The Journal of Economic Inequality
https://doi.org/10.1007/s10888-023-09594-6

Tax-benefit systems and the gender gap in income

Karina Doorley[1,2,3] · **Claire Keane**[1,3]

Received: 2 June 2022 / Accepted: 2 August 2023

Abstract
The gender wage gap and the gender work gap are sizable, persistent and well documented for many countries. The result of the gender wage and gender work gap combined is an income gap between men and women. A small literature has begun to examine how the tax-benefit system contributes to closing gender income gaps by redistributing between men and women. In this paper, we study the effect of tax-benefit policy on gender differences in income in the EU27 countries and the UK. We use microsimulation models linked to survey data to estimate gender gaps in market income (before taxes and transfers) and disposable income (after taxes and transfers) for each country. We then decompose the difference between the gender gap in market income and the gender gap in disposable income into the relative contribution of taxes and benefits in each country. We also isolate the relative contributions of the gender wage gap and the gender work gap to the overall gap in income between men and women in two of these countries.

Keywords Gender inequality · Decomposition · Tax-benefit system

The results presented here are based on EUROMOD version I2.0+, UKMOD version A1.5+and SWITCH version 1.3. 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). UKMOD is maintained, developed and managed by the Institute for Social and Economic Research (ISER) at the University of Essex. The process of extending and updating UKMOD is financially supported by the Nuffield Foundation, based on the annual update of the UK component of EUROMOD funded by the European Union Programme for Employment and Social Innovation "EaSI" (2014-2020). SWITCH is maintained, developed and managed by the Economic and Social Research Institute. Funding from the ESRI's Tax, Welfare and Pensions Research Programme (supported by the Departments of Public Expenditure and Reform, Employment Affairs and Social Protection, Health, Children and Youth Affairs and Finance) is gratefully acknowledged. We are grateful to the CSO for facilitating access to the Survey of Income and Living Conditions (SILC) Research Microdata File used to construct the database for the SWITCH tax-benefit model. The results and their interpretation are the authors' responsibility. We are grateful to research assistance from Míde Griffin and Alyvia McTague.

✉ Karina Doorley
karina.doorley@esri.ie

[1] Economic and Social Research Institute, Dublin, Ireland

[2] Institute of Labor Economics, Bonn, Germany

[3] Trinity College Dublin, Dublin, Ireland

JEL classification J16 · J31

1 Introduction

Recent research suggests that the wages of men and women are converging in many countries. This is largely due to the fact that women are catching up with men in terms of education and skills. However, a sizable gap in wages remains which can be attributed, among other factors, to occupational segregation, work-force interruptions and discrimination (Blau and Kahn 2017; Redmond and McGuinness 2019). Gender differences in participation in the labour market are also large and the extent of these differences varies across countries (Olivetti and Petrongolo 2008). Women are less likely to work and working women tend to work fewer hours, on average, than working men. The result of the gender wage and gender work gap combined is an earnings gap between men and women that is unlikely to close in the immediate future. This gap has knock-on effects on the career trajectories of men and women with implications for equality and poverty both during working life and into retirement.

Factors such as equal pay legislation, collective bargaining and minimum wages have all been shown to close the gender wage gap. Additionally, policies such as the individual taxation of spouses, parental leave for both parents and childcare subsidies have contributed to increasing the labour force participation of women in many countries and, consequently, to closing the gender work gap. A small literature has also begun to examine how the tax-benefit system can contribute to closing gender income gaps, not by tackling the gender wage or gender work gap, but by redistributing between men and women so that the gender gap in disposable income is relatively smaller than the gender gap in gross income. Although tax-benefit polices are not typically targeted at either gender, because women typically earn less than men, the fact that tax-benefit systems are usually progressive means that women pay less tax, on average, than men. The degree to which the gender earnings gap is affected by the tax-benefit system depends on the size and source of the gender earnings gap and the nature of the tax-benefit system. For example, in countries with low female labour force participation, the gender income gap will be cushioned if there is a strong welfare component to the tax-benefit system. In countries with large gender wage gaps, the gender income gap will be cushioned more if the taxation system is progressive.

The literature which evaluates the effect of taxes and welfare on gender income inequality uses microsimulation modelling to construct counterfactual income distribuitions for men and women with and without the tax and welfare system. Figari et al. (2011) show that the tax-benefit systems of a selection of European countries decrease income inequality between members of a couple, with some systems performing more redistribution than others. Gallego-Granados and Geyer (2015) go a little further and map how the gross gender pay gap is transformed into the net gender wage gap in Germany, showing that the design of the German tax-benefit system reduces gender income inequality. In a cross-country contribution, Avram and Popova (2022) show how the tax-benefit systems in eight European countries contribute to closing the gender income gap, concluding that taxes and transfers alone cannot fully compensate for the gender earnings gap.

In this paper we build on this literature and estimate the first EU-wide (including the UK) distribution of gender gaps in market income and disposable income. We then formally develop a novel method of decomposing the difference between the gender gap in market income and the gender gap in disposable income, distinguishing between the

cushioning work performed by the tax and benefit system separately. This method has parallels with the wider income inequality literature and is easily applicable.

In a further novel contribution, we explore the drivers of the gender gap in market income by decomposing it into the relative contributions of the unexplained gender wage gap and the gender work gap—at the intensive and extensive margins—for two of the countries in our sample, the UK and Ireland. A full EU-wide decomposition of this type is not possible because of the limitations of most of the datasets underlying the microsimulation model we use. However, we perform this market income decomposition for the two countries for which we have appropriate data, in order to showcase what is possible for researchers with access to microsimulation models linked to data containing current (rather than last year's) income. We show how such a decomposition can be used to assess how much of each type of gender income gap is cushioned by the tax-benefit system.

We look at the population as a whole rather than focusing on redistribution within couples. We apply our framework to the EU27 and UK to provide cross-country evidence of how tax-benefit systems cushion gender earnings inequality in the population as a whole and we provide the first cross-country evidence of how the components of the gender income gap are cushioned. We then discuss the trade-off between cushioning the gender earnings gap and incentivising a decrease in the gender earnings gap at source, through increased female labour supply and decreased gender pay gaps. Our results have particular implications for policymakers who engage in gender or equality budgeting.

2 Related literature

The gender gap in disposable income is made up of a number of components: the gender gap in hours of work, the gender gap in wages, the gender gap in non-labour income and the transformation of market income into disposable income via the tax-benefit system.

2.1 Gender differences in market incomes

Considering the gender gap in hours of work, female employment has increased in recent decades in most countries. Figure 1 shows the gender gap in employment rates for the last two decades and weekly hours of work for the last decade in Europe. Despite some convergence in male and female employment, a sizable gender gap—13% for employment rates and 15% for work hours—remains in the EU.

Economic literature advances several reasons for the existence the other major component of the gender income gap: the gender pay gap. Differences in human capital (Mincer and Polachek 1974), differences in employment types and occupational segregation (Bergmann 1974; Blau and Kahn 2007), and discrimination (Becker 1971) are all considered to contribute. There has been a narrowing of the gender difference in human capital and employment types over the last number of decades accompanied by a convergence in earnings between men and women (Goldin 2014; Keller 2019). However, there is still a well-documented gender pay gap which differs substantially across countries (Olivetti and Petrongolo 2008). The gender pay gap has been found to be small at the start of employment but to greatly increase with age (Goldin 2014) and at the point of becoming a parent (Albrecht et al. 2018; Kleven et al. 2019).

Data from the Structure of Earnings Survey (Fig. 2, LHS) shows that monthly earnings have increased over the last decade for both men and women in the EU, with

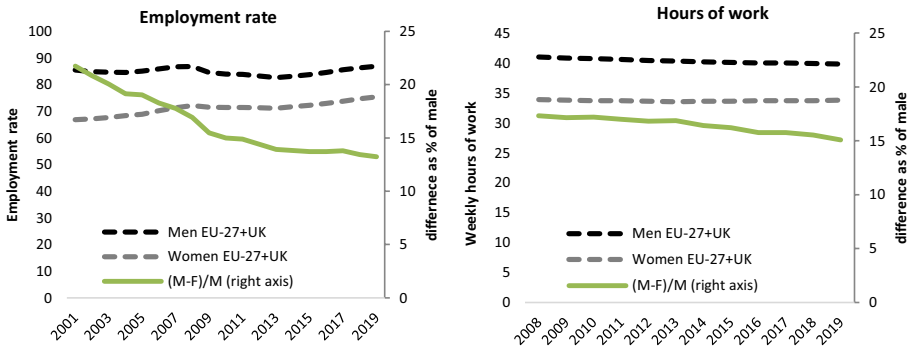

Fig. 1 Gender gap in employment rate and hours of work in Europe. Notes: Age range is 25–54 years of age. Source: Eurostat (Employment rate taken from the series 'Employment and activity by sex and age—annual data [lfsi_emp_a]'; Hours of Work taken from the series 'Average number of usual weekly hours of work in main job, by sex, professional status, full-time/part-time and economic activity (from 2008 onwards, NACE Rev. 2)—hours [lfsa_ewhun2]')

slightly sharper gains for women since 2014. The raw gender wage gap, which is simply the average hourly wage difference between men and women, has decreased over the last number of years but remains above 15% (Fig. 2, RHS). Controlling for worker characteristics, Redmond and McGuinness (2019) estimate that the adjusted gender wage gap, i.e. the portion that is unexplained by different labour market characteristics between men and women, is slightly lower than this at between 11–12% in the EU-28.

