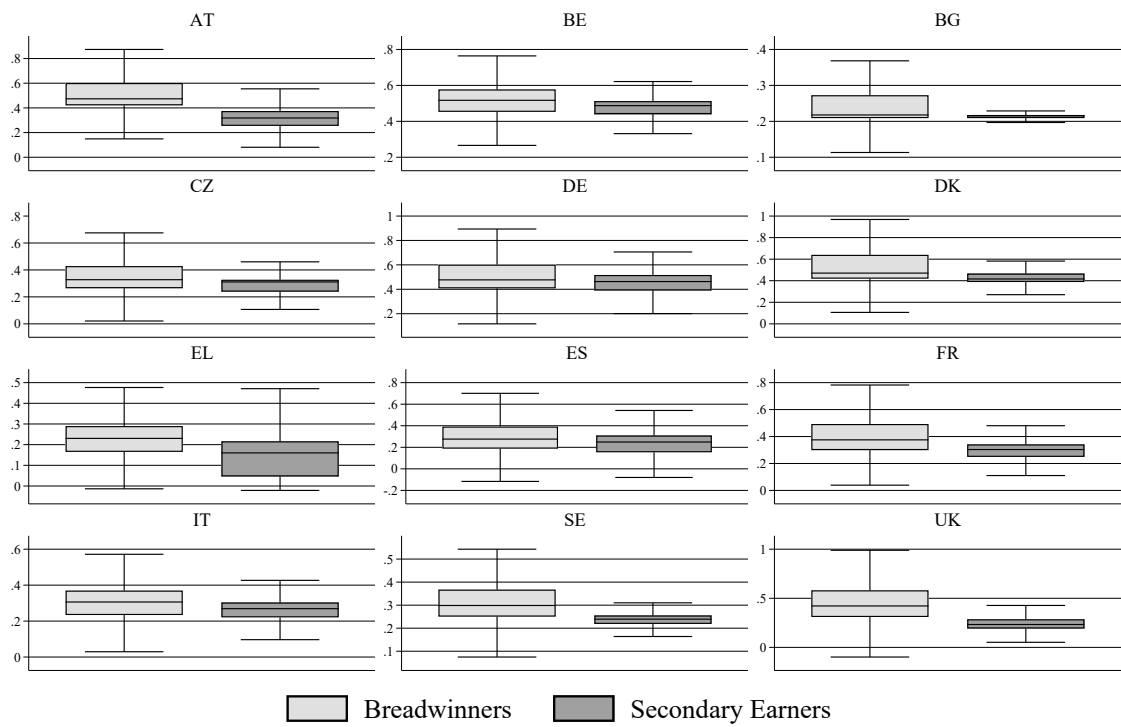
Table A.2: Mean PTR by Country and Earner Role in %, 2008-2014

	Breadwinners				Secondary Earners			
	2008	2010	2012	2014	2008	2010	2012	2014
Austria	49	50	55	55	32	32	27	31
Belgium	52	51	55		47	47	48	
Bulgaria	26	25	26	26	23	22	23	22
Czech Republic	36	36	37		30	28	27	
Germany	55	48	48		49	42	42	
Denmark	60		55		49		46	
Greece	24	22	21	22	18	14	14	14
Spain	27	32	35	33	23	23	23	24
France	41	41	42		29	31	33	
Italy	31	28	26	22	27	27	26	23
Sweden	36	35	35		24	24	24	
United Kingdom	46	46 ^b	44	42 ^c	26	26 ^b	25	23 ^c

Note: Estimation sample including working and non-working individuals weighted using EUROMOD sample weights. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. a. based on input 2007 b. based on input 2009 c. based on input 2013.

Source: EUROMOD data, own calculations.

Figure A.1: PTR Distributions by Earner Role



Note: Estimation sample including working and non-working individuals. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. The highest and lowest percentile of earnings are omitted from the sample. The figure pools together all years of the sample for exposition purposes.

Source: EUROMOD data, own calculations.

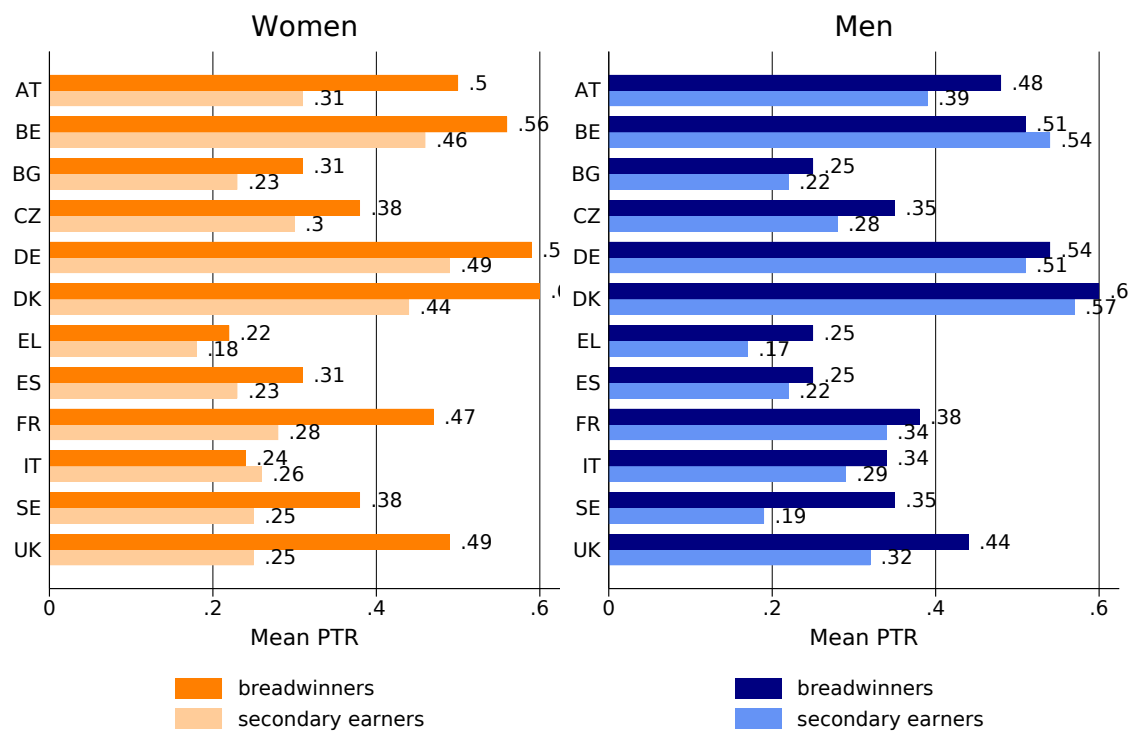
Table A.3: Predicted and Observed Mean Monthly Earnings for Subsample of Workers

	2008			2010			2012			2014		
	obs.	pred.	gap	obs.	pred.	gap	obs.	pred.	gap	obs.	pred.	gap
AT												
Women	2281.2	1966.2	0.1	2297.6	2201.9	0.0	2243.3	1597.2	0.3	2490.1	2431.0	0.0
Men	3174.5	4360.7	-0.4	3467.3	3371.8	0.0	3646.5	4241.1	-0.2	3814.2	3668.0	0.0
BE												
Women	2431.2	2109.8	0.1	2662.0	2391.1	0.1	2828.3	2385.2	0.2			
Men	3193.5	3466.5	-0.1	3291.0	3558.9	-0.1	3463.7	3722.7	-0.1			
BG												
Women	512.7	409.9	0.2	625.5	522.1	0.2	603.6	530.4	0.1	710.7	625.4	0.1
Men	671.6	681.2	-0.0	761.9	818.8	-0.1	754.2	786.4	-0.0	904.0	886.4	0.0
CZ												
Women	17663.9	18514.4	-0.0	19512.3	16601.2	0.1	19181.2	17748.4	0.1			
Men	25714.3	25325.4	0.0	27328.3	23395.0	0.1	28093.0	21259.9	0.2			
DE												
Women	2300.0	2035.0	0.1	2408.1	2147.3	0.1	2402.0	2268.3	0.1			
Men	3645.8	4208.4	-0.2	3537.3	4229.8	-0.2	3641.4	4563.9	-0.3			
DK												
Women	24576.7	23616.7	0.0	0.0	0.0	0.0	30381.3	29347.8	0.0			
Men	32581.9	22403.0	0.3	0.0	0.0	0.0	38521.3	44705.3	-0.2			
EL												
Women	1393.1	1110.2	0.2	1416.0	1162.6	0.2	1297.0	940.5	0.3	1129.4	741.2	0.3
Men	1926.2	2109.6	-0.1	1933.0	1988.3	-0.0	1725.9	1474.7	0.1	1480.6	1260.3	0.1
ES												
Women	1493.1	1122.0	0.2	1592.1	1163.1	0.3	1592.5	1124.2	0.3	1619.0	1304.7	0.2
Men	1895.9	2047.0	-0.1	1951.3	1795.4	0.1	1900.9	1672.2	0.1	2000.1	1911.3	0.0
FR												
Women	1827.0	1680.4	0.1	2070.7	1986.6	0.0	2219.6	2110.6	0.0			
Men	2442.5	2350.2	0.0	2793.9	2739.8	0.0	2935.5	2827.8	0.0			
IT												
Women	1926.8	1427.8	0.3	1905.0	1338.1	0.3	1910.1	1347.5	0.3	1939.2	1373.6	0.3
Men	2567.7	2866.6	-0.1	2423.9	2447.7	-0.0	2431.5	2249.0	0.1	2503.8	2187.4	0.1
SE												
Women	21250.4	20663.0	0.0	24572.0	24490.7	0.0	26323.5	30910.8	-0.2			
Men	28515.8	24710.3	0.1	32010.4	33479.4	-0.0	34649.7	31339.6	0.1			
UK												
Women	1798.3	1612.1	0.1	1793.3	1600.5	0.1	1905.1	1654.8	0.1	1914.8	1624.3	0.2
Men	2648.4	2425.8	0.1	2709.5	2497.2	0.1	2721.8	2671.6	0.0	2658.6	2422.3	0.1

Note: Subgroup of estimation sample observed working weighted using EUROMOD sample weights. Earnings are in country's currency, for example, SEK for Sweden. Gap is computed as $\frac{obs.-pred.}{obs.}$. FR 2008 is based on input from 2007, UK 2010 is based on input from 2009 and UK 2014 is based on input from 2013.

Source: EUROMOD data, own calculations.

Figure A.2: Mean PTR by Country, Gender and Earner Role (2008)



Note: Estimation sample including working and non-working individuals weighted using individual sample weights. Earner role is defined using potential earnings. Breadwinners include single-person households, sole earners in a joint household or the higher earning individual in a household. PTR for France is based on information from 2007.

