LIS
Working Paper Series

No. 918

Progressivity, Taxing for Growth, and Gender Differences in Tax Payment Patterns and Post-Tax Income

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May 2026

Luxembourg Income Study (LIS), asbl

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Abstract

Gender difference in taxation is generally understudied. However, existing scholarship, largely country case studies, suggests men pay higher tax rates where income tax progressivity is higher, due to their higher average income. Men's higher rates should then increase gender equality in income post-tax, meaning progressive taxation can be gender equalizing. However, many rich countries (including over half of the high income countries included in this study) reduced income tax progressivity starting in the 1980s-90s during "taxing for economic growth" reforms. These changes have previously unexplored implications for the extent to which the current (versus past) tax systems of rich countries reduce, leave unaffected, or compound gender disparities in pre-tax income. Further, some literature suggests that the use of less progressive taxation might be preferable to support more generous and stable social welfare systems (Steinmo 1993; Wilensky 2002; Kato 2003; Lindert, 2004). However, we know little about whether or not changes in transfers from potentially more generous or stable welfare states compensated for any gendered effects related to tax progressivity reductions.

This paper examines 1) how changes in levels of tax progressivity over time were associated with shifts in gender differences in tax rates and post-tax income and 2) whether the contribution of taxes to increasing gender income ratios (pre-to-post-tax) decreased where progressivity reduced, 3) whether transfers compensated for any reduction in this gender-equalizing role of taxes. Throughout, the primary data source is the Luxembourg Income Study (LIS) database, which I used to create an unbalanced panel of pooled country/year observations from 27 high income countries (total of 351 observations from 3-43 years per country). Using fixed effects regressions and a novel contribution analysis, I find that reductions in tax progressivity are associated with increases in women's tax rates relative to men's rates, as well as smaller post-tax-post-transfer gender income ratios (net of pre-tax gender income ratios). Similarly, tax payment contributed less to increasing gender income ratios (sometimes even yielding smaller ratios) in most countries where tax progressivity reduced over time. Transfers only compensated for the reduced contribution of taxes (meaning the combined gender equalizing effect of taxes and transfers remained the same or greater over time) in a third of the countries with tax progressivity reductions.

Based on this evidence, progressivity changes have reduced the gender equalizing potential of the tax systems of a number of study countries, without consistent compensation from transfers. These findings raise concerns that growth-oriented tax policy decisions may be problematic from a gender equity lens. In examining changes in the distribution of burdens (tax payment) and benefits (transfers) between men and women and how they relate to tax progressivity, this research fills a gap in the literature on gender differences in taxation and generates a fuller understanding how tax policy changes can have gendered outcomes.

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1. Introduction

Gender difference in taxation is generally understudied. However, the literature available has explored some core mechanisms producing gender difference in taxation. One such mechanism is the degree of tax progressivity. In the case of taxes levied on income, a progressive tax requires those with higher income to pay a higher percentage of that income in taxes. A regressive tax does the opposite, as those with lower income would pay a higher share of their income in taxes. Lower levels of progressivity likely result in men and women paying more similar tax rates, despite marked gender differences in income. In contrast, countries with progressive taxation would tend to tax those with higher incomes, usually men, at a higher rate, resulting in reductions in gender disparities in income post-tax. In this way, progressive taxation can be gender equalizing (Grown 2010).

Most research suggesting or documenting tax progressivity as a mechanism of gender difference in taxation analyzes specific policy changes in one or two countries (e.g., Eder 2016; Lahey 2015; Lin and Slemrod 2024). Less research has used cross-national methods and a larger set of countries to examine the relationship between tax progressivity and gender difference in tax payment and post-tax income. Importantly, many rich countries, to various degrees, reduced the overall progressivity of income taxes and/or social security contributions starting in the 1980s and 1990s as part of "taxing for economic growth" reforms (Gerber et al. 2018; Torres, Mellbye, and Brys 2012; Peter, Buttrick, and Duncan 2009). Existing literature has raised concerns about how reductions in tax progressivity might lessen the extent to which tax systems respond to gender disparities in pre-tax income by taxing men at a higher rate (e.g., Gunnarsson, Schratzenstaller, and Spangenberg 2017). This may be especially concerning as decompositions of the effect of taxes and transfers on the gender income gap suggest taxes perform the most redistribution between men and women (Doorly and Keane 2024). I know of no studies that have examined whether reductions in tax progressivity have lessened the gender redistributive effects of the tax-transfer system. Thus, policy changes associated with "taxing for growth" have unexplored implications for the extent to which the current (versus past) tax systems of rich countries reduce, leave unaffected, or compound gender disparities in income. Further, some literature suggests that the use of less progressive taxation might be preferable to support more generous and stable social welfare systems (Steinmo 1993; Wilensky 2002; Kato 2003; Lindert, 2004). However, we know little about whether or not changes in transfers from potentially more generous or stable welfare states compensated for any gendered effects related to tax progressivity reductions.

This research aims answer these questions about how changes in levels of tax progressivity over time are associated with changes in men and women's tax payment patterns and post-tax income and whether the contribution of taxes and transfers to gender differences in income changed over time. In examining the extent to which changes in transfers may have compensated for reductions in tax progressivity, this research is the first, to my knowledge, to provide evidence on whether greater welfare state generosity has consistently compensated for reductions in the role of tax progressivity in addressing gender disparities in market income. Thus, in analyzing these changes in the distribution of burdens (tax payment) and benefits (transfers) between men and women and how they related to tax progressivity, this research aims to fill a gap in the literature on gender differences in taxation and generate a fuller understanding how tax policy can create more gender equitable outcomes.

I find that, in countries where tax progressivity decreased over time, women paid rates more similar to men's rates (net of changes in pre-tax gender income gaps). Further, decreases in tax progressivity are associated with smaller post-tax-post-transfer gender income ratios (net of pre-tax gender income ratios). Similarly, tax payment contributed less to increasing gender income ratios pre-to-post-tax (sometimes even yielding smaller ratios) in most countries where tax progressivity reduced over time. Transfers only compensated for the reduced contribution of taxes (meaning the combined gender equalizing effect of taxes and transfers remained the same or greater over time) in a third of the countries with tax progressivity reductions. Thus, this research finds little evidence that tax progressivity reductions, which are associated with increases in women's tax rates relative to men's rates, are consistently compensated for by increases in the contribution of transfers to larger post-tax-post-transfer gender income ratios. Based on this evidence, progressivity changes have reduced the gender equalizing potential of the tax-transfer systems in a number of study countries. These findings raise concerns that growth-oriented tax policy decisions may be problematic from a gender equity lens.

2. Literature Review

2.1 Gender and Tax Policy Creation and Consequences

Tax policy creation and outcomes are a manifestation of the underlying normative features of societies, the "spirit of a people" (Schumpeter 1991 [1919], 101) and the true priorities of states, "stripped of all misleading ideologies" (Goldscheid 1917 in Schumpeter 1991 [1919], 100). In this way, tax policies reflect underlying societal values. Specifically, tax payment is a function of policy choices made by the administrative units in which an individual lives. Those choices are influenced by social norms and values and sociopolitical power struggles. Tax payment is also a function of each individual's resources and behaviors (e.g., paid work and spending patterns), similarly shaped by a complex array of social processes and experiences (Campbell 1993; Martin, Mehrotra, and Prasad 2009; Martin and Prasad 2014).

Social constructions of gender are one such set of social processes through which norms shape both tax policy creation and individual resource access and behavior. As Grown (2010, 4) explains, social norms produce different "roles, rights, responsibilities, and obligations" based on gender. These differences can lead to explicitly gendered tax policy formation. Alternatively, social constructions of gender may create differences between men and women in resource bases and behaviors, which then lead to distinct tax liabilities and benefits. Of particular importance here, social norms have historically resulted in different patterns of paid and unpaid labor for men and women (Charles 2011), producing income gaps which favor men. These different levels of income interact with tax progressivity to produce different tax payment patterns for men and women. Often, given that many countries' income and payroll tax systems are at least somewhat progressive, these gender differences favor women, with men paying higher tax rates where they earn higher income. Further, progressive taxation may help shrink gender income gaps post-tax by taxing higher-income men at a higher rate. Alternatively, introducing less progressive or regressive tax policies could increase women's rates relative to men's rates and compound rather than correct these gaps (Eder 2016; Lahey 2015).

An important caveat to this is that the relationship between tax progressivity and tax rates for coupled women would differ from those of single women where joint filing is in place.

Specifically, tax progressivity and joint filing for couples (and sometimes mixed filing) suppress women's labor force participation. Women are classically seen as "second earners" in a household, with their employment and labor income secondary to male breadwinners. Joint filing practices inherited from traditional notions of households as the tax unit (Lahey 2011) mean many countries historically taxed couples' collective income. Joint filing, when combined with progressive tax rates, increases women's tax rates (as compared to if they filed individually). This discourages women's employment (Blumberg 1971; Flood and Anxo 1999; Fuenmayor, Granell, and Mediavilla 2018; Gustafsson 1992; Smith et al. 2003) and full-time hours (Bettio and Verashchagina 2013; Rosenfeld and Birkelund 1995), as couples try to avoid entering higher tax brackets. Not all women can afford to leave paid work, including and especially lower income women and women from marginalized racial and ethnic groups, who must then accept a higher rate than they would pay as individuals (Staudt 1995; Brown 1997; McCaffery 1999; Brown 2021). Required joint filing is now rare. When looking at a very similar set of countries to those examined here, Schechtl (2020) found only 3 of 31 countries required joint filing. However, a further 10 offered couples the option to file together. Thus, women in dual-earner couples who must (or choose to) file jointly might pay higher tax rates under more progressive rate schedules, unless other provisions (like different rate schedules or base exemption levels for couples) offset the higher tax bracket.

In contrast, progressive tax treatment of income under fully individualized tax filing (the most common form of filing now) should generally result in a lower tax burden for women compared to men – when tax rates are progressive and pre-tax gender income gaps favor men, men should pay higher tax rates due to their higher income. Conversely, less progressive tax rates could shift the burden of taxation toward women if proportionally more men occupy positions in top income levels, and those levels are taxed at the same or lesser rates than lower income (Grown 2010). Examining the Austrian tax system, which uses individual filing, Eder (2016) finds that progressive labor income taxes did reduce the gap between men's and women's income pre-to-post-tax. However, Eder's analysis of recent tax reforms reveals that 64% of the tax rate reduction benefit would go to men. Lahey (2015) similarly examines a host of "detaxation" changes to the Canadian tax code, including a reduction in the personal income tax rate. Men accrued an estimated 60% of benefits from this reduction. Both these studies suggest that reductions in tax progressivity, like those reductions observable among some rich countries since the 1980s, would generally reduce men's tax burden, while women's tax rates would come to resemble men's more closely, regardless of the size of pre-tax gender income gaps.

These policy choices around tax progressivity also have important implications for gender differences in income. Although not directly testing the impact of tax progressivity on post-tax gender disparities in income (as is done here), several studies suggest a role for progressive taxation in reducing gender income gaps pre-to-post-tax. Simulations conducted by Colombino and Narazani (2018) find that gender-based taxation (higher tax rates for men) results in higher net income for women. Avram and Popova (2020) report taxes as generally gender-redistributive in a group of eight European countries, while Doorley and Keane (2020) conclude that Romania's relatively non-progressive tax system, compared to the other five countries examined, meant the tax system contributed less to reducing the gender income gap pre-to-post-tax. Thus, some research suggests progressive taxation could be a key component of tax systems which contribute to reducing gender income disparities.

2.2 Changes in Tax Progressivity Among Rich Nations

The literature reviewed above suggests more gender equitable tax systems might feature progressive taxation, as long as individual tax filing, rather than joint filing, is also in place. However, regressive tax reforms became common among rich countries, especially in the 1980s and 1990s (Steinmo 2003; Peter, Buttrick, and Duncan 2009; Torres, Mellbye, and Brys 2012; Gerber et al. 2020). Changes in the progressivity of personal income taxes and/or social security contributions came from several specific tax policy choices, adopted to various degrees across countries, including flattening of marginal tax schedules, reductions in top marginal tax rates (Ganghof 2005; Mankiw, Weinzierl, and Yagan 2009), increased reliance on social security contributions, which are often less progressively applied than personal income taxes (Kato 2003; Gunnarsson, Schratzenstaller, and Spangenberg 2017; Coelho et al. 2022), and more favorable tax treatment of capital income (especially financial capital income) (Kato 2003; Ganghof 2005; Mankiw, Weinzierl, and Yagan 2009). Gunnarsson, Schratzenstaller, and Spangenberg (2017) argue these changes have shifted the tax burden toward women – as lessening tax progressivity drives women's tax rates up relative to men's rates, due to women's relatively lower income. A core goal of the research presented here is to assess the evidence substantiating that argument.

Reductions in personal income tax and/or social security contribution progressivity were part of a package of policy changes, which scholars argue lessened the overall progressivity of many rich countries' tax systems during the 1980s and 1990s. Other changes include increased use of and higher rates applied to consumption taxes, as well as reductions in corporate income tax rates (Kato 2003; Ganghof 2005; Mankiw, Weinzierl, and Yagan 2009; Grown 2010; Gunnarsson, Schratzenstaller, and Spangenberg 2017). Given the focus of this research on income taxes and social security contributions, however, I examine changes in progressivity related to these tax types in greater detail. Recommendations from optimal theory of taxation or "taxing for growth" models informed these tax policy changes. Optimal taxation theory argues that lower top marginal tax rates and flat tax schedules are more efficient for economic growth, while still maintaining some (lower) level of progressivity (since higher earning individuals would still pay higher amounts of taxes, just not proportionally higher rates) (Mankiw, Weinzierl, and Yagan 2009). A deep exploration of the extent to which this is true is beyond the scope of this study and still a matter of debate in the literature, but the economic growth gains may be relatively small. For example, Li and Sarte (2011) used the Tax Reform Act of 1986 (a flagship reform for tax progressivity reduction) as a case study and found growth increases of just 0.12 to 0.34 percentage points. Optimal taxation theory further recommends avoiding taxing capital income, to encourage reinvestment and combat rising tax competition from globalization – the high mobility of capital means those with capital can concentrate their investments in countries with low or no taxation on capital income (Hays 2003; Ganghof 2005; Mankiw, Weinzierl, and Yagan 2009; Genschel and Schwarz 2011).

Further, some welfare state scholars suggest that less progressive configurations of taxes may facilitate more generous and stable welfare states, observing that the more redistributive Social Democratic and Conservative welfare states use progressive taxes less than Liberal welfare states (Steinmo 1993; Wilensky 2002; Kato 2003; Lindert, 2004; Prasad and Deng 2009). Scholars put forward several arguments for why robust welfare states might prefer less progressive taxation. In alignment with taxing for growth models, reducing the distortionary effects of taxation to encourage stronger economic growth could ultimately yield more stable revenue sources for social welfare spending, including by mitigating the risk of lost revenue due to tax competition from

globalization. The use of less progressive, but broader-based, consumption taxes, income taxes, and social security contributions (Ganghof 2005) may similarly raise more revenue. Additionally, progressive taxes may undermine political support for redistributive spending (Wilensky 1976; Wilensky 2002; Kato 2003).

The evidence connecting less progressive taxation with higher tax revenues is somewhat mixed. Consumption taxes, like the VAT, are fundamentally regressive, and evidence does suggest the VAT is often associated with higher revenue (Keen and Lockwood 2010; Hernández de Cos and Lopez Rodriguez 2014), though the effect might be small (Keen and Lockwood 2006) or dependent on other economic factors, like trade openness (Alavuotunki, Haapanen, and Pirtila 2016). The relationship between the progressivity of taxes levied on income and revenue generation, however, appears more complex. Theoretical models examining optimal top marginal rates and flatter schedules reveal mixed findings depending on the nature of assumptions related to the shape of ability distributions, social welfare functions, and labor supply elasticities (Saez 2001; Mankiw, Weinzierl, and Yagan 2009). Some early empirical findings (e.g., Hunter and Scott 1987) suggest that progressive income tax systems lead to lower revenue. Recent research indicates nuance is required. More progressive, broadly defined income taxes usually generate more revenue, but up to a point. Very strong tax progressivity generates less revenue. There are diminishing returns to high marginal tax rates, but this turning point occurs at a relatively high level, when rates approach 55-57% (Akgun, Bartolini, Cournede 2017). Collectively, this suggests some degree of tax progressivity, and even relatively high rates at the very top of the distribution, does not adversely affect revenue generation.

Thus, the literature indicates that the potential benefits of less progressive taxation, especially less progressive income tax and social security contribution payment, depend on the exact level of progressivity and structure of the rate schedule. If recent tax progressivity changes are more effective at raising revenue (while avoiding capital flight and political conflict over spending), then welfare state objectives for decommodification and reduced stratification could be met through redistributive spending, especially in the form of more generous and universal transfers (Kato 2003; Mankiw, Weinzierl, and Yagan 2009). If transfers accomplish the same sort of gender-equalizing redistribution of income that more progressive taxes used to achieve, perhaps reductions in tax progressivity are not problematic from a gender equity lens.

In practice, countries vary in both the extent of redistribution created by taxes and transfers and the contribution of each (taxes versus transfers) to this redistribution (Guillaud, Olckers, and Zemmour 2020). Whether transfers contribute more than taxes to redistribution may also depend on the calculation of taxes and classification of pensions as transfers or delayed market income (Caminada et al. 2019; Guillaud, Olckers, and Zemmour 2020).[2] Welfare state transfers address needs associated with both low income and other statuses or conditions (parenthood, unemployment, old age, sickness, etc.), meaning transfers have a redistributive effect not just by increasing income at the tail end of the distribution. Marx, Salanauskaite, and Verbist (2016) show that social assistance transfers, those targeted based on financial need, make up well under half of all social transfers for countries in their study. Non-social assistance transfers include family-related benefits, unemployment, sickness, and work injury insurance, and contributory pensions.

[2] Caminada et al. (2019) found transfers contributed more. But, after imputing employer social security contributions and classifying pensions as market income (pensions are often contributory based on paid work history), Guillaud, Olckers, and Zemmour (2020) report taxes contribute more to redistribution.

While transfer amounts might be adjusted based on income or assets, these benefits can be received by the non-poor and may even cover the entire population.

Thus, transfers are designed around a number of different goals. Some are universal or near-universal benefits, others are based on other life conditions, and some are explicitly designed with gender equity considerations in mind (e.g., maternity leave wage replacement and childcare-related transfers and tax benefits). Overall, transfers do tend to be progressive (Marx, Salanauskaite, and Verbist 2016). So, we might expect transfers to reduce the gap between men and women's income created by gender differences in market income especially for low-income women. Further, since many transfers do not require low income or assets, working women earning a variety of income levels, like those in the sample forming this analysis, might receive some level of these benefits. If less progressive taxation generates more revenue, which is then used for transfers, increased transfers might compensate for decreases in tax progressivity and any lessened contribution of taxation to gender income gap reductions. However, whether these potential trade-offs between tax progressivity and transfer generosity affect men and women differently is unclear from research thus far on the use of taxes and transfers for redistribution.

Scholars studying the gender dimensions of welfare states argue that policy choices must be assessed for their distinct impacts on outcomes for men and women, including the extent to which policies reproduce or confront existing gender hierarchies (e.g., Orloff 1996, Sainsbury 2008). In a reinterpretation of Esping-Andersen's (1990) classic stratification dimension of welfare states, Orloff introduces a *gender* stratification dimension by which scholars can typologize and assess separately the capacity of welfare states to address the inequalities experienced by men and women. Both the tax and transfer systems are such mechanisms through which the welfare state affects gender inequality (Sainsbury 2008), and this study similarly situates tax and transfer policies as part of the gender stratification dimension of welfare states. The literature suggesting that less progressive taxation enables a more generous welfare state considers the capacity of the welfare state to affect redistribution and poverty outcomes more broadly. However, and in line with the literature on the gender dimensions of welfare states, this research specifically examines the gendered consequences of tax policy changes and whether a potentially more generous welfare state compensates for those consequences. I both acknowledge that there might be a beneficial tradeoff to lower tax progressivity for income-based redistribution or poverty goals (and invite more research exploring this) and maintain that understanding the gendered consequences of taxing for growth policies is an independently valuable goal.

Therefore, I seek to answer several unaddressed questions about tax policy changes aligned with taxing for economic growth objectives and at least partially justified as supporting welfare state stability. First, if tax progressivity has decreased among many rich countries, are the tax payment patterns (tax rates) of men and women more similar than in the past in those countries? Second, among countries with tax progressivity reductions, are these countries contributing less to bringing men and women's post-tax income closer to parity than in the past? Finally, have increased transfers compensated for any reduction in the gender redistributive power of taxes, such that tax-transfer systems maintained their capacity to increase gender income ratios, even among countries with lessening tax progressivity?

In explaining optimal taxation theory, Mankiw, Weinzierl, and Yagan (2009, 153) acknowledge that "the question of what appropriate social welfare function to use—and in particular how much concern there should be over inequality—is a normative question." In this sense, the prioritization of economic growth over equality outcomes within the tax system represents a normative shift

(Musgrave 1981; Boskin and McLure 1990; Steinmo 2003; Gunnarsson 2022). Renowned fiscal economist Richard Musgrave wrote about this change in real-time, reflecting that "while my generation of tax economists has placed much emphasis on equity, the younger generation is now stressing efficiency…this shift in emphasis reflects, as well, changes in social values" (1981, 148). Just under ten years later, Boskin and McLure called this "a downplaying of vertical equity as a central objective of tax policy" in favor of avoiding distortions to the economy (Boskin and McLure 1990, 3).

Tracing the gender equality consequences of this normative shift in the objectives of tax policy away from equity and towards economic growth is a core motivation for this study. In investigating the gender equality consequences of this normative shift, I contribute to the fiscal social sciences literature which seeks to understand both how social norms inform tax policies and also the equality consequences born from those policies. In doing so, and especially in using the LIS data, I join a growing group of scholars separating taxes and transfers to isolate the unique effect of each on equality outcomes (e.g., Caminada et al. 2019; Guillaud et al. 2020; Schechtl 2020; Parolin and Gornick 2021).

Further, this research enhances the body of knowledge on taxation as a component of the gender stratification dimension of welfare states. Orloff (1996) and Sainsbury (2008) both caution against assuming the welfare state produces greater gender equality (or welfare more broadly). Similarly, Gunnarsson (2011, 78) encourages an assessment of tax equity based on whether or not policies create "a fair and just connection between burdens and benefits." Following this tradition, I apply a gender equity lens to arguments that less progressive taxation is a key strategy for maintaining a robust welfare state, asking whether or not policy shifts have instead created a less fair and just set of burdens and benefits for men and women.

3. Methodology

3.1 Data and Sample

Data for this study come from the LIS Database, as well as measures of social expenditure from the OECD Social Expenditure Database (SOCX). This analysis uses an unbalanced panel of pooled country/year observations from 27 high income countries contributing a total of 351 observations (between 3 and 43 years per country).[3] I selected high income countries for this analysis based on the literature, which details changes to the tax systems of mostly high income countries in response to a normative shift towards taxing for growth. This selection allows findings to more directly inform an analysis of the gendered impact of normative changes that value the role of tax systems in generating growth over equity.

