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### **Can Progressive Taxation Address Gender Inequality in Income? Cross-National Evidence of Gender Differences in Income Tax Payment Patterns and Post-Tax Income.**

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# Can Progressive Taxation Address Gender Inequality in Income? Cross-National Evidence of Gender Differences in Income Tax Payment Patterns and Post-Tax Income

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## Abstract

Gender difference in taxation is generally understudied, especially in sociology literature, which often overlooks taxation as a social phenomenon. While a small literature, studies on gender and taxation from a wider range of disciplines have offered and tested some core mechanisms producing gender difference in tax payment and post-tax income. One such mechanism is degree of tax progressivity. Most research on progressivity and gender difference in taxation analyzes one or two countries. Less research has used cross-national methods and larger samples of countries. This paper uses the most recent dataset for 27 countries (Waves IX, X, XI, from 2013 to 2018) from the Luxembourg Income Study Database (LIS) and a sample of single working men and women between the ages of 25 and 64 to address unanswered questions about the relationship between tax progressivity and gender differences in income tax payment and post-tax income. As expected, progressive taxation taxes men at a higher rate when gender income gaps favor men, while, in countries with less progressive taxation, men paid rates more similar to women, regardless of gender gap size. Income tax progressivity was also associated with greater gender equality in income post-tax. These results support tax progressivity as a tool for producing more gender-equal income distributions post-tax. Alongside previous research, these findings indicate that policymakers seeking greater gender equity should prioritize both progressive taxation and individual tax filing. Such arrangements allow progressive taxation to support gender equality in income without discouraging labor force participation for coupled women.

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## Introduction

Gender difference in taxation is generally understudied. This is especially true within the field of sociology, which often overlooks taxation as a social phenomenon. As Martin and Prasad (2014, 45) wrote when reviewing the body of fiscal sociology literature, “If sociologists continue to ignore the effects of tax policy, we will miss central dynamics of poverty and inequality in the twenty-first century and condemn our discipline to the margins of political discourse on these subjects.” One of these “central dynamics of poverty and inequality” about which sociology has remained relatively silent is the effect of tax policy on gender inequality. Even this review of sociological literature on taxes and inequality was able to offer only a few sentences on gender difference in taxation.

The gender and taxation literature outside of sociology also remains modest. However, studies on gender and taxation from a wider range of disciplines have offered and tested some core mechanisms producing gender difference in taxation. One such mechanism is degree of tax progressivity. In the case of income taxation, 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 inequality in income post-tax (Grown 2010).

Most research suggesting or documenting progressivity as a mechanism of gender difference in taxation analyzes one or two countries (e.g., Eder 2016; Lahey 2015). Less research has used cross-national methods and a larger sample of countries to examine the relationship between tax progressivity and gender difference in tax payment and post-tax income. A larger pool of countries provides additional data points at the country level from which to draw conclusions about how variation in tax progressivity might interact with gender income disparities to produce gender differences in tax payment patterns and post-tax income equality. To address this gap in the literature, this paper examines 27 countries with complete data on focal variables using harmonized microdata from the Luxembourg Income Study (LIS) Database. The harmonization process creates cross-nationally comparable, individual-level data, which enables the examination of tax payment patterns of men and women across these countries. While individual-level variables are available, some countries still tax only at the household level. So, this paper examines single (not living with a partner), sole earners to be confident that taxes paid correspond to the tax policies applied only to respondents’ (v. household) income.

Three key results emerge from this analysis. First, results suggest progressive taxation interacts with gender inequality in income by taxing higher-income men more. Thus, men paid higher income tax rates than women in countries with more progressive taxation and where gender income gaps favored men. In contrast, men paid rates more similar to women in countries with less progressive taxation, regardless of the size of those countries’ gender income gaps. Second, income tax progressivity is associated with greater gender equality in income post-tax. Third, tax relief for dependent children is also an important factor associated with gender difference in income tax payment and post-tax income, as single women with dependent children both paid lower tax rates and experienced greater gender equality in income post-tax.

Contemporary feminist theorists and scholars encourage an analysis of taxation that investigates not only whether laws treat men and women equally, but also how well laws produce substantive equity in their outcomes, creating fairer conditions by correcting unfair

gender-based social and economic inequalities. This paper takes a similar orientation, interpreting results alongside previous literature to suggest how policies can promote fairer outcomes for men and women. Specifically, previous research suggests progressive taxation and joint filing for couples tends to cause married women to pay a higher effective tax rate and reduce their labor force participation (“secondary earner bias”). However, results presented here indicate *single* women do benefit from progressive taxation. Thus, building on the literature reviewed below, this paper argues that a combination of progressive taxation and fully individualized tax filing represents a more gender equitable set of tax policies, supporting post-tax gender equality in income without discouraging the labor force participation of coupled women.

### **The Social Drivers and Consequences of Taxation**

As stated, sociology has been largely absent in conversations about the drivers and consequences of taxation. Nevertheless, the processes which shape an individual’s tax payment patterns are deeply social. Specifically, tax payment is a function of the policy choices made by the administrative units in which an individual lives and that individual’s resources. Both policy creation and resource access result from social processes, including social constructions of gender. As Grown (2010, 4) explains, gender differences in tax payment appear when social norms produce different “roles, rights, responsibilities, and obligations” based on gender, differences which then impact both tax policy formation and individual experiences with tax systems.

Regarding tax policy formation, when social constructions of gender influence the policy choices of governments, tax provisions may explicitly deal with men and women differently. Lahey (2011) traces the roots of some such gender differences in Western legal traditions to the “capture” or “coverture” of women in Roman tax law. Specifically, Roman legal code institutionalized the understanding of women as a productive unit belonging to a male head of household. Women had no recognized rights to property, income, or in-kind utility produced by their labor, so state agents, including tax collectors, only recognized the male head. The legacy of this arrangement survived for hundreds of years – married, male-headed couples remained the unit of taxation for most European nations and other countries, often former colonies, whose legal code followed European examples. Only in the latter part of the 20<sup>th</sup> century did such filing practices begin to change (Nelson 1996). Lahey (2011) also argues that tax policy was used to control women’s behavior, citing the example of heavy taxation on undesirable types of ornamentation specifically worn by women. In this way, explicit gendered tax practices result from a legal legacy which reflects larger patriarchal social and economic structures. Additionally, ostensibly gender-neutral tax policies can also produce gendered outcomes by interacting with gender differences in behavior and distributions of resources outside of the tax code. Such implicit gender bias creates, for example, the secondary earner bias mentioned above, which results in higher marginal tax rates on non-breadwinners, who are typically women due to traditional gender norms and roles (Stotsky 1996).

One could argue the differences between men and women that might lead to different tax payment patterns result from preference. Women make choices about their labor force participation or unpaid care work, with implications for their income and wealth accumulation and associated tax burdens. Under this logic, gender inequality, or observable gender differences, in resource bases and tax burdens would not represent inequity (understood here as unfair differences between men and women). However, many choices which create gender-based

differences are influenced by normative frameworks that constrain choice through proscriptions about the correct behavior of women (Gornick and Meyers 2009). Further, empirical evidence continues to suggest gender-based discrimination constrains labor market choices (Blau and Kahn 2017), with consequences for most kinds of taxation. When writing about these ideas on preference and choice, Gornick and Meyers (2009, 438) persuasively explain, “we cannot and should not interpret existing distributions of family forms and gender relations as revealed preferences.” Rejecting this assumption that current arrangements reflect preferences would mean that income differences are based on constrained choice, so represent inequitable differences. Accordingly, this paper takes the position that gender-based bias exists if gender differences in income and tax policies interact in ways which produce tax payment patterns that further disadvantage women.

Additionally, taxation has gendered consequences beyond tax payment patterns. Here again, sociology as a discipline should find taxation worth studying, as tax policies impact individual and collective outcomes of sociological interest. Specifically, tax policy has the potential to discourage or encourage gender parity in employment, unpaid labor, and post-tax income and wealth (Grown 2010). For example, regarding employment and returning to the secondary earner bias, joint filing and progressive taxation lead to higher marginal tax rates for women and discourage their labor force participation (Gustafsson 1992; Flood and Anxo 1999; Fuenmayor, Granell, and Mediavilla 2018; Smith et al. 2003). For post-tax income, the focus of this research, progressive income taxation may be a policy tool which helps shrink the gender income gap by taxing higher-income men at a higher rate. Alternatively, regressive tax policies could compound rather than correct these gaps.

Feminist scholarship on taxation often examines the impact of tax policy beyond tax payment patterns using a rights-based lens that understands equity as more than undifferentiated legal treatment (Elson 2006; Grown 2010; Hodgson and Sadiq 2017). In other words, equality *under the law* is not always sufficient to create equity or fair outcomes *beyond the law*. So, policymakers may need to introduce differential treatment to address gender-based disadvantages (Hodgson and Sadiq 2017). Grown (2010) provides an example of such a policy from India, where women’s labor income tax exemptions are intentionally higher to encourage women’s workforce participation. From this rights-based perspective, truly equitable tax policies should seek to *correct* existing social and economic disadvantages. In this sense, equitable policies are those that minimize observable differences (inequalities) between groups when those differences are understood as unfair. Thus, a rights-based analysis of gendered tax payment patterns considers not only whether men and women are equal under the law, but also whether laws intentionally create fairer outcomes for women (Elson 2006; Grown 2010; Hodgson and Sadiq 2017).