Source: EUROMOD data, own calculations.

Table A.4: Regression Results for Group IV with Alternative Group Definitions

	Burns & Ziliak 2015		Blundell et al. 1998		Jäntti et al. 2015	
	baseline	controls	baseline	controls	baseline	controls
	(1)	(2)	(3)	(4)	(5)	(6)
a. $(1 - PTR) \times e$	0.087*** (0.008)	0.083*** (0.007)	0.086*** (0.008)	0.081*** (0.008)	0.151*** (0.005)	0.098*** (0.005)
b. $(1 - PTR) \times e \times secondary$	0.056*** (0.005)	0.027*** (0.005)	0.058*** (0.005)	0.027*** (0.005)	-0.008 (0.005)	-0.005 (0.005)
Sec. earner	-0.034*** (0.005)	0.010* (0.005)	-0.033*** (0.005)	0.011* (0.006)	0.004 (0.002)	0.020*** (0.003)
Experience		0.043*** (0.000)		0.041*** (0.000)		0.040*** (0.000)
Experience sq.		-0.001*** (0.000)		-0.001*** (0.000)		-0.001*** (0.000)
Child 1-3		-0.001 (0.001)		-0.002 (0.001)		-0.004*** (0.001)
Child 4-6		-0.065*** (0.002)		-0.064*** (0.002)		-0.064*** (0.002)
Child 7-17		-0.036*** (0.002)		-0.036*** (0.002)		-0.035*** (0.002)
Hh. non-labor income		-0.022*** (0.002)		-0.028*** (0.002)		-0.026*** (0.002)
Constant	0.876*** (0.009)	0.196*** (0.007)	0.883*** (0.008)	0.274*** (0.006)	0.801*** (0.007)	0.254*** (0.007)
Avg. ME Breadwinners	0.087*** (0.008)	0.083*** (0.007)	0.086*** (0.008)	0.081*** (0.008)	0.151*** (0.005)	0.098*** (0.005)
(a)						
Avg. ME Sec. Earners	0.143*** (0.010)	0.110*** (0.009)	0.144*** (0.010)	0.109*** (0.010)	0.143*** (0.007)	0.094*** (0.006)
(a+b)						
Country & year FEs	✓	✓	✓	✓	✓	✓
Demographic controls		✓		✓		✓
First stage F-Statistic	4892.17	4439.20	4337.60	3964.17	13421.15	12091.44
Observations	355,757	355,757	355,757	355,757	355,757	355,757

Note: Estimation sample. Standard errors are heteroskedasticity cluster-robust at the group level and are corrected for generated variables bias. All equations include group, year and country fixed effects. Columns 1-2 show the results from the main analysis in Table 4 for comparison, which define the Group IV according to 5-year age groups, three educational attainment groups and country following Burns and Ziliak (2015). Columns 3-4 define groups according to 10-year age groups, education and country following Blundell et al. (1998). Columns 5-6 define groups according to 10-year age groups, education, gender and country following Jäntti et al. (2015). Earnings e are standardized. All regressions are estimated with 2SLS, instrumenting the individual-specific net-of-PTR earnings with the group average in each year and country.

Source: EUROMOD data, own calculations.

Table A.5: Regression Results for Group IV and Alternative Clustering Strategies

	group	group year	country	group	group year	country
	(1)	(2)	(3)	(4)	(5)	(6)
a. $(1 - PTR) \times e$	0.087*** (0.033)	0.087*** (0.033)	0.087* (0.052)	0.083* (0.044)	0.083* (0.044)	0.083** (0.040)
b. $(1 - PTR) \times e \times secondary$	0.056*** (0.019)	0.056*** (0.019)	0.056 (0.040)	0.027** (0.013)	0.027** (0.013)	0.027 (0.027)
Country & year FEs	✓	✓	✓	✓	✓	✓
Demographic controls				✓	✓	✓
Observations	355,757	355,757	355,757	355,757	355,757	355,757

Note: This table corresponds to Table 4 with alternative clustering strategies including clustering by group, clustering by group and year, and clustering by country. Columns (1)-(3) show baseline results, columns (4)-(6) add demographic controls.

Source: EUROMOD data, own calculations.

Table A.6: Robustness of Group IV to Time Trends

	Group IV				
	(1)	(2)	(3)	(4)	(5)
a. $(1 - PTR) \times e$	0.083*** (0.007)	0.063*** (0.007)	0.076*** (0.007)	0.082*** (0.007)	0.056*** (0.007)
b. $(1 - PTR) \times e \times secondary$	0.027*** (0.005)	0.020*** (0.004)	0.023*** (0.004)	0.023*** (0.004)	0.020*** (0.004)
Country \times Year		✓			✓
Age \times Year			✓		✓
Gender \times Year				✓	✓
Demographic controls	✓	✓	✓	✓	✓
Observations	355,757	355,757	355,757	355,757	355,757

Note: This table corresponds to Table 4, adding various time-trend controls.

Source: EUROMOD data, own calculations.

Table A.7: Robustness to Inclusion of Individuals on Parental Leave

	OLS		Group IV			
	(1)	(2)	(3)	(4)	(5)	(6)
a. $(1 - PTR) \times e$	0.135*** (0.002)	0.087*** (0.002)	0.095*** (0.008)	0.087*** (0.007)	0.088*** (0.007)	0.039*** (0.010)
b. $(1 - PTR) \times e \times secondary$	0.088*** (0.005)	0.044*** (0.003)	0.057*** (0.005)	0.028*** (0.005)	0.032*** (0.004)	0.078*** (0.006)
Sec. earner	0.007*** (0.003)	0.016*** (0.002)	-0.029*** (0.005)	0.013** (0.006)	0.025*** (0.003)	0.049*** (0.006)
Upper Secondary		-0.258*** (0.005)				
Tertiary		-0.270*** (0.005)				
Experience		0.041*** (0.000)		0.043*** (0.000)	0.042*** (0.000)	0.049*** (0.000)
Experience sq.		-0.001*** (0.000)		-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Child 1-3		-0.003*** (0.001)		-0.001 (0.001)	-0.003** (0.001)	-0.009*** (0.002)
Child 4-6		-0.072*** (0.002)		-0.066*** (0.002)	-0.066*** (0.002)	-0.055*** (0.004)
Child 7-17		-0.032*** (0.002)		-0.036*** (0.002)	-0.036*** (0.002)	-0.033*** (0.003)
Hh. non-labor income		-0.020*** (0.001)		-0.023*** (0.002)	-0.023*** (0.002)	-0.039*** (0.004)
Female					-0.017*** (0.004)	-0.099*** (0.008)
Constant	0.893*** (0.006)	0.598*** (0.005)	0.870*** (0.009)	0.193*** (0.007)	0.204*** (0.009)	0.294*** (0.015)
Avg. ME Breadwinners	0.135***	0.087***	0.095***	0.087***	0.088***	0.039***
(a)	(0.002)	(0.002)	(0.008)	(0.007)	(0.007)	(0.010)
Avg. ME Sec. Earners	0.223***	0.131***	0.152***	0.115***	0.119***	0.117***
(a+b)	(0.006)	(0.004)	(0.010)	(0.010)	(0.009)	(0.013)
Country, year & group FEs	✓	✓	✓	✓	✓	✓
Demographic controls		✓		✓	✓	✓
Additional gender control					✓	✓
Subsample couples w/children						✓
Adj. R-squared	0.13	0.28				
First stage F-Statistic			3850.77	3378.32	4782.55	1390.72
Observations	357,484	357,484	357,484	357,484	357,484	167,713

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

Note: All notes from Table 4 apply. In contrast to Table 4, this table includes individuals on parental leave.

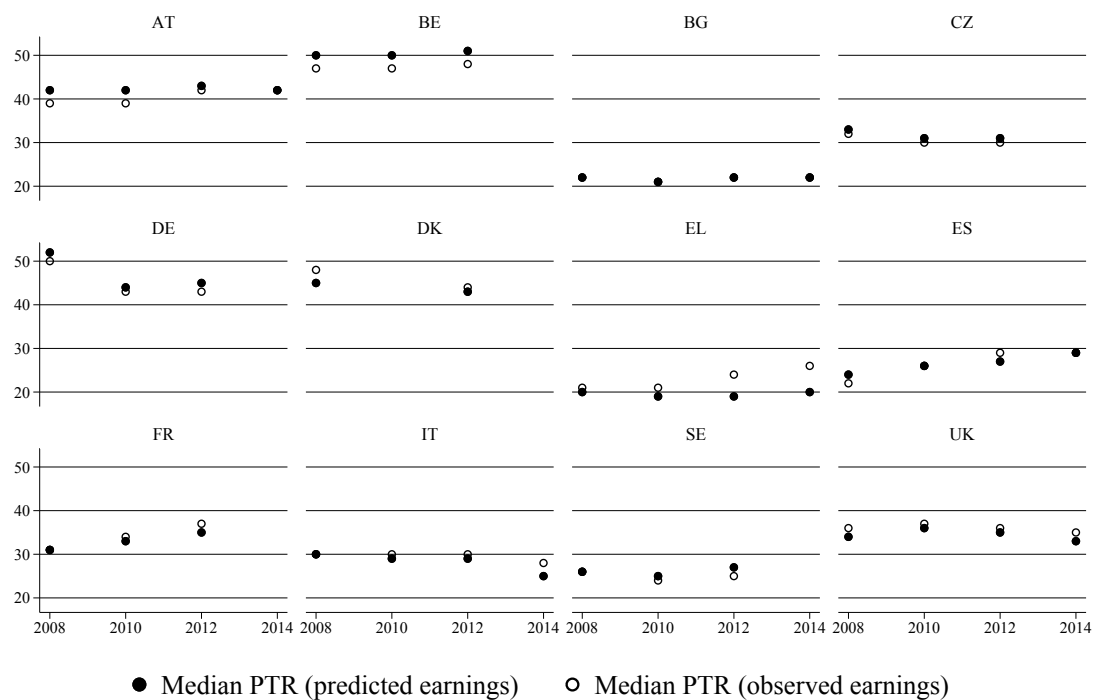
Table A.8: Shares of Breadwinner Types by Gender

Country	Average yearly observations	Female primary earners	Female sole earners	Female singles	Male primary earners	Male sole earners	Male singles
Austria	4,676	0.05	0.04	0.10	0.26	0.11	0.08
Belgium	4,795	0.03	0.06	0.08	0.28	0.12	0.08
Bulgaria	4,628	0.06	0.06	0.02	0.30	0.08	0.02
Czech Republic	7,746	0.10	0.05	0.06	0.21	0.11	0.05
Germany	9,008	0.03	0.05	0.11	0.25	0.14	0.09
Denmark	4,703	0.13	0.03	0.05	0.27	0.05	0.05
Greece	5,661	0.04	0.10	0.04	0.18	0.18	0.04
Spain	12,286	0.05	0.09	0.04	0.23	0.16	0.03
France	8,800	0.06	0.04	0.08	0.28	0.08	0.07
Italy	16,945	0.04	0.08	0.06	0.21	0.16	0.06
Sweden	5,527	0.12	0.03	0.05	0.31	0.04	0.06
United Kingdom	16,209	0.05	0.06	0.11	0.25	0.11	0.07

Notes: Unweighted shares of breadwinners, split into primary, single earners in single households and sole earners in multiple-person households using the analysis sample. Shares are pooled over all years for exposition purposes. These shares do not change substantially over the period of observation.