[3]Countries (and first to last observation) include Austria (2003-2019), Australia (1981-2018), Belgium (1992-2017), Canada (1971-2017), Switzerland (1982-2018), Czech Republic (1996-2016), Germany (1973-2019), Denmark (1987-2016), Estonia (2004-2016), Spain (2007-2016), Finland (1987-2016), Greece (2007-2016), Ireland (2002-2017), Israel (1986-2018), Iceland (2004-2010), Italy (2004-2016), Japan (2008-2013), Lithuania (2009-2018), Luxembourg (2004-2019), Netherlands (1983-2018), Norway (1979-2016), Russia (2011-2019), Sweden (1975-2005), Slovakia (2004-2018), Taiwan (1981-2016), United Kingdom (1974-2018), and United States (1974-2020).

Most variables generated from the microdata (except the Kakwani index, average tax rate, and the Gini coefficient for pre-tax income) are calculated using a subsample of unpartnered,[4] sole earning, working men and women aged 25-64. Several tax and income concepts are captured in the LIS data only at the household level by many countries.[5] This sample definition provides greater confidence that income tax payments and social security contributions from the household are connected to that person's income alone. Further, since this analysis is focused on how market-based gender disparities in income interacts with tax progressivity, the subsample are workers aged (25-64), who had non-zero values for labor income and were not receiving pension income.[6] I also use this subsample to calculate conditional gender income ratios for the contribution analysis. As a robustness check, I use a set of 13 high income countries with 144 country/year observations to remove the unpartnered/sole earner limitation and compare the tax payment patterns of all working men and women.[7] The countries in this robustness check still include a wide variety of welfare state types, which does support generalizability to other high income countries. In addition to the measurement challenge of income captured only at the household level, the way in which joint filing and other tax features (deductions, exemptions, credits, etc.,) consider partnership status in determining tax payment may complicate the relationship between gender differences in tax payment and tax progressivity for the expanded sample of individuals. Because I do not directly measure those factors, understanding how they influence findings is challenging.[8] Nevertheless, if the influence of tax progressivity on gender differences in tax payment is consistent for this adjusted sample, this provides some support for the generalizability of these findings to most working men and women.

The data from SOCX used here include data on social spending, both public and mandatory private expenditure (OECD 2022), from ten time points for 25 of the 27 countries examined here. Although I also assess changes in transfer rate and targeting using indicators generated from the LIS microdata (detailed below), the SOCX indicators provide a data source external to the

[4] For ease of narration, I use the term unpartnered or single as those not living with a partner. For some country/years, especially earlier observations, same-sex couples are likely not coded as partners, but as unrelated, co-residing adults. For observations prior to the legal recognition of same-sex partnerships, the inclusion of same-sex couples likely does not affect the primary concern leading to the sampling of single individuals (the way in which joint or mixed filing changes tax bases and rates). However, if the survey methodologies did not begin counting same-sex couples when same-sex partnerships gained legal status (and any tax benefits accompanying that status), this would introduce some couples to this sample whose tax payment is being affected by their couple status.
[5] Capital income, private transfers, and some types of public social benefits transfers are only captured at the household level in the LIS data. For many countries, taxes are similarly only captured at the household level.
[6] I exclude households where any individual is receiving a pension (i.e., "hipension" is equal to zero).
[7] These observations come from both a smaller number of countries, and also fewer observations for some of those countries (although all countries must have at least three country/year observations available to be included). Remaining countries include Austria, Australia, Canada, Czech Republic, Denmark, Finland, Italy, Lithuania, the Netherlands, Norway, Russia, Taiwan, and the United Kingdom. The data for these country/years include a variable for individual tax payment "pxitsc" in addition to the household tax payment variable ("hxitsc"), enabling this analysis of tax payment among couples. However, capital income, private transfers, and some public social benefits income variables are still captured only at the household level. The section on variables details my approach to this challenge. I update the other variables (except the Kakwani index, average tax rate, and the Gini coefficient for pre-tax income) using aggregated microdata for the expanded sample of individuals and the exact same approach followed for the single, sole earner sample.
[8] At the time of writing, no policy database existed detailing which countries did or did not have these policies available for this set of country/years.

microdata to analyze the relationship between transfer spending and post-tax-post-transfer gender income ratios.[9]

3.2 Analysis Approach and Variables

This paper includes three sets of analyses. First, I use fixed effects regressions to assess the relationship between changes over time in tax progressivity and changes over time in the gender tax ratio (ratio of women's tax rates to men's tax rates for a given country/year). In the second analysis I use the same fixed effects approach to examine how changes over time in 1) tax progressivity and 2) transfer indicators (transfer rates, transfer targeting, transfer spending, total social expenditure) are associated with changes in post-tax-post-transfer gender income ratios. Thus, these first two analyses reveal whether changes in tax progressivity are significantly associated with changes in gender differences in tax rates and whether changes in tax progressivity and transfers are significantly associated with changes in gender disparities in income.

I use fixed effects regressions for these first two analyses because the panel data include multiple observations for each country over time, and using OLS to analyze would shift the unobserved time-invariant factors not included in the models to the error term, creating heterogeneity bias. Fixed effects and random effects regression models are often used to address this issue. Fixed effects hold constant the time-invariant features of the study countries, addressing omitted variable bias from any of these features that influence gender differences in tax payment patterns. Fixed effects are also appropriate since the independent variables are time-variant, and the objective is to understand how changes in tax progressivity affected men's and women's tax payment patterns and post-tax-post-transfer income within countries, over time. However, I use a "within-between" modeling approach which integrates both fixed effects and random effects components (Long 2021). While I only discuss the within effects (more interesting for the motivating question), I report both the within country and between country results in tables. I applied several diagnostics and fitness tests to assess the appropriateness of fixed versus random effects regressions, as well as diagnose the presence of common problems with fixed effects models. None of the primary findings changed when using prescribed approaches to addressing these common problems where needed.[10]

[9]The SOCX data offer observations at ten time points (1980, 1990, 2000, 2005, 2010, 2015, 2016, 2017, 2018, 2019) for 25 of the 27 countries examined here. The LIS country/year observations do not always align perfectly with the time periods available from SOCX. To expand the number of observations available to make comparisons of spending patterns with indicators from the microdata, I assigned values from the SOCX data to LIS country/year observations within a two-year band on either side of the spending observation. So, for example, the 1980 observation of spending could be assigned to any year from 1978-1982. Because of this adjustment, the relationship between spending and variables generated from the microdata should be interpreted with caution. Earlier years where SOCX data coverage is not as complete will not offer nuanced information about changes from year to year, and the matches between a particular year's spending and tax progressivity are rarely perfect. However, this analysis largely examines overall time trends for spending and how those trends relate to trends over time for post-tax-post-transfer gender income ratios and tax progressivity, which should be less affected by these data gaps.

[10]For the first dependent variable (gender tax ratio), there was no evidence of roots/stationarity from the Dickey-Fuller test. While the "within-between" modeling approach captures both fixed and random effects components, I did test for differences between fixed and random effects models using the Hausman test. When I tested a model with the Kakwani index alone (Table 2, Model 1) and with the primary set of control variables (Table 2, Model 4), the test did not indicate a preference for fixed effects, reinforcing the utility of the within-between approach. The Breusch-Godfrey/Wooldridge test indicated the presence of serial correlation, while one test indicated the presence of cross-sectional dependence (the Breusch–Pagan Lagrange multiplier; the Pesaran CD test did not find cross-

In the third analysis, which I call the contribution analysis, I use a series of gender income ratio estimations to assess 1) how much conditional gender income ratios for market income are adjusted by taxes alone, transfers alone, and taxes and transfers together, 2) how the size of these adjustments in conditional gender income gaps may have shifted over time in different ways for countries with reduced versus increased tax progressivity, and 3) whether transfers compensated for any reduced contribution (to adjusting market income disparities) from taxes, especially in countries where tax progressivity decreased. I use the following process to accomplish this. For each country/year, I run four sets of regressions (with the individual as the unit of analysis) to generate four conditional gender income ratios: 1) market income ratio, 2) post-tax (pre-transfer) income ratio, 3) post-transfer (pre-tax) income ratio, and 4) post-tax-post-transfer ratio. These conditional gender income ratios are the exponentiated coefficient for gender generated from the regressions (with gender as a binary variable where 1 is female and 0 is male). The independent variables included for each regression sometimes vary slightly from country to country based on data availability, but the core variables are listed in the variables section below. Table 1 summarizes the generation of these conditional gender income ratios.[11]

I then use the conditional gender income ratios to calculate the contribution of transfers and taxes to reducing (or increasing) gender income disparities. I define this contribution as the extent to which transfers and taxes independently increase (or decrease) the gender income ratio when added to market income. Specifically, I calculate the percent change in the conditional gender income ratio pre-to-post-transfers[12] ($(Ratio_{Post\text{-}Transfers} - Ratio_{Market})/ Ratio_{Market}$), the percent change in the conditional gender income ratio pre-to-post-tax[13] ($(Ratio_{Post\text{-}Taxes} - Ratio_{Market})/ Ratio_{Market}$), and the percent change in the conditional gender income ratios pre-tax-pre-transfer to post-tax-post-transfer ($(Ratio_{Post\text{-}tax\text{-}post\text{-}transfers} - Ratio_{Market})/ Ratio_{Market}$). I then compare how these contributions of transfers and taxes to reductions in the gender income ratio changed over time by looking at the linear regression of these contribution values on time. By comparing the result of this process for

sectional dependence), and the Breusch-Pagan test revealed some heteroskedasticity. Using Driscoll and Kraay's heteroskedasticity and autocorrelation consistent errors that are also robust to cross-sectional dependence (Driscoll and Kraay 1998), however, did not change the relationship between tax progressivity and the gender tax ratio (Table A.1). The relationship between tax progressivity and the gender tax ratio is also robust to the use of Arellano heteroskedasticity-consistent covariance estimators (Table A.2) (Arellano 1987). However, the effect of the ratio of single women to single men with dependent children loses significance for both these robustness checks. For the second dependent variable (the post-tax-post-transfer gender income ratio), these tests indicate the presence of cross-sectional dependence, serial correlation, and heteroskedasticity, but not roots/stationarity. While reducing the significance values and coefficient size slightly, the relationship between tax progressivity and the post-tax-post-transfer gender income ratio remains when using Driscoll and Kraay's heteroskedasticity and autocorrelation consistent errors that are also robust to cross-sectional dependence (Table A.3) (Driscoll and Kraay 1998). The relationship between tax progressivity and the post-tax-post-transfer gender income ratio is also robust to the use of Arellano heteroskedasticity-consistent covariance estimators (Arellano 1987), although tax progressivity is only significant after controlling for the pre-tax-post-transfer gender income ratio (Table A.4). The Hausman test also indicates a preference for fixed effects when the model included the main set of control variables (Model 4), but the "within-between" modeling approach captures both fixed and random effects components, so no further modifications are necessary to address this.

[11] Table A.5 illustrates some results of this measurement process by displaying the conditional gender income ratios and contributions of taxes and transfers for each starting and ending time period for each country. Change in the contribution of taxes, transfers, or taxes and transfers from the first to last observation does not always match the overall trend. However, the table does illustrate some of the contribution values and their change over time.

[12] Both the pre-transfer and post-transfer income variable used to calculate the ratios are pre-tax. Thus, the pre-transfer income concept is market income, and the post-transfer income concept is market income plus transfers.

[13] Both the pre-tax and post-tax income variable used to calculate the ratios are pre-transfer. Thus, the pre-tax income concept is market income, and the post-tax income concept is market income minus taxes.

countries with different tax progressivity trends, this analysis shows (descriptively) whether tax payment contributed less to increasing gender income ratios in countries where tax progressivity decreased. I also examine whether changes in the contribution of transfer compensated for the reduced contribution of taxation for these countries, as might be the case if less progressive taxation enabled more generous transfers, such that the total contribution of both does not decrease over time.

Hypotheses

Collectively, the above approaches test the following hypotheses:

1) Reductions in tax progressivity are associated with women paying effective tax rates that are more similar to men's rates over time.
2) Changes in income tax progressivity, transfer rates, transfer spending, and total social expenditure will be positively associated with changes in post-tax-post-transfer gender income ratios (increases in tax progressivity, transfer rates, transfer spending, and total social expenditure will be associated with increases in the post-tax-post-transfer gender income ratio, while decreases in the tax/transfer variable values will be associated with decreases in the post-tax-post-transfer gender income ratio over time).[14]

In countries where tax progressivity reduced over time:

3) Taxes will contribute less to increasing the gender income ratio from market levels to post-tax levels.
4) The contribution of transfers to increasing the gender income ratio from market levels to post-transfer levels will not consistently compensate for the reduced contribution of taxes.

In countries where tax progressivity increased over time:

5) Taxes will contribute more to increasing the gender income ratio from market levels to post-tax levels.

Dependent Variables

The dependent variable for the first analysis is the gender tax ratio. The gender tax ratio is a measure of gender difference in tax payment, calculated for each country/year as the ratio of women's to men's median effective tax rate. Effective tax rates are calculated by dividing the income taxes and social security contributions variable ("hxitsc") by total income. Total income is the summed income variables for labor income ("hilabour"), capital income ("hicapital"), private transfers ("hiprivate"), and public social benefits ("hipubsoc").[15] As a note on terminology, unless

[14] I did not include transfer targeting in this hypothesis, as I expected the effect of targeting on income differences amongst men and women *at the median* to be somewhat weak or ambiguous (discussed in more detail in the results section). However, I deemed it important to assess the relationship nonetheless to understand which features of transfers affected post-tax-post transfer gender disparities in income.

[15] For the robustness check using the individual tax payment variable ("pxitsc"), I test two approaches to addressing the challenge of income components measured only at the household level. First, I artificially narrow the tax base to just labor income, which is captured at the individual level and makes up the vast majority of income for my sample (which is limited to workers). Then I recalculate effective tax rates using this tax base. Second, I allocate capital income between coupled individuals in proportional to the gender differences in capital income for single men and women in each country/year. Specifically, For each country/year, I generated a median capital income estimate separately for men and women based on the median capital income of working aged (25-64) men and women in single adult households. I then summed the median capital income estimates for men and women, imagining this as the pooled capital income of a new couple (the proportions of capital income men and women would bring into a

otherwise stated total income is also "pre-tax" income. Pre-tax income is (unless otherwise stated) also post-transfer income, as public social benefits ("hipubsoc") is the LIS variable for transfers. Similarly, unless otherwise stated, post-tax income is total income less taxes (so is also post-transfer income).

For the second analysis, the dependent variable is the ratio of women's to men's median post-tax-post-transfer income. Using the income variables from LIS, post-tax-post-transfer income for the fixed effects regressions is the sum of labor income ("hilabour"), capital income ("hicapital"), private transfers ("hiprivate"), and public social benefits ("hipubsoc") minus tax payment ("hxitsc").[16]

For regressions generating the gender income gap estimates for the contribution analysis, the dependent variables are market income (regression 1), market income plus transfers[17] (regression 2), market income minus taxes (regression 3), and market income minus taxes and plus transfers (regression 4). Market income is the sum of labor income ("hilabour") and capital income ("hicapital"). Each income variable used to generate a conditional gender income gap is logged for skewness prior to the regressions.

Independent Variables

For the first set of fixed effects regressions (gender tax ratio as the dependent variable), the focal independent variable is tax progressivity. Tax progressivity is primarily measured using the Kakwani index. The Kakwani index summarizes the distribution of tax amounts over households ordered according to their pre-tax income (concentration index of tax), then adjusts for inequality in the pre-tax income distribution by subtracting the Gini index from this concentration index of tax (Kakwani and Son 2020). Higher values indicate greater progressivity, lower values indicate less progressivity, and the tax is considered progressive if the index is positive. I use each country's complete population-weighted sample of households for the calculation, as progressivity is a

partnership). I assume later capital income changes become pooled capital, so would not contribute to gender differences (an admittedly large assumption). Then I calculate the different proportion men versus women contributed to the total capital income of the "new couple" (the portion of the sum of the median capital income coming from single male versus single female adult households). Finally, for each country/year, I multiplied the household capital income of partnered men and women by their respective portions of that constructed capital income total. Thus, household capital income is allocated to coupled men and women in proportions comparable to the capital income differences of men and women in single adult households in their country/years.

[16] For the robustness check using countries with the individual tax payment variable, I use two approaches to address the challenge of income components measured only at the household level. In the first approach, the dependent variable is just labor income less taxes, as labor income is captured at the individual level and makes up most income for my sample of workers. The pre-tax gender income ratio control variable is then simply labor income. For the second approach, I calculate the pre-tax-post-transfer gender income ratio based the same allocation of capital income between coupled individuals in proportional to the gender differences in capital income for single men and women in each country/year in the previous footnote. For public social benefits income and private transfers income, I again split this income evenly between adults in the household. The new total income concept, then, is the sum of individual labor income and allocated capital, public social benefits, and private transfers. I include the gender income ratio for that total income concept as the control variable. Then, I subtract taxes from this version of the total income variable for the post-tax-post-transfer gender income ratio dependent variable.

[17] This definition of transfers includes a mix of different types of benefits, including contributory and non-contributory transfers. With contributory transfers, receipt and sometimes amount depends on having paid social security contributions. With non-contributory (often means-tested benefits), this is not the case. In total, "hipubsoc" captures: family benefits (parental leave and child allowances), unemployment benefits (unemployment insurance and unemployment assistance), sickness and work injury pay, disability benefits, general assistance, housing benefits, and in-kind benefits (e.g., food benefits).

function of tax policy decisions made at the country (population)-level. I also include one other policy variable, average effective tax rate (also calculated using the full population weighted sample for each country year), to control for how high tax rates collect substantial taxes from higher incomes, even if progressivity is moderate.

I control for gender disparities in pre-tax income (pre-tax gender income gap) to create confidence that changes in women's tax rates relative to men's rates are a result of changes in tax progressivity, rather than changes in women's income relative to men's income.[18] In robustness checks, I also control for pre-tax inequality in the income distribution (Gini coefficient for pre-tax income, calculated using the same population sample and income definition as the Kakwani index) and pre-tax income disparities between men and women at different points in the income distribution (decile-specific gender income ratios)[19] to help address concerns about the influence of pre-tax inequality on effective progressivity measures.[20] The Kakwani index calculation does account for inequality in the pre-tax income distribution by subtracting the Gini coefficient for pre-tax income from the concentration index of tax. This means, among two countries with the same concentration index of tax values, the more unequal country would register as less progressive. Still, robustness checks with the Gini coefficient for pre-tax income and decile-specific pre-tax gender income gaps additionally nets out pre-tax inequality in the income distribution and pre-tax income disparities between men and women.

I aggregate several individual-level variables into ratios of gender difference to control for other factors that might affect gender differences in tax payment. First, countries might use a variety of tax relief approaches to support single earners providing for dependent children. If women access these supports more frequently than men, that could contribute to gender differences in tax payment. So, I control for the ratio of single women with children to single men with children. Second, experience with tax systems can vary with types of jobs. To account for this, I include the ratio of women to men in regular/dependent employment arrangements (v. employer, self-employed, non-regular employee, own-account worker, member of producers' co-operative, or contributing family worker). Using the smaller set of countries that offer full data on these variables, I also test the ratio of women to men in three major occupation and industry categories,[21] and ratio of women's to men's weekly hours worked at all jobs currently held. To control for income mix, I include a gender ratio for the percentage of income which comes from labor, which captures the extent of gender difference in the proportion of total income that comes from labor income.[22] Finally, I control for the ratio of women to men in three education levels (less than secondary education, secondary education, or post-secondary education completed).

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[18] For the robustness checks including coupled respondents, I recalculate the pre-tax gender income gap as either based on labor alone (where labor income is the tax base) or using the income allocation processes described above.

[19] Ten gender income ratios calculated using the median income of men and women within each decile of their respective income distributions. These decile-specific gender income ratios capture pre-tax gender disparities in income throughout the distribution (rather than only at the median, as is done with the pre-tax gender income gap variable included in most models).

[20] Arguments in favor of using structural instead of effective progressivity measures hold that structural measures are better able to capture the effect of policies themselves because they are not influenced by inequality in the pre-tax income distribution. However, there are no structural measures currently available that are fit for the analysis conducted here.

[21] Occupation: classification of the first job as manager/professional, other skilled worker, or laborer/elementary worker; industry: classification of the first job as agriculture, industry, or services

[22] I re-calculate this ratio using the income allocation process described above for the robustness checks using the expanded sample of coupled and single individuals from country/years with the individual tax payment variable.

For the second set of fixed effects regressions (post-tax-post-transfer gender income ratio as the outcome variable), the focal independent variables include tax progressivity, measured using the Kakwani index, as well as four transfer indicators– average transfer rate, transfer targeting, transfer spending, and social expenditure (which contains a broader set of 'in-kind" transfers that include some welfare state services). I calculate transfer rate and targeting from the LIS data using the entire population of households, since these indicators are also designed to capture policy decisions at the country (population) level. Transfer rate is transfer income ("hipubsoc") as a percent of total income – income from labor ("hilabour"), capital ("hicapital"), private transfers ("hiprivate"), and public social benefits ("hipubsoc"). I use the country/year average of this rate. Transfer targeting is also measured as progressivity, using the Kakwani index. The Kakwani index for transfers summarizes the distribution of transfer amounts over households ordered according to their market income ("hilabour" and "hicapital"), then adjusts for inequality in the market income distribution by subtracting the Gini coefficient for market income from this concentration index of transfers (Kakwani and Son 2020). I use market income following the approach of Caminada et al. (2019) who note that benefits are usually targeted based on market, not total income. To prevent confusion between transfer and tax progressivity, I refer to higher transfer progressivity as greater transfer targeting (with targeting here being based on income). To ease interpretation, I also reverse the sign of the Kakwani index values so that higher numbers mean greater transfer targeting.[23] The measures of transfer spending and social expenditure (both measured as a percent of GDP) come from the SOCX data and include both public and mandatory private social expenditure (OECD 2022). Transfer spending includes a sub-set of social expenditure designed to mirror the transfers captured by the microdata.[24] Social expenditures, in contrast, include all public and mandatory private spending, adding a number of in-kind benefits, including services, not captured by the LIS data.

For models with the tax variables alone, I control for the pre-tax-post-transfer gender income ratio. For models with the transfer variables alone, I control for the post-tax-pre-transfer gender income ratio. Finally, for models with both tax and transfer variables, I control for the pre-tax-pre-transfer gender income ratio. Across these ratios, the common income concept is the sum of labor income ("hilabour"), capital income ("hicapital"), and private transfers ("hiprivate). Then, public social benefits ("hipubsoc") is added for post-transfer (pre-tax) income. Tax payment ("hxitsc") is subtracted for post-tax (pre-transfer) income. Finally, public social benefits are added and taxes subtracted for post-tax-post-transfer income. I also control for average effective tax rate and the same series of gender ratios for individual characteristics used in the first set of fixed effects regressions. In robustness checks, I again include the Gini coefficient for pre-tax-post-transfer income (calculated using the same population sample and income definition as the Kakwani index) and decile-specific pre-tax-post-transfer gender income ratios.

[23] The interpretation of the "raw" Kakwani index for transfer progressivity is the opposite of that for tax progressivity, as more progressive transfers would decrease as income increases. Thus, in its original form, negative index values indicate greater transfer progressivity, and positive numbers indicate transfers are actually regressive. To make interpretation more intuitive, I multiplied the values of the Kakwani index for transfers by -1, yielding values where higher numbers indicate greater transfer targeting based on income and lower numbers indicate less targeting. With transfer rate and targeting, I do use the LIS protocol for bottom coding (Neugschwender 2020) to include those with non-zero total income, but zero market income. Such individuals would otherwise be excluded from the calculation of transfer rate (because you cannot divide by zero), even though they are included in other analyses (this further follows the example set by Caminada et al. (2019)).