Using this rights-based or equity lens requires not only identifying the gendered or gender-neutral intent of a policy, but also examining outcomes, as is done in this research. Specifically, this paper examines how income tax policies are associated with gendered differences in income tax payment and gender equality in post-tax income. In understanding pre-tax gender inequality in income as largely a result of discrimination and constrained choice, this approach views greater equality in post-tax income as a more equitable outcome. Thus, empirically examining relationships between tax progressivity, gendered tax payment patterns, and post-tax income is essential for both filling a gap in sociological literature on gender inequality and generating a fuller understanding how tax policy can create more gender equitable outcomes.

## Mechanisms of Gender Difference in Taxation

As argued above, gender difference in taxation has both social drivers and consequences. Previous research has theorized and tested a number of mechanisms which produce gender differences. Barnett and Grown (2004) compile these mechanisms into four key categories which encompass how tax policies are shaped by social constructions of gender or create gendered differences in tax payment. Much theory and research on gender and tax policy uses these or similar categories, so this typology provides a useful tool for framing how the research presented here fits into existing literature. These four areas include gender differences in: 1) paid employment (patterns of formal versus informal employment, earnings, and occupation), 2) unpaid care work, 3) consumption expenditure, and 4) property rights and asset ownership.

This paper focuses on how income tax policy (degree of progressivity) creates gender differences in income tax payment for working men and women. While the income mix for individuals in this sample includes both earnings (labor income) and other sources (capital, public and private transfers), earnings make up the vast majority of income for these working men and women. For that reason, the literature on paid employment and earnings is reviewed in greatest detail here. However, some literature on unpaid care work is also relevant for this analysis, as tax policies sometimes recognize the cost of child rearing by providing tax relief or supports to parents. To the extent that single mothers receive such tax supports more often, this may create gender differences in tax payment.

Gender differences in taxation related to paid employment tend to manifest either as gender differences in incentives for labor force participation or gender differences created by the tax treatment of income. While progressive tax treatment of income is the core mechanism examined here, the literature on incentives for labor force participation is also reviewed due to some complexity in how progressivity affects gender equity in taxation and tax-related outcomes. Specifically, research suggests progressivity and joint filing (and sometimes mixed filing) suppress women's labor force participation (Gustafsson 1992; Flood and Anxo 1999; Fuenmayor, Granell, and Mediavilla 2018; Smith et al. 2003). However, progressivity may also reduce the tax burden of working women who usually occupy lower income brackets (Eder 2016; Lahey 2015). Given this tension, discussion of the analyses conducted here integrates literature on women's labor force participation when reflecting on policy implications.

Regarding labor force participation incentives, while progress has been made, women's labor force participation rates lag behind men's globally (Dorius and Firebaugh 2010) and women often bear greater responsibility for unpaid care work (Charles 2011). These patterns mean 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, at least historically, tax couples' collective income. Joint filing, when combined with progressive tax rates, discourages employment and full-time hours among second earners, as couples try to avoid entering higher tax brackets (Barnett and Grown 2004). Notably, regarding the social causes of this form of gender bias in taxation, while these joint filing practices have their roots in institutionalized explicit gender bias – the *male-headed* family, rather than individuals, as the unit of taxation (Lahey 2011) – contemporary tax policy is ostensibly gender-neutral on this front, as some men are secondary earners (Klesment and Bavel 2017). Instead, current gender differences from joint filing arrangements more closely resemble implicit bias, resulting not from gender differences written in tax code but from the social construction of women as secondary earners.

A comparatively robust number of studies have examined this mechanism of gender bias in taxation. Gustafsson (1992) compares German and Swedish women's labor force participation following the introduction of separate tax filing for couples in Sweden. To demonstrate the impact of these different policies, Gustafsson calculates how the German joint filing system reduces the proportional contribution of women's labor income to total household income compared to the Swedish model. Under the Swedish tax system, women contributed 38% of household income. The same earnings under the German system would have been worth only 28% of household income. Gustafsson estimates the impact of this reduced earning capacity on the probability of women's labor force participation and concludes that the German system reduces the likelihood of women's employment. A number of scholars in different contexts find similar labor force participation suppression with joint filing and greater labor force engagement with individual filing (Flood and Anxo 1999; Fuenmayor, Granell, and Mediavilla 2018; Smith et al. 2003). Others report some evidence of joint filing leading to reductions in women's paid labor hours (Bettio and Verashchagina 2013; Rosenfeld and Birkelund 1995) or greater use of informal employment to avoid tax increases (Bettio and Verashchagina 2013).

Even countries that use individual filing sometimes institute tax provisions, exemptions, or credits in ways that treat the family as a tax unit and produce gendered outcomes. One study reports that 13 of 19 European Union countries with individual filing options also offer couples benefits not available to single filers (Gunnarsson, Schratzenstaller, and Spangenberg 2017). Tax credits granted for sole earner couples is one such policy. Governments use these credits to "correct" for the apparently inequitable higher taxation of single earner families. Specifically, under progressive individual filing, a household composed of a breadwinner and homemaker would pay higher tax rates than two earners with the same total household labor income. While this may seem inequitable at first, this represents a more equitable arrangement if we acknowledge the value created by the labor of the homemaker. Rather than expending additional resources in time or money to pay someone else to do care or cleaning tasks, the single-earner couple benefits from the homemaker's efforts *in addition to* the income of the full-time worker (Bettio and Verashchagina 2013; Grown 2010; Gunnarsson, Schratzenstaller, and Spangenberg 2017; McCaffery 2008; Nelson 1996). Tax credits that fail to recognize the labor of homemakers and give favorable tax treatment to single-earner couples disincentivize more gender-equitable divisions of paid and unpaid labor and increase the after-tax labor income of men, since they are often the sole earners in such couples (Schratzenstaller 2015; Gunnarsson, Schratzenstaller, and Spangenberg 2017).

While tax credits and exemptions can introduce labor force participation disincentives, some countries use these provisions as a lever for increasing women's employment, like the Maltese tax credit women receive for entering the labor market (Bettio and Verashchagina 2013) or the higher labor income exemption in India already mentioned (Grown 2010). Further, Kabátek, van Soest, and Stancanelli (2014) find that individual taxation could also lessen gender differences in unpaid labor, increasing men's household labor as well as women's paid labor. Returning to the rights-based approach outlined above, these examples suggest a role for tax policy in *correcting* existing gender inequalities in paid and unpaid labor.

The evidence above suggests progressive taxation under joint filing or with certain tax provisions for couples can contribute to gender inequality, suppressing women's labor force participation and increasing the post-tax income of male breadwinners. However, progressive tax treatment of income under fully individualized tax filing should generally result in a lower tax burden for women compared to men. When income tax rates are progressive and 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 levels (Grown 2010).

Examining the Austrian tax system, Eder (2016) finds that progressive labor income taxes did reduce the gap between men's and women's earnings. This speaks to the principle of equity described above, wherein the tax code as a policy instrument can correct gender inequalities. 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. Gunnarsson, Schratzenstaller, and Spangenberg (2017) argue these types of regressive personal income tax reforms have been common in Europe since 1995 and will shift the tax burden toward women.

Gender differences in tax payment resulting from various levels of progressivity are a form of implicit bias – the level of income tax progressivity treats income, not men and women, differently. Nevertheless, tax policy choices around progressivity have important implications for gender equality. Although not directly testing the impact of progressivity on post-tax gender income gaps (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) suggest 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 closing the gender income gap. Thus, some research suggests progressive taxation could be a key component of tax systems which contribute to gender equity. Returning to the ostensible conflict between progressive taxation and women's labor force participation, the literature suggests more gender equitable tax systems would pair progressive taxation with individual tax filing, rather than joint filing systems, and would not include credits that offset higher tax rates on single income, coupled households.

A final mechanism for gender difference in taxation is worth noting here. Tax credits and expenditures for childcare can create more gender-equitable tax payment patterns, help offset the cost of childcare, and lead to more equitable gender divisions of paid and unpaid labor, when targeted correctly. Tax supports for childcare can reduce the costs of employment for secondary earners, typically women, by reducing the taxes paid by these secondary earners (Bonin et al. 2013; Gunnarsson, Schratzenstaller, and Spangenberg 2017). However, to support gender equity, policymakers must carefully design credits to target work-related childcare costs for secondary earners and single parents. Grown (2010) uses the example of the U.K.'s, since refined, 1999 Working Families Tax Credit to demonstrate how child tax credits targeted at low-income families can sometimes have detrimental effects for gender equality. In particular, two workers could not split the 30-hour work requirement for this credit, which typically resulted in gendered divisions of paid and unpaid labor (i.e., male breadwinner, female homemaker). Similarly, Lahey (2015) critiques a Canadian tax reform for joint filing, called the "Family Tax Cut Credit." She calculates that this reform, alongside other joint filing policies, redirects billions of tax benefits from women's earnings toward male breadwinners, due to women's under-representation as main earners in two-parent families (the only family type eligible for this credit). Thus, to the extent that single mothers might receive tax supports more (or less) often, this may contribute to gender differences in tax payment and post-tax income.