Source: EUROMOD data, own calculations.

Figure A.3: Median PTR Based on Predicted vs. Observed Earnings



Source: EUROMOD data, own calculations.

Table A.9: Exclusion Restrictions for Heckman Predictions

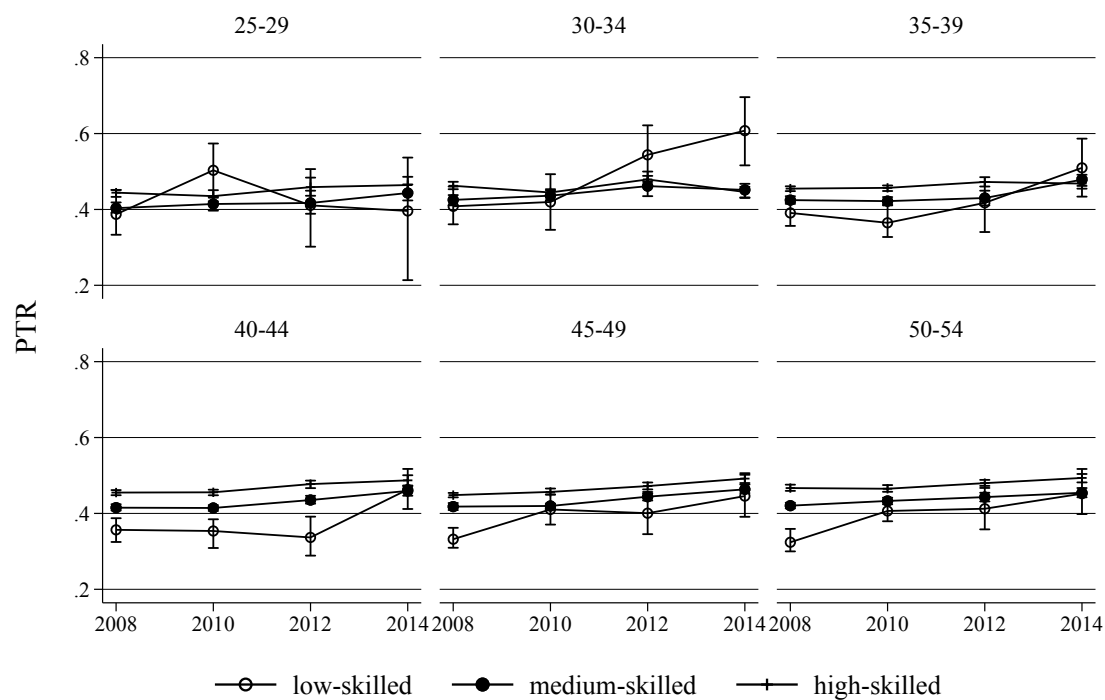
	2008	2010	2012	2014
Austria				
Women	1	1,6,9,10	1,6,9,10	1,3,6,9,10
Men	1	1,5,6,8,10	1,5,6,8	1,5,6,8
Belgium				
Women	1,3,4,9	1,3,4,9	1,3,4,9	
Men	1,9	1	1,9,10	
Bulgaria				
Women	1,3,4,5	1,3,4,5	1,3,4,5	
Men	3,4,6,10	1,8,10	1,8,10	1,8,10
Czech Republic				
Women			1	
Men	1,3,4,5,6,9	1,5	1,5,9	
Germany				
Women	1,3	1,6	1	
Men	1,6,9,10	1,6,9,10	1,6,9,10	
Denmark				
Women	9	9	1,3,6,8,9	
Men	1,6,10	1,6,10	5,9,10	
Greece				
Women	2,7	2,7	2,11	3,4,5
Men	1,11	1,11	1,11	1,11
Spain				
Women	1,6,3,4	1,6,3,4	1,6,3,4	1,6,3,4
Men	3,8,10	3,8,10	3,8,10	3,8,10
France				
Women	3,4,5,11	3,4,5,11	3,4,5,11	
Men	7,9	7,10,11,12	7,9,10,11,12	
Italy				
Women	1,3,4,5,9	1,3,4,5,9	1,3,4,5,9	1,3,4,5,9
Men	1,6,9,10,11	1,6,9,10,11	1,6,9,10,11	1,6,9,10,11
Sweden				
Women	2,9	2,9	2,9	
Men	3,9	9	9	
United Kingdom				
Women	1,3,4,5,12	1,3,4,5,12	2	2
Men	1,12	1,12	1,2,9	1,9

Note: Exclusion restrictions used to predict monthly earnings in separate regressions. The numbers above correspond to the following restrictions: 1) dummy for married; 2) number of children; 3) dummy for at least one child age 1-3; 4) dummy for at least one child age 4-6; 5) dummy for at least one child age 7-17; 6) presence of person 65+ in household; 7) presence of other worker 8) total number of household members; 9) household non-labor income; 10) foreign citizenship; 11) region; 12) occupation. In choosing exclusion restrictions, controls were selected according to their contribution to the quality of fit in the earnings distribution compared to observed workers. Only significant exclusion restrictions were retained.

Source: EUROMOD data, own calculations.

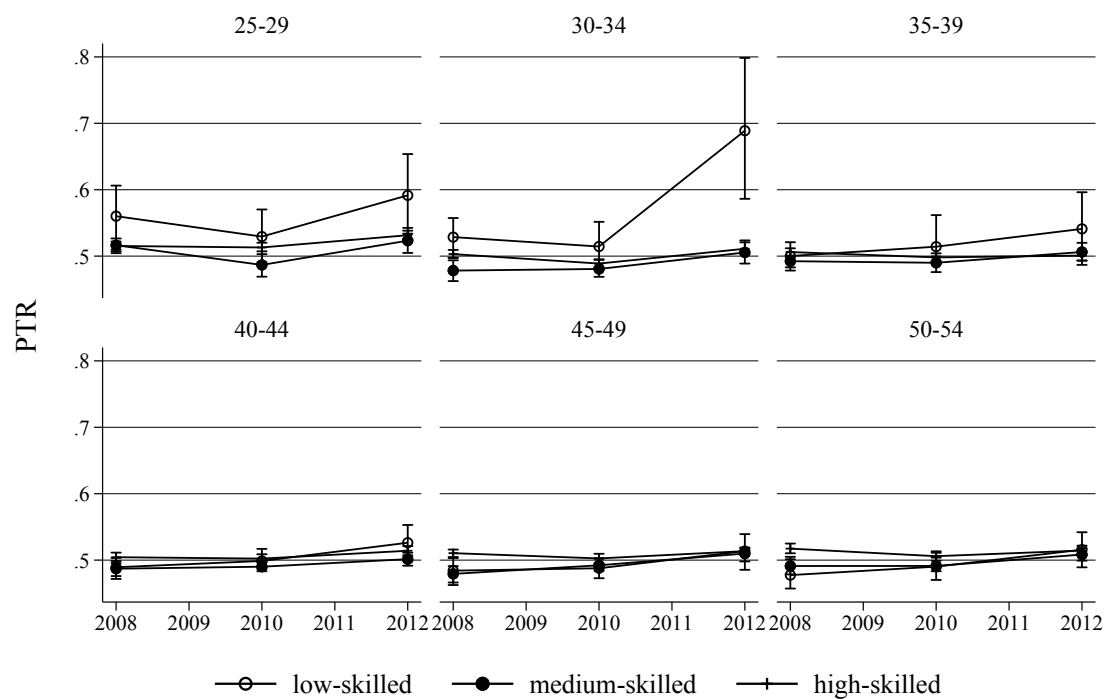
B Appendix B: Country-specific Figures

Figure B.1: PTR by age group and education level, AT



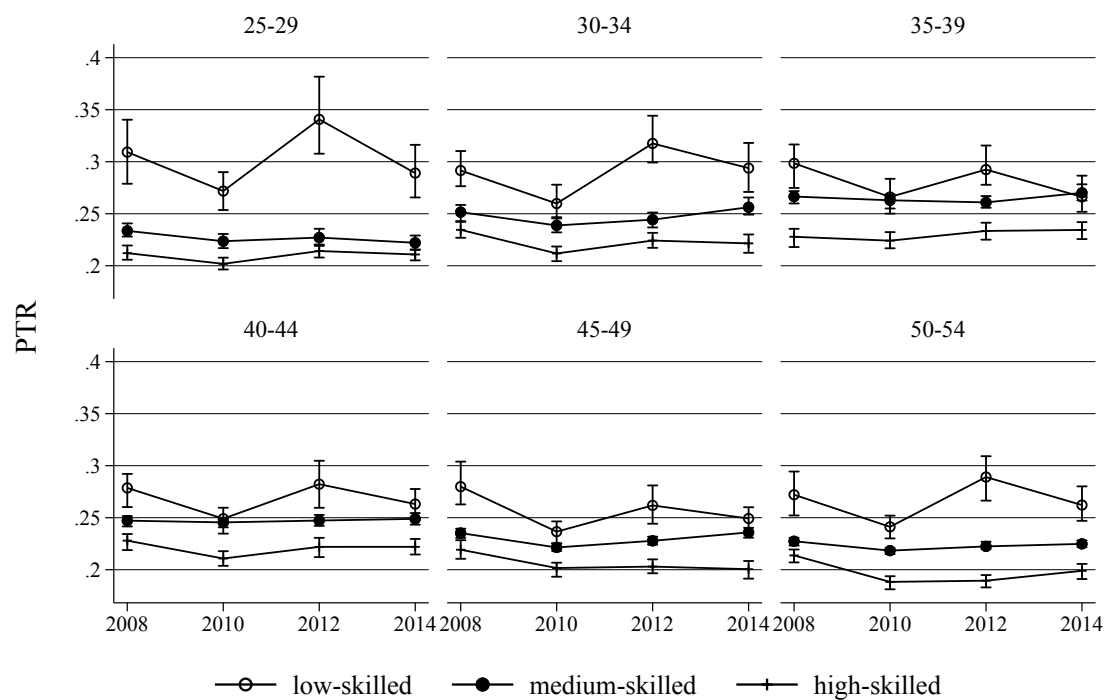
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.2: PTR by age group and education level, BE