[24] Cash transfers for family benefits, housing benefits, unemployment benefits, incapacity (sickness/disability) benefits, and social assistance, as well as certain in-kind social assistance.

Finally, for the third analysis, the independent variables for the regressions used to generate the conditional gender income gaps include the measurable characteristics of men and women associated with capital and labor income, and especially associated with gender differences in these income sources. These vary from country to country but include age, education (measured as a series of binary variables for less than secondary education, secondary education, or post-secondary education completed, with post-secondary education completed as the omitted variable), industry, occupation, type of employment (regular/dependent versus employer, self-employed, non-regular employee, own-account worker, member of producers' co-operative, or contributing family worker), a binary variable indicating full time (or not) status (30 or more weekly hours worked), rural (versus urban) location, and number of children.[25]

As a note on terminology, the gender income ratio concepts in the fixed effects regressions and the contribution analysis are slightly different. In the contribution analysis, I no longer include private transfers in any of the income concepts because I specifically wanted to examine how taxes and transfers adjust gender disparities in market income. Thus, for the contribution analysis, when I refer to pre-tax-post-transfer income ratios, that is the ratio of women's to men's summed income from labor ("hilabour"), capital ("hicapital"), and public social benefits ("hipubsoc"). Post-tax-pre-transfer gender income ratios are the ratio of women's to men's summed income from labor ("hilabour") and capital ("hicapital") minus taxes ("hxitsc"). Finally, post-tax-post-transfer gender income ratios are the ratio of women's to men's summed income from labor ("hilabour"), capital ("hicapital"), public social benefits ("hipubsoc"), minus taxes ("hxitsc").

4. Results

4.1 Changes in Tax Progressivity and Changes in Gender Tax Ratios

Among high income countries, the trends for the gender tax ratio are relatively split, with 16 (59.3%) countries showing overall increases in women's rates relative to men's rates over time, and 11 (40.7%) countries showing decreases (Figure 1).[26] Changes in tax progressivity over time align well with these different trajectories for the gender tax ratio (Figure 2). In most countries where progressivity decreased over time (85.7%), women's relative tax rates increased. While in most countries where tax progressivity increased (69.2%), women's rates decreased relative to

[25] Because not all of these variables are available for all country/years, I tested several approaches to the inclusion of these variables. First, I selected 2-5 periods for comparison for each country (with the number varying based on the length of the time series available to a given country) and included only those variables common to all of a country's observations in the calculation of the gender income ratios. This does allow variables to vary from country to country, but now within countries. As this analysis is primarily focused on change over time within countries, this helps address any distortions in the conditional gender income ratios created by different availability of variables. Then, I allowed the inclusion of variables to be based entirely on data availability for all country years. I compared the results from the country years with the same variables included in the regression models to those where different variables could be included for different country years and found that, while estimates for the ratios did differ based on the control variables included, these differences did not affect the overall conclusions drawn for any given country.

[26] Trends are based on the correlation between the gender tax ratio and year as a time variable. Countries where the gender tax ratio decreased over time include Australia, Belgium, Czech Republic, Germany, Denmark, Estonia, Ireland, Italy, the Netherlands, Russia, and the United Kingdom. Countries where the gender tax ratio increased over time include Austria, Canada, Switzerland, Spain, Finland, Greece, Israel, Iceland, Japan, Lithuania, Luxembourg, Norway, Sweden, Slovakia, Taiwan, and the United States.

men's rates. Further, this trend does not exclusively result from any kind of overlap between tax progressivity trends and trends in pre-tax gender income gaps. Those countries with decreased tax progressivity are not primarily those countries with decreases in pre-tax gender income gaps. Instead, countries where the pre-tax gender income gap decreased are perfectly split between trends of increasing versus decreasing tax progressivity. Additionally, increases in women's relative tax rate over time do not overwhelmingly co-occur with increases in women's relative income (and vice versa), as we might expect if shrinking gender income gaps explained most of the changes in women's relative tax rates (Figure 3). Thus, descriptive evidence shows that changes in women's tax rates relative to men's rates are more associated with changes in tax progressivity than changes in pre-tax gender disparities in income.

The fixed effects regressions support these descriptive findings. Changes in progressivity (Kakwani index) over time are negatively associated with changes in women's tax rates relative to men's tax rates. So, where tax progressivity increased over time, women's tax rates relative to men's rates decreased over time. And, where tax progressivity decreased over time, women paid tax rates more similar to men's rates (Table 2, Model 1), supporting the first hypothesis. This relationship holds when controlling for the pre-tax gender income gap, which is also (intuitively) negatively associated with the gender tax ratio (Model 2). Higher pre-tax gender income gaps are associated with women paying lower taxes relative to men. Changes in tax progressivity remain significant after accounting for average tax rate as well (Model 3). The relationship between tax progressivity and gender difference in tax rates also remains after including the remaining control variables. Model 4 introduces the first set of control variables, which do reduce the number of country/year observations slightly (from 351 to 325), although not the overall number of countries included.[27] Controlling for the effect of occupation and industry reduces the number of observations further, including the loss of four countries.[28] Still, the relationship between effective tax progressivity and the gender tax ratio remains significant and negative (Model 5).

To concretize the substantive impact on women and men from these changes in progressivity and associated changes in the gender tax ratio, let us consider the size of common changes in the Kakwani index and associated predicted values for the gender tax ratio. I calculated the unweighted mean for the maximum values of the Kakwani index for each country where the Kakwani index decreased over time.[29] Thus the "mean maximum" value for the Kakwani index for countries with progressive decreases was 0.186. I did the same for the minimum values (taking the unweighted mean of the minimum values among the countries). This "mean minimum" value for the Kakwani index was 0.092. Setting all the other predictors in Model 4 to their means and generating predicted values for the gender tax ratio at various levels of the Kakwani index shows that a decrease in the Kakwani from 0.186 to 0.092 is predicted to correspond with increase of 0.06 in the gender tax ratio (from 0.81 to 0.89). Applying this to actual effective tax rates, if men pay the mean effective tax rate for this set of country/year observations (22.78%), this is the difference between women paying a 18.45% versus 20.27% mean effective tax rate.

To further to concretize these numbers, let us imagine two men and two women in countries with different tax progressivity trajectories, both men have $50,000 in income and both women

[27] Table 3 shows the same 325 country/years for Models 1-4. Statistical significance remains unaffected, although the coefficient size for tax progressivity is slightly smaller. I chose to display the larger set of country/years as those include more observations from the time period when normative shift towards taxing for economic growth occurred.
[28] Italy, Japan, Norway, and Sweden
[29] Defined as the correlation between the Kakwani index and "time" (represented by a sequential variable marking the observation order over time for each country/year observation).

$44,000. For one set, tax progressivity did not change over time, so the man pays $11,390.00 in taxes (22.78% rate), while the woman pays $8,118.00 in taxes (18.45% rate). In the country where tax progressivity decreased, the woman pays $8,918.80 in taxes. The woman in the country where tax progressivity did not decrease keeps $3,272.00 more in income post-tax than her male countryman, while her female counterpart in the country with decreased progressivity keeps $2,471.20 more than her male countryman. Applying those amounts to potential expenses – the taxes "saved" by the woman in the country where tax progressivity remained the same (relative to her countryman) might cover two months of mortgage payments,[30] three months of infant childcare,[31] or over 4.5 months of food.[32] In contrast, the woman in the country where tax progressivity decreased saves enough for 1.5 months of mortgage payments, just over two months of infant childcare, or just over 3.5 months of food.

To address concerns that these findings might not be generalizable to other working adults (not just single, sole earners), I used the 13 high income countries with individual-level data on tax payment to expand the sample of individuals from which aggregate values for variables were calculated to include coupled women and single women with more than one earner in the household (the sample is still workers aged 25-64 with labor income and no pension income). The relationship between tax progressivity and women's relative tax rates remains for this group of individuals. This is true both when using all types of income (using the household-level income allocation strategy described above to calculate tax rate, pre-tax gender income gaps, and percent of income from labor, shown in Table 4), as well as when restricting the tax base to labor income only (Table 5).

As a final robustness check, I address endogeneity concerns related to the use of an effective measure of progressivity, the Kakwani index calculated from the microdata, as my main predictor variable. I include the Gini coefficient for pre-tax income alongside the other control variables, as well as a series of decile-specific gender income gaps, designed to capture gender disparities in pre-tax income throughout the distribution (rather than only at the median, as done so far). The inclusion of these variables does not change the relationship between tax progressivity and the gender tax ratio (Table 6). Given that measures of neither gender income disparities (at the median or throughout the distribution) nor pre-tax income inequality remove the relationship between effective progressivity and the gender tax ratio, I find little evidence that the Kakwani index is solely (or even primarily) related to the gender tax ratio because it captures elements of the income distribution and/or gender differences within that distribution.

4.2 Changes in Tax Progressivity and Post-Tax-Post-Transfer Gender Income Ratios

Post-tax-post-transfer gender income ratios increased over time in most study countries. Specifically, based on unadjusted median income for women and men,[33] ratios increased in 21 of

[30] Estimated $1,609 median cost of a mortgage each month, from https://www.businessinsider.com/personal-finance/average-mortgage-payment

[31] Estimated $1047.25/month ($12,567/year), from Economic Policy Institute: https://www.epi.org/child-care-costs-in-the-united-states/ for a mid-range state in the U.S. (Wisconsin).

[32] Estimated $690.75/month ($8,289/year), based on U.S. Bureau of Labor Statistics Consumer Expenditure Surveys Tables for all consumer units: https://www.bls.gov/cex/tables/calendar-year/mean-item-share-average-standard-error/cu-income-before-taxes-2021.pdf.

[33] Meaning not adjusted for changes in individual characteristics, unlike with the conditional gender income ratios.

27 countries (Figure 4).[34] Some of this change over time relates to changes in tax progressivity, as the fixed effects regressions indicate that tax progressivity is positively associated with changes in post-tax-post-transfer gender income ratios (Table 7). Increases in tax progressivity over time co-occurred with increases in these gender income ratios, while reductions in tax progressivity co-occurred with decreases in gender income ratios (Model 1). Thus, increases in tax progressivity are associated with post-tax-post-transfer gender income ratios that are closer to parity, which aligns with my second hypothesis.

The positive relationship between tax progressivity and the post-tax-post-transfer gender income ratio remains when controlling for the pre-tax-post-transfer gender income ratio. This indicates that the relationship between tax progressivity and the post-tax-post-transfer gender income ratio is not solely driven by increases in pre-tax-post-transfer gender income ratios among countries that also happen to have increases in tax progressivity, and vice versa (Model 2). Model 3 introduces average tax rate, which is also positively associated with post-tax-post-transfer gender income ratios. Thus, countries which increased their tax rates also had larger post-tax-post-transfer gender income ratios over time. Including average tax rate actually increases the size of the coefficient for tax progressivity. Tax progressivity and average tax rate tend to be negatively correlated among study countries (R= -0.538), but both policy choices are associated with greater post-tax-post-transfer gender equality. So, accounting for average tax rate helps clarify the relationship between tax progressivity and the post-tax-post-transfer gender income ratio by removing some pull in the opposite direction from tax progressivity's negative association with average tax rate.

The relationship between tax progressivity and the post-tax-post-transfer gender income ratio also remains with the inclusion of control variables capturing gender differences in care for dependent children, education, employment type, and income mix (Model 4). Accounting for gender differences in occupation and industry (Model 5), while reducing the number of countries included in the model, also does not affect the relationship between tax progressivity and the post-tax-post-transfer gender income ratio.[35] Finally, the significant and positive relationship between tax progressivity and the post-tax-post-transfer gender income ratio remains after controlling for weekly hours worked (Model 6).[36]

To address concerns that these findings might not be generalizable to other working adults (not just single, sole earners), I include a robustness check with all coupled and single working-age individuals to calculate the country/year variables for the 13 high income countries with individual-level data on tax payment. Tax progressivity remains positively associated with the post-tax-post-transfer gender income ratio.[37] This is true both when using all types of income and the household income allocation strategy described above (Table 8), as well as when restricting the tax base to labor income only (Table 9). The coefficients are generally smaller, indicating a weaker effect of tax progressivity when comparing the more diverse group of individuals (or the effect of confounding variables not captured here, like tax policies which consider relationship status).

Finally, I include two additional robustness checks to help address some fears that the Kakwani index is only related to the post-tax-post-transfer gender income ratio because of how inequality

[34] Excepting Austria, Belgium, Finland, Iceland, Sweden, and Switzerland.
[35] Number of countries drops to 23, losing Italy, Japan, Norway, and Sweden.
[36] Number of countries drops to 20, additionally losing Russia, Taiwan, and Denmark.
[37] Recalling this test uses the 13 high income countries with individual-level data on tax payment, but the sample is still restricted to workers aged 25-64 with labor income and no pension income.

in the pre-tax income distribution shapes the concentration index of tax (a core component of the Kakwani index). First, I include the pre-tax-post-transfer gender income ratio captured at specific points of the income distribution (deciles).[38] Second, I add the Gini coefficient for total income (Table 10). The relationship between tax progressivity and the post-tax-post-transfer gender income ratio remained positive and significant with the inclusion of these additional measures.

4.3 Changes in Transfers and Post-Tax-Post-Transfer Gender Income Ratios

Table 11 regresses the post-tax-post-transfer gender income ratio onto the four transfer indicators – average transfer rate, transfer targeting, total social expenditure, and transfer spending.[39] Changes in average transfer rate (Model 1), social expenditure (Model 3), and transfer spending (Model 4) are all positively associated with the post-tax-post-transfer gender income ratio. Where average transfer rate, social expenditure, and transfer spending increased over time, so did the post-tax-post-transfer gender income ratio (and vice versa). This supports the idea that public social benefits and social expenditure generally contribute to greater similarity between men's and women's income in a way that we could think of as "corrective" of market income disparities between men and women. This finding aligns with the second hypothesis.

Changes in transfer targeting, however, are not associated with changes in post-tax-post-transfer gender income ratios (Model 2). Thus, transfers becoming more (or less) targeted over time was not associated with increases or decreases in post-tax-post-transfer gender income ratios. This indicates that transfers are supportive of larger median gender income ratios not because they are means tested, but because of other criteria for receipt (e.g., family benefits, which the review of transfer types below shows are the most commonly received benefits for women in this subsample). This is not surprising, however, because this analysis assesses the relationship between transfer targeting and gender differences in income amongst men and women at the median (use median post-tax-post-transfer gender income ratio as the outcome variable). Greater targeting of transfers would imply increased receipt toward the bottom end of the income distribution relative to the rest of the distribution, so would affect income differences between men and women at the median less. From this perspective, targeting having little effect in bringing gender income ratios for men and women at the median closer to parity is logical.

The effect of the other transfer variables weakens, however, with the inclusion of the tax variables (and associated change in the gender income ratio control variable). Average transfer rate is no longer significant (Model 5), and transfer spending (the categories of which mirror those captured by the transfer variable in LIS) drops to marginal significance (Model 8). Social expenditure remains significant, however (Model 7). The relationship between changes over time in post-tax-

[38] The decile-based gender income ratios were highly correlated, so the table presents both models will all of the decile-based measures included (which did suffer from some multicollinearity) and models which only include every other decile (which did not have multicollinearity issues).

[39] The first four models do so while controlling for the post-tax-pre-transfer gender income ratio. This means the application of transfer income is the difference between the gender income ratio which serves as the outcome variable and the gender income ratio control variable. This makes these models analogous with the models discussed so far, but with transfer income (rather than tax payment) as the component of gender difference not included in the gender income ratio control variable. The latter four models control for the pre-tax-pre-transfer gender income ratio (ratio of women's to men's median summed labor, capital, and private transfers income). Because those models also include tax progressivity and tax rate alongside each transfer variable, tax payment should not be captured in the gender income ratio control variable.

post-transfer gender income ratios and tax progressivity and average tax rate remains positive and significant, despite the inclusion of the transfer variables.

Some part of this apparently more robust relationship between social expenditure and the post-tax-post-transfer gender income ratio (which remains net of the tax variables) as compared to average transfer rate (which does not remain net of the tax variables) relates to differences created by the smaller number of countries and observations with data available on expenditures. Average transfer rate remains significant among country/years with data on social expenditure, even with the inclusion of the tax variables and the accompanying change in the gender income ratio control variable (Table 12, Model 1).[40]

Thus, while the tax variables (rate and progressivity) remain clearly associated with the post-tax-post-transfer gender income ratio even after the inclusion of transfer variables, the relationship between transfer rate (and to some extent, transfer spending) and the post-tax-post-transfer gender income ratio is affected by the inclusion of the tax variables. This is especially the case when considering earlier country/years, as both tax rate and social expenditure remain related to the post-tax-post-transfer gender income ratio when only the more recent observations (those with SOCX data) are included.

4.4 Changes in the Contribution of Taxes and Transfers to Gender Income Ratios

Just over half (52%) of the study countries experienced a reduction in tax progressivity (Kakwani index values) during the time periods with observations in the LIS data. Looking at transfer and social spending changes over time, the vast majority of countries increased their overall social spending as a percent of GDP (all but 4 out of 25 with SOCX data).[41] Most increased transfer rate (all but 9 of 27). In contrast, about half of countries (13 out of 25 with SOCX data) reduced transfer spending – spending on transfers that mirror those captured in the LIS data.[42] Most also increased targeting (all but 8 out of 27).

[40] The remaining models in Table 16 walk through other possible changes that might affect the relationship between average transfer rate and the post-tax-post-transfer gender income ratio, ultimately identifying that it is the exclusion of early years which enables the significance of average transfer rate. Specifically, the significance of average transfer rate is not affected by only changing the gender income ratio control variable (to exclude tax payment from income calculation) (Model 2). Average tax rate (Model 3) and tax progressivity (Model 4) alone do not affect the relationship between transfer rate and the post-tax-post-transfer gender income ratio (rather, as shown in Table 16, Model 5, they affect its significance jointly during the full timeframe of years). Returning to the differences due to data availability, Taiwan and Russia are the two study countries with no data available on social expenditure, while the remaining countries have some years with and some without data available (between 1-11 years without, depending on the country). Removing Taiwan and Russia (Model 5), however, does not reveal the return to significance produced by limiting the country/years to those without SOCX data. Removal of the observations missing SOCX data (except Taiwan and Russia) does lead to significant relationship between transfer rate and the post-tax-post-transfer gender income ratio (Model 6). Most years without SOXC data are pre-1997. Thus, when earlier years are considered, changes in transfers rate were less associated with changes in the post-tax-post-transfer gender income ratio, net of the role of taxes (both rate and progressivity).

[41] Israel (from 2001-2018), Lithuania (from 2009-2018), Luxembourg (2004-2019), and Netherlands (from 1990-2018). The 25 countries are those with data from both LIS and SOCX. Years used to assess the time trend are those years with LIS data available. This does not always utilize the full SOCX time series.

[42] Austria (2003-2019), Belgium (1992-2017), Canada (1981-2017), Czech Republic (2002-2016), Germany (1978-2017), Spain (2007-2016), Finland (1991-2016), Israel (2000-2018), Japan (2008-2013), Lithuania (2009-2017), Luxembourg (2004-2017), Netherlands (1990-2017), and the United States (1979-2018).

The time trends for the transfer indicators in comparison to those for effective tax progressivity are not entirely consistent with the idea that progressivity reductions enabled more welfare state spending that was broader (less targeted). As stated, overall social expenditure increased in most countries, but it increased more often among countries where tax progressivity also *increased* (91.7% v. 76.9%). Similarly, transfer rate increased slightly more often for countries with increased tax progressivity (69.2% of countries) compared to those with decreased tax progressivity (64.3%). However, more countries with decreased tax progressivity (just over half, 53.8%) had higher transfer spending over time (versus 41.7% where tax progressivity increased). Further, targeting decreased (transfers became broader based) more often among countries where tax progressivity also decreased (57.1%), while the vast majority of countries where tax progressivity increased also increased transfer targeting (84.6%).

Thus, while the trends for transfer spending and targeting indicate that countries with *reduced* tax progressivity more often increased transfer spending and decreased targeting, the trends for total social expenditure and transfer rate indicate more spending and a higher transfer rate amongst countries with *increased* tax progressivity. This provides only mixed evidence that tax progressivity reductions coincided with (and possibly facilitated) increases in transfer receipt, thus offering inconclusive support for the idea that transfers compensated for tax progressivity reductions such that the tax-transfer system as a whole could maintain its overall contribution to increasing gender income ratios pre-tax-pre-transfers to post-tax-post-transfers. Additionally public social benefits make up only 8.7% of women's income and 4.0% of men's income for these country/year observations (far less than the median tax rates for these men and women at 22.5% and 19.2%, respectively). Public social benefits making up a relatively small portion of single, sole earners' total income would make compensation for tax changes more unlikely.

The third analysis in this paper aims to directly assess the contributions of taxes and transfers to altering gender disparities in market income. To do so, I examine how tax payment and transfer receipt separately and together adjust market gender income ratios and whether/how the contribution of taxes and transfers to the size of post-tax-post-transfer gender income ratios has changed over time.[43] As a brief note on terminology, I use "contribution" to mean the extent to which tax payment or transfer receipt is associated with adjustments (usually increases) in the conditional gender income ratios from market income to one of the "post-market" income concepts. I also use the terms "equalize" or "equalizing" as shorthand to communicate that the adjustment from market to one of the post-market income concepts led to more similar income between men and women. Finally, when I refer to the "overall trend in the contribution of taxes and transfers" or the "overall contribution of taxes and transfers" to the size of gender income gaps, I'm referring to the change over time in the extent to which gender ratios for market income are adjusted by both taxes and transfers (i.e., the percent change in the gender income ratio from market to post-tax-post-transfer income).

The overall trend for these countries is mixed in terms of the overall contribution of taxes and transfers to bringing market gender income ratios closer to parity (the level of change experienced by each country also varies within these overall trends). For 15 countries, the overall contribution reduced over time. For 11 countries, the overall contribution increased. For Ireland, which is held aside from those 27 countries whose trends I just noted, in the later years (2015-2017), single sole-earning women had higher conditional market income than their male counterparts. Further, taxes

[43]With the trend determined based on the linear regression of the change in contributions on year as a time variable

and transfers actually increased the extent to which the gender income ratio favored women. Because of these unique conditions, I'll discuss Ireland aside from the other countries.

Among the 14 countries where tax progressivity reduced, for all but two (Estonia and Denmark), taxes contributed less to bringing gender income ratios closer to parity (from market to post-tax-pre-transfer). Thus, in 12 of 14 (85.7%) countries, tax progressivity reductions co-occurred with taxes doing less to equalize gender income ratios (aligning with hypothesis 3). Similarly, in 7 of 12 countries where tax progressivity increased, the contribution of taxes to larger post-tax-pre-transfer gender income ratios also increased (tax rate decreases accounted for most of the instances where the contribution did not increase, despite tax progressivity increases, discussed in more detail below) (largely aligning with hypothesis 5). This is consistent with the results from the second analysis, which found reductions over time in tax progressivity are associated with smaller post-tax-post-transfer gender income ratios (and vice versa).