The gender wage gap and the gender gap in employment are inter-related and it is likely that the direction of causality goes in both directions. On the one hand, the fact that women are paid less than men for the same work leads to them substituting away from market work to work in the home. Olivetti and Petrongolo (2008) found that selection into employment explains nearly half of the observed negative correlation between wage and employment gaps. In other words, females with higher earnings potential are

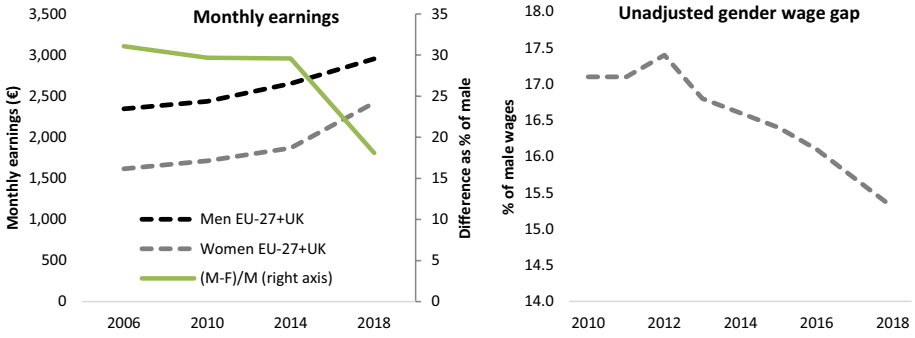

Fig. 2 Gender gap in monthly earnings and raw gender wage gap. Notes: The unadjusted gender wage gap measures the difference between average gross hourly earnings of male paid employees and of female paid employees as a percentage of average gross hourly earnings of male paid employees. All figures are nominal. Source: Eurostat (monthly Earnings taken from the series 'Structure of earnings survey: monthly earnings [earn_ses_monthly]'; Unadjusted Gender Wage Gap taken from the series 'Gender pay gap in unadjusted form by NACE Rev. 2 activity—structure of earnings survey methodology [earn_gr_gpgr2]).'

much more likely to join the labour market. Keller (2019) finds that declining gender pay gaps have contributed to decreasing occupational segregation.

On the other hand, the fact that women work fewer hours than men leads to a wage differential between men and women due to the resulting work experience and training gaps. This is particularly the case because hours of work in many occupations are worth more when given at particular moments and when the hours are more continuous. Because of this nonlinear relationship between earnings and hours of work, the relatively uninterrupted patterns of labour force participation by men compared to women results in a gender wage differential (Goldin 2014).

While the gender gap in earnings is well documented, gender gaps in non-labour income receive less attention. Significant gender gaps in investment have been found in the UK and US with 29% of females found to have traded or invested in stocks and shares online compared to 47% of men (Reuters 2022). Bacher (2022) finds that single women hold less risky portfolios than single men, which can influence the returns on such investments. This gender investment gap may itself be driven by the gender earnings gap as women tend to have lower labour income and, therefore, less to potentially invest. Gender gaps have also been found in housing returns with Goldsmith-Pinkman and Schue (2022) finding that single women earn 1.5 percentage points lower annualised returns on housing relative to single men. Less is known about gender differences in secondary properties that may generate rental income, but it is plausible that a gender gap exists here also – for example Deng et al. (2019) find that house ownership rates in China differ by gender with women less likely to own housing wealth, a finding partly driven by males receiving more intergenerational property transfers. Even in countries with high gender equality ownership of assets that can generate non-labour income can vary greatly by gender—Ownershift (2021) find significantly higher male ownership in Sweden of assets such as company ownership, shares, land and agricultural property.

2.2 The tax-benefit system and other policy interventions

Institutions such as trade unions; the minimum wage and generous policies concerning the reconciliation of work and family life have been found to reduce the gender wage gap, the gender gaps in hours of work and, thus, gender income gaps (Bargain et al. 2019; Christofides et al. 2013; Olivetti and Petrongolo 2017). These policy interventions often explicitly have a reduction in the gender gap in (gross) earnings as a specific aim. Tax-benefit policies also have a role to play in reducing the gender gap in disposable income in a more implicit fashion However, few studies in the economics literature have examined the potential of tax-benefit policy, not to alter behaviour of individuals or firms, but to cushion the existing gender gaps as market income is transformed into disposable income. The question of whether or not this is desirable must be balanced with other considerations around incentives to work among secondary earners and shifting the responsibility for closing the unexplained gender wage gap to employers – a point we will return to in the concluding section.

While tax-benefit policies do not specifically differentiate by gender, the differing employment rates and earnings of men and women result in differing impacts of tax-benefit policies by gender. The fact that men have higher earnings than women means that they, on average, pay more income tax than women, especially in countries with highly progressive income taxation. Ownership of assets may also differ by gender as does taxation on any incomes from, or transfers of, such assets. The gender gap in

pension benefits (both occupational and state pensions) is well documented reflecting the accumulation of lower female incomes, and pension contributions, over the lifetime. Across the OECD, pension payments to women over 65 were, on average, 25% lower than for men (Lis and Bonthuis 2019). Women have lower entitlements to other benefits such as unemployment insurance due to lower insurance contributions (themselves driven by higher part-time employment amongst women) and women may have reduced access to unemployment benefits that are means-tested against family income as they are more likely to have a partner in full-time employment (Leschke 2007). Women are often more likely to act as carers than men (ONS 2013) and are, therefore, more likely to be in receipt of caring-related benefits.

These differing impacts of taxes and benefits by gender is well recognised in the area of gender (responsive) budgeting. This is defined by the OECD as "integrating a clear gender perspective within the overall context of the budgetary process through special processes and analytical tools, with a view to promoting gender-responsive policies" (OECD 2016). Its scope includes, but is not limited to, expenditure policies, budgetary allocation, tax policy and equal opportunities legislation (Stotsky 2016). Many governments participate in gender budgeting exercises and some have even legislated for gender budgeting (e.g., Austria in 2004, Belgium in 2009). These exercises tend to estimate, in either an ex ante or an ex post framework, the relative impact of changes to tax-benefit policy on men and women with a view to avoiding policy changes which are unfairly skewed towards one gender or identifying policy areas which need to be "gender-proofed".

A small literature also examines how the tax-benefit system as a whole contributes to closing gender income gaps by redistributing between men and women. Figari et al. (2011) show that the tax-benefit systems of a selection of European countries decrease income inequality between members of a couple. They found that partners' incomes were equalised the most in Finland, the UK and Austria, and the least in Greece and Italy, detailing the role of a range of policy instruments. Gallego-Granados and Geyer (2015) combined decomposition methods, tax-benefit simulation and structural labour supply estimation to map relationships between the gross gender wage gap, the tax-benefit system and the net gender wage gap in Germany, showing that the design of the German tax-benefit system reduces gender income inequality. Avram and Popova (2022) examine the extent to which the tax-benefit system closes the gender gap in earnings with a focus on which policy instruments contribute most to reducing the gap. They find that the equalising effect of benefits is higher than that of taxes but find large variability across countries and groups within the population. In a different context, structural models have been developed to analyse the impact of tax-benefit policy on labour supply and welfare within couples (Bargain 2008; Immervoll et al. 2011; Bastani 2013). These analyses are typically conducted in an ex-ante framework but some research also attempts to validate the findings from structural models in an ex post setting using reduced-form models (Blundell 2005; Cai et al. 2008).

In this paper, we show how tax-benefit systems across the EU27 countries, and the UK cushion the gender income gap in the population as a whole (rather than simply redistributing between spouses) although we do also present results for married and single individuals separately. We start by estimating the gender gap in market income across countries. For two countries, we show how the unexplained gender wage gap and gender work gap contribute to the gender gap in market income. We then use a new decomposition method which allows us to separately identify the effect of taxes and benefits on the gender income gap across countries.

3 Data and method

3.1 Decomposition method

In this section, we describe the method we use to measure the size and source of the gender gap in market income and to show the cushioning effect of the tax-benefit system on this gap. Applying the tax-benefit system to the distribution of market income using microsimulation, we show how the tax-benefit system cushions the gender gap in market income and which instrument (tax or benefits) does most of the work. By then estimating counterfactual income distributions for women which close the unexplained gender wage gap and match women with a "male" labour force participation and hours choice, we estimate the size of these two sources of the gender gap in market income. Lastly, we show how the different sources of the gender income gap (wage and work gaps) are cushioned by the tax-benefit system separately.

This exercise identifies the size and source of the gender gap in market income and which parts of the tax-benefit system reduce it across countries. This method builds on the wider income inequality decomposition literature, initiated by Bargain and Callan (2010)[1] and extended by (Doorley et al. 2021); (Paulus and Tasseva 2020) and (Sologon et al. 2021). The resulting index has parallels with the Reynolds-Smolensky index, which is used to measure the effect of tax-benefit systems on income inequality.[2]

Market income, M, is calculated at the individual level (i) as the sum of labour income and non-labour income. Excluding gender superscripts for conciseness:

$$M_i = w_i * h_i + y_i$$

Labour income is the product of hourly wages, w, and monthly hours of work, h. Non-wage income, such as investment income, is denoted y. The average market income gap between men and women is simply the difference between average market income of men, m, and women, f. We express this gap – and all other income gaps estimated—as a proportion of average male disposable income, $\overline{D}^m$, in order to isolate the contribution of each income source to the overall gender gap in disposable income:

$$Gap_M = \left(\overline{M}^m - \overline{M}^f\right)/\overline{D}^m$$

Disposable income for men, D^m and for women D^f is calculated at the individual level as follows:

$$D_i = d\left(w_i * h_i, y_i, X_i\right)$$

d denotes the tax-benefit function which calculates individual disposable income based on wages, w, hours of work, h, non-wage income, y and household characteristics, X. The disposable income gap between men and women is calculated as the difference between the average disposable income of men and women:

[1] This method decomposes the total change in income inequality into two parts—the contribution of tax-benefit policy changes and all other sources of change.