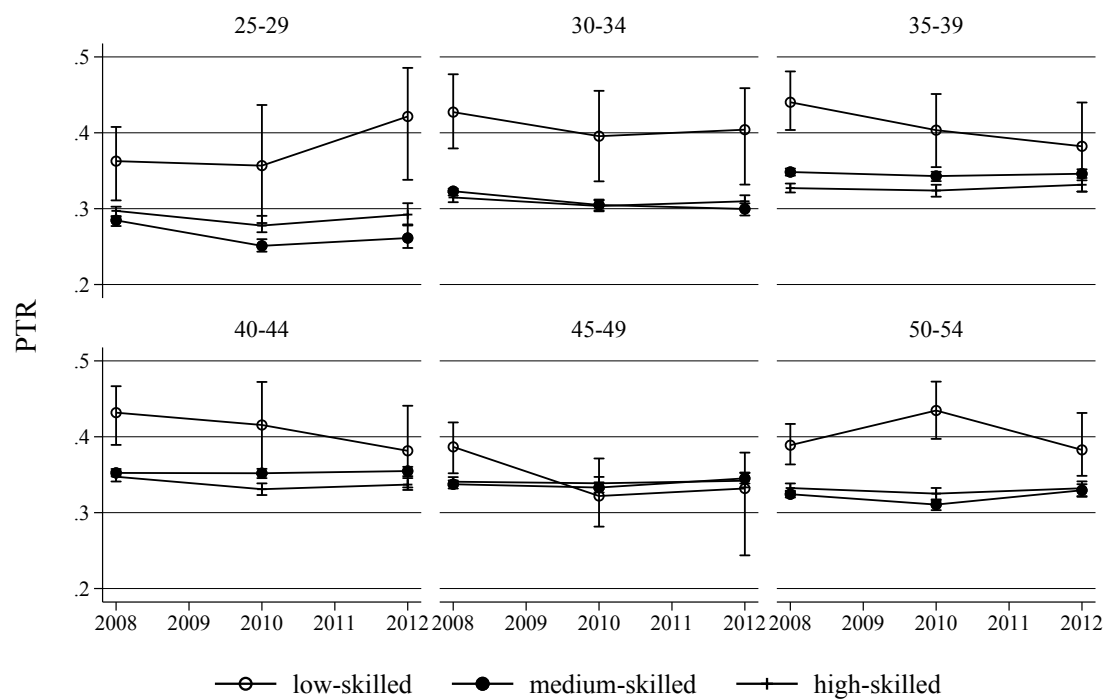
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.3: PTR by age group and education level, BG



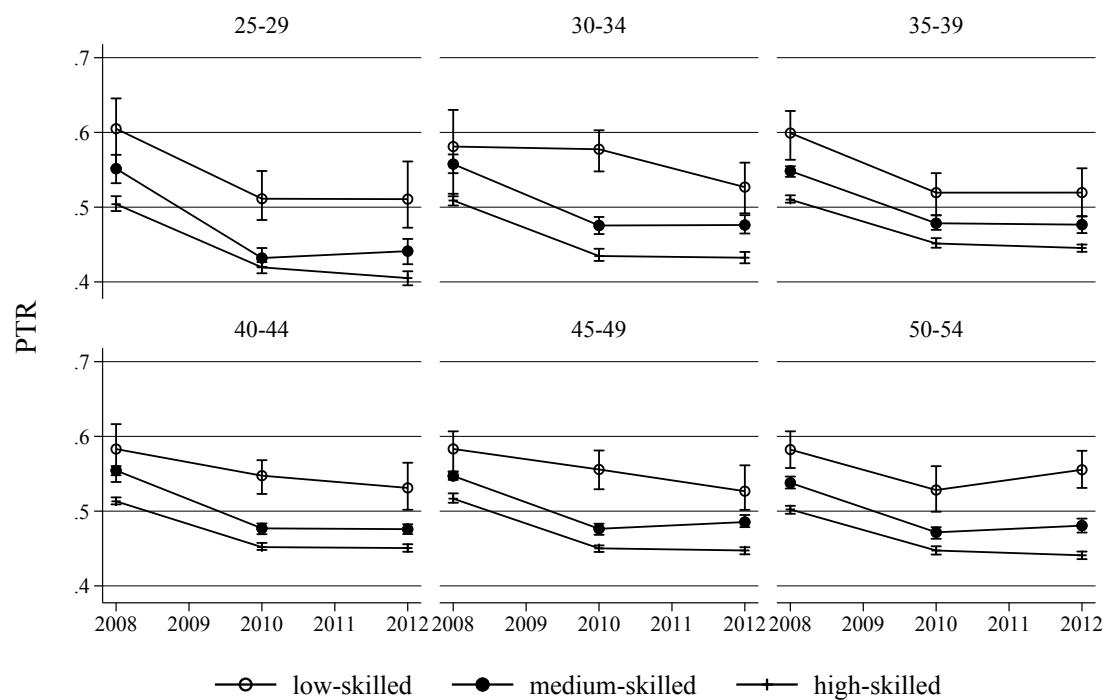
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.4: PTR by age group and education level, CZ



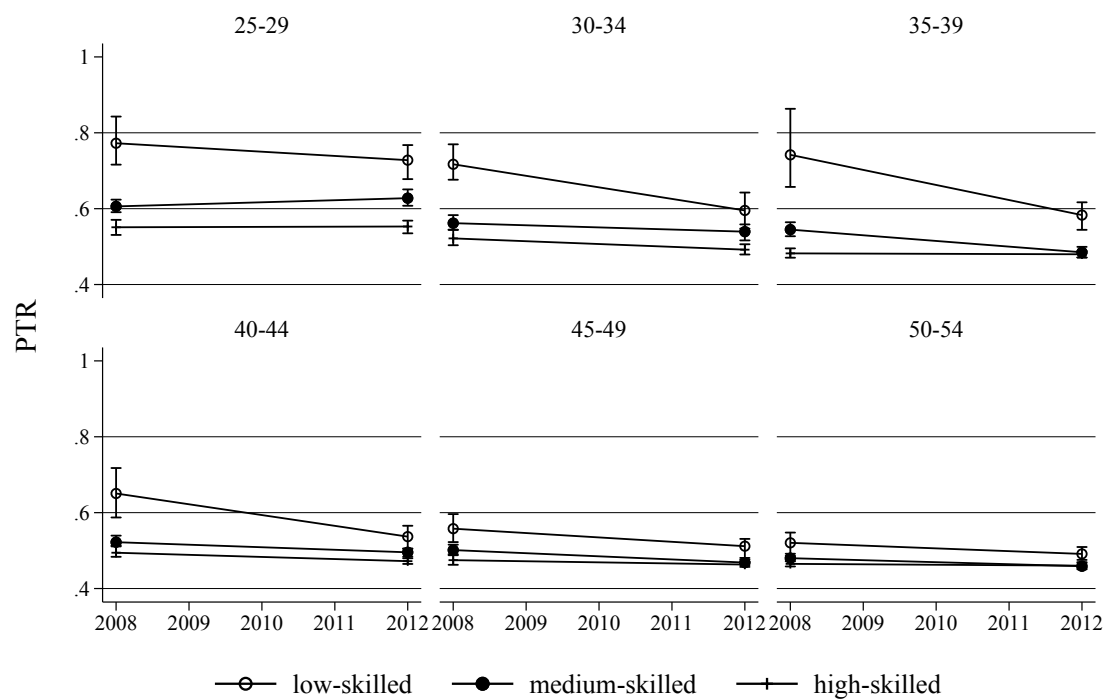
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.5: PTR by age group and education level, DE



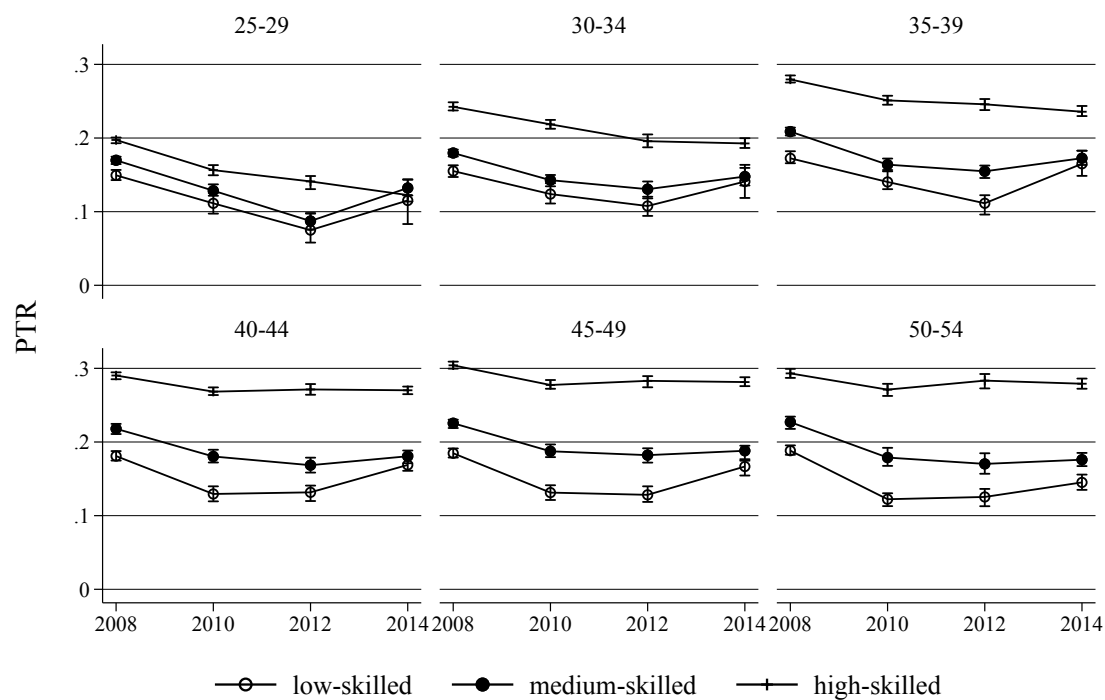
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.6: PTR by age group and education level, DK