Then, the question becomes whether or not changes in transfers were able to compensate for the reduced role of taxes in these countries. The most informative instances to help answer this question are those where the contribution of taxes decreased (the case for 17 countries) *and* where contribution decreases co-occurred with reductions in tax progressivity (the 12 mentioned above). In those instances, the contribution of transfers can 1) also decrease, 2) increase, but not enough to offset the reduced contribution from taxes, 3) increase sufficiently to offset the reduced contribution of taxes. In the third scenario, the collective effect of taxes and transfers then maintains or increases its contribution to bringing gender ratios for market income closer to parity. Figure 5 visualizes the trajectories leading to each of these possibilities (as well as the outcomes for countries outside of these 12 especially relevant cases).

Of the 12 countries informing the primary question of this analysis, 4 fall into the first possibility, where the contribution of both taxes and transfers reduced (Finland, Sweden, Switzerland, and Taiwan) (relationships depicted in the first set of boxes leading to "Outcome of Path 1" in Figure 5 and contribution values over time shown in Figure 6). An additional 4 of 12 countries experienced the second possibility, where the contribution from transfers did increase, but not enough to offset the reduced contribution of taxes (Canada, Greece, Norway, and Slovakia) ("Outcome of Path 2" and Figure 7). The remaining 4 (of 12 countries where the contribution of taxes reduced alongside tax progressivity decreases) fall into the third possibility - increases in the contribution of transfers to larger pre-tax-post-transfer gender income ratios did offset tax progressivity reductions such that the overall contribution of the tax-transfer system to bringing gender ratios for market income closer to parity increased. These include Iceland, Japan, Lithuania, and Luxembourg ("Outcome of Path 3" and Figure 8).

Overall, then, in 8 countries the contribution of transfers to reducing gender disparities in market income did not increase sufficiently to compensate for the reduced contribution of taxes (associated with tax progressivity reductions). In 4 instances, transfers did compensate. Rather than suggesting that we need not worry about changes in tax progressivity from a gender equity lens because a more generous welfare system can pick up the slack, these findings indicate that this compensation occurred in just a third of the instances where tax progressivity decreases co-occurred with less gender equalization from taxation (largely aligning with hypothesis 4).

The remaining country trends provide some additional insights. Of the remaining 5 (of 17) countries with reduced contributions from taxes (besides the 12 where the contribution reduction co-occurred with tax progressivity decreases), 3 experienced rate decreases that could explain the reduced contribution from taxes (Australia, Belgium, and the United States). For the 2 remaining

countries, the lower contribution from taxes did not co-occur with tax progressivity or tax rate decreases (Russia and Spain). Instead, some other policy change(s) not captured here affected the extent to which taxation is gender equalizing in those countries. In Russia, the reduced contribution from taxes actually meant taxation contributed to gender *disparities* in income. The contribution from transfers also reduced, leading to an overall lower equalization from taxes and transfers. In Belgium and Australia, transfers similarly reduced their contribution over time, leading to lower total equalization ("Outcome of Path 4" in Figure 5 and contribution values over time shown in Figure 9). In contrast, transfers did compensate for the reduced contributions from taxes in Spain and the United States ("Outcome of Path 5" and Figure 10). Thus, inclusive of those countries where the lower contribution from taxation is not clearly connected to changes in tax progressivity, transfers compensated for lower equalization from taxation in 6 countries (35.3%) and did not compensate in 11 countries (64.7%).

In the remaining 9 study countries (excepting Ireland), contributions from taxes increased. For most (7) of these countries, tax progressivity increased,[44] leaving Estonia and Denmark. In Estonia, the increased contribution from taxes does not clearly originate in either tax progressivity or tax rate changes, as both decreased. So, other tax policy changes drove that trend. For Denmark, both tax progressivity and tax rate reduce very little, and the contribution of taxes increases just enough over time to no longer contribute to gender disparities in income in most years. This small increase is also likely connected to a different policy change. Among these 9 countries with increased contributions from taxes (contribution values over time shown in Figure 11), the contribution of transfers decreased in 5 countries (Czech Republic, Germany, Israel, Estonia, and the Netherlands). Only in Estonia are the increased contributions from taxes sufficient to counteract these reduced contributions from transfers such that the overall contribution from both is more equalizing ("Outcome of Path 6" for the first 4 and "Outcome of Path 7" for Estonia in Figure 11). In the remaining 4 countries, Austria, Denmark, Italy, and the United Kingdom, the overall contribution from both taxes and transfers increased ("Outcome of Path 8").

Finally, in Ireland, the contribution of both taxes and transfers switches over time from addressing gender disparities in income which favor men, to increasing the gender income ratio from a market income ratio that already favored women such that the post-tax-post-transfer gender income ratios favored women even more. Selection effects can help explain the very large market income ratios, as single, sole earning women have higher education and are more likely to work all year than other women in Ireland (signaling both higher human capital and stronger attachment to the labor market). Thus, the effect of both taxes and transfers in Ireland changed from equalizing a difference which disadvantages women to contributing to gender difference, by enhancing the extent to which post-tax-post-transfer ratios favor single, sole-earning women.

5. Conclusion

The first objective of this paper is to assess the extent to which changes in tax progressivity are associated with changes in women's tax rates relative to men's rates. Descriptively, women pay lower rates relative to men in country/years with greater tax progressivity, and women's tax rates increased relative to men's rates in most countries where progressivity decreased over time. Fixed effects regression analyses confirm these findings, with tax progressivity negatively associated

[44] Austria, Czech Republic, Germany, Israel, Italy, the Netherlands, and the UK

with the gender tax ratio over time – where progressivity fell, women's rates relative to men's rates increased and vice versa.

This negative relationship between changes in tax progressivity and changes in the gender tax ratio remains even when removing the single, sole earner sample restriction among country/years with data on individual tax payment. This does provide some confidence that these findings are generalizable to all workers. Further, despite concerns about the influence of inequality in the pre-tax income distribution on the Kakwani index, the relationship between tax progressivity and the gender tax ratio is robust to multiple approaches to accounting for pre-tax gender disparities in income and inequality in the income distribution: controlling for the pre-tax gender income gap at the median and at each decile and controlling for the Gini coefficient for pre-tax income.

This paper also sought to 1) identify whether or not changes in tax progressivity, along with transfer rate, transfer targeting, transfer spending, and total social expenditures, are associated with changes in the post-tax-post-transfer gender income ratio, 2) determine whether or not tax systems contributed less to increasing gender income ratios pre-to-post-tax in countries where tax progressivity reduced (versus countries where progressivity increased), and 3) indicate the extent to which changes in transfer income compensated for any reduction in the contribution of taxation, such that the overall contribution of taxes and transfers to bringing gender income ratios closer to parity remained at least stable.

Regarding the first question, tax progressivity is positively associated with the post-tax-post-transfer gender income ratio. Increases in tax progressivity over time co-occurred with increases in the post-tax-post-transfer gender income ratio, while reductions in progressivity co-occurred with decreases in that gender income ratio. Similarly, changes in average transfer rate, social expenditure, and transfer spending are all positively associated with the post-tax-post-transfer gender income ratio. Thus, where average transfer rate, social expenditure, and transfer spending increased over time, so did the post-tax-post-transfer gender income ratio (and vice versa), indicating that public social benefits and social expenditure are generally supportive of gender equality. However, the relationship between transfer rate (and transfer spending, to a lesser extent) is weaker when controlling for the tax variables, especially in earlier years.

Among those countries where tax progressivity reduced over time, in most cases (12 of 14 countries) the contribution of taxes to bringing gender ratios in market income closer to parity also reduced. Similarly, in most countries where tax progressivity increased (7 of 12), the contribution of taxes also increased. Where the contribution of taxes reduced alongside tax progressivity decreases, transfers only compensated for this in 4 of 12 countries (such that the gender equalizing effect of the tax-transfer system remained the same or greater over time). Even when considering the total pool of countries (17) in which the contribution of taxes reduced, transfers compensated for these changes in only 6 countries. Thus, I find little evidence to support the argument, from a gender lens, that reductions in tax progressivity are not problematic because less progressive, broader based taxes support more generous welfare states. While this did occur for some countries, this tradeoff does not appear inherent or automatic.

Following the tradition of gender and the welfare state literature, this research interrogates the gendered effect of policy changes, which some advocate are optimal for both economic growth and maintaining a robust welfare system. Reductions in income tax and/or social security contribution progressivity are part of a package of progressivity-reducing reforms advocated for by optimal tax theory and which gained popularity amongst some policymakers in high income countries. Findings here indicate that reductions in tax progressivity are associated with increases

in women's tax burden relative to men's burden (regardless of changes in women's relative income). Further, these changes were not consistently compensated for by shifts in transfers provided by government revenue amongst study countries. Thus, for most countries with tax progressivity reductions, lower tax progressivity increased women's tax burden without commensurate increases in benefits. As a result, men's and women's disposable income was not as equal as it might have been under previous policy configurations, representing a reduction in the effectiveness of fiscal policy in addressing market-based gender disparities in income.

Given that most study countries with reduced progressivity also had reduced contributions from taxes and transfers to bringing gender income ratios closer to parity, and provided we continue to see market-based disparities in the incomes of men and women, there are two key avenues through which tax policy development and implementation could be more gender equitable. First, policymakers could more effectively forecast changes in the distribution of burdens and benefits between men and women in terms of tax payment, transfer/service receipt, and economic growth associated with tax progressivity decreases, as well as a follow-up analysis of how those changes actually manifested. Second, policymakers could develop amelioration strategies within the tax system or other policy levers to either maintain the tax system's gender equalizing potential or ensure spending or economic growth is gender equitable enough to compensate for tax progressivity reductions.

Additional research would benefit these processes by improving our understanding of several key relationships. First, we need more evidence on the actual degree to which progressivity discourages labor supply at different points of the income distribution (a key economic-growth related argument for less progressive taxation). We also need more research on how much of any reduction in labor supply can be absorbed before reducing economic growth in a way that is of general concern (not just of concern for high income individuals). Replication of studies like that done by Carneiro, Turnovsky, and Tourinho (2022) would also provide important information about how to craft tax policies which both promote both economic growth and income equality. Expanding these kinds of simulations to various forms of horizontal inequality would be similarly useful. Finally, evidence on the extent to which the progressivity reductions noted in this study 1) contributed to economic growth and 2) contributed to economic growth that is gender equitable would also better inform our understanding of the gender equity of these progressivity changes.

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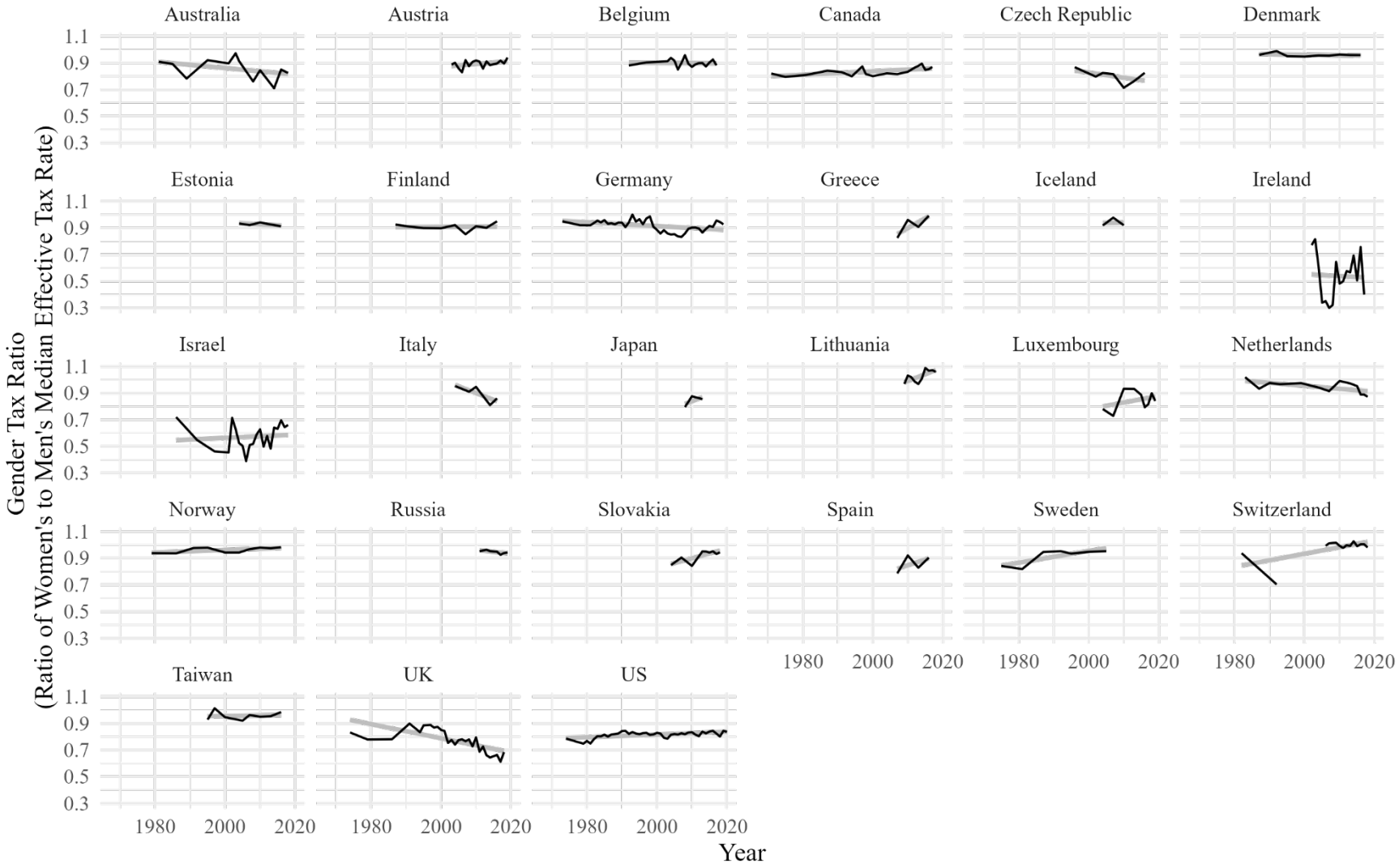
Figures and Tables

Table 1. Estimation of Conditional Gender Income Ratios

Regression No.	Description	Estimation	Estimate Produced	Contribution Calculation
1	Regress the log of <u>market income</u> on gender (binary value with 1 = female) and individual characteristics which affect gender differences in income $\log(\text{Market Income}) = \beta_0 + \beta_1 \times \text{Female} + \beta_n \times \text{Characteristic}_n + \epsilon$	Extract the coefficient for female from regression 1 and exponentiate the value to generate the conditional ratio of women's to men's market income. Done for each country/year.	Conditional gender income ratio for market income $\text{Ratio}_{\text{Market}} = \exp(\beta_1)$	N/A
2	Regress the log of <u>market income plus transfers</u> on gender (binary value with 1 = female) and individual characteristics $\log(\text{Post Transfer Income}) = \beta_0 + \beta_1 \times \text{Female} + \beta_n \times \text{Characteristic}_n + \epsilon$	Extract the coefficient for female from regression 2 and exponentiate the value to generate the conditional ratio of women's to men's post-transfer income. Done for each country/year.	Conditional gender income ratio post-transfers, pre-tax $\text{Ratio}_{\text{Post-Transfers}} = \exp(\beta_1)$	$\text{Contribution}_{\text{Transfers}} = (\text{Ratio}_{\text{Post-Transfers}} - \text{Ratio}_{\text{Market}})/ \text{Ratio}_{\text{Market}}$
3	Regress the log of <u>market income minus taxes</u> on gender (binary value with 1 = female) and individual characteristics $\log(\text{Post Tax Income}) = \beta_0 + \beta_1 \times \text{Female} + \beta_n \times \text{Characteristic}_n + \epsilon$	Extract the coefficient for female from regression 3 and exponentiate the value to generate the conditional ratio of women's to men's post-tax income. Done for each country/year.	Conditional gender income ratio post-taxes, pre-transfer $\text{Ratio}_{\text{Post-Taxes}} = \exp(\beta_1)$	$\text{Contribution}_{\text{Taxes}} = (\text{Ratio}_{\text{Post-Taxes}} - \text{Ratio}_{\text{Market}})/ \text{Ratio}_{\text{Market}}$
4	Regress the log of <u>market income minus taxes</u> <u>and plus transfers</u> on gender (binary value with 1 = female) and individual characteristics $\log(\text{Post Tax and Transfer Income}) = \beta_0 + \beta_1 \times \text{Female} + \beta_n \times \text{Characteristic}_n + \epsilon$	Extract the coefficient for female from regression 4 and exponentiate the value to generate the conditional ratio of women's to men's post-tax-post-transfer	Conditional gender income ratio post-taxes, pre-transfer $\text{Ratio}_{\text{Post-Taxes and Transfers}} = \exp(\beta_1)$	$\text{Contribution}_{\text{Taxes and Transfers}} = (\text{Ratio}_{\text{Post-Taxes and Transfers}} - \text{Ratio}_{\text{Market}})/ \text{Ratio}_{\text{Market}}$

		income. Done for each country/year.		

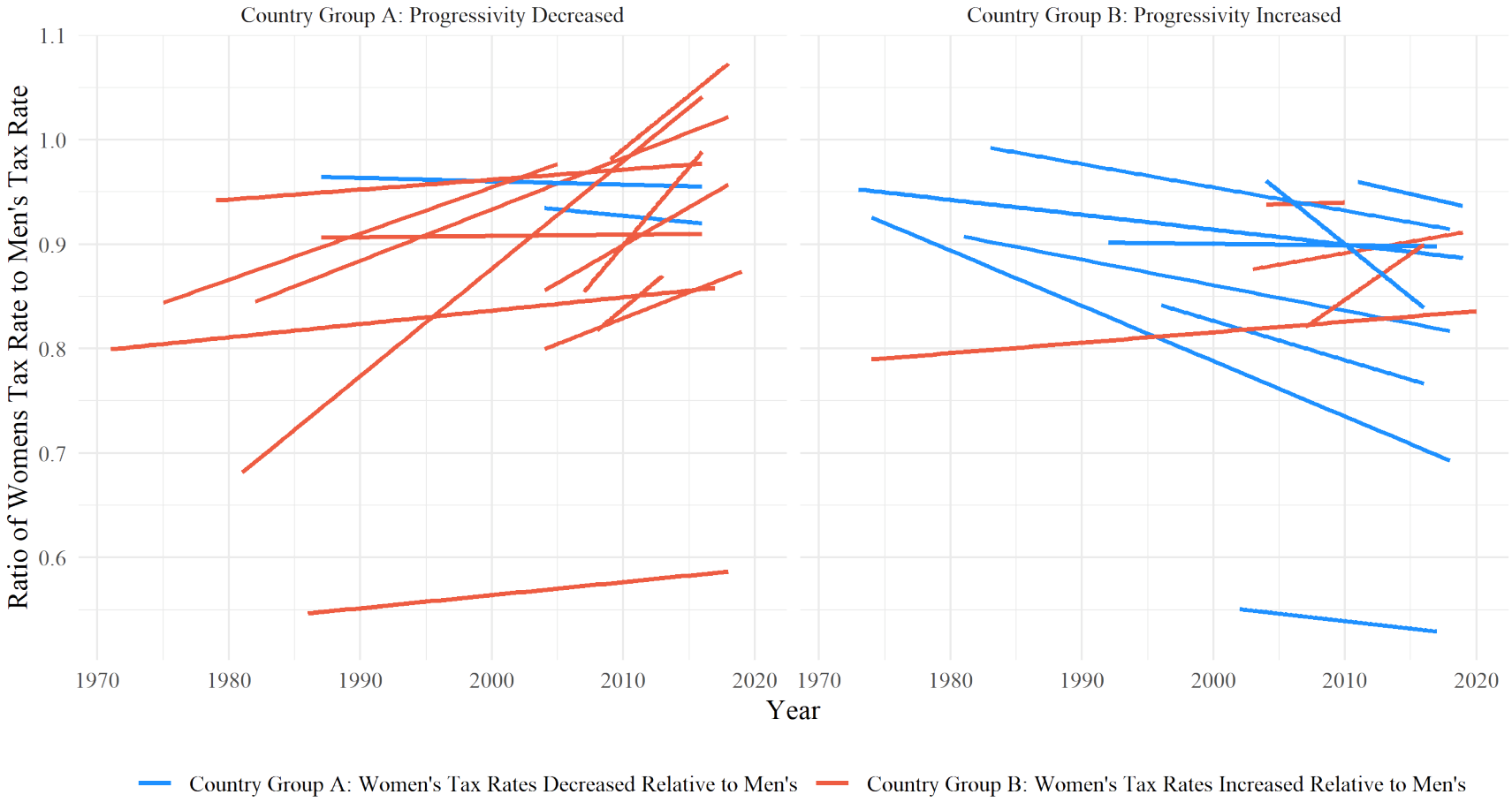
Figure 1. The Trends in Gender Tax Ratios Very Across Study Countries



Source: Luxembourg Income Study (LIS) Database

Lower values (under one) for the gender tax ratio (y-axis) indicate women pay lower tax rates than men, while higher values (over one) indicate higher tax rates for women. The grey regression line comes from a bivariate linear regression of the gender tax ratio on year.

Figure 2. Country Trends in Women's Relative Tax Rates Largely Align with Tax Progressivity Trends



Source: Luxembourg Income Study (LIS) Database

Note: Lower values (under one) on the y-axis indicate women pay lower tax rates than men, while higher values (over one) indicate higher tax rates for women. The two panels separate countries into those where tax progressivity decreased over time (first panel, 14 countries) and those where tax progressivity increased over time (second panel, 13 countries). This trend categorization is based on a set of bivariate linear regressions of the Kakwani on year for each counry. Each blue or red line shows a linear regression of the gender difference in tax rate on year. The color coding of those lines indicates the direction of that trend for gender difference in tax rate over time.

Figure 3. Country Trends in Women's Relative Tax Rates Align Less with Gender Income Gap Trends

Source: Luxembourg Income Study (LIS) Database
Note: Lower values (under one) on the y-axis indicate women pay lower tax rates than men, while higher values (over one) indicate higher tax rates for women. The two panels separate countries into those where gender income gaps decreased over time (first panel, 20 countries) and those where gender income gaps increased over time (second panel, 7 countries). This trend categorization is based on a set of bivariate linear regressions of the gender income gap, based on median total income for single, sole-earning, working men and women, on year for each counry. Total income is the sum of labor income, capital income, private transfers, and public social benefits income. Each blue or red line shows a linear

regression of the gender difference in tax rate on year. The color coding of those lines indicates the direction of that trend for gender difference in tax rate over time.