[2] This measures the redistributive impacts of the tax-benefit system by estimating the Gini coefficient before and after tax-benefit policy interventions.

$$Gap_D = \left(\overline{D}^m - \overline{D}^f\right)/\overline{D}^m$$

The "cushioning" effect of the tax-benefit system on the gender gap in market income can be quantified as the gender gap in market income minus the gender gap in disposable income.

$$C = Gap_M - Gap_D$$

3.1.1 Taxes vs. benefits

We can isolate the contribution of benefit policy from the contribution of tax policy to the overall cushioning effect of the tax-benefit system by introducing a benefit function,$b(.)$, which transforms market income into post-transfer, pre-tax income, giving us:

$$D_i^b = b\left(w_i * h_i, y_i, X_i\right)$$

Following the method employed, for example, by Paulus and Tasseva (2020), we isolate the effect of (i) benefits by comparing market income to market income plus gross benefits and (ii) taxes by comparing market income plus gross benefits to disposable income. We then have:

$$Gap_{D^b} = \left(\overline{D}^{m,b} - \overline{D}^{f,b}\right)/\overline{D}^m$$
$$C = \underbrace{\left(Gap_M - Gap_{D^b}\right)}_{benefits} + \underbrace{\left(Gap_{D^b} - Gap_D\right)}_{tax}$$

3.1.2 Wage gaps vs. work gaps

We can also examine the targeting of the tax benefit system by isolating the cushioning effect of the tax-benefit system on the gender wage gap and the gender work gap separately. To do this, we introduce a wage function. Market income for men ($j = m$) and for women ($j = f$) is calculated as:

$$M_i = \widehat{w}_i\left(X_i, \widehat{p}^j\right) * h_i + y_i$$

Wages, w, are predicted for all workers and are a function of individual characteristics, X, and a price structure, p^j. This price structure is estimated separately for men and women via OLS models for workers between 20–65 years of age.[3] Results of these models are provided in Appendix 1. For those who do not work, we can impute a counterfactual wage based on the average wage of workers within their age, education, marital status and family size cell.

[3] A selection corrected model could also be used here and would likely result in lower predicted wages for those out of work. However, since this wage prediction is used in a simulation where women have the same employment structure as men—in a scenario in which the barriers to secondary work and working as a mother are lower – this does not seem appropriate. We therefore assume that wages for women out of work who, if male, would work are similar to the wages of women in work.

We define a further set of market income and disposable income distributions for women if they were paid according to the price structure of men, i.e., if there were no unexplained gender wage gap. In this scenario, the remaining wage gap between men and women is due to observable characteristics such as education, experience and so forth. We assume that women do not change their labour market behavior in response to this closing of the unexplained gender wage gap.[4]

$$M_i^{wage} = \widehat{w}_i\left(X_i, p^m\right) * h_i + y_i$$
$$D_i^{wage} = d\left(\widehat{w}_i\left(X_i, p^m\right), h_i, y_i, X_i\right)$$

The gender gaps in market income and disposable income that are attributable to the unexplained gender wage gap are:

$$Gap_{M^{wage}} = \left(\overline{M}^{f,wage} - \overline{M}^{f}\right)/\overline{D}^{m}$$
$$Gap_{D^{wage}} = \left(\overline{D}^{f,wage} - \overline{D}^{f}\right)/\overline{D}^{m}$$

We next introduce a market income distribution for women, based on the male work hours distribution. We do this in a two-step manner, first adjusting hours of work for women who already participate in the labour market (intensive margin adjustment) and then adjusting participation and hours of work for women who are not working (extensive margin adjustment). This allows us to separately identify the effect of the gender gap in the intensive and extensive margins of work on market income.

We randomly draw an hours choice for each woman, h_i^m from the male distribution, matching along age categories, education, marital status and the number of children in the family.[5] We assign this hours choice to women who we observe to be working, resulting in our first counterfactual hours distribution, $h1_i^m$. We next adjust the participation rate of women who we observe to not be working but who draw a positive hours choice from h_i^m. We assign the average female hours choice (by age, education, marital status and number of children) to this group, giving a second counterfactual hours distribution, $h2_i^m$. Lastly, assigning h_i^m to all women in a third counterfactual hours distribution gives the total effect of adjusting female labour force participation to match the male structure in terms of both hours (as in $h1_i^m$) and participation (as in $h2_i^m$).

For each of these counterfactuals, the choice of working hours is converted into employment income using the individual's predicted wage (as described above).

Figures A.1 and A.2 in Appendix 3 show how this matching of hours of work from men to women modifies the distribution of female hours of work. The adjusted market income and disposable income distributions for women are estimated as follows:

[4] This is a reasonably restrictive assumption which could be relaxed in future work. However, it provides us with a useful snapshot of how the tax-benefit system cushions current gender wage and gender work gaps.

[5] We could also match by work hours of partners as members of a couple do not choose their work hours independently of each other. However, men typically have very inelastic labour supply so that matching women with partners to men with partners who work a similar number of hours makes little difference to our simulations. For example, in Ireland, average work hours for partnered men with children were 39.8 for those whose partner didn't work; 40.6 for those whose partner worked part-time and 41.7 for those whose partner worked full-time. The UK follows a very similar pattern.

$$M_i^{hours} = \widehat{w}_i\left(X_i, p^f\right) * h1_i^m + y_i$$
$$D_i^{hours} = d\left(\widehat{w}_i\left(X_i, p^f\right), h1_i^m, y_i, X_i\right)$$
$$M_i^{part} = \widehat{w}_i\left(X_i, p^f\right) * h2_i^m + y_i$$
$$D_i^{part} = d\left(\widehat{w}_i\left(X_i, p^f\right), h2_i^m, y_i, X_i\right)$$

The gender gaps in market income and disposable income that are attributable to differences in hours of work between working men and working women are defined as follows:

$$Gap_{M^{hours}} = \left(\overline{M}^{f,hours} - \overline{M}^f\right)/\overline{D}^m$$
$$Gap_{D^{hours}} = \left(\overline{D}^{f,hours} - \overline{D}^f\right)/\overline{D}^m$$

The gender gaps in market income and disposable income that are attributable to differences in participation rates between men and women are defined as follows:

$$Gap_{M^{part}} = \left(\overline{M}^{f,part} - \overline{M}^f\right)/\overline{D}^m$$
$$Gap_{D^{part}} = \left(\overline{D}^{f,part} - \overline{D}^f\right)/\overline{D}^m$$

So far, the decomposition deals separately with the gender gap in hours of work for workers, the gender gap in labour market participation rates and the unexplained gender wage gap. There is, however, an interaction between the gender gap in participation, the gender gap in hours and the unexplained gender wage gap. To isolate this interaction effect in the decomposition, we define a new counterfactual female market income and disposable income distribution if all three gaps were closed simultaneously.

$$M_i^{total} = \widehat{w}_i\left(X_i, p^m\right) * h_i^m + y_i$$

$$D_i^{total} = d\left(\widehat{w}_i\left(X_i, p^m\right), h_i^m, y_i, X_i\right)$$

The gender gaps in market income and disposable income that are attributable to the combination of differences in participation rates, hours of work and unexplained wage differences between men and women are defined as follows:

$$Gap_{M^{total}} = \left(\overline{M}^{f,total} - \overline{M}^f\right)/\overline{D}^m$$

$$Gap_{D^{total}} = \left(\overline{D}^{f,total} - \overline{D}^f\right)/\overline{D}^m$$

We can now decompose C into (i) the effect of the tax-benefit system on the unexplained gender wage gap, its effect on the gender work gap: (ii) intensive and (iii) extensive margins; (iv) the interaction between the unexplained gender wage gap, the intensive margin gap and the extensive margin gap and (v) a residual which includes gender income gaps from other sources. These other sources include the explained gender wage gap (demographic characteristics, occupational segregation); gender differences in self-employment status and self-employment income (which we do not simulate counterfactuals for) and non-labour income (e.g. investment income, etc.).

$$C = \underbrace{\left[Gap_{M^{wage}} - Gap_{D^{wage}}\right]}_{wage} + \underbrace{\left[Gap_{M^{hours}} - Gap_{D^{hours}}\right]}_{intensive} + \underbrace{\left[Gap_{M^{part}} - Gap_{D^{part}}\right]}_{extensive} + \underbrace{\left[Gap_{M^{total}} - Gap_{D^{total}}\right] - \left(\left[Gap_{M^{wage}} - Gap_{D^{wage}}\right] + \left[Gap_{M^{hours}} - Gap_{D^{hours}}\right] + \left[Gap_{M^{part}} - Gap_{D^{part}}\right]\right)}_{interaction} + \underbrace{\left[\left(Gap_{M} - Gap_{D}\right) - \left(Gap_{M^{total}} - Gap_{D^{total}}\right)\right]}_{other}$$

3.2 Microsimulation and data

We use three tax-benefit microsimulation models in this work: SWITCH for Ireland, UKMOD for the UK and EUROMOD for all other EU countries. SWITCH and UKMOD are based on the EUROMOD platform and, so, are harmonised in terms of simulation structure. The models numerically simulate tax-benefit rules, allowing the computation of all social contributions, direct taxes and transfers to yield household disposable income.[6] EUROMOD is linked to EU-SILC data, the most recent and important source of microdata for comparative studies on income distribution in Europe. UKMOD is linked to the Family Resources Survey and SWITCH is linked to the SILC Research Microdata File for Ireland which contains administrative information on income and welfare. We estimate market income and disposable income distributions for 2017 for all countries, which represents the latest available data at the time of writing.