### *Testing Progressivity as a Mechanism for Gender Difference in Taxation*

This research, while not establishing causal connections, rests on certain assertions and relationships documented in the literature that understand gender differences in taxation as caused by gendered social processes. Gender norms often result in women's disproportionate representation in lower-income employment arrangements and occupations, creating an earnings gap (Blau and Kahn 2017). Income tax policy will likely interact with this earnings gap differently, depending on the degree of tax progressivity, to produce gender differences in tax payment patterns and post-tax income (Grown 2010). In this way, social constructions of gender and associated gender differences in income might interact with tax progressivity such that:

- 1) Men pay higher tax rates than women under progressive tax systems and where income gaps favor men.
- 2) Men and women pay similar rates under less progressive tax systems, regardless of the size of the gender income gap.
- 3) Progressivity is associated with greater reductions in the gender income gap post-tax.

In testing these hypotheses, differences *among* women remain unexamined (beyond differences in parental status). Women, however, are not a monolith – race, ethnicity, immigration status, sexuality, disability status, and other characteristics and experiences likely create tax payment differences among women. While beyond the scope of this paper, such relationships should be explored to enhance our understanding of how gender difference in taxation intersects with other identities and statuses.

### **Data, Analysis Approach, and Variables**

#### *Data and Sample*

Data come from the Luxembourg Income Study (LIS) Database. The LIS data are microdata from many different national surveys harmonized into a common framework. The harmonization process makes variables as equivalent as possible in conceptual content and measurement units or categories. This creates cross-nationally and historically comparable household and individual-level data. Because of this individual-level detail, the LIS data allow for an examination of tax payment patterns by gender and other relevant demographic characteristics. This ability to include individual characteristics is unique as compared to other tax data sources, like the Organisation for Economic Co-operation and Development (OECD) data or World Inequality Database.

However, several tax and income concepts are captured only at the household level by many countries, so the sample here only includes unpartnered respondents with no other labor income earners in the household. Creating this subsample allows for comparisons of income tax differences between men and women by ensuring the household income and tax values are the values for those individual men and women. As this analysis is primarily interested in labor income taxation and labor market earnings, the sample also includes only those between the ages of 25 and 64 who were working for pay, had non-zero values for labor income, and were not receiving pensions. Of the full sample of employed, working, men and women aged 25-64 available in the LIS data, the percentage included in this sub-sample ranges from a low of 4.5% of men in Slovakia to a high of 30.4% of women in Italy (Table A1).

Legally recognized couples are often treated differently by tax systems. Therefore, the tax experiences of this sub-sample do likely differ from their coupled peers. Key differences between couples and this group of non-partnered, sole earners would derive from joint filing and from tax exemptions or credits for marriage or domestic partnership. This subsample likely differs less from those in families with additional income earners who are not spouses or legally recognized partners. From this, results can be interpreted as revealing how tax progressivity treats the income of men and women at a baseline, prior to additional gender differences introduced by joint tax filing or other partnership provisions.

The 27 sampled countries are those with data on key independent and dependent variables, sufficient numbers of working single men and women with no other earners in the household,<sup>1</sup> meaningful levels of income taxation, and labor income and taxes coded as taxes and contributions fully captured, taxes and contributions collected, or taxes and contributions imputed. This analysis uses the most recent wave of data from these countries (Waves IX, X, XI, from 2013 to 2018), which include Australia, Austria, Belgium, Brazil, Canada, Colombia, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Ireland, Israel, Italy, Lithuania, Luxembourg, Netherlands, Norway, Panama, Russia, Slovakia, Spain, Switzerland, Taiwan, United Kingdom, and the United States.

### *Analysis Approach and Variables*

Hierarchical linear modeling (HLM), a type of multilevel modeling (MLM), is used to test the hypotheses detailed above. HLM is appropriate for data in which units of analysis are “nested.” In this case, individuals are nested within countries. Such nesting violates the OLS regression assumption of independence of observations, as individuals within the same country will be more like one another. HLM adjusts for dependence among observations to yield more accurate estimates. Additionally, HLM allows for the inclusion of independent variables at multiple levels (Robson and Pevalin 2016). This enables an analysis of how progressivity, measured at the country level, interacts with gender (individual level) to produce gender differences in tax payment patterns.

The first dependent variable is income tax payment, measured as effective income tax rate (results using tax amount as a robustness check are in Table A3). Effective income tax rate is typically calculated as income taxes paid divided by income. Several challenges exist with this straightforward definition. First, many LIS datasets do not differentiate between income taxes and social security contributions. Second, income tax base definitions vary from country to country, including various combinations of income types (labor, public transfer, private transfer, and capital). Some countries tax certain transfers and not others or lump income from employment with income from assets and capital. Other countries do not define transfers or income from assets and capital as personal income for tax purposes. The LIS tax data do not differentiate which taxes were paid on which kind of income, so working around these tax base differences by isolating gender differences in a particular kind of income, labor income, for example, is not possible. Complicating matters, gender differences often exist in income sources. Men tend to earn more income from the labor market. Where government transfers target those with lower incomes, women are more likely to have income from such sources (Brady and Kall 2008). Given gender differences in income sources, what income types form the denominator, will affect the degree and direction of differences in effective tax rates for men and women.

At the heart of this research is a question about how tax systems interact with gender differences in income along a spectrum of compounding those differences to ameliorating them.

The goal is not to calculate *the* effective tax rate for these countries. Instead, this research is interested in gender differences in how much of a cut the government takes from the income men and women have at their disposal. For this reason, effective tax rate is calculated based on a standard definition of income including labor income, capital income, private transfers, and public and social transfers. The way countries vary in whether and by how much they tax these resources is exactly what produces the gender differences in tax payment across countries this research wishes to examine. Admittedly, the inclusion of transfer income will likely attenuate some differences between men and women's income, and questions of gender and redistribution often consider both taxes and transfers together (e.g., Doorley and Keane 2020). However, taxation also exerts an independent effect on income equality. By examining gender differences after the effect of transfers is accounted for, this approach also more fully isolates the role of taxation in ameliorating, leaving unaffected, or compounding gender inequality in income.

Thus, this study calculates effective income tax rate by dividing the income taxes and social security contributions variable ("hxitsc") by the summed income variables for labor income ("hilabour"), capital income ("hicapital"), private transfers ("hiprivate"), and public and social transfers ("hipubsoc").<sup>2</sup> This effective tax rate captures the percent of a person's income paid in taxes. Several additional adjustments to effective tax rate are made here prior to inclusion in analyses. First, a small number of individuals paid higher taxes than their income. To address this, effective tax rate is top coded at the highest marginal tax rate for each country.<sup>3</sup> Effective tax rate is also normalized using a natural logarithm transformation. To account for negative or zero values and enable this transformation, one plus the absolute value of the most negative value of effective tax rate is first added to all values of the untransformed effective tax rate variable. This yields a positive-valued, non-zero variable that maintains the original distribution and can then be logarithmically transformed. The same procedure is used for supplemental analyses using amount of taxes paid as the dependent variable (Table A3).

The second dependent variable is post-tax gender equality in income, captured at the individual level so person-level characteristics can be controlled for while assessing the association between progressivity and gender equality. This study constructs the measure of post-tax gender equality in income by dividing each individual woman's post-tax income by the median post-tax income for men in their country. In essence, this captures the extent to which women's income is like the average man's income post-tax. To create this variable, taxes paid are subtracted from income using the same tax payment variable ("hxitsc") and income definition described above and utilized throughout this paper. First, though, to account for skewness from extreme values and negative post-tax income, the post-tax income variable is top and bottom coded, a common practice with income variables. The negative post-tax income values are set to zero and extreme values set to the value of the ninetieth percentile. As this measure of post-tax income inequality is only calculated for women, HLM regressions with this outcome variable include only women. Most income for this sample comes from labor income (an average of 90%; see Table A1 for a complete breakdown). So, this examination of post-tax income equality largely speaks to changes in the gender earnings gap. Accordingly, results help reveal how the degree of tax progressivity as a policy tool more or less effectively addresses gender earnings gaps from labor market inequalities.

The primary independent variables for models with tax payment as the dependent variable include gender and the presence of dependent children (individual level) and progressivity and the pre-tax gender income gap (country level). Both individual-level variables are taken directly from LIS, though the presence of dependent children is recoded. Gender is measured in the LIS data as male or female, without any additional categories for other gender

identities. The presence of dependent children is recoded from a count variable to a binary variable for none versus at least one child (age 17 or under). Additionally, a series of four recoded binary variables (single woman with or without children and single man with or without children) capture combinations of gender and family form.