Table 2. Regression of Gender Tax Ratio on Tax Progressivity (Kakwani Index) and Control Variables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	-1.026***	-1.064***	-1.000***	-0.823***	-0.775***	-0.851***
	(0.137)	(0.136)	(0.143)	(0.144)	(0.155)	(0.174)
Pre-Tax Gender Income Gap		-0.191**	-0.189**	-0.235***	-0.244***	-0.253***
		(0.059)	(0.059)	(0.059)	(0.067)	(0.067)
Average Tax Rate			0.222	0.331+	0.034	0.159
			(0.157)	(0.173)	(0.202)	(0.212)
Gender Ratio - Dependent Children				-0.003**	-0.002*	-0.003*
				(0.0009)	(0.001)	(0.001)
Gender Ratio - % of Income from Labor				0.912***	0.913***	1.006***
				(0.123)	(0.134)	(0.144)
Gender Ratio - Regular Employment				0.074	0.200*	0.161
				(0.091)	(0.101)	(0.100)
Gender Ratio - High Education				-0.016	-0.009	-0.020
				(0.025)	(0.030)	(0.029)
Gender Ratio - Medium Education				-0.037	-0.031	-0.023
				(0.026)	(0.033)	(0.032)
Gender Ratio - Low Education				0.0009	0.007	0.007
				(0.008)	(0.008)	(0.008)
Gender Ratio - Managerial Occupations					-0.037	-0.025
					(0.024)	(0.025)
Gender Ratio - Other Skilled Occupations					-0.166**	-0.065
					(0.052)	(0.055)
Gender Ratio - Labor/Elementary Occupations					-0.006	-0.0002
					(0.008)	(0.007)
Gender Ratio - Industry					0.093*	0.016
					(0.044)	(0.044)
Gender Ratio - Service					0.142**	0.124**
					(0.046)	(0.047)
Gender Ratio - Agriculture					0.0003	0.0001
					(0.0004)	(0.0004)
Gender Ratio - Hours						0.572***
						(0.111)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Between Effects						
Tax Progressivity	-1.476***	-1.500***	-1.489***	-1.166***	-1.221***	-1.484**
	(0.260)	(0.256)	(0.264)	(0.241)	(0.179)	(0.156)
Pre-Tax Gender Income Gap		-0.395	-0.375	-0.111	0.314	-0.673
		(0.292)	(0.309)	(0.371)	(0.275)	(0.397)
Average Tax Rate			0.059	0.070	0.238	0.228
			(0.246)	(0.184)	(0.178)	(0.215)
Gender Ratio - Dependent Children				-0.0004	0.001	0.0005
				(0.004)	(0.003)	(0.004)
Gender Ratio - % of Income from Labor				1.458***	0.908*	0.277
				(0.351)	(0.308)	(0.344)
Gender Ratio - Regular Employment				0.345	0.780*	0.291
				(0.355)	(0.299)	(0.330)
Gender Ratio - High Education				-0.001	0.092	-0.027
				(0.073)	(0.071)	(0.061)
Gender Ratio - Medium Education				-0.212*	0.075	-0.193
				(0.090)	(0.124)	(0.121)
Gender Ratio - Low Education				0.023	0.118*	0.039
				(0.046)	(0.046)	(0.040)
Gender Ratio - Managerial Occupation					-0.356*	-0.371**
					(0.097)	(0.080)
Gender Ratio - Other Skilled Occupations					-1.132**	-0.683*
					(0.244)	(0.242)
Gender Ratio - Labor/Elementary Occupations					-0.105*	-0.102*
					(0.032)	(0.025)
Gender Ratio - Industry					-0.249	-0.030
					(0.142)	(0.127)
Gender Ratio - Service					0.302*	0.270*
					(0.094)	(0.088)
Gender Ratio - Agriculture					-0.006	-0.007+
					(0.004)	(0.003)
Gender Ratio - Hours						0.585+
						(0.238)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Constant	1.093***	1.138***	1.122***	-0.507	0.300	1.016+
	(0.041)	(0.052)	(0.085)	(0.610)	(0.461)	(0.359)
Random Effects - Intercept SD	0.072	0.071	0.072	0.049	0.025	0.010
Random Effects - Residual SD	0.058	0.057	0.057	0.051	0.051	0.049
Num.Obs.	351	351	351	325	283	256
R2 Marg.	0.446	0.471	0.467	0.733	0.847	0.884
R2 Cond.	0.783	0.792	0.796	0.862	0.877	0.889
AIC	-912.0	-915.6	-910.8	-854.0	-668.8	-609.7

Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. Regression of Gender Tax Ratio on Tax Progressivity (Kakwani Index) and Control Variables (Sample Constant Models 1-4)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	-0.979***	-1.003***	-0.940***	-0.823***	-0.775***	-0.851***
	(0.149)	(0.146)	(0.155)	(0.144)	(0.155)	(0.174)
Pre-Tax Gender Income Gap		-0.234***	-0.224***	-0.235***	-0.244***	-0.253***
		(0.062)	(0.063)	(0.059)	(0.067)	(0.067)
Average Tax Rate			0.229	0.331+	0.034	0.159
			(0.187)	(0.173)	(0.202)	(0.212)
Gender Ratio - Dependent Children				-0.003**	-0.002*	-0.003*
				(0.0009)	(0.001)	(0.001)
Gender Ratio - % of Income from Labor				0.912***	0.913***	1.006***
				(0.123)	(0.134)	(0.144)
Gender Ratio - Regular Employment				0.074	0.200*	0.161
				(0.091)	(0.101)	(0.100)
Gender Ratio - High Education				-0.016	-0.009	-0.020
				(0.025)	(0.030)	(0.029)
Gender Ratio - Medium Education				-0.037	-0.031	-0.023
				(0.026)	(0.033)	(0.032)
Gender Ratio - Low Education				0.0009	0.007	0.007
				(0.008)	(0.008)	(0.008)
Gender Ratio - Managerial Occupations					-0.037	-0.025
					(0.024)	(0.025)
Gender Ratio - Other Skilled Occupations					-0.166**	-0.065
					(0.052)	(0.055)
Gender Ratio - Labor/Elementary Occupations					-0.006	-0.0002
					(0.008)	(0.007)
Gender Ratio - Industry					0.093*	0.016
					(0.044)	(0.044)
Gender Ratio - Service					0.142**	0.124**
					(0.046)	(0.047)
Gender Ratio - Agriculture					0.0003	0.0001
					(0.0004)	(0.0004)
Gender Ratio - Hours						0.572***

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
						(0.111)
Between Effects						
Tax Progressivity	-1.490***	-1.518***	-1.502***	-1.166***	-1.221***	-1.484**
	(0.253)	(0.250)	(0.259)	(0.241)	(0.179)	(0.156)
Pre-Tax Gender Income Gap		-0.400	-0.377	-0.111	0.314	-0.673
		(0.298)	(0.312)	(0.371)	(0.275)	(0.397)
Average Tax Rate			0.080	0.070	0.238	0.228
			(0.245)	(0.184)	(0.178)	(0.215)
Gender Ratio - Dependent Children				-0.0004	0.001	0.0005
				(0.004)	(0.003)	(0.004)
Gender Ratio - % of Income from Labor				1.458***	0.908*	0.277
				(0.351)	(0.308)	(0.344)
Gender Ratio - Regular Employment				0.345	0.780*	0.291
				(0.355)	(0.299)	(0.330)
Gender Ratio - High Education				-0.001	0.092	-0.027
				(0.073)	(0.071)	(0.061)
Gender Ratio - Medium Education				-0.212*	0.075	-0.193
				(0.090)	(0.124)	(0.121)
Gender Ratio - Low Education				0.023	0.118*	0.039
				(0.046)	(0.046)	(0.040)
Gender Ratio - Managerial Occupation					-0.356*	-0.371**
					(0.097)	(0.080)
Gender Ratio - Other Skilled Occupations					-1.132**	-0.683*
					(0.244)	(0.242)
Gender Ratio - Labor/Elementary Occupations					-0.105*	-0.102*
					(0.032)	(0.025)
Gender Ratio - Industry					-0.249	-0.030
					(0.142)	(0.127)
Gender Ratio - Service					0.302*	0.270*
					(0.094)	(0.088)
Gender Ratio - Agriculture					-0.006	-0.007+
					(0.004)	(0.003)
Gender Ratio - Hours						0.585+

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
						(0.238)
Constant	1.094***	1.140***	1.118***	-0.507	0.300	1.016+
	(0.040)	(0.052)	(0.084)	(0.610)	(0.461)	(0.359)
Random Effects - Intercept SD	0.072	0.071	0.072	0.049	0.025	0.010
Random Effects - Residual SD	0.057	0.056	0.056	0.051	0.051	0.049
Num.Obs.	325	325	325	325	283	256
R2 Marg.	0.467	0.492	0.487	0.733	0.847	0.884
R2 Cond.	0.793	0.804	0.807	0.862	0.877	0.889
AIC	-844.2	-851.6	-846.7	-854.0	-668.8	-609.7

Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4. Regression of Gender Tax Ratio on Tax Progressivity and Control Variables for Expanded Sample of Individuals (All Income Tax Base)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	-1.487***	-1.455***	-1.265***	-1.222***	-1.158***	-1.113***
	(0.124)	(0.083)	(0.100)	(0.089)	(0.128)	(0.274)
Pre-Tax Gender Income Gap		-0.932***	-0.940***	-0.630***	-0.654***	-0.690***
		(0.074)	(0.071)	(0.097)	(0.115)	(0.137)
Average Tax Rate			0.856**	1.235***	1.761***	0.561
			(0.266)	(0.227)	(0.282)	(0.463)
Gender Ratio - Dependent Children				-0.287*	0.030	-0.114
				(0.112)	(0.182)	(0.198)
Gender Ratio - % of Income from Labor				0.318	0.010	-0.531
				(0.284)	(0.315)	(0.375)
Gender Ratio - Regular Employment				0.151	0.392*	0.332
				(0.142)	(0.158)	(0.235)
Gender Ratio - High Education				-0.012	-0.195**	0.002
				(0.043)	(0.064)	(0.093)
Gender Ratio - Medium Education				-0.151*	-0.442***	0.006
				(0.059)	(0.111)	(0.178)
Gender Ratio - Low Education				0.050	-0.035	0.005
				(0.034)	(0.044)	(0.052)
Gender Ratio - Managerial Occupations					0.158*	-0.019
					(0.061)	(0.089)
Gender Ratio - Other Skilled Occupations					0.299+	-0.172
					(0.154)	(0.210)
Gender Ratio - Labor/Elementary Occupations					-0.004	-0.018
					(0.020)	(0.022)
Gender Ratio - Industry					-0.057	0.254
					(0.122)	(0.160)
Gender Ratio - Service					0.051	0.013
					(0.092)	(0.099)
Gender Ratio - Agriculture					-0.023	0.003
					(0.023)	(0.025)
Gender Ratio - Hours						-0.106
						(0.176)
<u>Between Effects</u>						
Tax Progressivity	-0.819	-0.728	-0.766	-0.455	2.493***	-2.025

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	(0.722)	(0.574)	(0.613)	(1.068)	(0.188)	(6.774)
Pre-Tax Gender Income Gap		-0.876*	-0.902*	-1.534	-3.999***	-0.657
		(0.328)	(0.355)	(0.898)	(0.222)	(2.082)
Average Tax Rate			-0.103	-0.862	-0.198+	-1.108
			(0.333)	(0.891)	(0.110)	(3.396)
Gender Ratio - Dependent Children				-0.0006	0.416***	-1.148
				(0.381)	(0.102)	(4.670)
Gender Ratio - % of Income from Labor				2.775		
				(3.234)		
Gender Ratio - Regular Employment				-2.852	-4.346***	2.395
				(2.436)	(0.407)	(4.524)
Gender Ratio - High Education				-0.459	-2.651***	
				(0.394)	(0.196)	
Gender Ratio - Medium Education				0.225	-0.395***	
				(0.390)	(0.062)	
Gender Ratio - Low Education				0.056	-0.381***	
				(0.147)	(0.039)	
Constant	0.995***	1.229***	1.262***	2.174	9.659***	0.162
	(0.112)	(0.125)	(0.171)	(3.350)	(0.681)	(5.455)
Random Effects - Intercept SD	0.099	0.079	0.083	0.097	0.000	0.221
Random Effects - Residual SD	0.076	0.051	0.050	0.035	0.031	0.029
Num.Obs.	144	144	144	131	96	66
R2 Marg.	0.303	0.615	0.606	0.628	0.961	0.187
R2 Cond.	0.738	0.886	0.897	0.957	0.961	0.986
AIC	-281.4	-384.1	-389.1	-399.0	-274.6	-189.2
BIC	-266.5	-363.4	-362.3	-338.6	-207.9	-136.7
RMSE	0.07	0.05	0.05	0.03	0.03	0.02

Expanded sample here means single, sole earners as well as singles with other earners in the household and couples.
Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
Between effects are not available to all variables in Models 5 and 6 due to model convergence issues with smaller samples of countries.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. Regression of Gender Tax Ratio on Tax Progressivity and Control Variables for Expanded Sample of Individuals (Labor Income Tax Base)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 IT Sample†
Tax Progressivity	-1.055***	-1.750***	-1.579***	-1.531***	-1.273***	-1.257***	-0.821***
(Kakwani Index)	(0.247)	(0.176)	(0.198)	(0.159)	(0.182)	(0.282)	(0.147)
Pre-Tax Gender Income Gap		-0.933***	-0.924***	-0.662***	-0.473***	-0.492**	-0.028
		(0.076)	(0.075)	(0.096)	(0.107)	(0.141)	(0.078)
Average Tax Rate			0.482+	0.809***	1.326***	0.403	-0.431+
			(0.264)	(0.213)	(0.274)	(0.480)	(0.225)
Gender Ratio				-0.136	0.071	0.082	0.003*
- Dependent Children				(0.102)	(0.164)	(0.204)	(0.001)
Gender Ratio				0.053	0.121	0.235	-0.302**
- Regular Employment				(0.091)	(0.095)	(0.246)	(0.111)
Gender Ratio				-0.018	-0.113+	-0.023	0.0008
- High Education				(0.040)	(0.062)	(0.099)	(0.029)
Gender Ratio				-0.056	-0.158	0.001	-0.103*
- Medium Education				(0.060)	(0.115)	(0.187)	(0.046)
Gender Ratio				0.035	0.004	0.010	0.028
- Low Education				(0.031)	(0.044)	(0.055)	(0.020)
Gender Ratio					0.041	-0.058	
- Managerial Occupations					(0.059)	(0.095)	
Gender Ratio					0.020	-0.295	
- Other Skilled Occupations					(0.150)	(0.224)	
Gender Ratio - Labor/					-0.028	-0.034	
Elementary Occupations					(0.018)	(0.023)	
Gender Ratio - Industry					-0.208+	-0.008	
					(0.120)	(0.166)	
Gender Ratio - Service					-0.004	-0.031	
					(0.086)	(0.105)	
Gender Ratio - Agriculture					-0.032	-0.006	
					(0.023)	(0.027)	
Gender Ratio - Hours						0.034	
						(0.184)	
Between Effects							
Tax Progressivity	-0.676	-0.695+	-0.664+	-0.407	0.081	-2.983	0.072
	(0.436)	(0.343)	(0.339)	(0.358)	(0.103)	(6.058)	(0.169)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 IT Sample†
Pre-Tax Gender Income Gap		-0.638*	-0.691*	-1.467*	-2.235***	-0.326	-0.687
		(0.237)	(0.238)	(0.431)	(0.190)	(1.721)	(0.540)
Average Tax Rate			-0.270	-0.994	-1.003***	-1.423	0.189
			(0.246)	(0.519)	(0.141)	(3.065)	(0.210)
Gender Ratio				0.038	0.350**	-1.467	0.007
- Dependent Children				(0.208)	(0.120)	(4.623)	(0.003)
Gender Ratio				-2.131	-2.729***	2.519	1.019
- Regular Employment				(1.241)	(0.468)	(4.443)	(0.696)
Gender Ratio				-0.287	-1.177***		-0.115
- High Education				(0.195)	(0.177)		(0.080)
Gender Ratio				0.215	0.153+		-0.094
- Medium Education				(0.210)	(0.084)		(0.081)
Gender Ratio				0.062	-0.112**		-0.067
- Low Education				(0.083)	(0.038)		(0.039)
Constant	0.996***	1.184***	1.250***	3.907*	5.639***	0.485	-0.732
	(0.066)	(0.087)	(0.105)	(1.263)	(0.707)	(5.212)	(0.860)
Random Effects - Intercept SD	0.076	0.061	0.060	0.055	0.008	0.214	0.021
Random Effects - Residual SD	0.072	0.048	0.048	0.032	0.030	0.031	0.036
Num.Obs.	141	141	141	128	93	66	128
R2 Marg.	0.132	0.555	0.572	0.687	0.928	0.165	0.820
R2 Cond.	0.593	0.827	0.832	0.921	0.933	0.983	0.867
AIC	-298.0	-396.1	-394.9	-408.0	-272.1	-184.5	-369.2
BIC	-283.2	-375.5	-368.3	-353.9	-208.8	-134.2	-309.3
RMSE	0.07	0.05	0.05	0.03	0.03	0.03	0.03

Expanded sample here means single, sole earners as well as singles with other earners in the household and couples.
Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
Between effects are not available to all variables in Models 5 and 6 due to model convergence issues with smaller samples of countries.
† IT sample indicates a restriction of the primary single-sole earner sample to those country/years with the individual tax payment variable. Thus, this model includes country-level variables calculated with a different subpopulation of individuals as compared to the other models but holds the country/year sample constant to those country years available in Model 4 of this table.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Regression of Gender Tax Ratio on Tax Progressivity, Additional Measures of Gender Income Disparities and Pre-Tax Income Inequality, and Control Variables

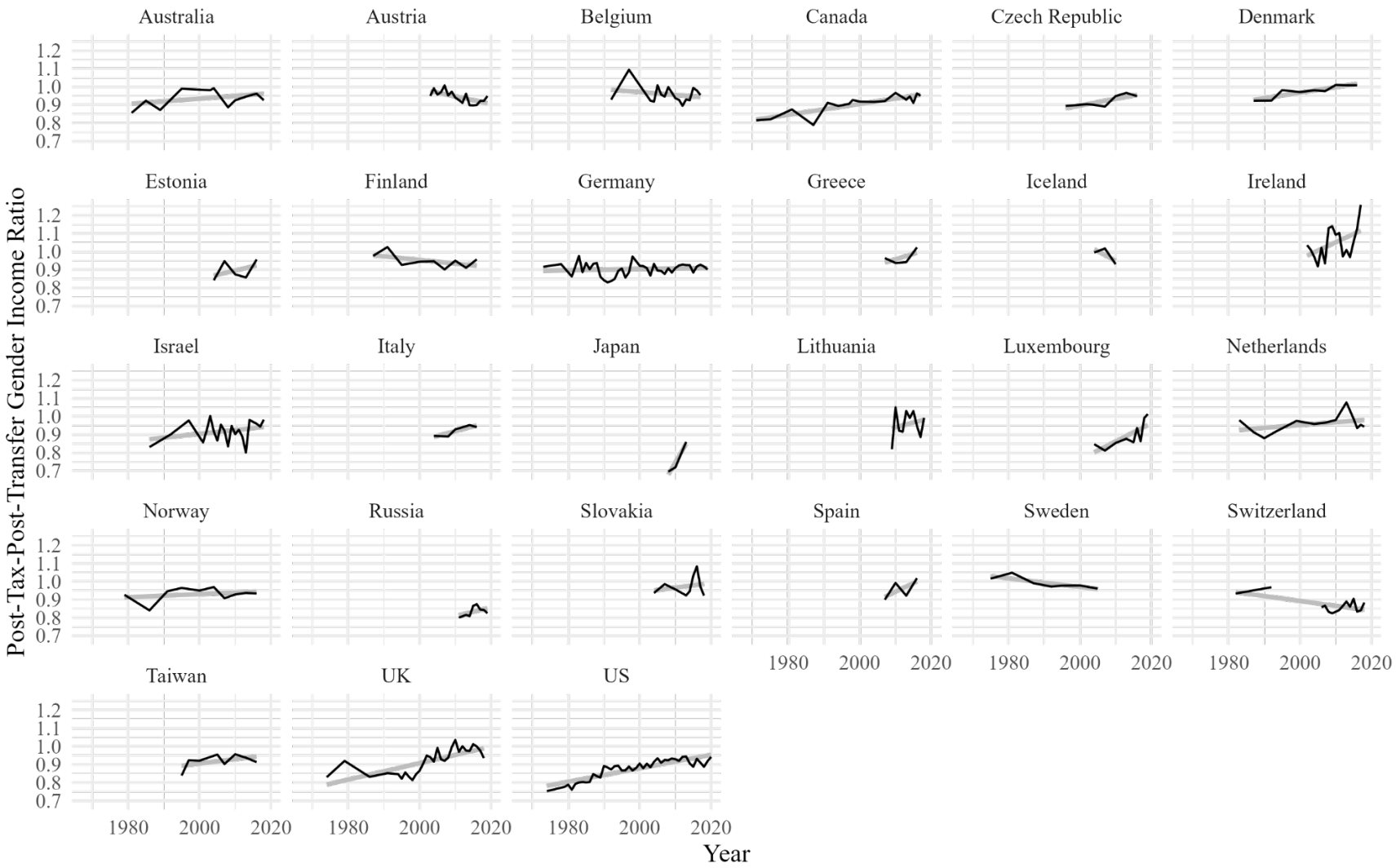
	Model 1	Model 2	Model 3	Model 4
Tax Progressivity (Kakwani Index)	-0.820***	-0.817***	-0.804***	-0.813***
	(0.144)	(0.152)	(0.150)	(0.152)
Pre-Tax Gender Income Gap	-0.234***			
	(0.059)			
Pre-Tax Gender Income Gap - 1st Decile		-0.030	-0.035+	-0.030
		(0.020)	(0.019)	(0.020)
Pre-Tax Gender Income Gap - 2nd Decile		-0.011		-0.013
		(0.060)		(0.060)
Pre-Tax Gender Income Gap - 3rd Decile		-0.043	0.003	-0.043
		(0.094)	(0.065)	(0.094)
Pre-Tax Gender Income Gap - 4th Decile		0.140		0.144
		(0.133)		(0.133)
Pre-Tax Gender Income Gap - 5th Decile		0.062	0.062	0.057
		(0.139)	(0.104)	(0.140)
Pre-Tax Gender Income Gap - 6th Decile		-0.157		-0.158
		(0.135)		(0.135)
Pre-Tax Gender Income Gap - 7th Decile		0.081	0.074	0.083
		(0.148)	(0.111)	(0.148)
Pre-Tax Gender Income Gap - 8th Decile		0.081		0.079
		(0.134)		(0.135)
Pre-Tax Gender Income Gap - 9th Decile		0.052	0.035	0.054
		(0.091)	(0.071)	(0.091)
Pre-Tax Gender Income Gap - 10th Decile		-0.051		-0.049
		(0.041)		(0.041)
Pre-Tax Income Gini Coefficient	0.024			0.078
	(0.205)			(0.217)
Average Tax Rate	0.332+	0.435*	0.408*	0.434*
	(0.173)	(0.187)	(0.182)	(0.188)
Gender Ratio - Dependent Children	-0.003**	-0.002*	-0.002*	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
Gender Ratio - % of Income from Labor	0.912***	0.907***	0.903***	0.910***
	(0.123)	(0.127)	(0.126)	(0.127)
Gender Ratio - Regular Employment	0.074	0.069	0.099	0.067
	(0.092)	(0.097)	(0.096)	(0.098)

	Model 1	Model 2	Model 3	Model 4
Gender Ratio - High Education	-0.017	-0.006	-0.007	-0.008
	(0.025)	(0.026)	(0.025)	(0.026)
Gender Ratio - Medium Education	-0.037	-0.038	-0.037	-0.036
	(0.027)	(0.028)	(0.027)	(0.028)
Gender Ratio - Low Education	0.001	0.0003	0.0008	0.0008
	(0.008)	(0.008)	(0.008)	(0.009)
Between Effects				
Tax Progressivity (Kakwani Index)	-1.013**	-1.287***	-0.964**	-1.326**
	(0.279)	(0.204)	(0.266)	(0.277)
Pre-Tax Gender Income Gap	0.018			
	(0.388)			
Average Tax Rate	0.038	0.027	0.196	0.041
	(0.185)	(0.150)	(0.241)	(0.182)
Gender Ratio - Dependent Children	-0.0009	0.001	-0.003	0.002
	(0.004)	(0.003)	(0.004)	(0.003)
Gender Ratio - % of Income from Labor	1.467***	0.971***	1.303**	0.966**
	(0.350)	(0.181)	(0.360)	(0.197)
Gender Ratio - Regular Employment	0.388	1.121**	0.310	1.164*
	(0.355)	(0.317)	(0.452)	(0.384)
Gender Ratio - High Education	-0.018	0.108+	-0.005	0.116+
	(0.074)	(0.050)	(0.064)	(0.060)
Gender Ratio - Medium Education	-0.220*	-0.263**	-0.251*	-0.263**
	(0.090)	(0.076)	(0.115)	(0.081)
Gender Ratio - Low Education	-0.008	-0.042	0.065	-0.040
	(0.054)	(0.041)	(0.067)	(0.045)
Constant	-0.377	-0.306	-0.383	-0.386
	(0.620)	(0.307)	(0.547)	(0.520)
Random Effects - Intercept SD	0.048	0.016	0.045	0.018
Random Effects - Residual SD	0.051	0.052	0.052	0.052
Num.Obs.	325	325	325	325
R2 Marg.	0.740	0.846	0.757	0.842
R2 Cond.	0.865	0.860	0.861	0.860
AIC	-850.1	-814.8	-818.5	-809.7
BIC	-763.0	-667.3	-708.7	-654.6
RMSE	0.05	0.05	0.05	0.05

	Model 1	Model 2	Model 3	Model 4

Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 4. Unadjusted Post-Tax-Post-Transfer Gender Income Ratios Increased Over Time in Most Countries



Source: Luxembourg Income Study (LIS) Database

Note: The grey regression lines for each country comes from a bivariate linear regression of the post-tax-post-transfer gender income ratio (median income for women divided by median income for men) on year for each country. Unadjusted here means not adjusted for changes in individual characteristics, as is done for the conditional gender income ratios displayed in later Figures.