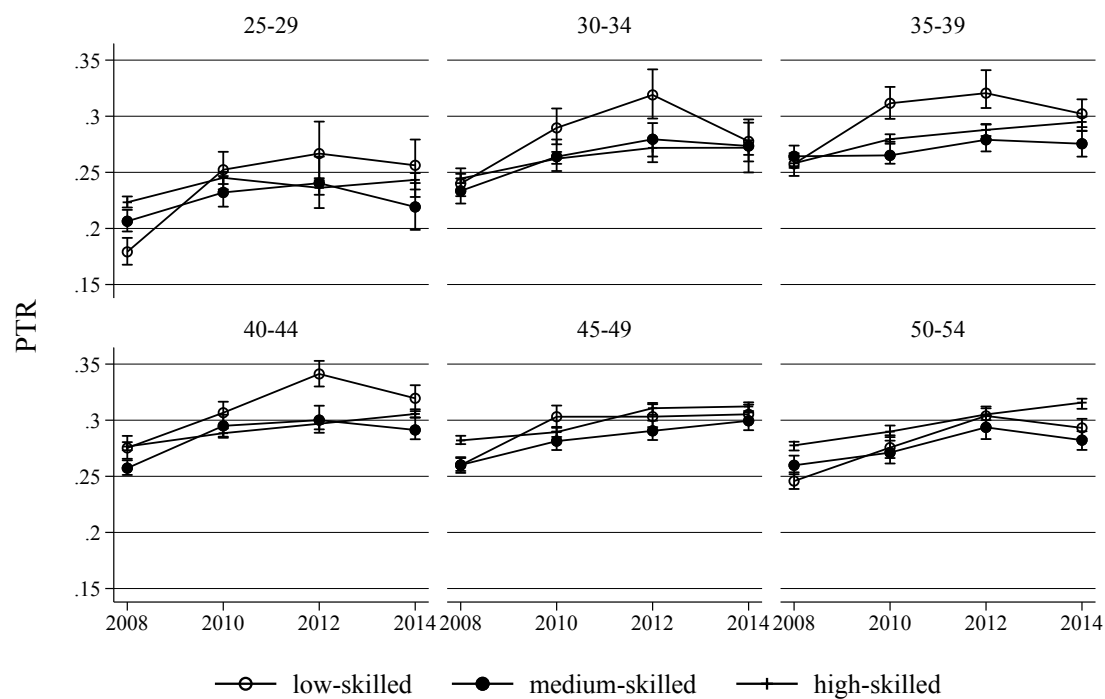
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.7: PTR by age group and education level, EL



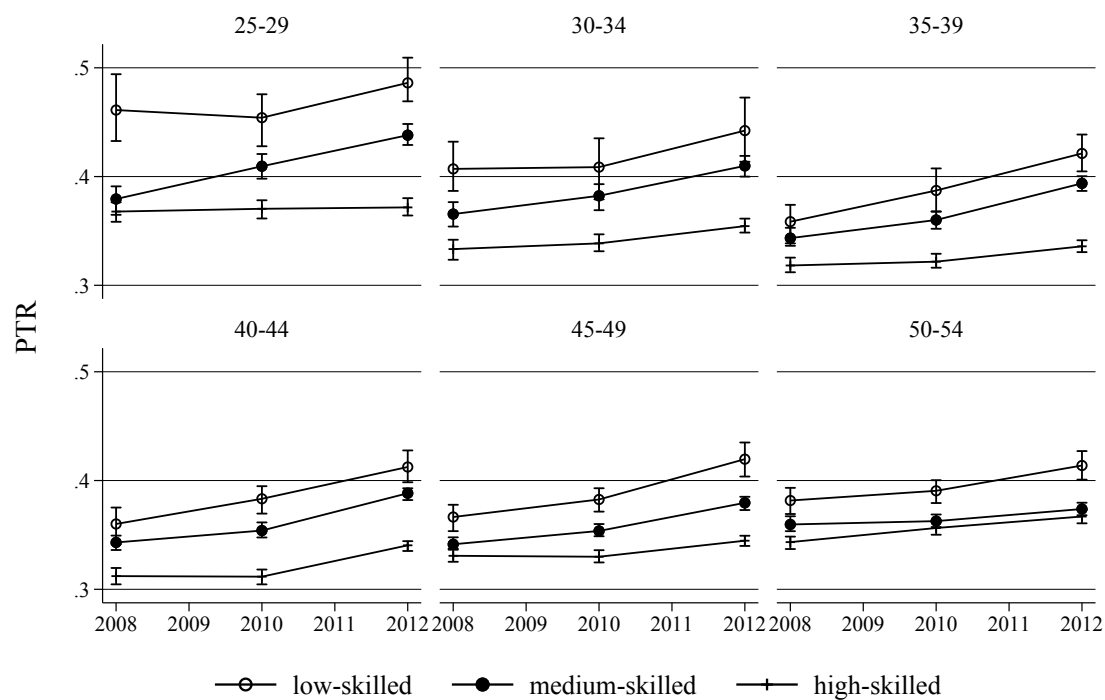
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.8: PTR by age group and education level, ES



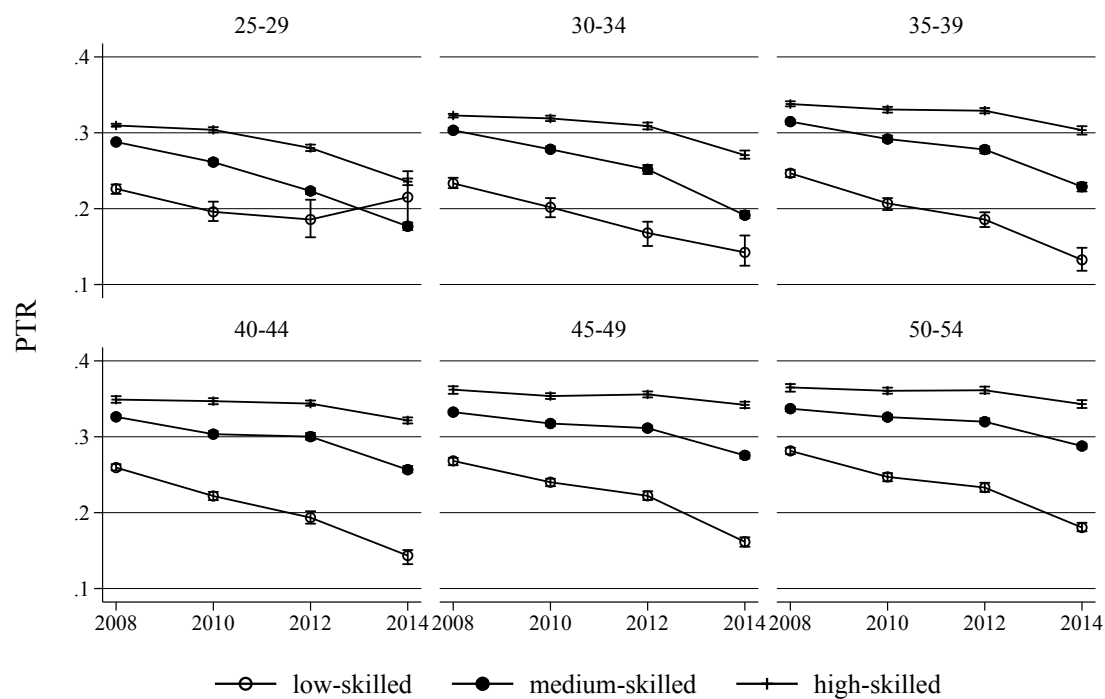
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.9: PTR by age group and education level, FR



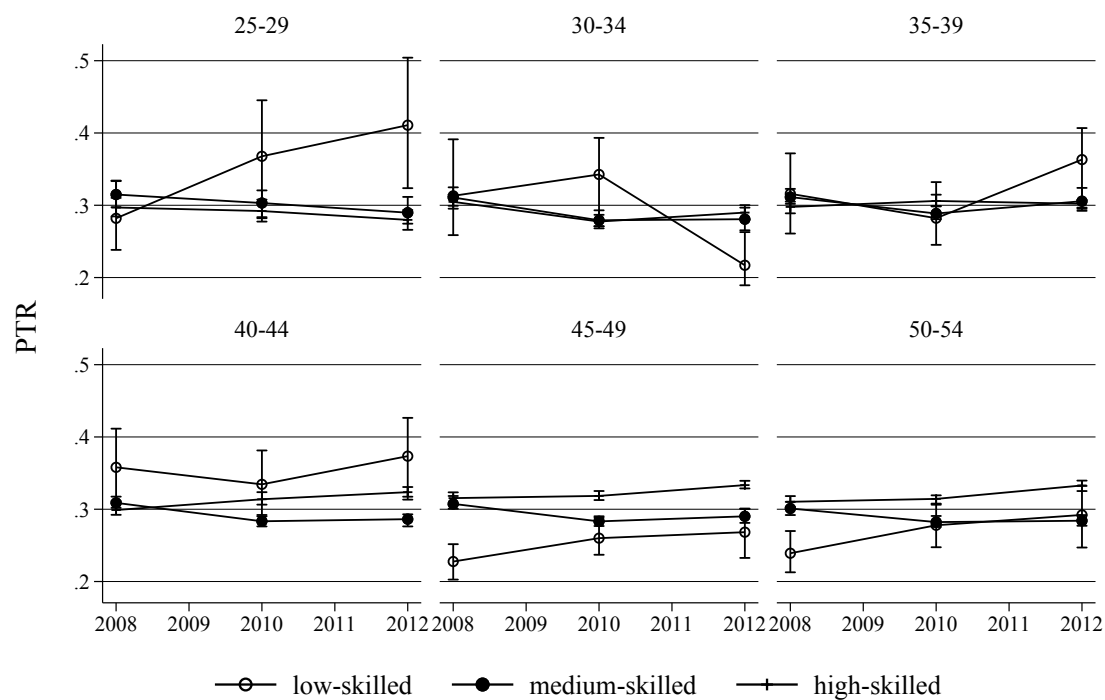
Note: Whiskers indicate bootstrapped 95% confidence intervals.
 Source: EUROMOD data, own calculations.