At the country-level, this study creates two indicators from the LIS data – measures of progressivity and the gender income gap. Progressivity is measured by constructing a Kakwani index value for each country. The Kakwani index summarizes the distribution of taxes over households ordered according to their income (concentration index of tax), then controls for pre-tax inequality by subtracting the Gini index from this concentration index of tax. The Kakwani index is a classic measure of progressivity. Though other measures exist, Kakwani and Son (2020) recently found that results are fairly robust across different measures, suggesting this measure remains relevant and effective. Higher values indicate greater progressivity, while lower values indicate less progressivity, and the tax is considered redistributive if the index is positive. The Kakwani index is calculated for each country's complete population-weighted sample of households in the LIS data, as progressivity is a function of tax policy decisions made at the country (population)-level. This study calculates the pre-tax gender income gap as the median pre-tax income of women divided by the median pre-tax income of men and subtracted from one.

For models with post-tax gender equality as the dependent variable, the primary independent variables are the presence of dependent children (individual level) and progressivity (country level). The presence of dependent children is measured using the recoded binary variable described above. Progressivity is measured again with the constructed Kakwani index values. These models also include two controls specific to this dependent variable. First, pre-tax gender equality is controlled for at the individual level and created to mirror the dependent variable - the ratio of each woman's *pre-tax* income to the *pre-tax* median income of men in their country. Second, this study constructs one additional country-level indicator, median effective tax rate, to control for how high tax rates collect substantial tax amounts from higher incomes, even if progressivity is moderate. Median effective tax rate is aggregated at the country-level from the individual effective tax rate variable described above. Values for the country-level indicators calculated for this study are in Table A2.

Models with both tax payment and post-tax gender equality as the dependent variables also control for two individual-level variables, age and employment arrangement, which may affect income amounts and taxation. Both individual-level variables come directly from LIS, though employment status is recoded. Age is measured in years. Employment status is a recoded binary variable comparing regular/dependent employment against other arrangements (employer, self-employed, non-regular employee, own-account worker, member of producers' co-operative, and contributing family worker). Several additional control variables at the individual level are also tested. Each reduces the pool of countries with available data. Their presence did not markedly alter focal relationships, so most models presented maintain the larger sample of countries. These variables, taken directly from the LIS data with slight recoding for some, include education (dichotomized as having completed post-secondary education or not), hours worked (continuous variable for regular hours worked at all jobs currently held), and occupation (classification of the first job as manager/professional, other skilled worker, or laborer/elementary worker). The sensitivity analyses include models which regress both dependent variables on these control variables, as well as a model that uses tax amount as the dependent variable and also controls for income, measured as described above (Table A3).

## Results

Gender differences in income tax payment patterns vary markedly across countries. Figure 1 shows the gender differences in median effective tax rates for single, sole-earner men and women in this sample of countries. Positive values indicate men pay a higher rate, while negative values indicate women pay a higher rate. For most countries, men have higher effective tax rates, ranging from 0.3 to 10.3 percentage points higher.<sup>4</sup> Women have higher median effective tax rates (0.01 to 2.4 percentage points higher) in only five of the twenty-seven countries – Taiwan, Switzerland, Lithuania, Panama, and Colombia. In Taiwan and Switzerland, regressive taxation likely explains women’s higher tax rates, as discussed in more detail below. For relatively progressive Colombia and Panama, women have higher median incomes than men (although not higher labor income), which likely accounts for women’s higher median effective tax rates. The difference for Lithuania could relate to the high percentage of men’s income from capital, generally taxed at a lower rate than labor income in Lithuania.<sup>5</sup>

[FIGURE 1 ABOUT HERE]

Figure 2 provides initial descriptive evidence of an association between progressivity and gender differences in income tax rates. As with Figure 1, positive values for gender difference in tax rate indicate higher tax rates for men. For this set of countries, men tend to pay higher tax rates in more progressive countries. Figure 3 visualizes how gender income gaps interact with progressivity to explain gender differences in tax payment. Specifically, the degree to which gender income gaps are associated with tax payment differences between men and women varies based on levels of progressivity. In low progressivity countries, men do not pay higher tax rates at higher gender income gaps. Instead, men and women pay similar rates, regardless of the size of the gender income gap. Conversely, in high progressivity countries, men’s tax rates are higher where there are larger gender income gaps. This is also true, to a lesser extent, for moderate progressivity countries. In essence, this suggests less progressive tax systems do not “respond” to gender income gaps by taxing men at higher rates. Figure 3 thus provides descriptive evidence that some cross-national variation in gender difference in income tax payment is explained by whether or not countries tax higher income individuals, more often men, at higher rates.

[FIGURE 2 ABOUT HERE]

[FIGURE 3 ABOUT HERE]

Table 1 shows a series of HLM regression results for the relationship between tax rate and gender, progressivity, the gender income gap, the presence of dependent children, and control variables. Coefficients are exponentiated to account for the log transformation, so values less than one indicate negative associations, while values greater than one indicate positive associations. The null model interclass correlation coefficient (ICC) indicates that a fairly high percentage (41.5%) of variation in tax rate comes from differences across countries, while the test comparing model fit to a linear model is statistically significant.<sup>6</sup> Both these results support the use of HLM as an analysis technique to account for within-country homogeneity (i.e., greater similarity between respondents in the same country).

[TABLE 1 ABOUT HERE]

Women generally pay a significantly lower tax rate than men (Model 2), although this varies across countries. Comparing the random intercept and random coefficient models reveals significant improvements when gender is included as a random effect.<sup>7</sup> This means allowing the effect of gender to vary across countries improves model fit, which provides evidence that gender has a different effect on tax rate in different countries and confirms the descriptive finding that gender differences in tax payment patterns vary across countries. Similarly, the extent to which caring for children is associated with tax supports also varies across countries, so the presence of dependent children is also included as a random coefficient.<sup>8</sup>

Greater progressivity is associated with lower tax rates, on average, which suggests most people pay lower tax rates under more progressive tax systems (Model 3). Model 4 introduces a significant interaction term for gender, the gender income gap, and progressivity, which remains significant after including controls (Model 5). Figure 4 aids in the interpretation of this three-way interaction by displaying the adjusted predicted values of the natural log of tax rate for men and women at different levels of the gender income gap and degrees of progressivity. With progressive taxation (third panel), men's income tax rates are generally higher than women's. This difference grows as gender inequality in income increases. In contrast, without progressive taxation (first panel), men's rates are lower than women's, and this becomes more pronounced at higher levels of gender inequality in income. Thus, men pay higher tax rates where income taxation is progressive and when gender inequality is higher, but regressive taxation does the opposite, taxing men less, especially at higher levels of gender inequality in income. Notably, this finding is robust to the inclusion of additional control variables, removal of transfers from the income definition for the calculation of effective tax rate, and use of tax amount (v. rate) as the dependent variable (Table A3).

[FIGURE 4 ABOUT HERE]

The random slope variance for gender provides an interesting tool for understanding the degree to which the interaction between gender inequality in income and progressivity explains gender differences in income tax payment patterns. The random slope variance captures the extent to which the relationship between gender and tax rate varies from country to country. The size of this variance reduces markedly with the addition of the interaction term between gender, progressivity, and the gender income gap. From Model 2 in Table 1, with just the fixed and random coefficients for gender, to Model 4, with the interaction term, the variance reduces by 96%. In other words, accounting for how gender inequality and progressivity interact explains a great deal of the cross-national variation in the gender difference in tax payment.

Parental status also differentiates single women with and without children (Table 2). Single women with dependent children pay significantly lower rates than single women without dependent children (Model 1). This relationship exists even after accounting for level of progressivity, country-level gender inequality (Model 2), and control variables (Model 3). This suggests countries with a variety of levels of progressivity and gender inequality offer provisions for single women with children. However, tax provisions for women with children are not the only driver of the relationship between gender and taxation. When single men without children are used as the omitted category, single women without children still pay a significantly lower rate than their male peers without children (Models 4-6).

[TABLE 2 ABOUT HERE]

Notably, Ireland is not included in Figures 2-4 or in the HLM regressions in Tables 1-2 because of the strong influence wielded on the regression coefficients.<sup>9</sup> Ireland is unique in that men in this subsample have a high tax rate relative to women, despite women's higher median income. However, women in this subsample from Ireland receive a very large portion of their income (28.5%) from public assistance and social transfers. The ratio of women's to men's median *labor* income (0.79), in contrast, reveals marked gender inequality (Table A2). Public assistance and social transfers are generally taxed to a much lesser degree. In Ireland, only the lone parent benefit is taxed, while social assistance, housing, and family benefits are not taxed.<sup>10</sup> Thus, the high gender difference in earnings likely explains the higher tax rate paid by men relative to women. In this sense, Ireland is an interesting example of how transfers can dramatically reduce, even reverse, gender inequality in income for single working women.

Turning to the question of how income taxation might affect post-tax gender inequality in income, Figure 5 suggests that higher levels of progressivity are associated with greater post-tax gender equality in income.<sup>11</sup> The difference between Germany and Switzerland is especially telling. Both have high pre-tax gender income gaps of 0.17 and 0.15 percentage points, respectively. Germany has fairly progressive income taxation, while Switzerland's taxation is not progressive. Germany's gender income gap reduced 0.07 percentage points to a post-tax gap of 0.09 percentage points. Switzerland post-tax gender income gap increased slightly to 0.16. In Russia and Taiwan, also countries with minimally progressive taxation, the gender income gap is also slightly higher post-tax.