The income reference period for the data underlying the EUROMOD model is the year prior to the data collection i.e. survey respondents are asked about their annual income last year. However, work hours reported are current. This leads to a mismatch between labour income and hours of work as income may have changed by the time hours of work are reported. However, the income reference period for the data underlying both SWITCH and UKMOD is the current year, which matches the timeframe for the information on hours of work. This allows us to calculate current hourly wages and estimate gender wage gaps for Ireland and the UK and counterfactual income distributions if these gender wage gaps were closed.[7] The extension of the decomposition to gender wage gaps and gender work gaps is therefore confined to these two countries. Hourly wages are calculated as monthly employee income divided by monthly hours of work. We restrict the sample studied in each country to the working age population, aged 20–65.

We must make an assumption about how couples share their resources. Standard analyses of income distribution are generally carried out at the household level, assuming that income is fully shared or 'pooled' so that all household members enjoy the same standard of living. This unitary model of family behaviour is often an appropriate way to characterise household income sharing. Non-unitary models of family behaviour, which posit some form of bargaining or negotiation within the family, challenge this approach and

[6] For a comprehensive overview of EUROMOD, see Sutherland and Figari (2013). SWITCH is described in (Keane et al. 2023). UKMOD is described by (Richiardi et al. 2021).

[7] Estimating the gender wage gap when the income reference period is not the same as the period in which hours of work and demographics is reported is difficult as the measure of hourly wage is subject to much measurement error.

have been shown to have some validity (Lundberg et al. 1997; Cantillon and Nolan 2001; Browning et al. 2010). For example, it has been found that the distribution of cash income across household members can have a strong influence on the distribution of consumption (Browning et al. 1994; Lundberg et al. 1997). This has implications for the economic independence of each individual as well as for bargaining power within the household.

We therefore consider two alternative scenarios. In the individual scenario, which constitutes our central scenario, we consider each member of a couple as an individual in terms of their market income, tax liability and benefit entitlement. One exception is family benefits, such as child benefit, and household level benefits, such as housing benefits, which we assume to be shared equally among members of a couple.[8] For countries with joint income taxation, we split the income tax liability between members of a couple in proportion to their earned income. All other income sources and deductions are retained by the individual who receives or is liable for them. This approach is in line with the related literature (Avram and Popova 2022; Figari et al. 2011). In the alternative income-sharing scenario, we assume that members of a couple fully pool their income (results available in the Online Appendix 4). The individual approach can be considered to represent an upper bound of the gender gap in income. It is a useful measure in that it represents potential income (consumption, bargaining, etc.) inequality. It also allows us to focus on inter-household redistribution performed by the tax-benefit system rather than a mix of inter- and intra-household redistribution, the latter representing income sharing between spouses. However, it should not be considered as a concrete measure of economic welfare as most households do share income to some extent (Watson et al. 2013).

4 Results

The results of our analysis will be influenced by two main factors—female employment rates and the features of the tax-benefit systems in place in each country. This section provides a brief overview of these factors. We group countries together into similar welfare regimes as per (Olivera 2018) which expands the classic Esping Andersen welfare state categories to cover the EU-27 and UK. The country groupings are as follows:

Regime	Countries
Social Democratic	Denmark (DK), Finland (FI), Sweden (SE)
Southern	Cyprus (CY), Greece (EL), Italy (IT), Malta (MT), Portugal (PT), Spain (ES)
Liberal/Anglo-Saxon	Ireland (IE), United Kingdom (UK)
Conservative	Austria (AT), Belgium (BE), France (FR), Germany (DE), Luxembourg (LU), Netherlands (NL)
Former USSR	Estonia (EE), Latvia (LV), Lithuania (LT)
Post-Communist	Bulgaria (BG), Croatia (HR), Czech Republic (CZ), Hungary (HU), Poland (PL), Romania (RO), Slovakia (SK), Slovenia (SI)

Source: Olivera (2018)

[8] Appendix 2 details, for each country, the benefits which are split between members of a couple in this scenario.

As discussed in Whelan and Maitre (2010) the *Social Democratic* regime has a high level of employment flexibility coupled with benefit universalism—high income security through generous social welfare and unemployment benefits guaranteeing adequate financial recourses independent of market of familial circumstances. At the other end of the spectrum is the *Southern* regime. This is characterised by poorly developed and selective labour market policies coupled with a high reliance on family support systems – benefit entitlement is uneven and low, lacking guaranteed minimum income protection. The *Liberal/Anglo-Saxon* regime sees the role of government as working in tandem with, rather than replacing, the market with flexible employment laws. Benefits are often means tested with an increase in work-conditional policies in recent years. The Conservative regime places less emphasis on redistribution with a focus on insurance-based benefits with entitlements tending to depend on lifelong employment. The *post-Communist* countries tend to have weaker social rights and lower levels of spending on social protection. These countries have a more flexible labour market than the Southern countries. Finally, the *former-USSR* countries tend to have an even more flexible labour market with little employer support for regulation of the market.

Female employment rates differ across the social welfare regime types (Fig. 3). The former-USSR and the Social Democratic countries have the highest average female employment rate of 74% and 73% respectively. The Conservative, Anglo-Saxon and Post-Communist countries have similar female employment rates (68/66/65%) but average work hours once in employment are substantially higher in the post-Communist countries (39.5 on average compared to the low/mid 30's in the Conservative and Anglo-Saxon countries). The Southern countries have the lowest female employment rate with an average of 59% of women in these countries in paid employment. For those women in employment in these countries, work hours tend to be relatively high at an average of 37 h per week.

Expenditure on social protection, which reflects the government's ability and willingness to redistribute income and wealth differs across the social welfare regimes (see top panel of Fig. 4). Expenditure is highest in the Social Democratic and Conservative regimes

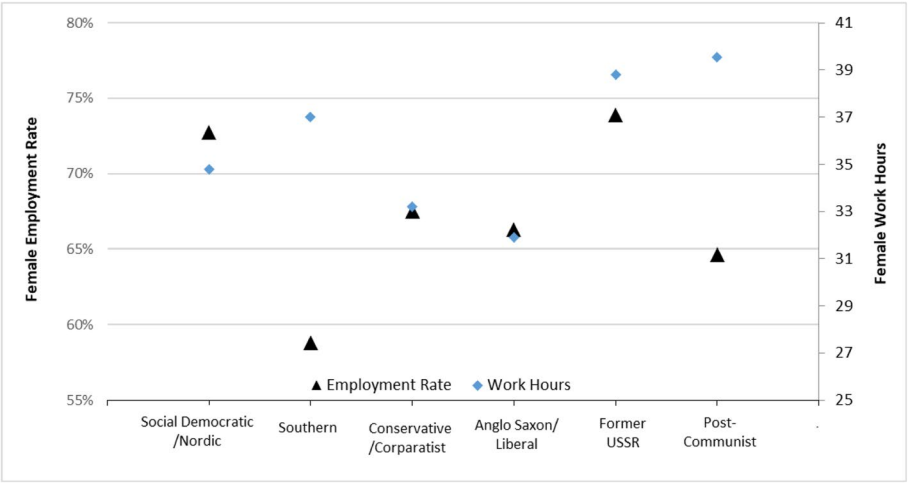

Fig. 3 Female Employment Rate and Work Hours (2017) by Social Welfare Regime. Source: Own calculations using EUROMOD/SWITCH/UKMOD input databases. Women are aged between 20–65

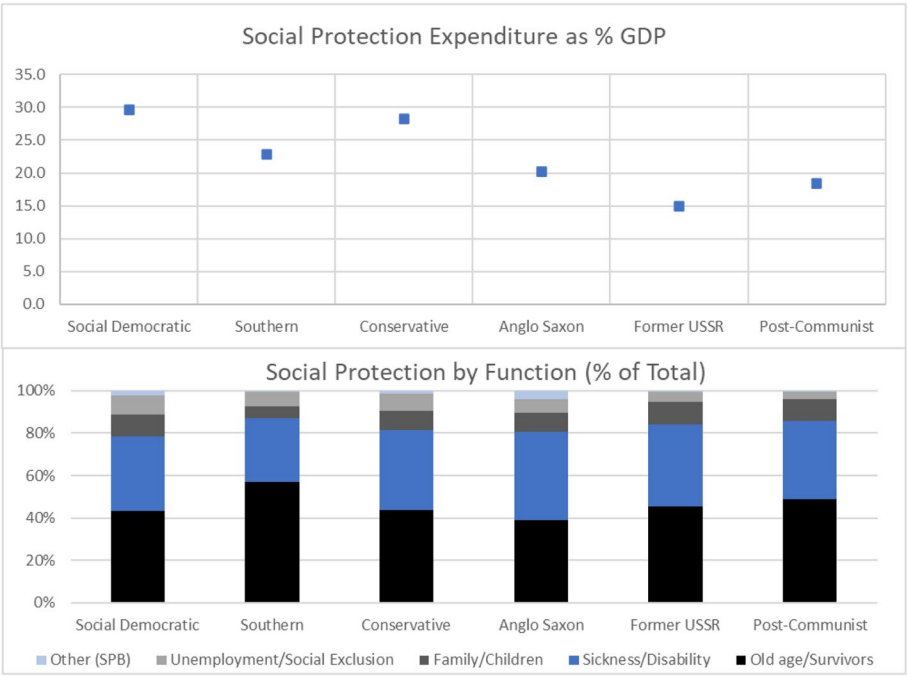

Fig. 4 Social Protection Expenditure (2017). Source: Eurostat

(30% and 28% of GDP respectively) and lowest in the Former USSR countries at 15% of GDP.[9]