Figure B.10: PTR by age group and education level, IT



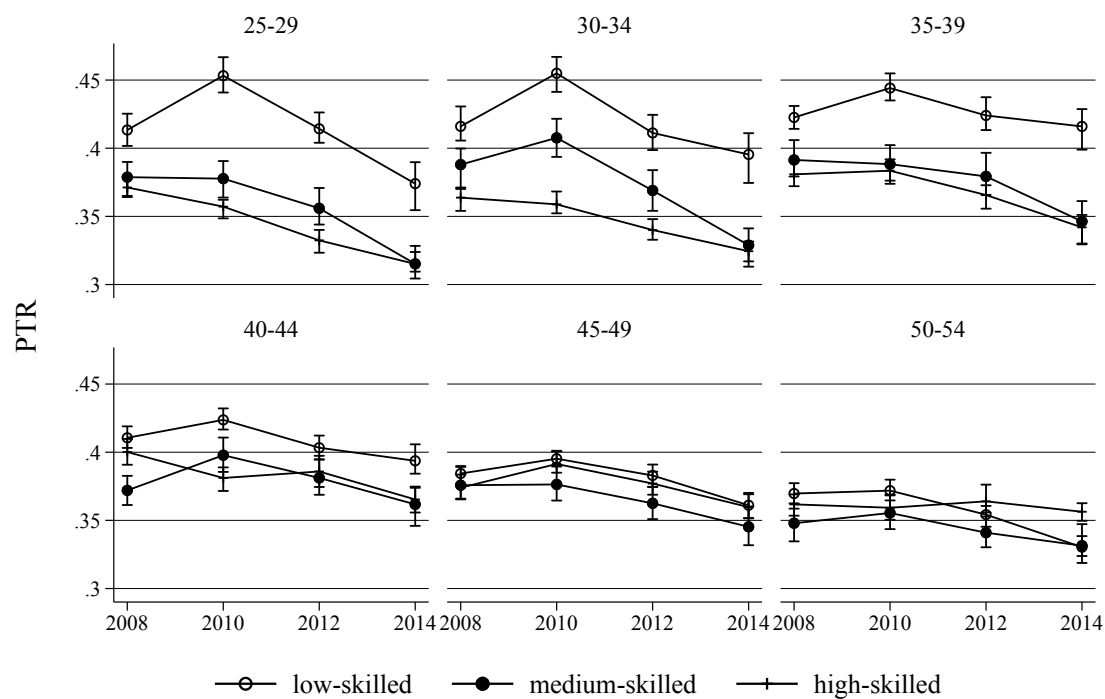
Note: Whiskers indicate bootstrapped 95% confidence intervals.
 Source: EUROMOD data, own calculations.

Figure B.11: PTR by age group and education level, SE



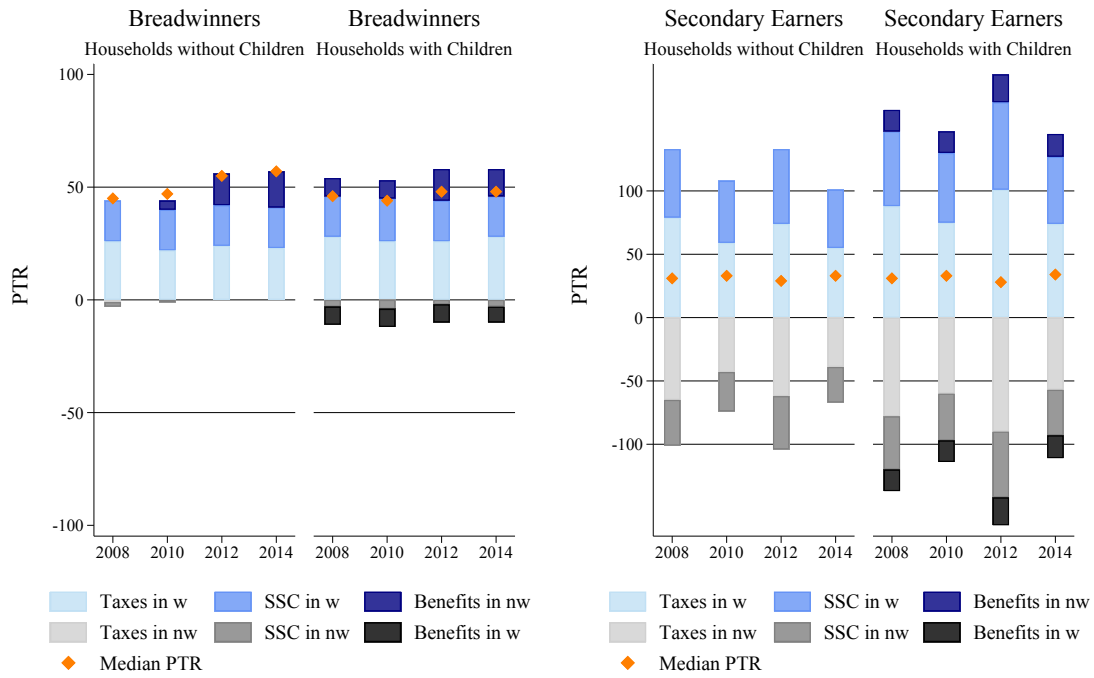
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.12: PTR by age group and education level, UK



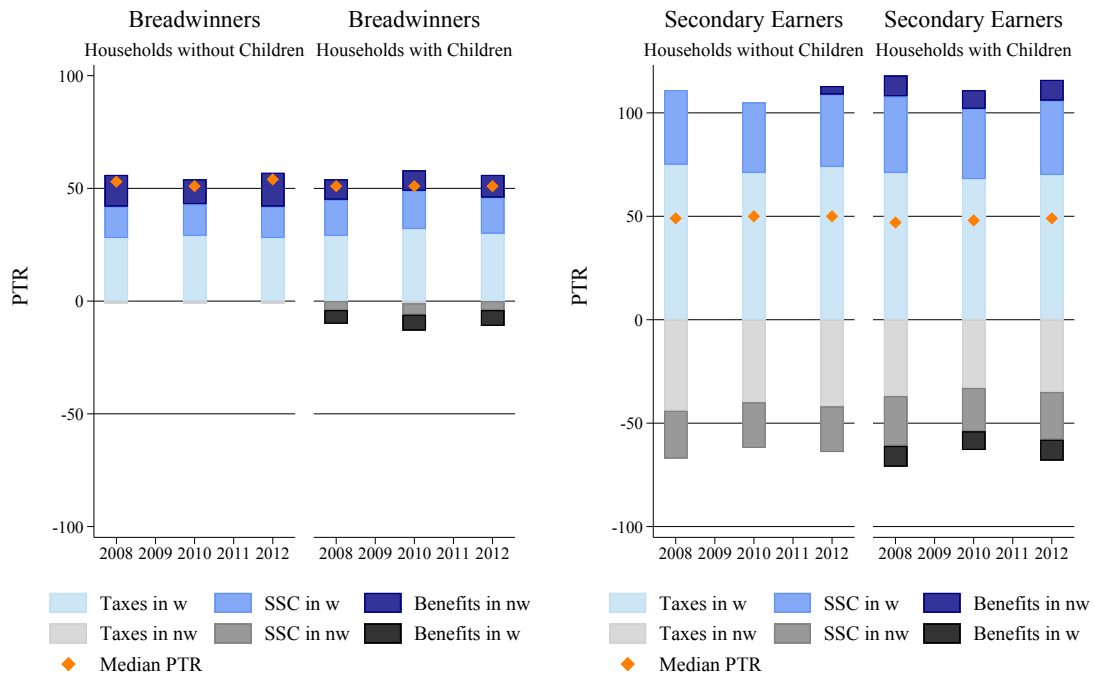
Note: Whiskers indicate bootstrapped 95% confidence intervals.
Source: EUROMOD data, own calculations.

Figure B.13: PTR Compositions by Earner Role, with and without Children, AT



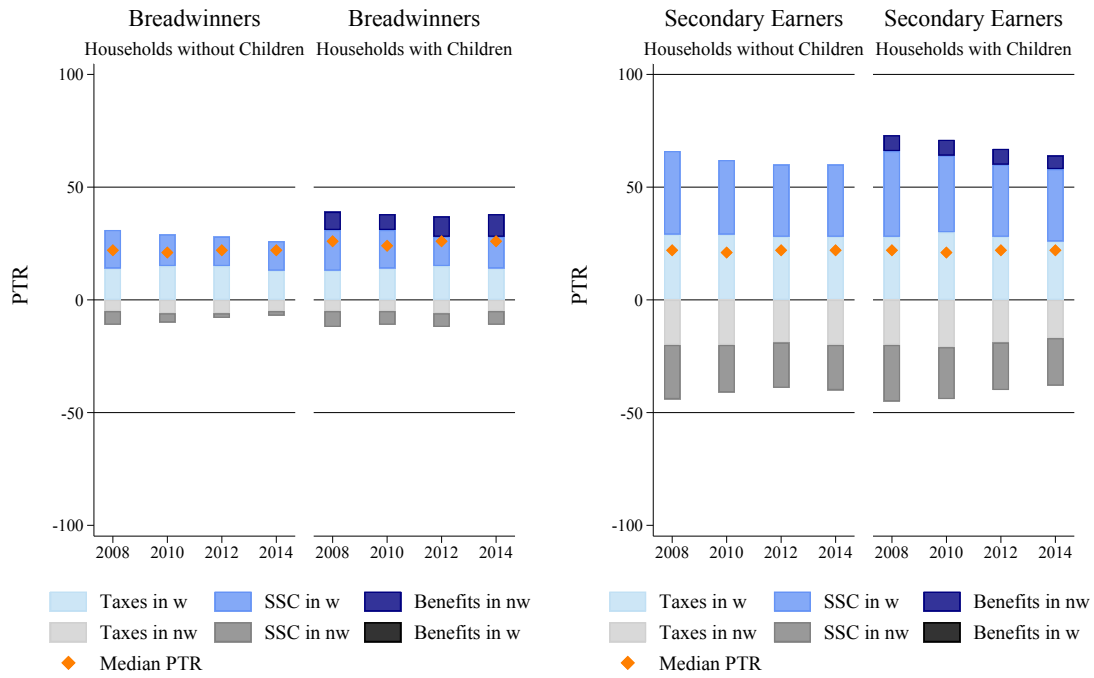
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.14: PTR Compositions by Earner Role, with and without Children, BE



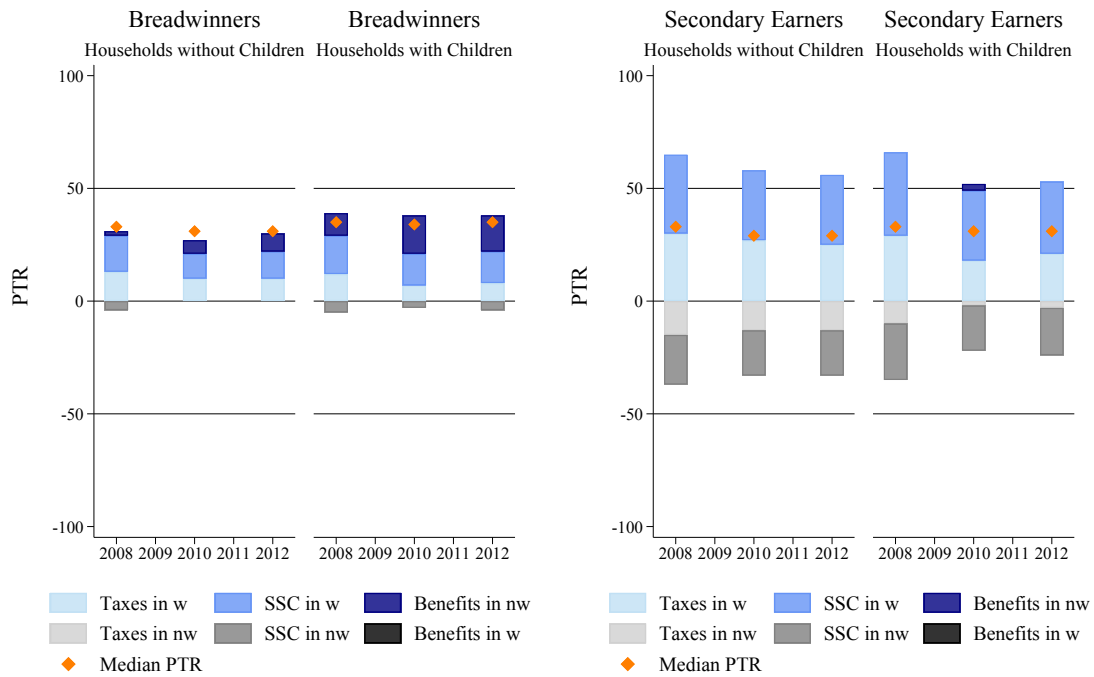
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.15: PTR Compositions by Earner Role, with and without Children, BG