[FIGURE 5 ABOUT HERE]

Table 3 displays the results from HLM regressions predicting post-tax gender equality in income (post-tax ratio of individual women's income to the median income of men in their country). Positive values in these models indicate a positive association with gender *equality* in income (women's income representing a higher ratio of men's income). Results from Model 1 suggest that progressive taxation is associated with greater gender equality in income. Model 2 shows that this relationship remains, even after controlling for the pre-tax ratio of women's income to men's income, as well as median effective tax rate. Subsequent models reveal that this relationship is robust to the inclusion of various control variables. Parental status is also a significant predictor throughout, suggesting post-tax gender equality is significantly higher for women caring for children than those without children. This does raise questions about the extent to which tax codes more effectively reduce gender inequality for women with children.

[TABLE 3 ABOUT HERE]

While Ireland is included in the models in Table 3, as the country does not act as an outlier in this case (the highly progressive tax system does tax higher *earning* men more, creating an increase in the ratio of women's income relative to men's income). Taiwan, however, is removed, as the size and significance of the coefficients for progressivity and median effective tax rate are affected once the variable for dependent children is included in models with Taiwan. Taiwan, like Ireland, has a somewhat unique configuration of income sources, as well as unexpected tax treatment for caregivers. First, those caring for children actually pay a higher median tax rate, and Taiwan is the only country with no significant difference in post-tax gender equality in income for women with and without children.<sup>12</sup> Caregivers' unusual tax treatment and gender equality outcomes might explain why including dependent children altered the

association between the tax policy variables and post-tax gender equality, especially if Taiwan's configuration of income sources already weakened this association, as seems to be the case. Specifically, a comparatively large portion of income for the Taiwan sample comes from public social transfers and private transfers.<sup>13</sup> Individuals throughout the income distribution receive these income types,<sup>14</sup> but this income is taxed both at lower rates and less progressively.<sup>15</sup> This pattern of taxation would weaken the relationship between both tax policy variables and post-tax gender equality. Further, removing public and private transfer income from the calculation of median tax rate and progressivity yields values for the tax policy and post-tax gender equality indicators for Taiwan which make the country less of an outlier compared to other countries.<sup>16</sup> Ultimately, both Ireland and Taiwan demonstrate the complexities of including a comprehensive income definition for calculating effective income tax rate. Nevertheless, the ways in which they are exceptional provide information about gender difference in tax payment and post-tax income.

In summary, gender differences in income tax payment patterns vary markedly across countries and three key patterns emerged from this variation. First, levels of progressivity interact with gender income gaps such that men pay higher rates where income tax is progressive and gender income gaps favor men, supporting hypothesis one. Conversely, where income taxation is not progressive, men tend to pay rates similar to (possibly lower than) women, even at high levels of the gender income gap, in alignment with hypothesis two. Second, progressivity is also associated with a higher ratio of women's income to men's income post-tax, suggesting the lower tax rates paid by women under progressive conditions generate greater post-tax equality. This finding supports hypothesis three. Finally, women with children both paid lower tax rates and experienced greater gender equality post-tax as compared to women without children. Thus, these results provide some evidence that both tax progressivity and tax benefits for single mothers are policy choices which can respond to gender inequality in income by encouraging higher tax rates for men and greater post-tax gender equality.

## **Conclusion**

Scholars concerned with the gendered consequences of tax policies tend to examine gender differences in four key areas - patterns of employment and earnings, engagement in unpaid care work, consumption, and access to financial assets and physical property. When examining these areas through an equity lens, researchers seek to assess not only whether tax policies treat men and women in the same way, but also whether tax policies help mitigate existing social and economic inequalities between men and women. This analysis examined cross-national variation in the relationship between gender and income tax payment for working men and women. Findings addressed one of the four areas typically studied by scholars interested in taxation - patterns of employment and earnings. As such, this research informs how tax policy can be a tool for addressing unequal labor market conditions which produce gender income differences. Because this research includes public and social transfers in the definition of income, welfare transfers already reduced some of the gender income gap due to gender differences in labor income. As such, these results speak especially to how tax policy, net of transfers, can reduce gender income gaps.

In most countries examined here, single working women paid a lower effective income tax rate than single working men. However, the degree of difference ranged markedly. Evidence suggests some of this variation is explained by how progressively countries tax income and how levels of progressivity interact with gender income gaps. Specifically, high progressivity is associated with higher tax rates for men where gender income gaps favor men, while low



progressivity is not associated with higher tax rates paid by men where gender income gaps favor men. Additionally, this analysis suggests that more progressive taxation creates greater gender equality in post-tax income, while regressive taxation may actually worsen income inequality between men and women.

Whether and to what extent parental status is associated with tax exemptions, credits, deductions, refunds, or other tax-based supports also proved an important explanatory factor. In general, tax provisions which provide some form of relief or support for having children seem to help both reduce the tax burden of single women with children and address gender inequality in income for such women. However, this does raise questions for further exploration about the equity of tax policies which reduce gender inequality in income for women caregivers to a greater extent than women without dependent children.

Early research on gender differences in taxation frequently highlighted the risk progressive taxation poses to women's labor force participation when couples file taxes jointly. This led many feminist tax policy advocates to recommend fully individual tax filing for men and women.<sup>17</sup> Research presented here suggests that progressive taxation can be a tool for addressing labor market inequalities and creating greater gender equality in post-tax income. In doing so, this analysis indirectly provides additional evidence in favor of individual tax filing for men and women. Such filing practices mean progressive taxation can fully support gender equality, rather than creating conditions which help close gender income gaps post-tax for single women but discourage labor force participation for coupled women.

Future research could extend to other components of the four areas of gender differences in taxation identified in the literature. In particular, deep gaps remain in our understanding of how gender differences in wealth and consumption increase or decrease women's tax payment relative to men. Further, as explained, this research largely neglects differences in taxation *among* women, based on women's many intersecting identities and statuses. Thus, the lines of inquiry in this area are many, as gender bias in taxation remains both a vital and understudied area of research for understanding how social norms and associated behaviors interact with tax policy to shape gender equality.

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<sup>1</sup> All countries had at least 300 observations.

<sup>2</sup> See the “METIS” system from the LIS Data Center for detailed variable definitions

<http://www.lisdatacenter.org/frontend#/home>

<sup>3</sup> Based on OECD Top statutory personal income tax rates [https://stats.oecd.org/Index.aspx?DataSetCode=](https://stats.oecd.org/Index.aspx?DataSetCode=TABLE_I7)

TABLE\_I7 or PricewaterhouseCooper Worldwide Tax Summaries <https://taxsummaries.pwc.com/>

<sup>4</sup> Based on bivariate OLS regressions for each country, gender is significantly associated with tax rate in 19 out of the 27 countries (70.4%). These include Austria, Australia, Brazil, Canada, Colombia, Czech Republic, Germany, Denmark, Estonia, Finland, Ireland, Israel, Italy, Luxembourg, Norway, Panama (marginally), Slovakia, the UK, and the US.

<sup>5</sup> Current Lithuanian tax law has a 20% personal income tax rate up to around 81,000 EUR and 32% after that on employment income. Income from dividends, business income, property sales, rent, etc. is usually taxed at 15% below a threshold, then at 20%. <https://taxsummaries.pwc.com/lithuania/individual>

<sup>6</sup> Likelihood ratio test vs. linear model: chi-square=160000, Prob > chi2 = 0.0000.

<sup>7</sup> Likelihood ratio test yields LR chi-square= 2013.23, Prob > chi2 = 0.0000.

<sup>8</sup> Likelihood ratio test yields LR chi-square= 5437.88, Prob > chi2 = 0.0000.

<sup>9</sup> Results with Ireland are in Table A3.

<sup>10</sup> OECD Tax-Benefit Data Portal <https://www.oecd.org/els/soc/benefits-and-wages/data/>

<sup>11</sup> Note, pre-tax gender ratios in Colombia, Greece, Ireland, Netherlands, Norway, Panama, and Spain are equal or favored women, so their relatively high gender ratios post-tax partially result from high pre-tax ratios.

<sup>12</sup> Based on an OLS regression of post-tax gender equality in income on pre-tax gender equality in income, parental status, age, and type of employment for the Taiwan observations. Available on request.

<sup>13</sup> Men and women in the Taiwan sample, on average, receive a relatively low portion of their income from labor, 80.6% and 77.0%, respectively. Respondents receive at least 8% of income from public social benefits, with men showing higher percentages of income from these sources (9.2% to women’s 8.6%). These benefits percentages are higher for men than in all the other sample countries. Private transfers also make up a comparatively high portion of income, constituting a larger portion of men’s income (7%) than in any other sample country and more of women’s income (11.5%) than in all countries except Panama.