Table 7. Regression of Post-Tax-Post-Transfer Gender Income Ratio on Tax Progressivity (Kakwani Index) and Control Variables

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.360**	0.191***	0.242***	0.195**	0.143*	0.163*
	(0.121)	(0.052)	(0.054)	(0.059)	(0.062)	(0.075)
Pre-Tax-Post-Transfer		0.866***	0.865***	0.857***	0.829***	0.827***
Gender Income Ratio		(0.023)	(0.022)	(0.024)	(0.027)	(0.028)
Average Tax Rate			0.181**	0.154*	0.272***	0.286**
			(0.059)	(0.071)	(0.081)	(0.091)
Gender Ratio - Dependent Children				0.0004	0.0004	0.0004
				(0.0004)	(0.0004)	(0.0004)
Gender Ratio - % of Income from Labor				-0.208***	-0.153**	-0.174**
				(0.050)	(0.054)	(0.061)
Gender Ratio - Regular Employment				0.093*	0.079+	0.071
				(0.037)	(0.041)	(0.043)
Gender Ratio - High Education				-0.003	-0.007	-0.010
				(0.010)	(0.012)	(0.013)
Gender Ratio - Medium Education				-0.015	-0.003	-0.007
				(0.011)	(0.013)	(0.014)
Gender Ratio - Low Education				-0.005	-0.003	-0.003
				(0.003)	(0.003)	(0.003)
Gender Ratio - Managerial Occupations					0.007	0.004
					(0.010)	(0.011)
Gender Ratio - Other Skilled Occupations					0.002	0.001
					(0.021)	(0.023)
Gender Ratio -					-0.003	-0.003
Labor/Elementary Occupations					(0.003)	(0.003)
Gender Ratio - Industry					-0.066***	-0.063***
					(0.018)	(0.019)
Gender Ratio - Service					-0.017	-0.015
					(0.019)	(0.020)
Gender Ratio - Agriculture					0.0002	0.0002
					(0.0002)	(0.0002)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Ratio - Hours						0.006
						(0.048)
Between Effects						
Tax Progressivity (Kakwani Index)	0.295	0.238***	0.261***	0.239***	0.223+	0.388+
	(0.174)	(0.057)	(0.052)	(0.050)	(0.094)	(0.146)
Pre-Tax-Post-Transfer		0.962***	0.915***	0.893***	0.837***	0.764+
Gender Income Ratio		(0.067)	(0.062)	(0.076)	(0.144)	(0.334)
Average Tax Rate			0.129*	0.112*	0.093	0.295
			(0.049)	(0.039)	(0.091)	(0.173)
Gender Ratio - Dependent Children				-0.002+	-0.002	-0.001
				(0.0008)	(0.002)	(0.004)
Gender Ratio - % of Income from Labor				-0.216*	-0.235	-0.367
				(0.072)	(0.161)	(0.295)
Gender Ratio - Regular Employment				0.0004	0.022	-0.019
				(0.073)	(0.157)	(0.293)
Gender Ratio - High Education				0.002	0.015	0.046
				(0.016)	(0.036)	(0.047)
Gender Ratio - Medium Education				-0.005	0.022	0.103
				(0.020)	(0.063)	(0.095)
Gender Ratio - Low Education				0.026*	0.027	0.033
				(0.010)	(0.024)	(0.032)
Gender Ratio - Managerial Occupations					-0.001	0.024
					(0.051)	(0.066)
Gender Ratio - Other Skilled Occupations					-0.033	-0.098
					(0.127)	(0.197)
Gender Ratio -					0.00005	-0.003
Labor/Elementary Occupations					(0.017)	(0.023)
Gender Ratio - Industry					-0.005	-0.035
					(0.074)	(0.110)
Gender Ratio - Service					-0.007	-0.025
					(0.048)	(0.075)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Ratio - Agriculture					0.0008	0.00002
					(0.002)	(0.002)
Gender Ratio - Hours						0.059
						(0.191)
Constant	0.885***	0.033	0.045	0.265*	0.320	0.379
	(0.028)	(0.060)	(0.054)	(0.107)	(0.228)	(0.342)
Random Effects - Intercept SD	0.047	0.015	0.013	0.008	0.014	0.016
Random Effects - Residual SD	0.051	0.022	0.021	0.021	0.020	0.021
Num.Obs.	351	351	351	325	283	256
R2 Marg.	0.062	0.860	0.870	0.892	0.870	0.859
R2 Cond.	0.491	0.905	0.905	0.907	0.912	0.910
AIC	-1010.0	-1610.3	-1613.9	-1422.3	-1124.9	-985.3
BIC	-990.7	-1583.3	-1579.2	-1342.8	-1004.6	-861.2
RMSE	0.05	0.02	0.02	0.02	0.02	0.02

Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8. Regression of Post-Tax-Post-Transfer Gender Income Ratio on Tax Progressivity (Kakwani Index) and Control Variables for Expanded Sample of Individuals (All Income Types)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.877***	0.092**	0.125**	0.154***	0.153**	0.327***
	(0.188)	(0.035)	(0.039)	(0.039)	(0.048)	(0.065)
Pre-Tax-Post-Transfer Gender Income Ratio		0.950***	0.948***	0.865***	0.885***	0.863***
		(0.015)	(0.015)	(0.026)	(0.032)	(0.032)
Average Tax Rate			0.093+	0.140*	0.214**	0.299**
			(0.051)	(0.054)	(0.076)	(0.109)
Gender Ratio - Dependent Children				0.045+	0.058	0.080+
				(0.026)	(0.047)	(0.047)
Gender Ratio - % of Income from Labor				0.122+	0.138+	0.133
				(0.067)	(0.082)	(0.088)
Gender Ratio - Regular Employment				0.086*	0.053	-0.065
				(0.034)	(0.041)	(0.055)
Gender Ratio - High Education				0.005	0.018	0.021
				(0.010)	(0.017)	(0.022)
Gender Ratio - Medium Education				0.005	0.015	0.009
				(0.015)	(0.032)	(0.042)
Gender Ratio - Low Education				-0.018*	-0.017	-0.004
				(0.008)	(0.012)	(0.012)
Gender Ratio - Managerial Occupations					0.020	0.031
					(0.016)	(0.021)
Gender Ratio - Other Skilled Occupations					0.092*	0.178***
					(0.042)	(0.049)
Gender Ratio - Labor/Elementary Occupations					0.010+	0.015**
					(0.005)	(0.005)
Gender Ratio - Industry					0.036	0.041
					(0.033)	(0.038)
Gender Ratio - Service					-0.024	-0.031
					(0.024)	(0.023)
Gender Ratio - Agriculture					0.009	0.007
					(0.006)	(0.006)
Gender Ratio - Hours						-0.011
						(0.041)
<u>Between Effects</u>						

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.151	0.133	0.119	0.187	0.008	0.117
	(0.370)	(0.087)	(0.071)	(0.125)	(0.180)	(0.734)
Pre-Tax-Post-Transfer Gender Income Ratio		0.907***	0.881***	0.793*	0.708	0.867
		(0.066)	(0.055)	(0.142)	(0.241)	(0.225)
Average Tax Rate			0.125*	0.267	0.218	0.255
			(0.051)	(0.149)	(0.258)	(0.367)
Gender Ratio - Dependent Children				0.015	-0.139	0.147
				(0.060)	(0.206)	(0.504)
Gender Ratio - % of Income from Labor				-0.421		
				(0.538)		
Gender Ratio - Regular Employment				0.370	-0.123	-0.322
				(0.320)	(0.579)	(0.491)
Gender Ratio - High Education				0.048	0.095	
				(0.063)	(0.229)	
Gender Ratio - Medium Education				-0.057	0.069	
				(0.063)	(0.139)	
Gender Ratio - Low Education				-0.014	-0.0002	
				(0.024)	(0.059)	
Constant	0.718***	0.067	0.063	0.095	0.290	0.255
	(0.056)	(0.049)	(0.040)	(0.435)	(0.635)	(0.725)
Random Effects - Intercept SD	0.065	0.016	0.013	0.016	0.022	0.024
Random Effects - Residual SD	0.054	0.009	0.009	0.008	0.008	0.007
Num.Obs.	141	141	141	128	93	66
R2 Marg.	0.066	0.955	0.967	0.935	0.893	0.883
R2 Cond.	0.617	0.988	0.988	0.986	0.988	0.991
AIC	-371.3	-835.8	-831.8	-708.4	-451.3	-316.6
BIC	-356.5	-815.1	-805.3	-648.5	-385.4	-264.0
RMSE	0.05	0.009	0.009	0.007	0.007	0.006

Expanded sample here means single, sole earners as well as singles with other earners in the household and couples
Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
Between effects are not available to all variables in Models 5 and 6 due to model convergence issues with smaller samples of countries.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9. Regression of Post-Tax Gender Income Ratio on Tax Progressivity (Kakwani Index) and Control Variables for Expanded Sample of Individuals (Labor Income Only)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.840***	0.137***	0.196***	0.245***	0.194***	0.380***
	(0.188)	(0.038)	(0.042)	(0.044)	(0.053)	(0.061)
Gender Income Ratio for Labor Income		0.943***	0.940***	0.869***	0.891***	0.850***
		(0.016)	(0.016)	(0.027)	(0.031)	(0.030)
Average Tax Rate			0.164**	0.228***	0.208*	0.157
			(0.056)	(0.059)	(0.079)	(0.103)
Gender Ratio - Dependent Children				0.021	-0.063	-0.041
				(0.028)	(0.047)	(0.044)
Gender Ratio - Regular Employment				0.067**	0.032	-0.121*
				(0.025)	(0.027)	(0.053)
Gender Ratio - High Education				-0.026*	0.017	0.0005
				(0.011)	(0.018)	(0.021)
Gender Ratio - Medium Education				-0.040*	0.046	0.005
				(0.017)	(0.033)	(0.040)
Gender Ratio - Low Education				-0.033***	-0.010	-0.004
				(0.009)	(0.013)	(0.012)
Gender Ratio - Managerial Occupations					-0.009	0.019
					(0.017)	(0.020)
Gender Ratio - Other Skilled Occupations					0.017	0.140**
					(0.043)	(0.048)
Gender Ratio - Labor/Elementary Occupations					0.006	0.010*
					(0.005)	(0.005)
Gender Ratio - Industry					-0.014	-0.022
					(0.035)	(0.036)
Gender Ratio - Service					-0.020	-0.030
					(0.025)	(0.022)
Gender Ratio - Agriculture					0.009	0.008
					(0.007)	(0.006)
Gender Ratio - Hours						-0.065
						(0.040)
<u>Between Effects</u>						
Tax Progressivity (Kakwani Index)	0.180	0.140	0.125	0.108	-0.006	0.194
	(0.421)	(0.092)	(0.076)	(0.110)	(0.023)	(0.843)
Gender Income Ratio for Labor Income		0.943***	0.916***	0.769**	0.702***	0.921***

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		(0.064)	(0.053)	(0.133)	(0.048)	(0.239)
Average Tax Rate			0.133*	0.290	0.293***	0.286
			(0.055)	(0.160)	(0.032)	(0.426)
Gender Ratio - Dependent Children				-0.017	-0.207***	0.087
				(0.064)	(0.027)	(0.642)
Gender Ratio - Regular Employment				0.417	0.099	-0.430
				(0.381)	(0.110)	(0.618)
Gender Ratio - High Education				0.040	0.150**	
				(0.060)	(0.045)	
Gender Ratio - Medium Education				-0.067	0.015	
				(0.065)	(0.019)	
Gender Ratio - Low Education				-0.016	0.008	
				(0.026)	(0.009)	
Constant	0.706***	0.041	0.035	-0.288	0.087	0.373
	(0.064)	(0.047)	(0.039)	(0.310)	(0.131)	(0.861)
Random Effects - Intercept SD	0.075	0.017	0.013	0.017	0.000009	0.030
Random Effects - Residual SD	0.054	0.011	0.010	0.009	0.009	0.007
Num.Obs.	141	141	141	128	93	66
R2 Marg.	0.054	0.957	0.968	0.941	0.988	0.869
R2 Cond.	0.673	0.988	0.988	0.987	0.988	0.994
AIC	-367.8	-806.2	-807.5	-691.5	-445.9	-322.9
BIC	-353.0	-785.6	-781.0	-637.4	-382.6	-272.5
RMSE	0.05	0.01	0.01	0.008	0.007	0.005

Expanded sample here means single, sole earners as well as singles with other earners in the household and couples.
Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
Between effects are not available to all variables in Models 5 and 6 due to model convergence issues with smaller samples of countries.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10. Regression of Post-Tax-Post-Transfer Gender Income Ratio on Tax Progressivity (Kakwani Index), Additional Measures of Pre-Tax Income Inequality and Gender Disparities in Income, and Control Variables

	Model 1	Model 2	Model 3	Model 4
Tax Progressivity (Kakwani Index)	0.191**	0.218*	0.203+	0.210*
	(0.059)	(0.102)	(0.103)	(0.103)
Pre-Tax-Post-Transfer Gender Income Ratio	0.859***			
	(0.024)			
Pre-Tax-Post-Transfer Gender Income Ratio Deciles				
1st Decile		0.016	0.016	0.016
		(0.013)	(0.013)	(0.013)
2nd Decile		0.026		0.029
		(0.040)		(0.041)
3rd Decile		0.031	0.028	0.030
		(0.063)	(0.045)	(0.063)
4th Decile		-0.051		-0.055
		(0.089)		(0.089)
5th Decile		0.190*	0.342***	0.198*
		(0.093)	(0.072)	(0.094)
6th Decile		0.326***		0.327***
		(0.091)		(0.091)
7th Decile		0.039	0.293***	0.036
		(0.100)	(0.077)	(0.100)
8th Decile		0.183*		0.186*
		(0.090)		(0.090)
9th Decile		-0.060	0.007	-0.064
		(0.061)	(0.049)	(0.061)
10th Decile		0.027		0.025
		(0.028)		(0.028)
Pre-Tax Income Gini Coefficient	-0.069			-0.117
	(0.084)			(0.146)
Average Tax Rate	0.156*	0.318*	0.274*	0.318*
	(0.071)	(0.126)	(0.125)	(0.126)
Gender Ratio - Dependent Children	0.0004	0.00004	0.0002	0.0001
	(0.0004)	(0.0007)	(0.0007)	(0.0007)
Gender Ratio - % of Income from Labor	-0.210***	-0.273**	-0.261**	-0.278**
	(0.050)	(0.085)	(0.087)	(0.086)
Gender Ratio - Regular Employment	0.095*	0.005	-0.015	0.007

	Model 1	Model 2	Model 3	Model 4
	(0.037)	(0.065)	(0.066)	(0.066)
Gender Ratio - High Education	-0.001	0.001	0.004	0.004
	(0.010)	(0.017)	(0.018)	(0.018)
Gender Ratio - Medium Education	-0.017	-0.014	-0.015	-0.017
	(0.011)	(0.019)	(0.019)	(0.019)
Gender Ratio - Low Education	-0.005	-0.005	-0.003	-0.006
	(0.003)	(0.006)	(0.006)	(0.006)
Between Effects				
Tax Progressivity	0.236**	0.306	0.374**	0.423
	(0.061)	(0.191)	(0.109)	(0.257)
Pre-Tax-Post-Transfer Gender Income Gap	0.894***			
	(0.084)			
Pre-Tax-Post-Transfer Gender Income Ratio Deciles				
1st Decile		0.040	0.076	0.036
		(0.109)	(0.049)	(0.114)
2nd Decile		0.210		0.145
		(0.317)		(0.339)
3rd Decile		-0.811	-0.528+	-0.740
		(0.762)	(0.259)	(0.795)
4th Decile		0.151		0.435
		(1.123)		(1.249)
5th Decile		0.929	1.036*	0.325
		(1.754)	(0.398)	(2.029)
6th Decile		0.057		0.737
		(1.288)		(1.664)
7th Decile		-0.188	0.073	-0.689
		(0.977)	(0.381)	(1.256)
8th Decile		0.355		0.337
		(0.919)		(0.952)
9th Decile		-0.028	0.086	0.291
		(0.710)	(0.251)	(0.870)
10th Decile		-0.022		-0.227
		(0.251)		(0.392)
Pre-Tax Income Gini Coefficient	0.009			-0.269
	(0.095)			(0.391)
Average Tax Rate	0.114*	0.170	0.213*	0.114

	Model 1	Model 2	Model 3	Model 4
	(0.041)	(0.140)	(0.099)	(0.167)
Gender Ratio - Dependent Children	-0.002+	-0.003	-0.004*	-0.003
	(0.0008)	(0.003)	(0.001)	(0.003)
Gender Ratio - % of Income from Labor	-0.217*	-0.274	-0.272+	-0.262
	(0.075)	(0.175)	(0.144)	(0.183)
Gender Ratio - Regular Employment	0.002	-0.020	-0.028	-0.140
	(0.075)	(0.302)	(0.183)	(0.358)
Gender Ratio - High Education	0.002	0.071	0.048+	0.053
	(0.017)	(0.046)	(0.027)	(0.054)
Gender Ratio - Medium Education	-0.005	0.077	0.038	0.079
	(0.021)	(0.070)	(0.048)	(0.073)
Gender Ratio - Low Education	0.027*	0.037	0.040	0.030
	(0.012)	(0.038)	(0.028)	(0.041)
Constant	0.260+	0.337	0.353	0.599
	(0.127)	(0.297)	(0.217)	(0.483)
Random Effects - Intercept SD	0.009	0.019	0.015	0.020
Random Effects - Residual SD	0.021	0.035	0.036	0.035
Num.Obs.	325	325	325	325
R2 Marg.	0.890	0.686	0.689	0.686
R2 Cond.	0.907	0.758	0.737	0.763
AIC	-1413.0	-1037.8	-1053.1	-1032.8
BIC	-1325.9	-890.2	-943.4	-877.7
RMSE	0.02	0.03	0.03	0.03

Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11. Regression of Post-Tax-Post-Transfer Gender Income Ratio on Transfer Rate, Targeting, Spending, and Social Expenditure

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Average Transfer Rate	0.276***				0.137			
	(0.078)				(0.094)			
Transfer Targeting		-0.031				-0.027		
		(0.028)				(0.032)		
Social Expenditure (% GDP)			0.355***				0.317***	
			(0.068)				(0.079)	
Transfer Spending (% GDP)				0.691*				0.511+
				(0.269)				(0.302)
Post-Tax-Pre-Transfer	0.869***	0.850***	0.837***	0.831***				
Gender Income Ratio	(0.034)	(0.034)	(0.036)	(0.039)				
Pre-Tax-Pre-Transfer					0.750***	0.738***	0.744***	0.730***
Gender Income Ratio					(0.036)	(0.036)	(0.040)	(0.042)
Tax Progressivity					0.468***	0.500***	0.534***	0.650***
(Kakwani Index)					(0.090)	(0.087)	(0.105)	(0.110)
Average Tax Rate					0.270*	0.331**	0.261*	0.256*
					(0.107)	(0.106)	(0.119)	(0.124)
Gender Ratio -	0.0005	0.0003	0.0007	0.0005	0.0006	0.0005	0.0007	0.0005
Dependent Children	(0.0005)	(0.0005)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0007)
Gender Ratio -	-0.071	-0.084+	-0.083	-0.079	-0.008	-0.005	-0.016	-0.008
Regular Employment	(0.047)	(0.048)	(0.052)	(0.057)	(0.054)	(0.055)	(0.061)	(0.065)
Gender Ratio -	-0.498***	-0.533***	-0.556***	-0.572***	-0.493***	-0.505***	-0.535***	-0.544***
% of Income from Labor	(0.066)	(0.067)	(0.076)	(0.080)	(0.076)	(0.075)	(0.086)	(0.090)
Gender Ratio - High Education	0.012	0.009	0.001	0.020	0.010	0.008	-0.005	0.011
	(0.013)	(0.013)	(0.014)	(0.016)	(0.015)	(0.015)	(0.016)	(0.018)
Gender Ratio -	-0.040**	-0.046**	-0.036*	-0.041*	-0.017	-0.019	-0.008	-0.009
Medium Education	(0.014)	(0.014)	(0.016)	(0.017)	(0.016)	(0.016)	(0.018)	(0.019)
Gender Ratio - Low Education	-0.004	-0.005	-0.002	-0.005	-0.005	-0.005	-0.001	-0.003
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
<u>Between Effects</u>								
Average Transfer Rate	0.446***				0.412**			
	(0.110)				(0.127)			
Transfer Targeting		0.037				-0.017		
		(0.037)				(0.056)		
Social Expenditure (% GDP)			0.187				0.126	
			(0.125)				(0.177)	