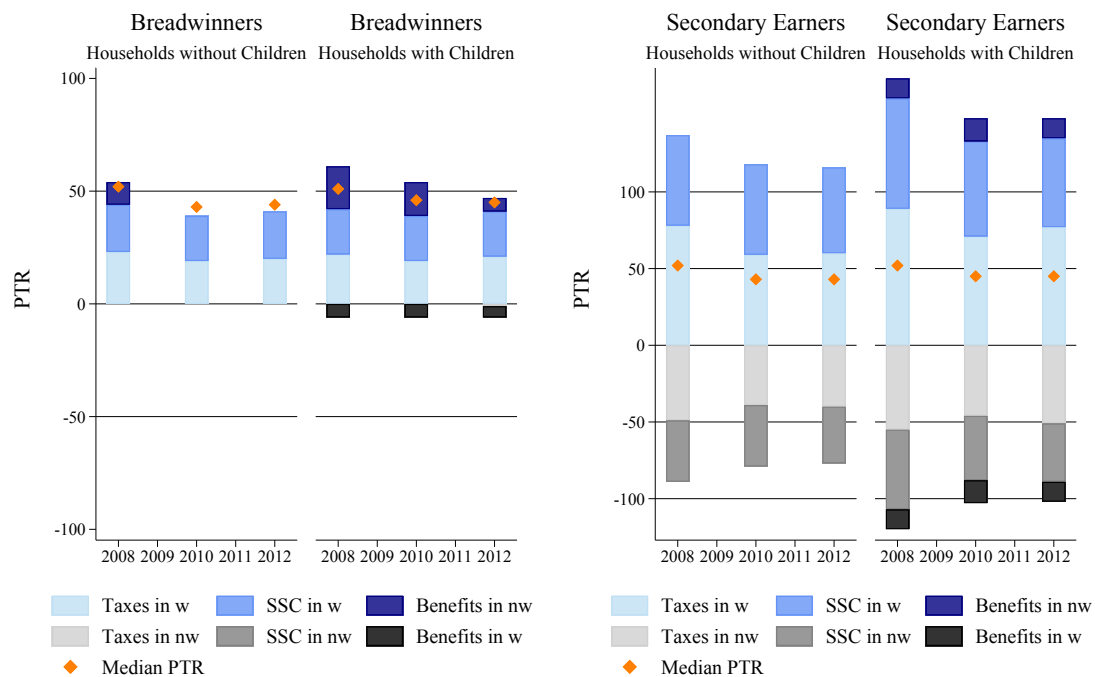
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.16: PTR Compositions by Earner Role, with and without Children, CZ



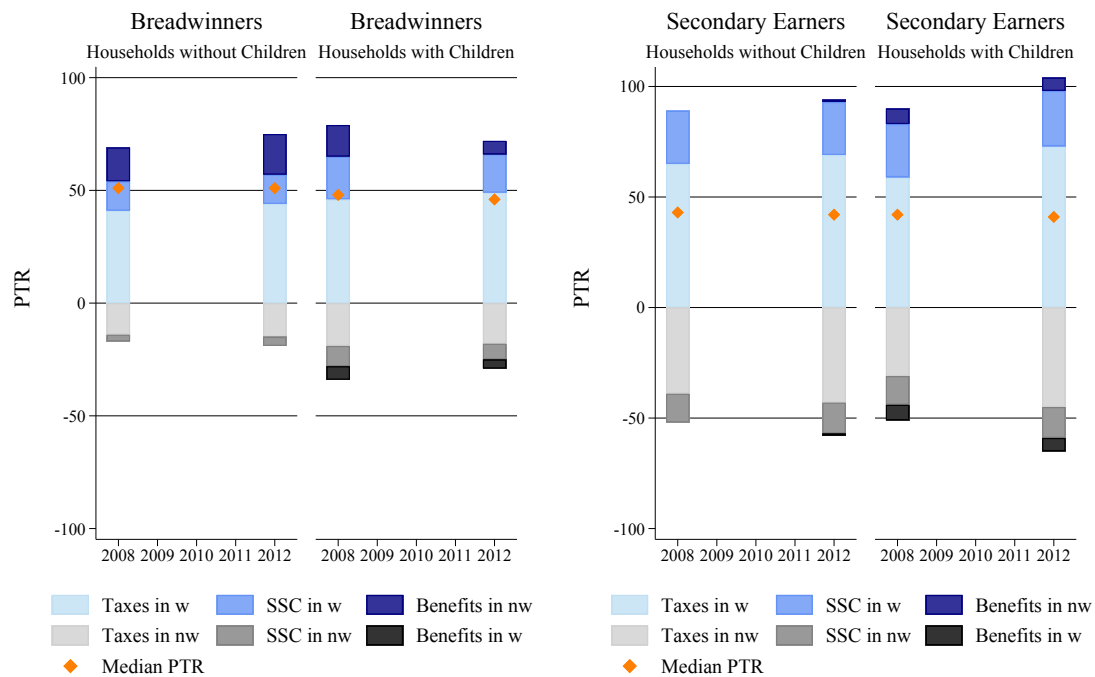
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.17: PTR Compositions by Earner Role, with and without Children, DE



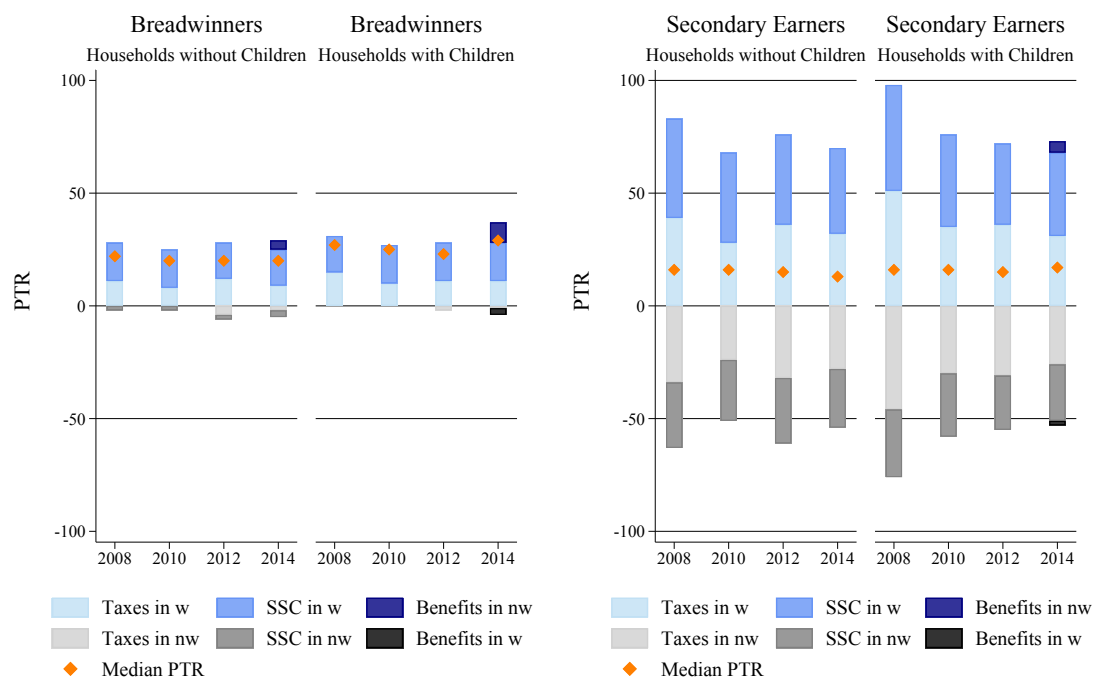
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.18: PTR Compositions by Earner Role, with and without Children, DK



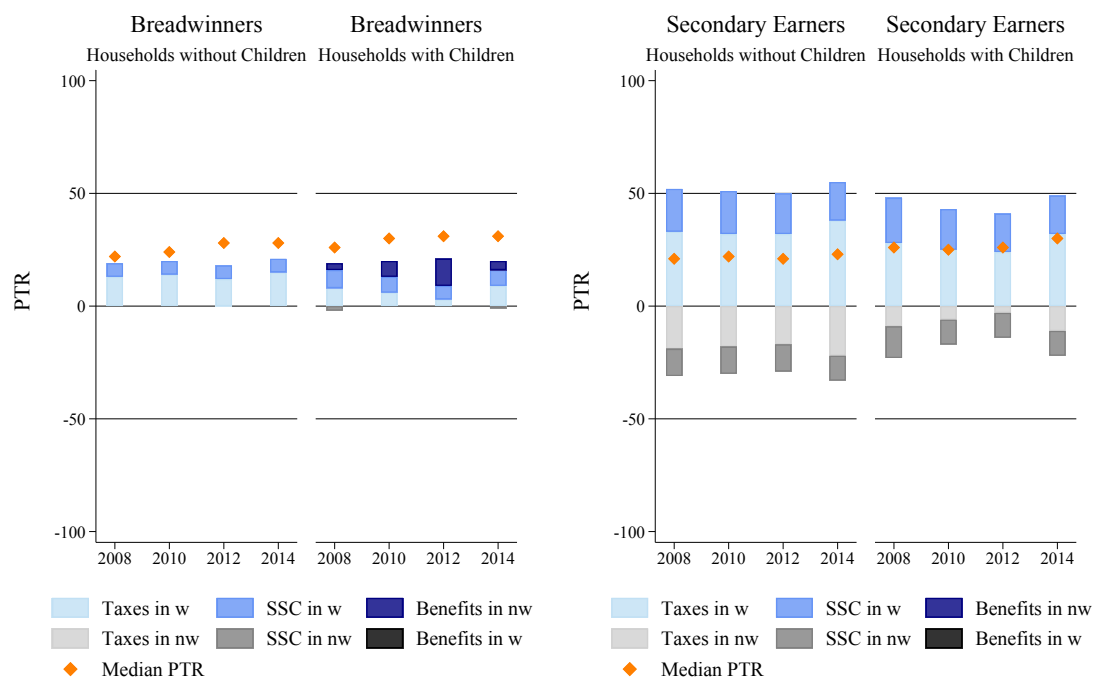
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.19: PTR Compositions by Earner Role, with and without Children, EL