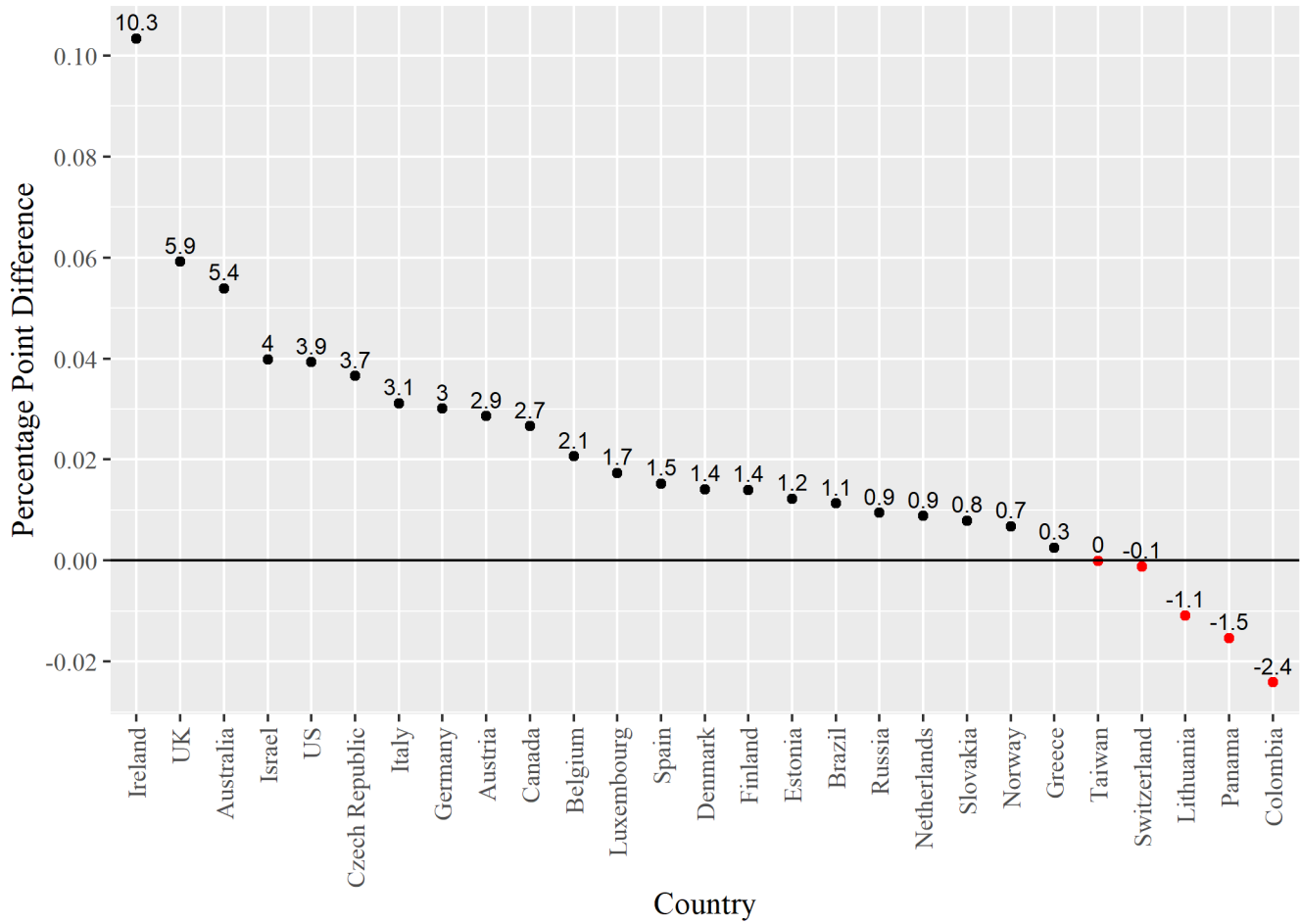
<sup>14</sup> Men and women received public social benefits at all deciles of income, with those in the fourth decile receiving the largest portion of their income from benefits (decile breakdowns available on request). Private transfers were received throughout the income distribution and also made up a comparatively larger portion of income for those in the middle.

<sup>15</sup> Recalculating the Kakwani index using only labor and capital income yields a more progressive index (0.08), and slightly higher tax rate 16%. This suggests the taxes on benefits and private transfers are less progressive and at a lower rate.

<sup>16</sup> Comparing Taiwan to Switzerland and Russia provides a helpful illustration. The change in gender gap pre- to post-tax is the same for all three (0.01 increase). The Kakwani index is slightly higher for Switzerland (0.02) than Taiwan (-0.02), and Switzerland has a much higher median effective tax rate (29% v. 13% in Taiwan). Under these conditions, Taiwan should show a larger increase in the gender income gap post-tax than Switzerland, because Switzerland’s slightly higher progressivity and higher median effective tax rate should decrease post-tax gender inequality more than Taiwan’s lower values. In contrast, Russia has a Kakwani index (0.11) and median effective tax rate (12%) similar to the values Taiwan would have if only labor and capital income were included (Kakwani index of 0.08 and median effective tax rate of 16%). With these similar values for the tax policy indicators, we would expect Russia and Taiwan to have a similar change in the gender income gap pre- to post-tax, as found here.

<sup>17</sup> See Nelson (1996) for a well-respected proposal with specific principles for gender-equitable individual filing.

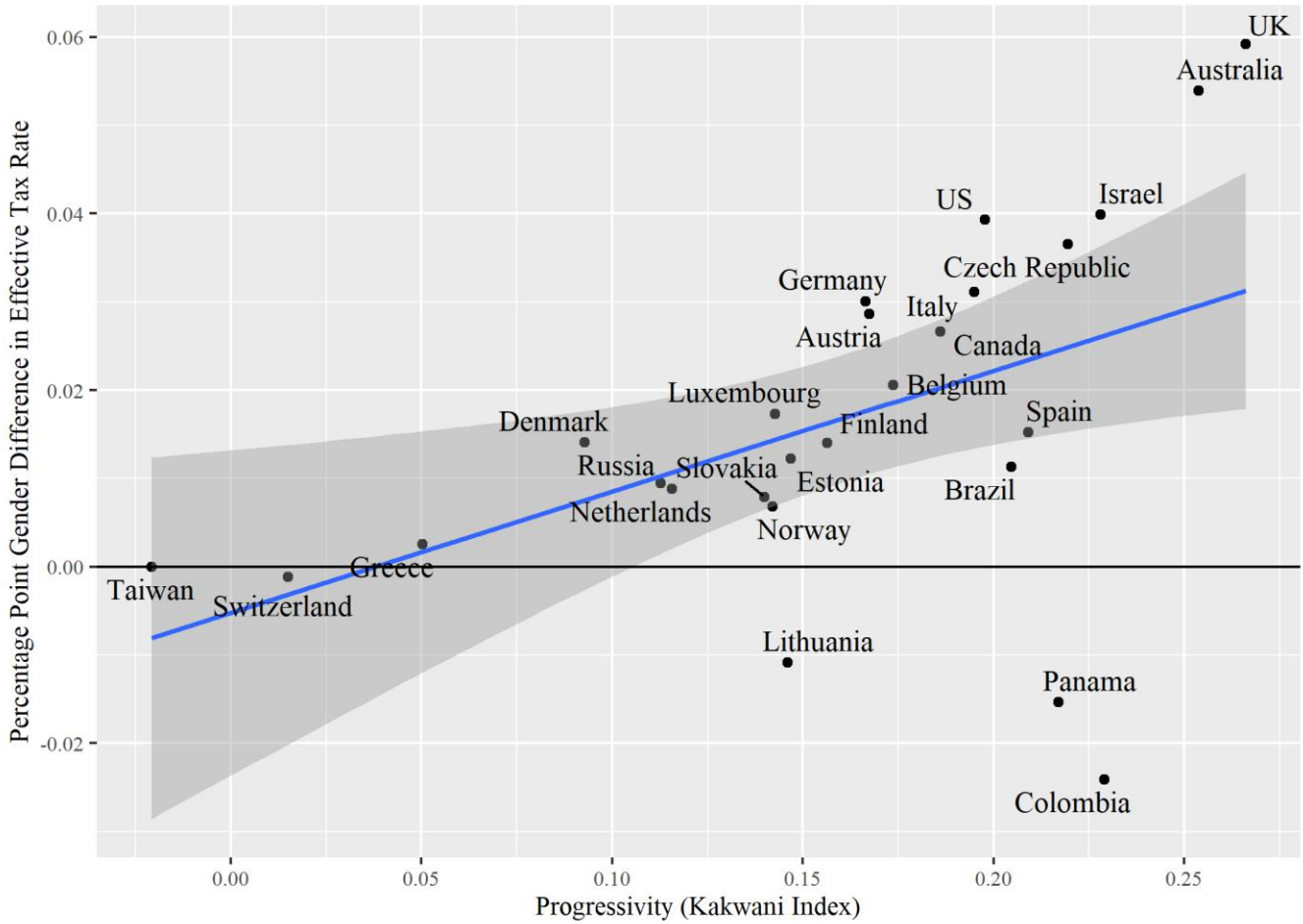
Figure 1. Difference between Men and Women’s Median Effective Income Tax Rates



Source: Luxembourg Income Study (LIS) Database

Note: Percentage point difference in median effective tax rate is calculated as men’s median rate minus women’s median rate. As such, positive values for the gender difference in tax rate indicate higher tax rates for men and negative values indicate higher tax rates for women.