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Transfer Spending (% GDP)				0.668*				0.662
				(0.291)				(0.381)
Post-Tax-Pre-Transfer	0.545***	0.574***	0.561***	0.565***				
Gender Income Ratio	(0.086)	(0.117)	(0.131)	(0.118)				
Pre-Tax-Pre-Transfer					0.594***	0.591***	0.668***	0.700***
Gender Income Gap					(0.105)	(0.144)	(0.159)	(0.143)
Tax Progressivity					0.226*	0.251+	0.351*	0.339*
					(0.080)	(0.131)	(0.133)	(0.118)
Average Tax Rate					0.071	0.178+	0.182	0.106
					(0.066)	(0.095)	(0.147)	(0.126)
Gender Ratio -	-0.002+	-0.003	-0.004+	-0.004+	-0.003*	-0.003+	-0.004*	-0.005*
Dependent Children	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Gender Ratio -	0.302**	0.385**	0.360**	0.331**	0.265*	0.351*	0.286*	0.239+
Regular Employment	(0.086)	(0.113)	(0.120)	(0.108)	(0.101)	(0.130)	(0.133)	(0.122)
Gender Ratio -	-0.412**	-0.602**	-0.736***	-0.674***	-0.464**	-0.693**	-0.749**	-0.745***
% of Income from Labor	(0.132)	(0.175)	(0.181)	(0.162)	(0.146)	(0.182)	(0.204)	(0.172)
Gender Ratio -	0.061**	0.084**	0.074*	0.084**	0.043+	0.051	0.063+	0.075*
High Education	(0.021)	(0.027)	(0.031)	(0.028)	(0.023)	(0.030)	(0.032)	(0.029)
Gender Ratio -	0.031	0.011	0.009	0.044	0.034	0.004	0.050	0.089
Medium Education	(0.029)	(0.039)	(0.058)	(0.052)	(0.033)	(0.041)	(0.062)	(0.059)
Gender Ratio -	0.041*	0.042*	0.032	0.035+	0.040*	0.033	0.035	0.037+
Low Education	(0.014)	(0.020)	(0.022)	(0.019)	(0.015)	(0.021)	(0.021)	(0.019)
Constant	0.349+	0.419+	0.598*	0.523*	0.388*	0.563+	0.510+	0.488*
	(0.164)	(0.239)	(0.237)	(0.211)	(0.173)	(0.274)	(0.245)	(0.206)
Random Effects - Intercept SD	0.014	0.020	0.020	0.018	0.014	0.020	0.020	0.016
Random Effects - Residual SD	0.027	0.027	0.027	0.028	0.030	0.030	0.030	0.031
Num.Obs.	325	325	269	258	325	325	269	258
R2 Marg.	0.805	0.745	0.742	0.758	0.759	0.711	0.710	0.734
R2 Cond.	0.845	0.837	0.837	0.829	0.800	0.797	0.795	0.792
AIC	-1273.7	-1246.3	-1024.7	-964.8	-1179.1	-1165.4	-951.0	-902.3
BIC	-1201.8	-1174.4	-956.4	-897.3	-1092.1	-1078.4	-868.3	-820.6
RMSE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03

Models 1-4 control for the post-tax-pre-transfer gender income ratio – such that the difference between the gender income ratio control variable and the outcome variable is the application of transfer income. Models 5-8 control for the pre-tax-pre-transfer gender income ratio (ratio of women's to men's median summed labor, capital, and private transfers income), as those models also include tax progressivity and tax rate alongside each of the transfer variables, so tax payment should not be captured in the gender income ratio control. Models with social

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8

expenditure or transfer spending do not include any observations from Taiwan or Russia. Spending data disaggregated into the specific types of transfers included in the transfer spending variable were not available for all country/years. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12. Additional Regressions of Post-Tax-Post-Transfer Gender Income Ratio on Transfer Rate

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Average Transfer Rate	0.252*	0.284**	0.277**	0.200*	0.127	0.262*
	(0.121)	(0.092)	(0.094)	(0.091)	(0.096)	(0.117)
Pre-Tax-Pre-Transfer	0.754***	0.737***	0.735***	0.756***	0.751***	0.752***
Gender Income Ratio	(0.041)	(0.037)	(0.038)	(0.037)	(0.037)	(0.040)
Tax Progressivity (Kakwani Index)	0.537***			0.378***	0.554***	0.448***
	(0.112)			(0.084)	(0.102)	(0.099)
Average Tax Rate	0.239+		0.046		0.267*	0.233+
	(0.125)		(0.102)		(0.111)	(0.119)
Gender Ratio - Dependent Children	0.0005	0.0008	0.0009	0.0006	0.0006	0.0004
	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Gender Ratio - Regular Employment	-0.007	-0.056	-0.052	-0.034	-0.004	-0.014
	(0.062)	(0.055)	(0.056)	(0.054)	(0.056)	(0.060)
Gender Ratio - % of Income from Labor	-0.564***	-0.488***	-0.487***	-0.500***	-0.482***	-0.576***
	(0.088)	(0.079)	(0.079)	(0.077)	(0.077)	(0.086)
Gender Ratio - High Education	-0.0005	0.011	0.011	0.010	0.008	0.0009
	(0.017)	(0.015)	(0.015)	(0.015)	(0.015)	(0.016)
Gender Ratio - Medium Education	-0.012	-0.024	-0.024	-0.018	-0.016	-0.013
	(0.019)	(0.016)	(0.016)	(0.016)	(0.016)	(0.018)
Gender Ratio - Low Education	-0.002	-0.007	-0.007	-0.005	-0.005	-0.003
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
<u>Between Effects</u>						
Average Transfer Rate	0.362*	0.413**	0.360*	0.461***	0.425**	0.337*
	(0.137)	(0.141)	(0.156)	(0.114)	(0.128)	(0.138)
Pre-Tax-Pre-Transfer	0.728***	0.511***	0.499***	0.603***	0.666***	0.632***
Gender Income Gap	(0.138)	(0.122)	(0.125)	(0.103)	(0.122)	(0.118)
Tax Progressivity (Kakwani Index)	0.385**			0.221*	0.318**	0.260*
	(0.115)			(0.079)	(0.102)	(0.091)
Average Tax Rate	0.190+		0.072		0.120	0.121
	(0.092)		(0.081)		(0.088)	(0.071)
Gender Ratio - Dependent Children	-0.004*	-0.002	-0.002	-0.003+	-0.004*	-0.003*
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Gender Ratio - Regular Employment	0.150	0.399**	0.419**	0.254*	0.205+	0.234+
	(0.127)	(0.109)	(0.113)	(0.097)	(0.108)	(0.118)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Ratio - % of Income from Labor	-0.600**	-0.408*	-0.437*	-0.422*	-0.500**	-0.544**
	(0.178)	(0.179)	(0.184)	(0.141)	(0.154)	(0.171)
Gender Ratio - High Education	0.048+	0.054+	0.050+	0.045+	0.059*	0.034
	(0.026)	(0.027)	(0.028)	(0.023)	(0.025)	(0.026)
Gender Ratio - Medium Education	0.092+	0.030	0.018	0.046	0.089+	0.032
	(0.053)	(0.038)	(0.041)	(0.031)	(0.050)	(0.036)
Gender Ratio - Low Education	0.036+	0.052*	0.047*	0.044**	0.048**	0.029
	(0.017)	(0.018)	(0.019)	(0.015)	(0.017)	(0.017)
Constant	0.432+	0.291	0.316	0.346+	0.326+	0.481*
	(0.199)	(0.213)	(0.218)	(0.168)	(0.176)	(0.201)
Random Effects - Intercept SD	0.015	0.018	0.018	0.013	0.013	0.016
Random Effects - Residual SD	0.031	0.032	0.032	0.031	0.031	0.031
Num.Obs.	269	325	325	325	309	285
R2 Marg.	0.738	0.720	0.715	0.758	0.757	0.740
R2 Cond.	0.788	0.789	0.787	0.797	0.796	0.794
AIC	-945.3	-1165.5	-1156.6	-1181.9	-1113.4	-1010.2
BIC	-862.6	-1093.6	-1077.2	-1102.4	-1027.5	-926.2
RMSE	0.03	0.03	0.03	0.03	0.03	0.03

Models should be compared to Table 11, Models 5-8 to understand how changes in variables and samples affect the relationship between average transfer rate and the post-tax-post-transfer gender income ratio. Model 1 includes only those observations in the SOCX data. Model 2 changes Model 5 in Table 11 only in that the gender income ratio control changes to exclude tax payment in the calculation. Model 3 includes average tax rate, but not tax progressivity. Model 4 includes tax progressivity, and not average tax rate. Model 5 removes Russia and Taiwan. Model 6 keeps Russia and Taiwan but removes the other observations not in the SOCX data. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 5. Study Countries Display Eight Different Outcomes for Changes in the Contribution of Taxes and Transfers to More Equal Post-Tax-Post-Transfer Gender Income Ratios

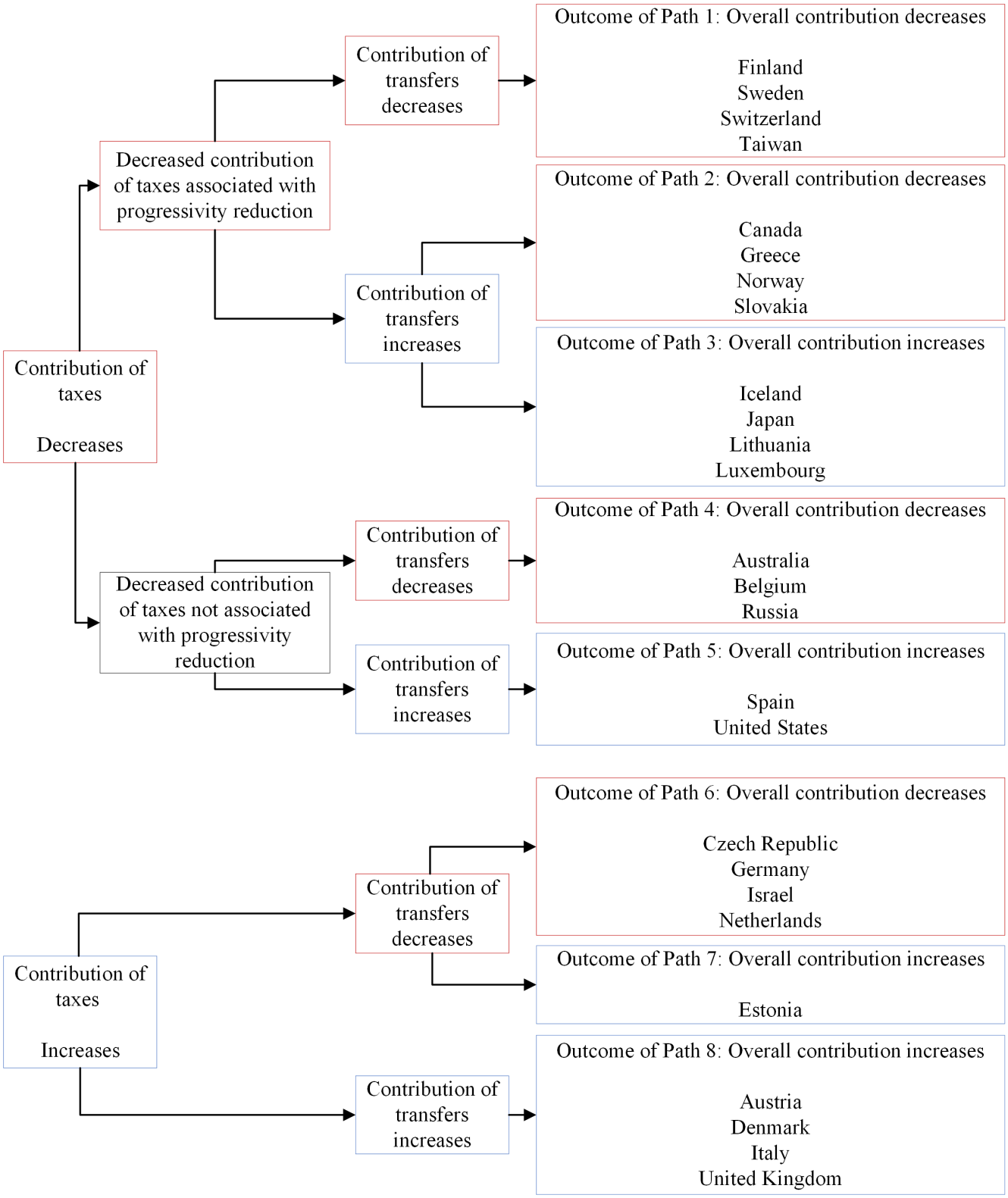
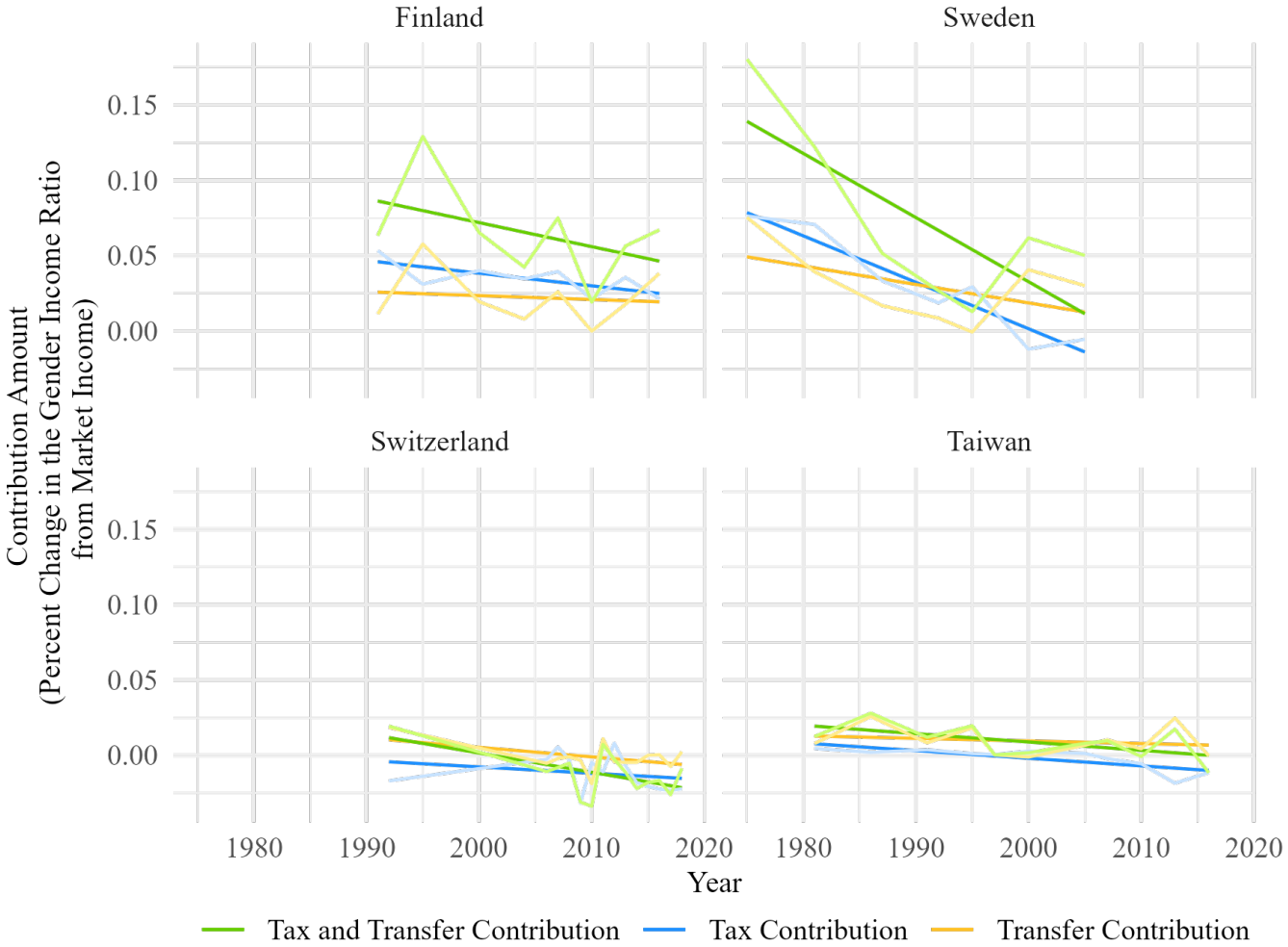


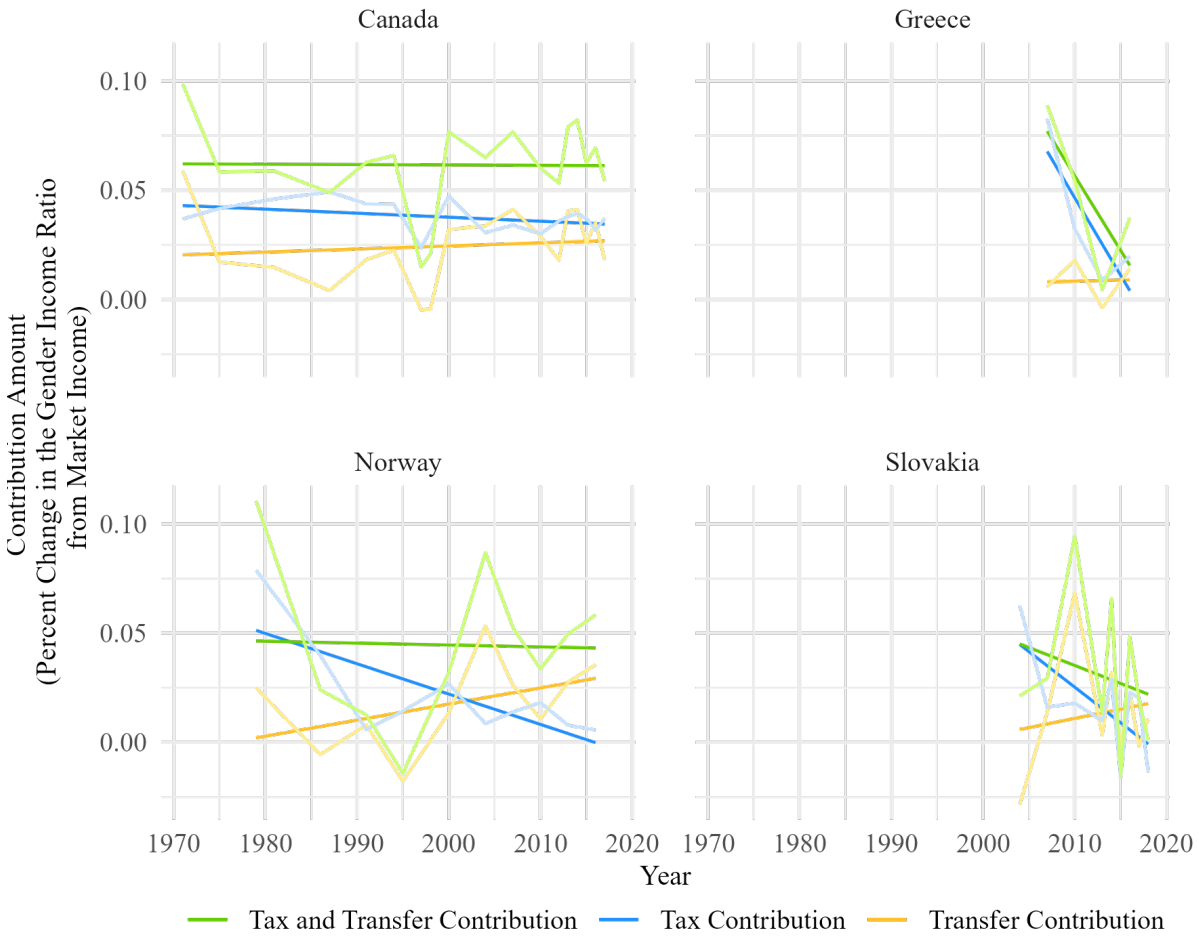
Figure 6. Both Taxes and Transfers Were Less Gender Equalizing over Time in Four Countries (Path 1)



Source: Luxembourg Income Study (LIS) Database

Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

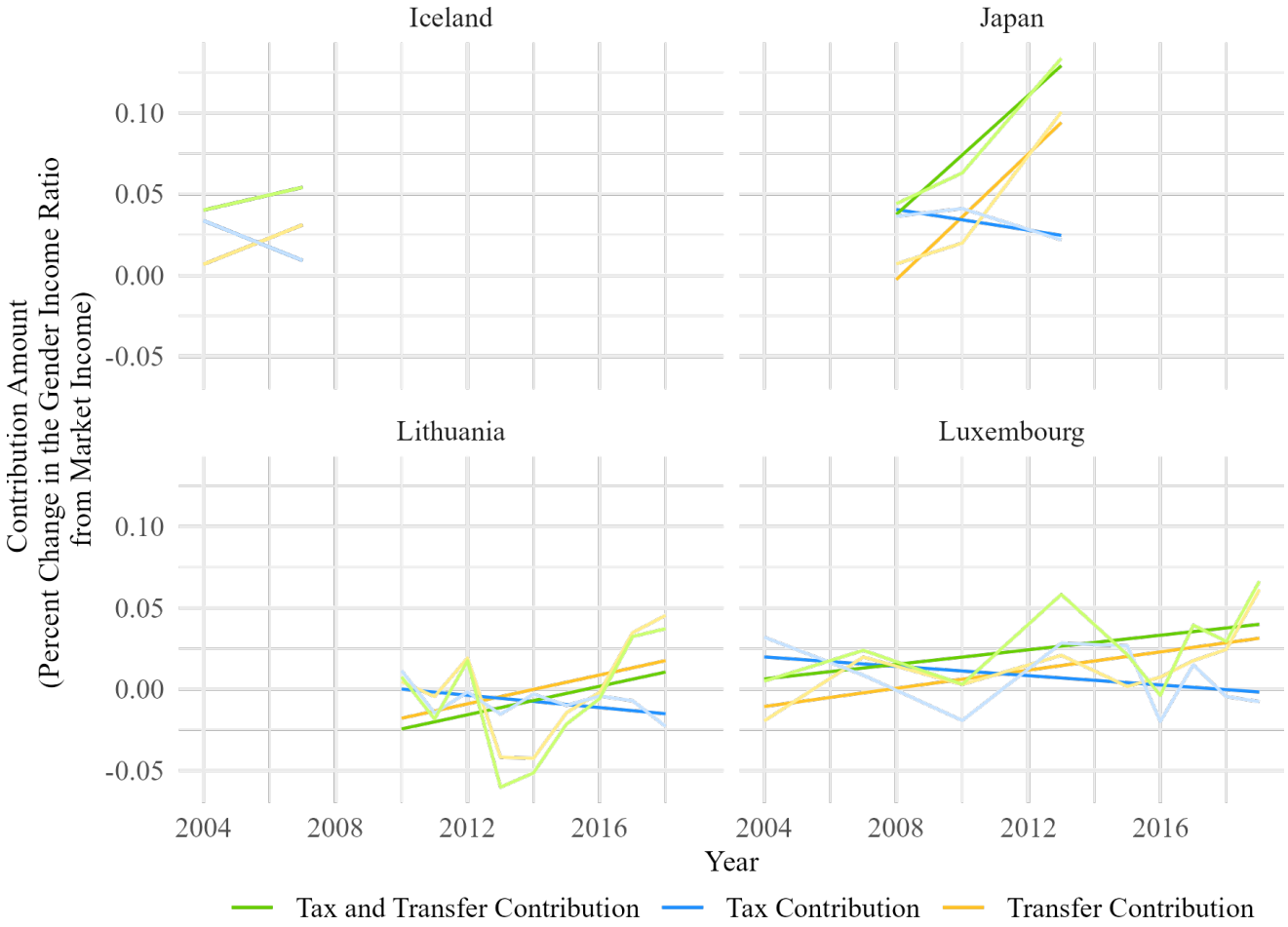
Figure 7. In Four Countries, Taxes Became Less Gender Equalizing Over Time, Transfers Become More Gender Equalizing, but Not Enough to Compensate for Taxes (Path 2)



Source: Luxembourg Income Study (LIS) Database

Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

Figure 8. In Four Countries, the Contributions of Taxes Decreased but Transfer Contributions Increased Enough that the Overall Contribution of Both to Reducing Disparities in Market Income Increased (Path 3)