Perhaps more interesting is the breakdown of social protection by function. While most benefits (with the exception of maternity and paternity benefit) are not targeted at a particular gender, the division of paid work and caring duties mean that their impact is typically not gender-neutral. For example, women benefit more from family and child benefits as they are more likely to be lone parents and more likely to be engaged in caring for children in the home. On the other hand, men typically benefit more from unemployment benefits and old-age benefits as they are more likely to be in the labour market or have sufficient labour market contributions to receive a state pension.

Expenditure on old-age benefits is relatively higher in the Southern regime and lowest in Anglo-Saxon countries. Unemployment and social exclusion expenditure is particularly low in the Former USSR and Post-Communist countries (4–5%). Expenditure on family and child benefits is in the region of 10% in all regimes apart from the Southern countries where it makes up only 5% of total social protection expenditure, reflecting the stronger reliance on family support structures, rather than transfers, in these countries.

Income tax rates also have differing impacts by gender – as women tend to earn less than men the more progressive the tax system, the more it will take from men compared to women. A number of EU member states have flat rates of income tax.[10] However, through tax allowances and deductions, these tax systems still display an element of progressivity (Barrios et al. 2020).

[9] These figures can be compared to the EU-27 and UK average of 27% of GDP.

[10] In 2017, Estonia, Bulgaria, Romania, Lithuania, Latvia and Hungary had flat tax systems.

Figure 5 displays the average tax and social security rates (ATRs) at selected points of the market income distribution (the 25th, the 50th and the 75th centile), expressed as a percentage of market income across the six welfare regimes. The ATR at the median income is highest in the Social Democratic countries (30%) and lowest in the Southern countries (19%). The Social Democratic countries have higher ATRs across the market income range while ATRs tend to be significantly lower in the Former USSR and Post-Communist countries, perhaps reflecting the size and role of the state in redistribution. The Anglo-Saxon countries have the most progressive taxation system with the ATR for the 75th centile of the income distribution over twice as large as the ATR for the 25th centile. By this measure, the Social Democratic countries have the least progressive system with the ATR at the 75th income centile just marginally higher than the ATR at the 25th income centile.

4.1 Summary statistics

Summary statistics for the simulated income distributions are displayed in Tables A3 and A4 of the Online Appendix.

Table A3 shows employment statistics for men and women in each country and wage statistics for the UK and Ireland. The employment rate of men is systematically higher than that of women with the largest gap of 24 percentage points observed in Malta. The smallest employment gap, of 1 percentage point, is observed in Finland. Among the employed, men usually work full-time (ranging from a low of 88% in Ireland to a high of 99% in the Czech Republic and Hungary) while, on average, 15% of working women work part-time, with particularly high proportions doing so in the Netherlands, Ireland, UK, Germany and Austria. Consequently, hours of work are significantly higher for men than for women in each country.

As discussed in Section 3, we calculate the gender wage gap only for Ireland and the UK. In both countries, the average hourly wage for women is lower than for men – by 4% in Ireland and 14% in the UK (Table A3). Splitting these gender wage gaps into the portion that can be explained by labour market attributes and the part that is unexplained (and often interpreted as bargaining power, preferences or discrimination), we find that the

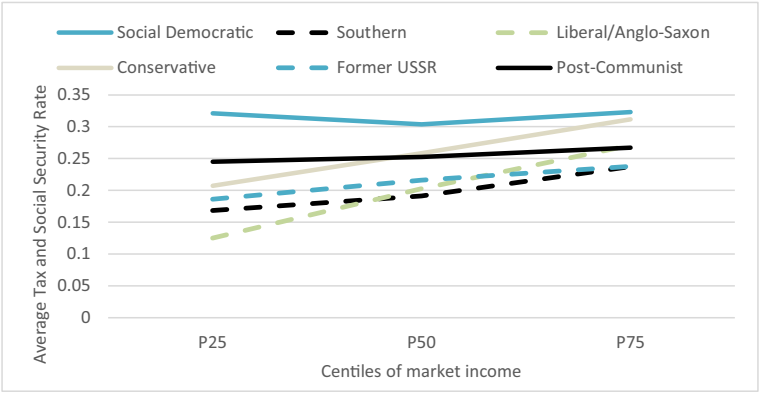

Fig. 5 Average income tax and social security contribution rate in 2017, by percentage of market income. Source: Source: Own calculations using EUROMOD/SWITCH/UKMOD output databases. Notes: ATRs are calculated for those with positive market income. Taxes and employee social security contributions are combined and expressed as a proportion of market income

hourly gender wage gap in each country is largely unexplained.[11] As demonstrated by the negative 'explained' component in Ireland and the fact that the adjusted hourly wage for women is higher than the average male hourly wage, given their labour market characteristics, women in Ireland would be paid more than men if they were compensated under the male wage structure. Note that the gender pay gap estimation is based on a model controlling for occupation and industry (see Appendix 1).[12] Occupational segregation has been shown to contribute to the gender pay gap with horizontal segregation resulting in women being concentrated in lower paid occupations and vertical segregation resulting in women being concentrated at lower (paying) levels within an occupational group. McGuinness et al. (2009) found that industrial and occupational segregation accounted for around 13% of the gender pay gap in Ireland while the corresponding figure in the UK is over 25% (Office for National Statistics 2018). Omitting occupation and industry controls would, therefore, result in a larger gender wage gap. Our estimate of the gender wage gap, treating occupation and industry as exogenous, can therefore be seen as a lower bound.

Table A3 also shows by how much hours worked by women would increase if they were to adopt male working patterns (both participation and hours) in the UK and Ireland – female hours worked would jump from an average of 20 per week in Ireland to 29 while in the UK they would increase from 23 to 32.

Table A4 shows income statistics for men and women in each EU country and the UK assuming no income sharing takes place between members of a couple.[13] Market income (the vast majority of which is from labour market earnings) in each country, is systematically higher for men than for women with the smallest gap in Finland (20%) and the largest in Ireland (48%). Regarding the gender difference in benefit levels, the results vary widely—men receive less in benefits in 15 of the 28 countries and the ratio of male to female benefit receipt ranges from 60% in the Czech Republic to 143% in Italy. On average, men pay 58% more in taxes and social security than women, ranging from 28% more in Bulgaria to more than double in Austria. The result of this is that gender differences in disposable income are not as large as gender differences in market income[14]: on average across the 28 countries women earn 33% less market income than men while the average gap in disposable income is 26%.

4.2 Decomposition results: taxes vs. benefits

The main results of our decomposition are displayed in Fig. 6 which shows the gender gap in market income and the gender gap in disposable income in each country. Both are expressed as a proportion of average male disposable income in each country and ranked in decreasing order of the gender gap in market income. Figure 6 also shows how the difference between the two, the cushioning effect of the tax-benefit system, is divided between the tax and the benefit system, with results expressed as a proportion of male disposable

[11] Appendix 1 shows the models used to estimate the explained and unexplained portion of the gender wage gap.

[12] Omitting occupation and industry dummies from the wage model results in a counterfactual female wage of €22 in Ireland (compared to €20.9 with these controls) and €17.6 in the UK (compared to €16.9 with these controls).

[13] Only family level benefits are assumed to be split between members of a couple.

[14] This is also true if we compare gender earnings gaps (i.e. without non-labour income) to gender disposable income gaps.

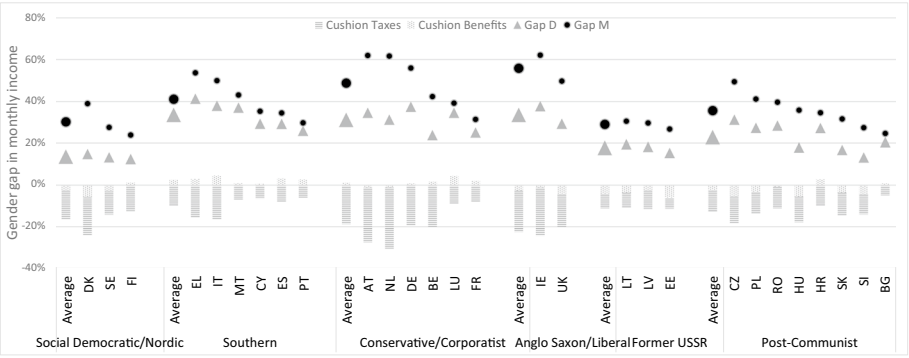

Fig. 6 The gender gap in market income, the gender gap in disposable income and the contribution of the tax and benefit system to the difference between the two. Source: Own calculations using 2017 SWITCH (IE), UKMOD (UK) and EUROMOD (all other countries) policies with SILC data for 2017 (IE), FRS data for 2017 (UK) and EU-SILC data for 2017 (all other countries). Sample is aged 20–65. Countries are grouped by social welfare regime, sorted within the regime type by the gender gap in market income (Gap M) ranked from highest to lowest

income. No income sharing between members of a couple is assumed. Results for the assumption of full income sharing are shown in Appendix 4.