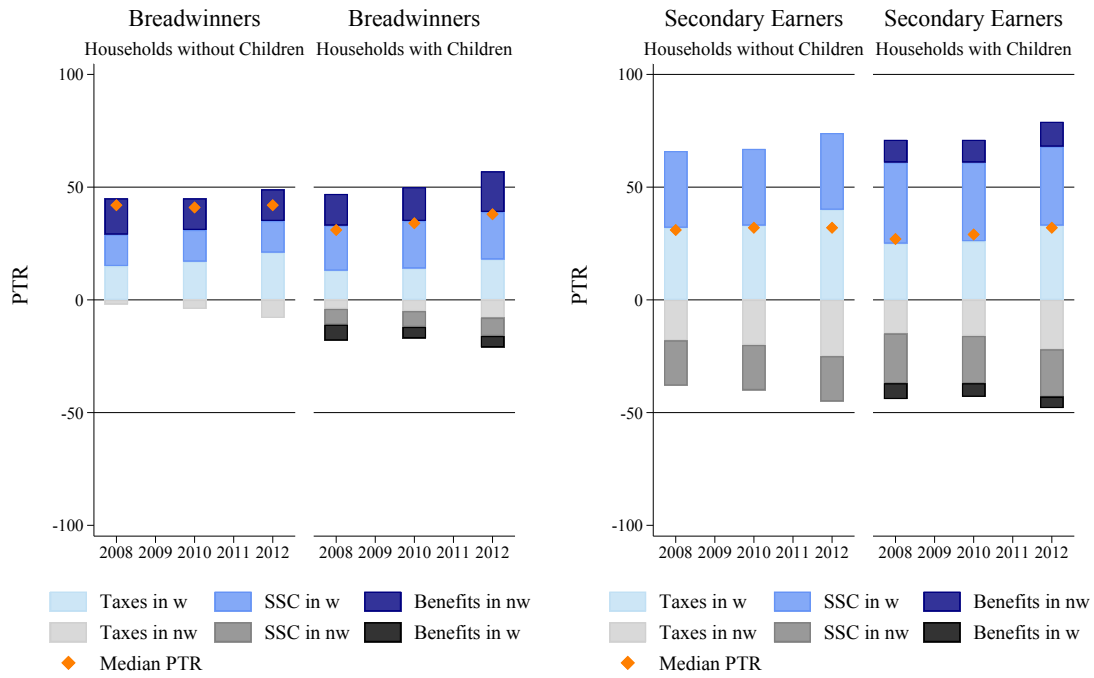
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.20: PTR Compositions by Earner Role, with and without Children, ES



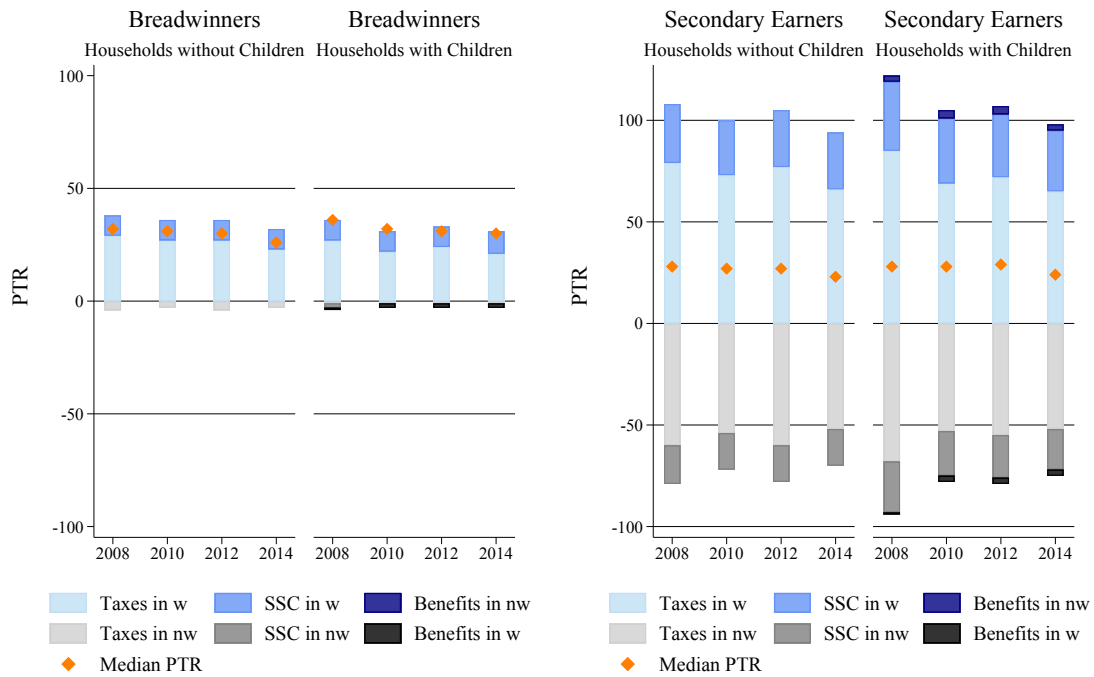
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.21: PTR Compositions by Earner Role, with and without Children, FR



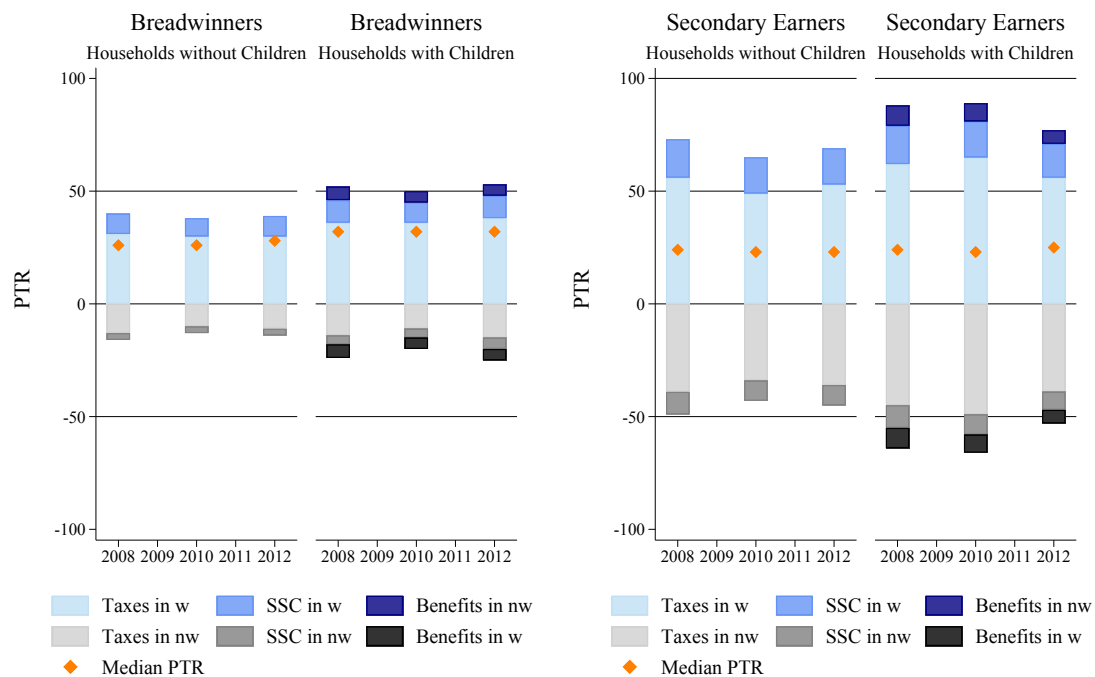
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.22: PTR Compositions by Earner Role, with and without Children, IT



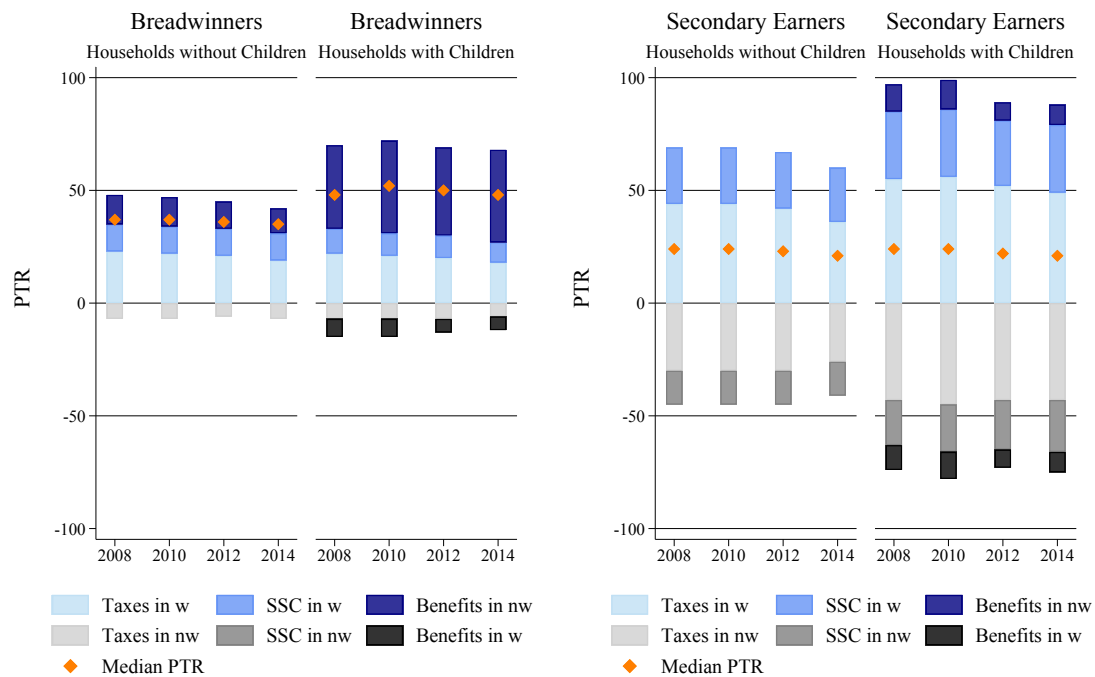
Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.23: PTR Compositions by Earner Role, with and without Children, SE



Note: See note below Figure 3.
Source: EUROMOD data, own calculations.

Figure B.24: PTR Compositions by Earner Role, with and without Children, UK



Note: See note below Figure 3.
Source: EUROMOD data, own calculations.