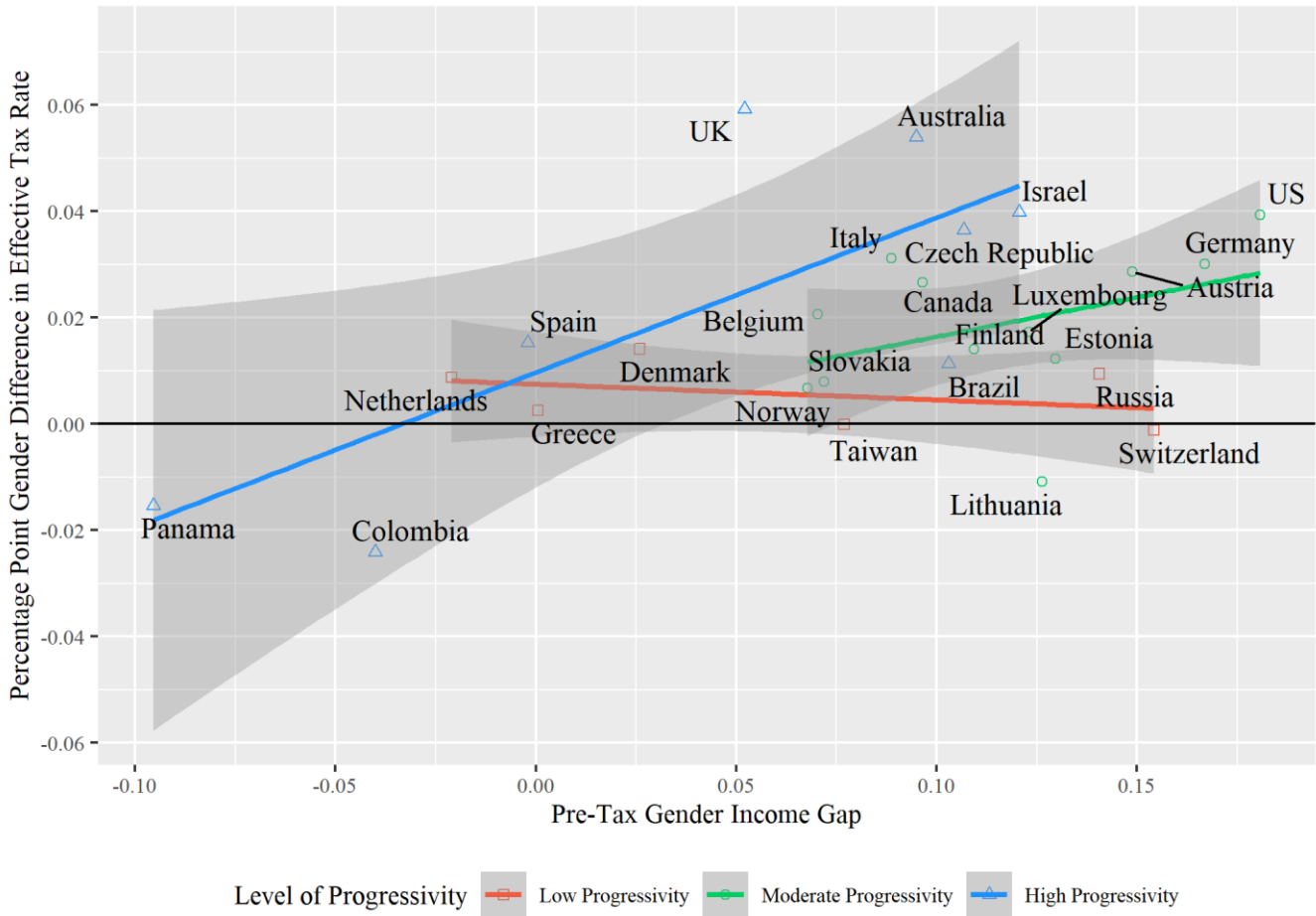
Figure 2. Progressivity and Gender Difference in Effective Income Tax Rate



Source: Luxembourg Income Study (LIS) Database

Note: Higher values for the percentage point gender difference in tax rate indicate higher tax rates for men. The regression line comes from a bivariate linear regression of gender difference in effective tax rate on progressivity. The shaded area is the standard error for the regression line at a 0.95 confidence interval.

Figure 3. Gender Income Gap and Gender Difference in Effective Income Tax Rate



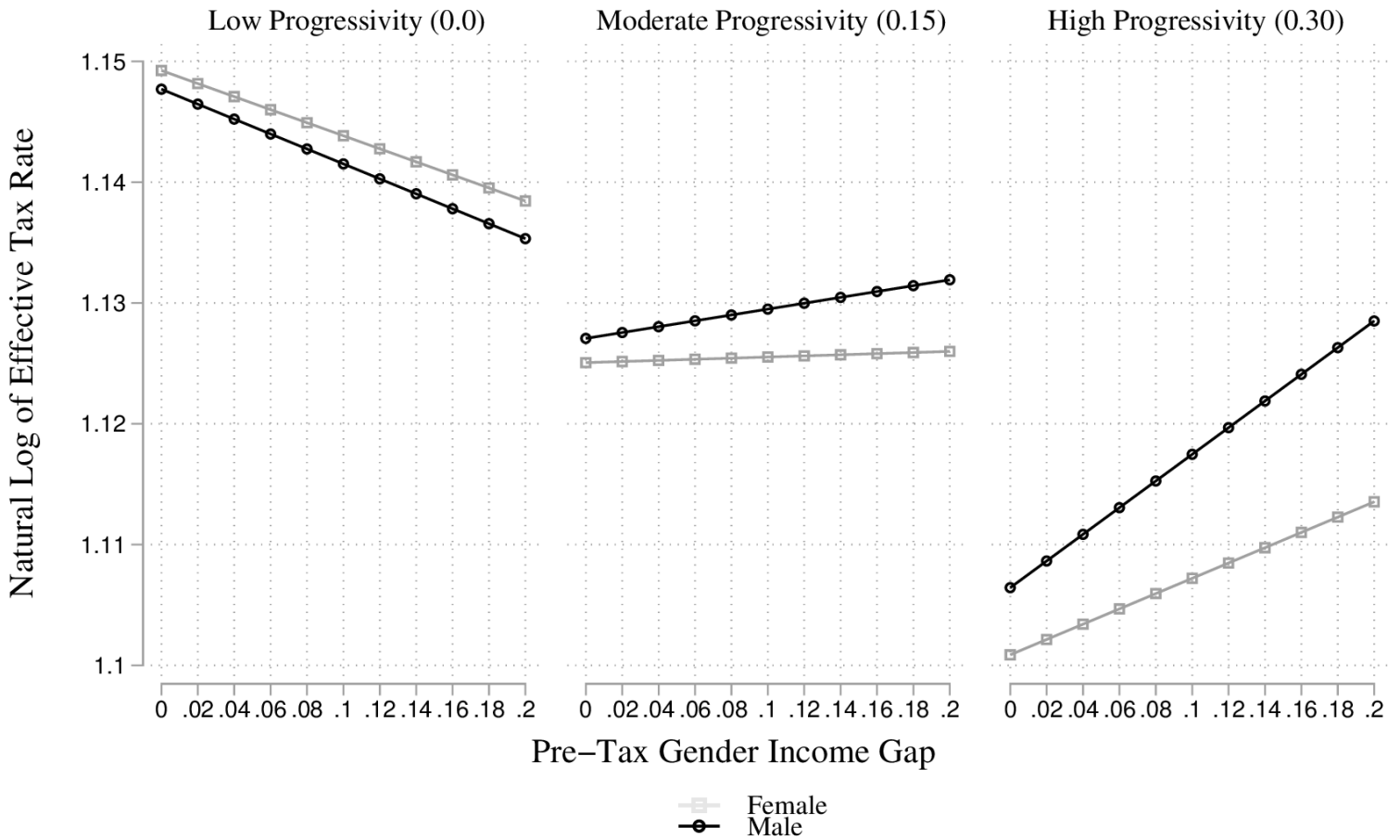
Source: Luxembourg Income Study (LIS) Database

Note: Higher values for the percentage point gender difference in tax rate indicate higher tax rates for men. Levels of progressivity are based on the Kakwani index values for the sample mean (0.165) and standard deviation (0.074). Low progressivity countries have values at least half a standard deviation below the mean ( $\leq 0.128$ ); moderate countries have values less than half a standard deviation above or below the mean ( $> 0.128$ ;  $< 0.203$ ); and high countries have values at least half a standard deviation above the mean ( $\geq 0.203$ ). The regression lines come from three bivariate linear regressions of gender difference in effective tax rate on the pre-tax gender income gap for each sub-group of countries (grouped by level of progressivity). The shaded areas indicate the standard error for each regression line at a 0.95 confidence interval for each level of progressivity.