The gender gap in market income (black circle) varies substantially across regime types. It is smallest in the Former USSR countries (29%) and Social Democratic regime (30%).These low market income gaps are likely driven by the fact that these two regimes have the highest female employment rates, approaching 75% (see Fig. 3). The largest market income gap (56%) is seen in the Anglo-Saxon regime. Gaps are also relatively high in the Conservative (49%) and Southern (41%) regimes. While this seems logical for the Southern countries given their low female employment rate of less than 60%, the Anglo-Saxon and Conservative countries have a female employment rate of over 65%, closer to that of the Social Democratic and post-Communist countries. These results are likely driven by two factors—firstly, while the female employment rate is high on average in these two regimes, average work hours tend to be lower (see Fig. 3). Secondly, the hourly wage gap in each regime influences the gap in market income.

The tax-benefit system, through which market income is transformed into disposable income, narrows the gap in market income in all regimes, but to differing extents. The grey triangles indicate that the gender disposable income gap varies from a low of 14% in the Social Democratic countries to a high of 34% in the Anglo-Saxon countries. Across all 28 countries the tax-benefit system closes the gap in market income by an average 34%. Interestingly, while the Social Democratic countries have the lowest gap in market income, the tax-benefit system also does the most to close this gap with taxes and benefits closing 55% of the market income gap. The tax-benefit system in the Southern countries, which has a relatively high gap in market income at 41% only closes 19% of this gap. Across the other four regimes, the tax-benefit system closes between 36% (Conservatist and post-communist regimes) to 40% (Anglo-Saxon regime) of the gap in market income.

The cushioning effect of the tax and benefit system i.e. the difference between the gender gap in market income and the gender gap in disposable income, is represented by the grey bars and is broken down into the cushioning effect of the tax system and benefit system separately. On average the tax system contributes substantially more to the total cushioning than the benefit system (41%) and in some regimes, particularly the Southern countries, the benefit system actually slightly exacerbates the gender income

gap. Benefit receipt by women in the Southern countries is lower than for men—on average women in these countries receive 12% less than men while in the other countries women receive, on average, 16% more than men in benefits (see Table A4). This reflects the fact that social protection expenditure is more highly concentrated in old age benefits and less so on family benefits which may benefit women more (see Fig. 4). In addition, benefit receipt in the Southern countries tends to be more contributory/insurance based (Flaquer 2000). Due to lower female participation rates benefit entitlement is therefore lower for females. The benefit system performs relatively more cushioning in the Former-USSR regime and in some of the post-Communist countries – both of these regimes have relatively flat tax schedules. However, in all regimes, the tax system performs the most redistribution between men and women.

A large driver of the market gap in income is gender differences in participation and work hours. Given that the labour market behaviour of single women is more similar to that of their male counterparts than is the case for married/cohabitating women, we perform the same decomposition for these two subgroups (Fig. 7). Unsurprisingly, the gap in

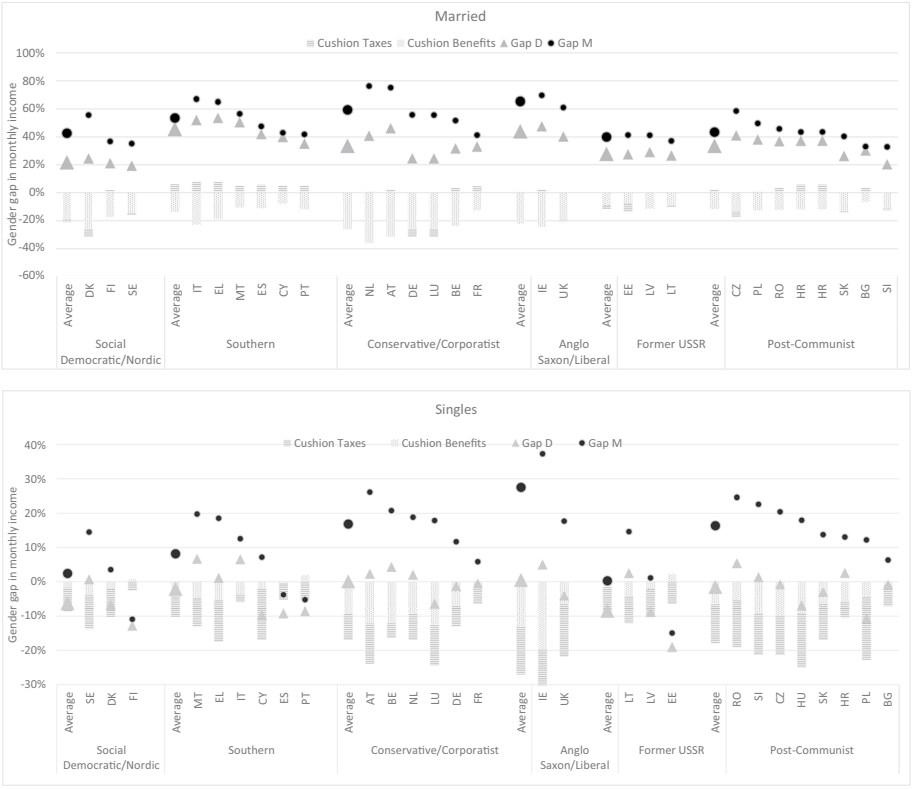

Fig. 7 The gender gap in market income, the gender gap in disposable income and the contribution of the tax and benefit system to the difference between the two: married/cohabitating and single individuals. Source: Own calculations using 2017 SWITCH (IE), UKMOD (UK) and EUROMOD (all other countries) policies with SILC data for 2017 (IE), FRS data for 2017 (UK) and EU-SILC data for 2017 (all other countries). Sample is aged 20–65 and married/cohabitating (top panel) of single (bottom panel). Countries are grouped by social welfare regime, sorted within the regime type by the gender gap in market income (Gap M) ranked from highest to lowest

market income between married men and women is higher (50% on average across the 28 countries) than that between single men and women (12%).[15]

The differences across regimes are important in explaining the overall gender gaps in market income seen in Fig. 6: There is little or no gender gap in market income amongst singles in the Social Democratic and former USSR regimes, indicating that the overall gender gap in market income in these regimes is driven entirely by a gender income gap within couples. This is true to a lesser extent in the Southern regime where the gender market income gap is just 8% for singles. The gender market income gap amongst singles in the other three regimes ranges from an average of 16% in the post-Communist countries to 27% in the Anglo-Saxon ones. The gap is particularly large in Ireland at 37%, driven by the low labour market attachment of lone parents, who are predominantly women, in this country.

Across the EU-27 and the UK, the average gender gap in disposable income for married couples is 35%, compared to a gender gap in market income of 50%. For singles, the corresponding figures are 12% for market income and -2% for disposable income. The tax-benefit system, therefore, redistributes just as much, as a proportion of average male disposable income, between single men and women as it does between married men and women. This is likely to be accounted for by the fact that many benefits are means tested at the household level (which may disqualify many married women) and that single women are likely to have higher eligibility to benefits than single men as they are more likely to be single parents.

These results are based on examination of individual income and therefore assume no income sharing between couples. Relaxing this assumption and allowing within household redistribution leads to much more muted gender inequality. (see Appendix 4). The average gender gap in market income in the Nordic countries is zero while the average gap in the other regimes ranges from a low of 2% in the Former USSR regime to 10% in Anglo Saxon countries. The tax-benefit systems in these regimes further redistributes between men and women so that the gender gap in disposable income is close to zero in all countries. This means that if, as the literature suggests, couples share a significant portion of their income between them, this inter-household redistribution is doing much to close the gender income gap, independently of the tax-benefit system. One interpretation of the gender gap in disposable income, under the assumption of no income sharing, is therefore the portion of the gender income gap that is left for households to close by themselves if they can do so.

4.3 Decomposition results: wage gaps vs. work gaps

Figure 8 shows, for the UK and Ireland, how the gender gap in market income is decomposed into the relative contributions of (i) the unexplained gender wage gap; (ii) the gender participation gap; (iii) the gender gap in hours of work (iv) the interaction between these three and (v) other factors as described in Section 3.1.2. The contribution of the gender wage gap is relatively small, resulting in a gender gap in market income of 4 percentage points in Ireland (6% of the total) and 7 percentage points in the UK (14% of the total),

[15] It would be informative to perform the same decomposition for families with and without children to see if the child penalty drives the gender income gap. However, we can only identify mothers if the child is living in the house with them. As the child penalty affects income across the lifecycle (Albrecht et al. 2018; Kleven et al. 2019), we would also need to be able to identify mothers whose children have grown up and left home.