Source: Luxembourg Income Study (LIS) Database

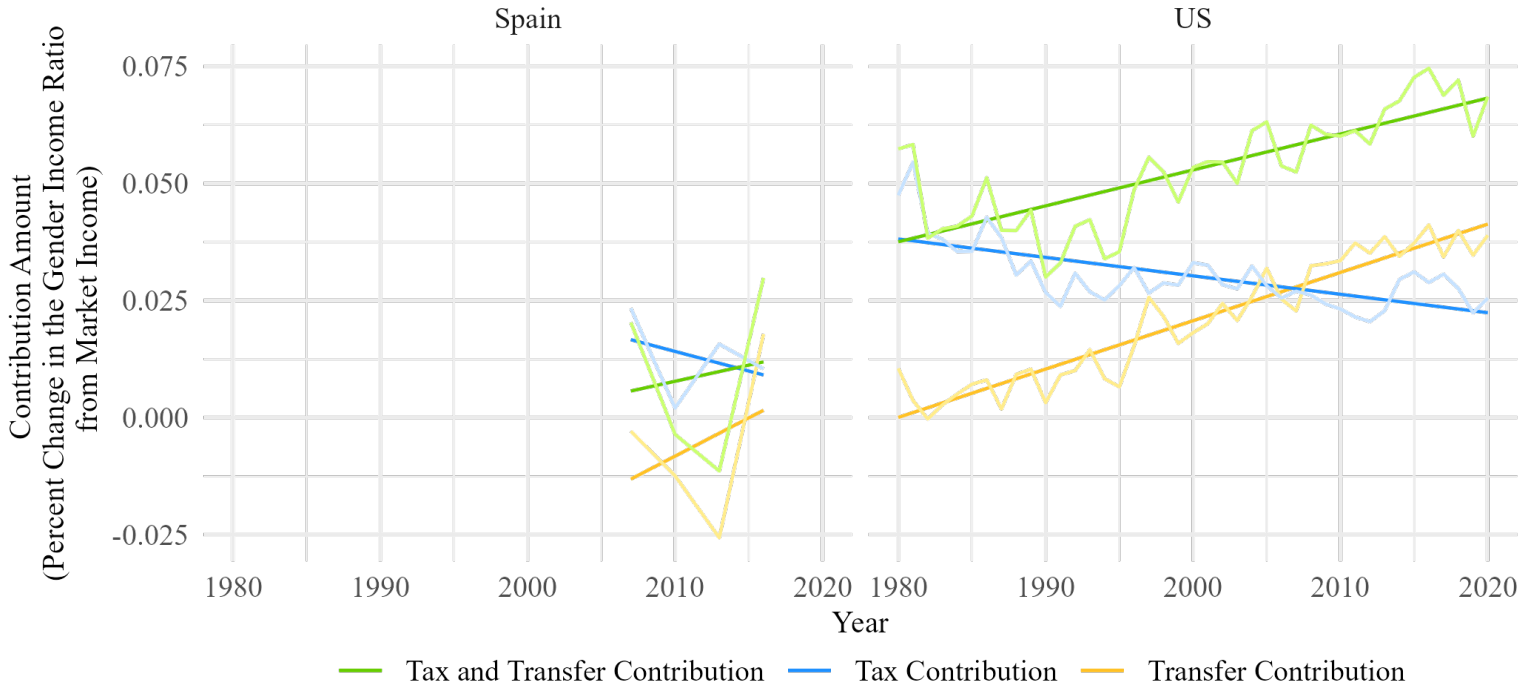
Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

Figure 9. Three Countries Experienced Co-Occuring Tax Progressivity Decreases Where the Contributions of Taxes and Transfers Both Decreased (Path 4)

Source: Luxembourg Income Study (LIS) Database

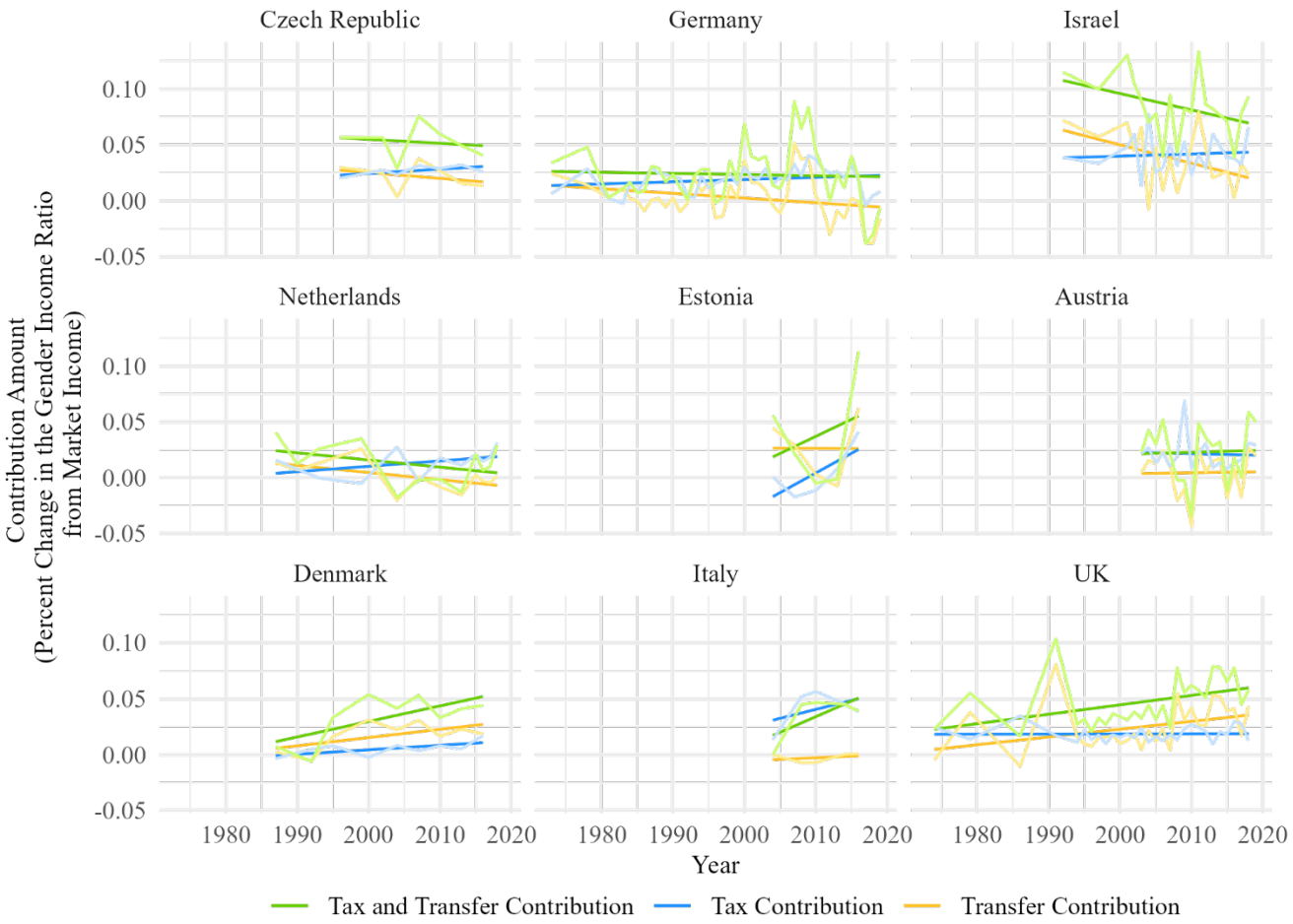
Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

Figure 10. In Two Countries the Tax Contribution Decreased (Even though Tax Progressivity Increased), but Transfer Contributions Increased Enough that the Overall Gender Equalizing Contribution of Both Increased (Path 5)



Source: Luxembourg Income Study (LIS) Database
Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

Figure 11. The Contribution of Taxes Increased in Nine Countries (Paths 6-8)



Source: Luxembourg Income Study (LIS) Database

Note: The values on the y-axis show the percent change in conditional gender income ratios with starting income being market income and the ending income being post-tax (pre-transfer) income, post-transfer (pre-tax) income, and post-tax-post-transfer income. Ratios are conditioned by regressing individual characteristics on logged income and extracting and exponentiating the coefficient for gender. Negative values on the y-axis indicate that the contribution was negative or that taxes, transfers, or both made the gender income ratios smaller (i.e., less equal). The straight lines come from three bivariate linear regressions of the contribution amount on year.

Annex A

Table A.1. Regression of Gender Tax Ratio on Tax Progressivity and Control Variables with Cross-sectional and Serial Correlation Corrected Covariance Matrix

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	-1.025***	-1.063***	-1.000***	-0.825***	-0.780***	-0.867**
	(0.175)	(0.196)	(0.176)	(0.173)	(0.154)	(0.275)
Pre-Tax Gender Income Gap		-0.191+	-0.189+	-0.232***	-0.239***	-0.249***
		(0.102)	(0.100)	(0.068)	(0.071)	(0.071)
Average Tax Rate			0.222	0.332	0.036	0.183
			(0.162)	(0.309)	(0.228)	(0.184)
Gender Ratio - Dependent Children				-0.003	-0.002	-0.003
				(0.002)	(0.002)	(0.002)
Gender Ratio - % of Income from Labor				0.914*	0.925*	1.014**
				(0.359)	(0.364)	(0.359)
Gender Ratio - Regular Employment				0.069	0.196	0.156
				(0.192)	(0.225)	(0.172)
Gender Ratio - High Education				-0.016	-0.007	-0.019
				(0.018)	(0.020)	(0.032)
Gender Ratio - Medium Education				-0.038+	-0.029	-0.023
				(0.021)	(0.038)	(0.049)
Gender Ratio - Low Education				0.0009	0.007	0.007
				(0.007)	(0.006)	(0.011)
Gender Ratio - Managerial Occupations					-0.036	-0.024
					(0.044)	(0.034)
Gender Ratio - Other Skilled Occupations					-0.165	-0.066
					(0.136)	(0.051)
Gender Ratio - Labor/Elementary Occupations					-0.006	0.0002
					(0.009)	(0.010)
Gender Ratio - Industry					0.094	0.017
					(0.068)	(0.053)
Gender Ratio - Service					0.144	0.125

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
					(0.119)	(0.089)
Gender Ratio - Agriculture					0.0003	0.0002
					(0.0002)	(0.0005)
Gender Ratio - Hours						0.564+
						(0.330)
Num.Obs.	351	351	351	325	284	257
AIC	-387.7	-400.9	-405.1	-477.1	-440.6	-422.9
BIC	859.3	842.3	834.2	616.4	453.4	357.8

Reports Driscoll and Kraay's heteroskedasticity and autocorrelation consistent errors that are also robust to cross-sectional dependence. Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.
+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.2. Regression of Gender Tax Ratio on Tax Progressivity and Control Variables with Heteroskedasticity Consistent Coefficients

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	-1.025***	-1.063***	-1.000***	-0.825**	-0.780**	-0.867**
	(0.271)	(0.298)	(0.287)	(0.265)	(0.253)	(0.309)
Pre-Tax Gender Income Gap		-0.191+	-0.189+	-0.232***	-0.239***	-0.249***
		(0.106)	(0.105)	(0.069)	(0.065)	(0.070)
Average Tax Rate			0.222	0.332	0.036	0.183
			(0.152)	(0.272)	(0.261)	(0.294)
Gender Ratio - Dependent Children				-0.003	-0.002	-0.003
				(0.002)	(0.002)	(0.002)
Gender Ratio - % of Income from Labor				0.914**	0.925**	1.014**
				(0.291)	(0.316)	(0.360)
Gender Ratio - Regular Employment				0.069	0.196	0.156
				(0.218)	(0.293)	(0.212)
Gender Ratio - High Education				-0.016	-0.007	-0.019
				(0.018)	(0.025)	(0.030)
Gender Ratio - Medium Education				-0.038+	-0.029	-0.023
				(0.019)	(0.038)	(0.044)
Gender Ratio - Low Education				0.0009	0.007	0.007
				(0.008)	(0.006)	(0.011)
Gender Ratio - Managerial Occupations					-0.036	-0.024
					(0.048)	(0.036)
Gender Ratio - Other Skilled Occupations					-0.165	-0.066
					(0.164)	(0.074)
Gender Ratio - Labor/Elementary Occupations					-0.006	0.0002
					(0.012)	(0.009)
Gender Ratio - Industry					0.094	0.017
					(0.078)	(0.056)
Gender Ratio - Service					0.144	0.125
					(0.114)	(0.087)
Gender Ratio - Agriculture					0.0003	0.0002
					(0.0003)	(0.0005)
Gender Ratio - Hours						0.564+
						(0.313)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Num.Obs.	351	351	351	325	284	257
AIC	-387.7	-400.9	-405.1	-477.1	-440.6	-422.9
BIC	859.3	842.3	834.2	616.4	453.4	357.8

Reports Arellano heteroskedasticity-consistent covariance estimators. Gender income gap refers to the median pre-tax gender income gap. Pre-tax income includes labor income, capital income, private transfers, and public social benefits income. Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men.

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.3. Regression of Post-Tax and Post Transfer Gender Income Ratio on Tax Progressivity (Kakwani Index) and Control Variables with Cross-sectional and Serial Correlation Corrected Covariance Matrix

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.361+	0.190*	0.242***	0.192**	0.139**	0.159*
	(0.199)	(0.077)	(0.066)	(0.064)	(0.052)	(0.061)
Pre-Tax-Post-Transfer Gender Income Ratio		0.866***	0.865***	0.856***	0.828***	0.828***
		(0.047)	(0.046)	(0.042)	(0.049)	(0.053)
Average Tax Rate			0.182*	0.152	0.277*	0.290*
			(0.081)	(0.126)	(0.116)	(0.140)
Gender Ratio - Dependent Children				0.0004	0.0004	0.0004
				(0.0004)	(0.0004)	(0.0004)
Gender Ratio - % of Income from Labor				-0.207**	-0.153*	-0.174**
				(0.069)	(0.064)	(0.057)
Gender Ratio - Regular Employment				0.090***	0.078***	0.071**
				(0.023)	(0.020)	(0.023)
Gender Ratio - High Education				-0.002	-0.007	-0.010
				(0.012)	(0.015)	(0.018)
Gender Ratio - Medium Education				-0.015*	-0.004	-0.008
				(0.007)	(0.010)	(0.012)
Gender Ratio - Low Education				-0.005	-0.003**	-0.003*
				(0.003)	(0.001)	(0.001)
Gender Ratio - Managerial Occupations					0.007	0.004
					(0.009)	(0.013)
Gender Ratio - Other Skilled Occupations					0.002	0.002
					(0.019)	(0.023)
Gender Ratio - Labor/Elementary Occupations					-0.003	-0.003
					(0.004)	(0.005)
Gender Ratio - Industry					-0.067***	-0.063***
					(0.015)	(0.019)
Gender Ratio - Service					-0.018	-0.015
					(0.020)	(0.021)
Gender Ratio - Agriculture					0.0002	0.0002
					(0.0004)	(0.0004)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Ratio - Hours						0.004
						(0.038)
Num.Obs.	351	351	351	325	284	257
AIC	-474.9	-1083.0	-1095.4	-1058.6	-958.0	-860.7
BIC	772.2	160.2	143.9	34.9	-64.0	-79.9

Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.4. Regression of Post-Tax-Post-Transfer Gender Income Ratio on Tax Progressivity (Kakwani Index) and Control Variables with Heteroskedasticity Consistent Coefficients

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Tax Progressivity (Kakwani Index)	0.361	0.190*	0.242**	0.192*	0.139*	0.159*
	(0.261)	(0.086)	(0.077)	(0.077)	(0.067)	(0.075)
Pre-Tax-Post-Transfer Gender Income Ratio		0.866***	0.865***	0.856***	0.828***	0.828***
		(0.041)	(0.039)	(0.037)	(0.054)	(0.059)
Average Tax Rate			0.182*	0.152	0.277**	0.290*
			(0.091)	(0.123)	(0.101)	(0.115)
Gender Ratio - Dependent Children				0.0004	0.0004	0.0004
				(0.0005)	(0.0005)	(0.0005)
Gender Ratio - % of Income from Labor				-0.207**	-0.153*	-0.174*
				(0.065)	(0.070)	(0.079)
Gender Ratio - Regular Employment				0.090**	0.078**	0.071*
				(0.032)	(0.029)	(0.031)
Gender Ratio - High Education				-0.002	-0.007	-0.010
				(0.010)	(0.013)	(0.015)
Gender Ratio - Medium Education				-0.015+	-0.004	-0.008
				(0.008)	(0.010)	(0.011)
Gender Ratio - Low Education				-0.005	-0.003*	-0.003*
				(0.003)	(0.001)	(0.001)
Gender Ratio - Managerial Occupations					0.007	0.004
					(0.011)	(0.015)
Gender Ratio - Other Skilled Occupations					0.002	0.002
					(0.019)	(0.022)
Gender Ratio - Labor/Elementary Occupations					-0.003	-0.003
					(0.004)	(0.004)
Gender Ratio - Industry					-0.067**	-0.063**
					(0.020)	(0.021)
Gender Ratio - Service					-0.018	-0.015
					(0.022)	(0.024)
Gender Ratio - Agriculture					0.0002	0.0002
					(0.0004)	(0.0004)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Ratio - Hours						0.004
						(0.042)
Num.Obs.	351	351	351	325	284	257
AIC	-474.9	-1083.0	-1095.4	-1058.6	-958.0	-860.7
BIC	772.2	160.2	143.9	34.9	-64.0	-79.9

Gender ratios are always calculated as the value for women divided by the value for men and include (in detail): the ratio of the percent of women to percent of men with dependent children, the ratio of the percent of women to percent of men with regular employment, with high, medium, and low education, working in managerial occupations, other skilled occupations, labor/elementary occupations, industry, service, or agriculture, and the ratio of weekly hours worked for women versus men

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.5. Conditional Gender Income Ratios and the Contribution of Taxes and Transfers to Changes in the Gender Income Ratios for the First and Last Observation of Each Country

		Conditional Gender Income Ratios				Percent Change from Market Income Ratio to the Ratio of the Respective Income Concept		
Country	Year	Market Income Ratio	Post-Transfers Income Ratio	Post-Tax Income Ratio	Post-Tax and Transfer Income Ratio	Contribution of Transfers	Contribution of Taxes	Contribution of Taxes and Transfers
Australia	1981	0.746	0.788	0.779	0.826	0.055	0.043	0.107
Australia	2018	0.846	0.864	0.871	0.892	0.022	0.03	0.055
Austria	2003	0.869	0.873	0.887	0.889	0.005	0.021	0.023
Austria	2019	0.832	0.849	0.856	0.874	0.02	0.029	0.05
Belgium	1992	0.885	0.888	0.926	0.924	0.004	0.047	0.045
Belgium	2017	0.881	0.898	0.91	0.919	0.019	0.032	0.043
Canada	1971	0.692	0.733	0.718	0.761	0.059	0.037	0.099
Canada	2017	0.842	0.858	0.874	0.888	0.018	0.037	0.054
Czech Republic	1996	0.814	0.838	0.831	0.86	0.03	0.02	0.057
Czech Republic	2016	0.802	0.813	0.823	0.835	0.013	0.026	0.041
Denmark	1987	0.83	0.833	0.828	0.837	0.002	-0.003	0.007
Denmark	2016	0.838	0.853	0.852	0.875	0.019	0.017	0.044
Estonia	2004	0.786	0.821	0.786	0.83	0.044	0.001	0.056
Estonia	2016	0.85	0.903	0.885	0.946	0.062	0.041	0.113
Finland	1991	0.845	0.854	0.89	0.898	0.011	0.053	0.063
Finland	2016	0.857	0.89	0.875	0.915	0.038	0.021	0.067
Germany	1973	0.843	0.863	0.848	0.871	0.024	0.006	0.034
Germany	2019	0.945	0.929	0.952	0.939	-0.016	0.008	-0.006
Greece	2007	0.783	0.787	0.848	0.852	0.006	0.083	0.089
Greece	2016	0.871	0.883	0.888	0.903	0.014	0.02	0.037
Iceland	2004	0.807	0.813	0.834	0.839	0.007	0.034	0.04
Iceland	2007	0.859	0.886	0.867	0.906	0.031	0.009	0.054
Ireland	2002	0.846	0.847	0.862	0.866	0.001	0.019	0.023
Ireland	2017	1.008	1.04	1.017	1.052	0.031	0.009	0.043
Israel	1992	0.792	0.849	0.823	0.883	0.072	0.039	0.115
Israel	2018	0.756	0.773	0.806	0.826	0.023	0.066	0.093
Italy	2004	0.83	0.83	0.841	0.83	0	0.013	0
Italy	2016	0.855	0.856	0.888	0.889	0.001	0.038	0.039
Japan	2008	0.731	0.736	0.758	0.763	0.007	0.036	0.044

Japan	2013	0.779	0.858	0.796	0.883	0.1	0.022	0.133
Lithuania	2010	0.954	0.958	0.965	0.961	0.005	0.011	0.008
Lithuania	2018	0.806	0.843	0.788	0.836	0.045	-0.023	0.037
Luxembourg	2004	0.891	0.874	0.92	0.896	-0.02	0.032	0.005
Luxembourg	2019	0.875	0.929	0.869	0.933	0.061	-0.008	0.066
Netherlands	1987	0.901	0.913	0.915	0.937	0.013	0.016	0.041
Netherlands	2018	0.904	0.905	0.932	0.931	0.001	0.031	0.029
Norway	1979	0.743	0.762	0.802	0.825	0.025	0.079	0.11
Norway	2016	0.795	0.823	0.799	0.841	0.036	0.006	0.058
Russia	2011	0.751	0.762	0.75	0.762	0.015	-0.001	0.016
Russia	2019	0.804	0.806	0.801	0.803	0.002	-0.003	-0.001
Slovakia	2004	0.806	0.783	0.856	0.823	-0.028	0.063	0.021
Slovakia	2018	0.789	0.798	0.779	0.79	0.011	-0.014	0.001
Spain	2007	0.848	0.845	0.867	0.865	-0.003	0.023	0.02
Spain	2016	0.85	0.865	0.859	0.875	0.018	0.01	0.03
Sweden	1975	0.722	0.776	0.777	0.852	0.075	0.076	0.18
Sweden	2005	0.856	0.882	0.851	0.899	0.03	-0.005	0.05
Switzerland	1992	0.836	0.851	0.822	0.852	0.019	-0.017	0.019
Switzerland	2018	0.852	0.854	0.833	0.845	0.002	-0.022	-0.009
Taiwan	1981	0.747	0.752	0.75	0.756	0.008	0.005	0.013
Taiwan	2016	0.865	0.865	0.855	0.855	0	-0.011	-0.011
UK	1974	0.77	0.766	0.789	0.788	-0.005	0.024	0.023
UK	2018	0.854	0.89	0.864	0.903	0.043	0.013	0.058
US	1980	0.735	0.742	0.77	0.777	0.011	0.047	0.057
US	2020	0.797	0.828	0.817	0.851	0.039	0.026	0.069

Conditional gender income ratios for market income, post-tax income, post-transfer income, and post-tax-post-transfer income are calculated by using the coefficients generated from equations regressing gender (and other characteristics which affect income) on these four income concepts. Market income is labor income and capital income. Post-tax income here is market income less taxes (but pre-transfers). Post-transfer income here is market income plus transfers (so, pre-tax). The contribution of taxes, transfers, and taxes and transfers is then the percent change in the gender income ratio from market income to each of those income concepts. See Table 1 for more details on calculation.