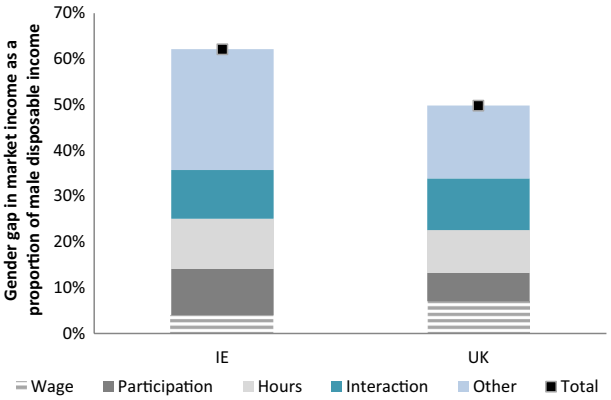

Fig. 8 The contribution of the gender wage gap and the gender work gap to the gender gap in market income. Source: Own calculations using 2017 SWITCH and UKMOD policies linked to 2017 SILC and FRS data, respectively. Sample is aged 20–64. Hourly wages in the baseline are predicted using an OLS model for men and women separately. Hourly wages in the adjusted scenario are predicted using coefficients from the male model for both men and women. Adjusted hours of work for women are drawn from the male distribution as described in Section 3.1.2

reflecting the fact that the unexplained gender wage gap in the UK is larger than that in Ireland (Table A3). The gender gap in participation and work hours contribute 10 and 11 percentage points respectively to the market income gap in Ireland while the gender hours gap contributes more (9 percentage points) than the gender participation gap (6 percentage points) in the UK. Including the interaction between the gender wage and work gaps, we can explain over half of the gender gap in market income in Ireland (58%) and two-thirds in the UK (66%). The residual gap in each country is composed of the explained gender wage gap, gender differences in self-employment rates and self-employment income and gender differences in non-labour income. This "other" gap is larger in Ireland than in the UK.

Panel (A) in Fig. 9 shows how the tax benefit system as a whole redistributes between men and women in transforming market income into disposable income. The gender gap in market income is again represented by a black circle. The gender gap in disposable income is represented by a grey triangle. Panel (B) in Fig. 9 shows the composition of the difference between the gender gap in market and disposable income i.e. which part of the gap is targeted by the tax-benefit system. The tax-benefit system cushions the gender income gap caused by unexplained wage differences between men and women by around one-third in both the UK and Ireland.[16] It provides a similar level of cushioning for the gender gap in hours. It provides much less cushioning of the participation gap, reducing the corresponding gender income gap by just one-fifth in both countries.

Overall, more than half of the total cushioning observed in each country can be attributed to either the unexplained gender wage gap or the gender work gap. The remaining effect falls into the "other" category and represents cushioning of gender income gaps due to the explained gender wage gap, gender gaps in self-employment and gender gaps in non-labour income.

[16] The contribution of the unexplained gender wage gap to the gender gap in market income is 4 percentage points in Ireland and 7 percentage points in the UK. The tax-benefit system reduces these gaps by 1.5 percentage points and 2.7 percentage points in Ireland and the UK respectively.

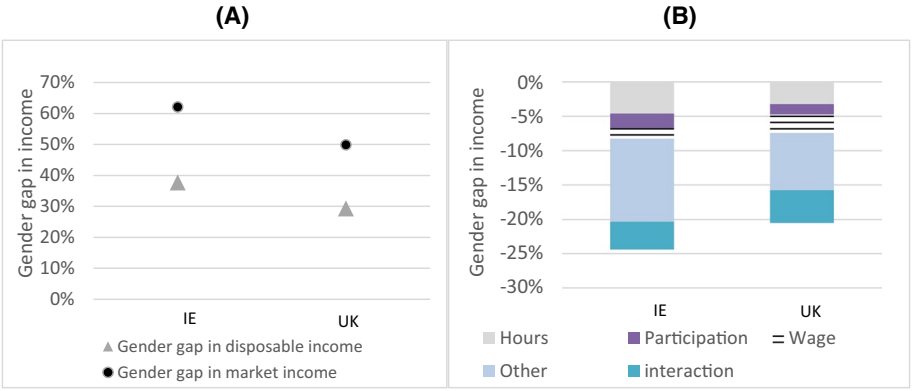

Fig. 9 The gender gap in market and disposable income (A) and the cushioning effect of the tax-benefit system on the gender wage gap and the gender work gap (B). Source: Own calculations using 2017 SWITCH and UKMOD policies linked to 2017 SILC and FRS data, respectively. Sample is aged 20–65. Hourly wages in the baseline are predicted using an OLS model for men and women separately. Hourly wages in the adjusted scenario are predicted using coefficients from the male model for both men and women. Adjusted hours of work for women are drawn from the male distribution as described in Section 3.1.2

5 Discussion

Using microsimulation together with a new decomposition method, we establish the level of gender gaps in income across European countries and the UK and evaluate how the tax-benefit system affects these gender income gaps. The gap in market income, expressed as a proportion of average male disposable income, varies substantially across welfare regimes from a low of 29–30% in the Social Democratic and former USSR countries to a high of 56% in the Anglo-Saxon regime. This is driven by higher gender gaps in market income amongst married and cohabitating people – the gender gap for singles is either smaller or (in the case of the Former-USSR regimes) nil. Results from this analysis indicate that the tax-benefit system reduces gender income gaps to varying degrees across different welfare regimes and is not necessarily linked to the initial gender market income gap – while the Social Democratic regime has one of the lowest gender market income gaps, the tax-benefit system in these countries closes 55% of the initial gap, the largest proportion across all six regimes. The tax-benefit system in the Southern regime, which has a relatively high gender market income gap of 41%, only closes 19% of this gap. In the remaining four regimes 36–40% of the gender market income gap is closed by the tax-benefit system. The taxation system does more to close the gender gap in market income than the benefit system in almost every country.

Should tax-benefit systems cushion gender income gaps? In a population where women work less than men and earn less than men, a progressive tax-benefit system will tend to cushion the gender income gap. The question of how much it should do this is an open one. On the one-hand, cushioning the gender income gap reduces income inequality and reduces the risk of women being over-represented among the poor. This is an argument often put forward in favour of gender budgeting. It can also compensate for poor childcare options by facilitating the choice of one parent (usually the mother) to stay home, or work part-time hours, to care for children. Facilitating a parent who wants to care for their child at home is usually considered a good policy option. However,

the kind of progressivity needed in the tax-benefit system to accomplish this can often dis-incentivise those who would rather engage in market work from doing so as excessive progressivity in the tax-benefit system reduces incentives to work (Bick and Fuchs-Schuendeln 2017). This may exacerbate the gender income gap at source i.e. the gender gap in market income. Striking a balance between these objectives is tricky and the policy mix implemented is ultimately a political choice based on competing demands on resources.

Focusing on the UK and Ireland, we find that the gender income gap is primarily caused by the gender work gap although the unexplained gender wage gap and other factors (demographics, occupational segregation, self-employment, non-labour income etc.) also play a smaller role. The unexplained gender wage gap accounts for only 6% of the gender gap in market income in Ireland and 14% in the UK. Approximately one-third of this unexplained gender wage gap is cushioned by the tax benefit system, suggesting that the tax-benefit system is not providing a major disincentive to firms to pay equal wages for equal work. This finding has interesting repercussions for policymakers – while closing the hourly (unexplained) gender pay gap may be desirable, it will do little to close the overall gender income gap. Tackling the gender work gap by removing barriers to secondary work would do significantly more to equalise the incomes of men and women. We find that the tax-benefit system works to alleviate the part of the gender income gap which is due to this gender work gap, particularly at the intensive margin. This supports the prevalent view in the literature that the tax-benefit system can disincentivise secondary work (Bick and Fuchs-Schuendeln 2017; Rastrigina and Verashchagina 2015). These findings merit further discussion and investigation in the gender budgeting literature.

Finally, this analysis takes the gender gap in market incomes as given without trying to explain the source of cross-country differences. The analysis by regime type does, however, provide some insights – for example the Social Democratic countries have both a culture of high female labour force participation and strong coverage and income support through the welfare system. This is apparent in their low initial gender gap in market income and their significant further closing of this gap by the tax-benefit system. In the Southern countries, where female labour force participation is substantially lower, a larger initial gender market income gap exists. The Southern regime is characterised by a weaker benefit system that provides less income support with a higher reliance on family support systems. This is apparent in our results which show that the tax-benefit system in this regime does the least to close the gender market income gap.

For two countries, we have been able to break the gender gap in market income down into the contribution of work and wage gaps. Future work using the same method in one country across time may provide useful insights, for example to examine the role of rising female labour force participation on the evolution of gender gaps in market income or by examining the impact of significant tax-benefit reforms, such as a move to individual taxation, on the cushioning index.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10888-023-09594-6.

Funding Open Access funding provided by the IReL Consortium. Funding from the ESRI's Tax, Welfare and Pensions Research Programme (supported by the Departments of Public Expenditure and Reform, Employment Affairs and Social Protection, Health, Children, Equality, Disability, Integration and Youth and Finance) is gratefully acknowledged.

Data availability The data used in this work is EU-SILC (for the European countries other than Ireland), FRS (for the UK) and SILC for Ireland. The EU-SILC datasets are adapted by the Joint Research Centre and

Eurostat for use with EUROMOD. The FRS data is adapted by the Centre for Microsimulation and Policy Analysis for use with UKMOD. The SILC data is adapted by the Economic and Social Research Institute for use with SWITCH. The EU-SILC and FRS data can be accessed by researchers who apply through the EUROMOD website:

Access EUROMOD | EUROMOD—Tax-benefit microsimulation model for the European Union (europa.eu)

The Irish SILC data can be accessed by researchers based in Ireland who are appointed Officer of Statistics by the Central Statistics Office:

RMF Application Procedure—CSO—Central Statistics Office

Declarations

Conflict of interests/Competing interests The authors have no conflicts of interest to declare.
The authors have no relevant financial or non-financial interests to disclose.

References

Albrecht, J., Bronson, M.A., Skogman Thoursie, P., Vroman, S.: The career dynamics of high-skilled women and men: evidence from Sweden. Eur. Econ. Rev. **105**, 83–102 (2018)

Avram, S., Popova, D.: Do taxes and transfers reduce gender inequality? Evidence from eight European welfare states. Soc. Sci. Res. **102**, 102644 (2022)

Bacher, A.: The gender investment gap over the life cycle. Working paper available online at https://annikabacher.github.io/Bacher_GenderInvestmentGap.pdf (2022)

Bargain, O.: Normative evaluation of tax policies: from households to individuals. J. Popul. Econ. **21**, 339–371 (2008)

Bargain, O., Callan, T.: Analysing the effects of tax-benefit reforms on income distribution: a decomposition approach. J. Econ. Inequality, 8, issue 1, p. 1-21. (2010)

Bargain, O., Doorley, K., Van Kerm, P.: Minimum wages and the gender gap in pay. New evidence from the UK and Ireland. Rev. Income Wealth **65**(3), 514–539 (2019)

Barrios, S., et al.: Progressive tax reforms in flat tax countries. East. Eur. Econ. **58**(2), 83–107 (2020)

Bastani, S.: Gender-based and couple-based taxation. Int. Tax Public Financ. **20**, 653–686 (2013)

Becker, G.: The economics of discrimination, 2nd edn. The University of Chicago Press, Chicago (1971)

Bergmann, B.: Occupational segregation, wages and profits when emplloyers discriminate by race or sex. East. Econ. J. **1**, 103–10 (1974)

Bick, A., Fuchs-Schuendeln, N.: Quantifying the disincentive effects of joint taxation on married women's labor supply. Am. Econ. Rev. **107**(5), 100–104 (2017)

Blau, F., Kahn, L.: The gender pay gap. The Economists' Voice (2007)

Blau, F.D., Kahn, L.M.: The gender wage gap: extent, trends, and explanations. J. Econ. Lit. **55**(3), 789–865 (2017)

Blundell, R.: Earned income tax credit policies: impact and optimality: the Adam Smith Lecture, 2005. Labour Econ. **13**(4), 423–443 (2005)

Browning, M., Bourguignon, F., Chiappori, P.-A., Lechene, V.: Incomes and outcomes: a structural model of intra-household allocation. J. Polit. Econ. **102**, 1067–1096 (1994)

Browning, M., Chiappori, P.-A., Lechene, V.: Distributional effects in household models: separate spheres and income pooling. Econ. J. **120**, 786–799 (2010)

Cai, L., Kalb, G., Tseng, Y.-P.V.H.: The effect of financial incentives on labour supply: evidence for lone parents from microsimulation and quasi-experimental evaluation. Fisc. Stud. **29**(2), 285–325 (2008)

Cantillon, S., Nolan, B.: Poverty within households: measuring gender differences using nonmonetary indicators. Fem. Econ. **7**(1), 5–23 (2001)

Christofides, L.N., Polycarpou, A., Vrachimis, K.: Gender wage gaps, 'sticky floors' and 'glass ceilings' in Europe. Labour Econ. **21**(C), 86–102 (2013)

Deng, W.J., Hoestra, J., Elsinga, M.: Why women own less housing assets in China? The role of intergenerational transfers. J. Hous. Built Environ. **34**, 1–22 (2019)
Doorley, K., Callan, T., Savage, M.: What drove income inequality in EU crisis countries during the great recession? Fisc. Stud. **42**(2), 319–343 (2021)
Figari, F., Immervoll, H., Levy, H., Sutherland, H.: Inequalities within couples in Europe: market incomes and the role of taxes and benefits. East. Econ. J. **37**, 344–366 (2011)
Flaquer, L.: Family policy and welfare state in Southern Europe. Universitat Autònoma de Barcelona, Barcelona (2000)
Gallego-Granados, P., Geyer, J.: Distributional and behavioural effects of the gender wage gap. Deutsches Institut für Wirtschaftsforschung, Berlin (2015)
Goldin, C.: A grand gender convergence: its last chapter. Am. Econ. Rev. **104**(4), 1091–1119 (2014)
Goldsmith-Pinkman, P., Schue, K.: The gender gap in housing returns. NBER Working Paper 26914 (2022)
Immervoll, H., Kleven, H.J., Kreiner, C.T., Verdelin, N.: Optimal tax and transfer programs for couples with extensive labor supply responses. J. Public Econ. **95**, 1485–1500 (2011)
Keane, C., Doorley, K., Kakoulidou, T., O'Malley, S.: Switch: a tax-benefit model for ireland linked to survey and register data. Int. J. Microsimulation forthcoming (2023)
Keller, E.: Labor supply and gender differences in occupational choice. Eur. Econ. Rev. **115**, 221–241 (2019)
Kleven, H., Landais, C., Søgaard, J.E.: Children and gender inequality: evidence from Denmark. Am. Econ. J. Appl. Econ. **11**(4), 181–209 (2019)
Leschke, J.: Gender differences in unemployment insurance coverage: A comparative analysis. Discussion Papers, Research Unit: Labor Market Policy and Employment SP I 2007-106, WZB Berlin Social Science Center (2007)
Lis, M., Bonthuis, B.: Drivers of the Gender Gap in Pensions : Evidence from EU-SILC and the OECD Pension Model. World Bank Social Protection Discussion Papers and Notes (2019)
Lundberg, S.J., Pollak, R.A., Wales, T.J.: Do husbands and wives pool their resources? Evidence from the United Kingdom child benefit. J. Hum. Resour. **32**(3), 463–480 (1997)
McGuinnes, S., Kelly, E., Callan, T., O'Connell, P.: The Gender Wage Gap in Ireland: Evidence from the National Employment Survey. The Equality Authority (2009)
Mincer, J., & Polachek, S.: Family investment in human capital: earnings of women. J. Polit. Econ. **82**(2), S76–S108 (1974)
OECD: Gender Budgeting in OECD Countries (2016)
Office for National Statistics. Understanding the gender pay gap in the UK (2018)
Olivera, J.: A Cross-country and cohort analysis of active ageing differences among the elderly in Europe. In: Building Evidence for Active Ageing Policies, pp. 261–294. Palgrave Macmillan, s.l. (2018)
Olivetti, C., Petrongolo, B.: Unequal pay or unequal employment? A cross-country analysis of gender gaps. J. Labor Econ. **26**(4), 621–654 (2008)
Olivetti, C., Petrongolo, B.: The economic consequences of family policies: lessons from a century of legislation in high-income countries. J. Econ. Perspect. **31**(1), 205–230 (2017)
ONS: Full Story: The Gender Gap in Unpaid Care Provision: Is there an Impact on Health and Economic Position? Office for National Statistics, s.l. (2013)
Ownershift: Who owns Swedish land? an overview of women and men's ownership of houses and land. Available online at https://uploads-ssl.webflow.com/5fd2320d783c8684ffc7e240/60ec319b73dd54c5fe3e239b_2021-Eng_Rapport_ownershift_Web.pdf. Ownershift, Stockholm (2021)
Paulus, A., Tasseva, I.: Europe through the crisis: discretionary policy changes and automatic stabilizers. Oxford Bull. Econ. Stat. **82**(4), 864–888 (2020)
Rastrigina, O., Verashchagina, A.: Secondary earners and fiscal policies in Europe. European Commission, Directorate-General for Justice (2015)
Redmond, P., McGuinness, S.: The gender wage gap in Europe: job preferences, gender convergence and distributional effects. Oxf. Bull. Econ. Stat. **81**, 564–587 (2019)
Reuters: Closing the gender investment gap: Why women typically trade less than men – and why that may be changing (2022)
Richiardi, M., Collado, D., Popova, D.: UKMOD – a new tax-benefit model for the four nations of the UK. Int. J. Microsimul. **14**(1), 92–101 (2021). https://doi.org/10.34196/IJM.00231
Sologon, D., Van Kerm, P., Li, J., O'Donoghue, C.: Accounting for differences in income inequality across countries: tax-benefit policy, labour market structure, returns and demographics. J. Econ. Inequal. **19**, 13–43 (2021)
Stotsky, J.: Gender Budgeting: Fiscal Context and Current Outcomes. IMF Working Paper 16/149 (2016)
Sutherland, H., Figari, F.: EUROMOD: the European Union tax-benefit microsimulation model. Int. J. Microsimulation **1**(6), 4–26 (2013)

Watson, D., Maître, B., Cantillon, S.: Implications of Income Pooling and Household Decision-making for Poverty and Deprivation: An Analysis of the SILC 2010 Special Module for Ireland. Department of Social Protection, Dublin (2013)
Whelan, C.T., Maitre, B.: Welfare regime and social class variation in poverty and economic vulnerability in Europe: an analysis of EU-SILC. J. Eur. Soc. Policy **20**(4), 316 (2010)