Table 1. Hierarchical Linear Modeling Regressions of Effective Tax Rate (Logged)					
	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Individual-Level Variables</i>					
Female		0.994*** (0.001)	0.994*** (0.001)	0.998 (0.002)	1.000 (0.002)
<i>Country-Level Variables</i>					
Progressivity			0.743** (0.091)	0.732** (0.097)	0.747*** (0.075)
Gender Income Gap			0.973 (0.0426)	0.725 (0.220)	0.783 (0.159)
<i>Cross-Level Interaction Variables</i>					
Female*Gender Income Gap				1.043 (0.030)	1.028 (0.020)
Female*Progressivity				0.987 (0.015)	0.990 (0.012)
Gender Income Gap*Progressivity				10.94* (1.127)	4.418 (0.792)
Female* Gender Income Gap* Progressivity				0.637** (0.165)	0.723** (0.113)
<i>Control Variables</i>					
Dependent Children					0.985*** (0.002)
Regular Worker					1.009 (0.005)
Age					1.000*** (0.0005)
Intercept	3.080*** (0.005)	3.090*** (0.005)	3.247*** (0.019)	3.236*** (0.019)	3.193*** (0.016)
Variance Components					
Level 1 Variance	0.0009	0.0009	0.0009	0.0009	0.0008
Level 2 Variance	0.0006	0.0006	0.0007	0.0004	0.0005
Random Slope - Gender		2.20E-05	2.19E-05	4.89E-06	8.14E-07
Random Slope - Dependent Children					0.0001
Level 1 Observations	140,186	140,186	140,186	140,186	140,186
Level 2 Observations	26	26	26	26	26
AIC	-61,301.0	-61,516.0	-61,526.3	-61,544.5	-62,485.7
BIC	-61,271.4	-61,456.9	-61,447.5	-61,426.3	-62,308.4
Log Likelihood	30,653.5	30,764.0	30,771.2	30,784.2	31,260.8
ICC	0.415	0.427	0.441	0.327	0.363
Exponentiated fixed effects coefficients; Robust standard errors in parentheses					
Regressions do not include Ireland.					
^p<0.10, *p<0.05, **p<0.01, ***p<0.001					
Source: Luxembourg Income Study (LIS) Database					



Figure 4. Adjusted Predicted Values for the Interaction of Gender, Progressivity, and Gender Income Gap



Source: Luxembourg Income Study (LIS) Database

Note: Predicted values are generated using results from Model 5 in Table 4. The panels are generated using three Kakwani index values for progressivity that are close to the minimum, average, and maximum values for the full sample of countries analyzed here. These three values for progressivity differ from the ranges used in Figure 3.

Table 2. Hierarchical Linear Modeling Regressions of Effective Tax Rate (Logged) by Family Formation

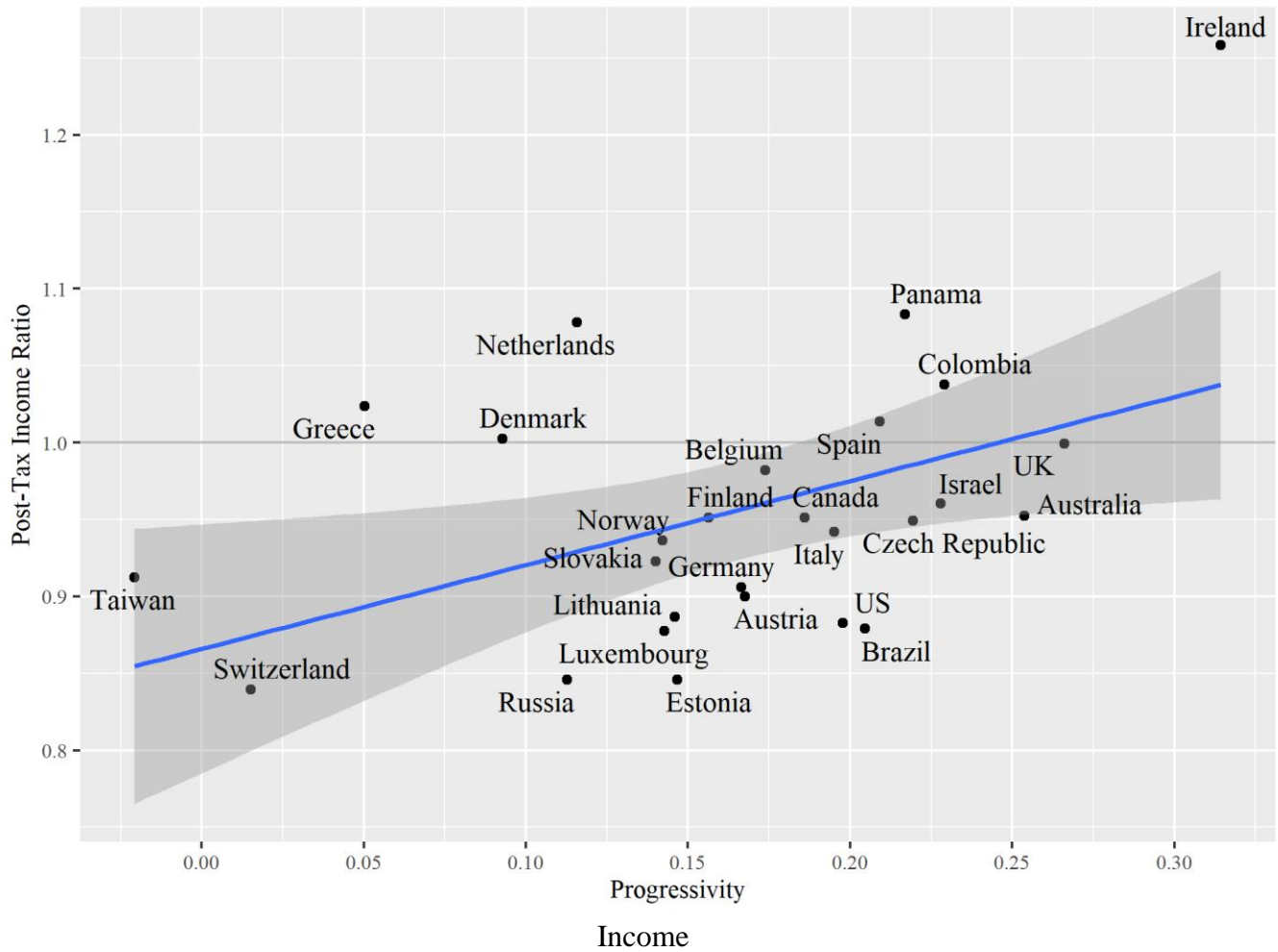
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Individual-Level Variables</i>						
Single Man w/o Children	1.021*** (0.003)	1.020*** (0.003)	1.021*** (0.003)	(Omitted)	(Omitted)	(Omitted)
Single Man w/ Children	1.014*** (0.002)	1.014*** (0.002)	1.014*** (0.002)	0.993*** (0.002)	0.993*** (0.002)	0.994** (0.002)
Single Women w/o Children	1.019*** (0.002)	1.019*** (0.002)	1.018*** (0.002)	0.998^ (0.001)	0.999^ (0.001)	0.998** (0.001)
Single Women w/ Children	(Omitted)	(Omitted)	(Omitted)	0.980*** (0.003)	0.980*** (0.003)	0.980*** (0.003)
<i>Country-Level Variables</i>						
Progressivity		0.767*** (0.067)	0.766*** (0.067)		0.767*** (0.067)	0.766*** (0.067)
Gender Income Gap		0.942 (0.032)	0.936* (0.030)		0.942 (0.032)	0.936* (0.030)
<i>Control Variables</i>						
Regular Worker			1.009 (0.005)			1.009 (0.005)
Age			1.000*** (0.0005)			1.000*** (0.0005)
Intercept	3.023*** (0.004)	3.174*** (0.014)	3.130*** (0.015)	3.089*** (0.005)	3.238*** (0.015)	3.193*** (0.015)
Variance Components						
Level 1 Variance	8.13E-04	8.13E-04	8.01E-04	8.13E-04	8.13E-04	8.01E-04
Level 2 Variance	6.56E-04	6.97E-04	6.85E-04	6.56E-04	6.97E-04	6.85E-04
Random Slope - Parent	1.01E-04	1.01E-04	1.05E-04	1.01E-04	1.01E-04	1.05E-04
Random Slope - Female	1.16E-05	1.17E-05	1.15E-05	1.16E-05	1.17E-05	1.15E-05
Level 1 Observations	140,186	140,186	140,186	140,186	140,186	140,186
Level 2 Observations	26	26	26	26	26	26
AIC	-62,299.0	-62,313.6	-62,519.5	-62,299.0	-62,313.6	-62,519.5
BIC	-62,190.7	-62,185.5	-62,391.5	-62,190.7	-62,185.5	-62,391.5
Log Likelihood	31,160.5	31,169.8	31,272.8	31,160.5	31,169.8	31,272.8
ICC	0.446	0.462	0.461	0.446	0.462	0.461

Exponentiated fixed effects coefficients; Robust standard errors in parentheses

^p&lt;0.10, \*p&lt;0.05, \*\*p&lt;0.01, \*\*\*p&lt;0.001

Source: Luxembourg Income Study (LIS) Database

Figure 5. Progressivity and Post-Tax Ratio of Women's Median Income to Men's Median



Source: Luxembourg Income Study (LIS) Database

Note: The regression line comes from a bivariate regression of the post-tax income ratio of women's median income to men's median income on progressivity. Shaded area indicates the standard error for the regression line at a 0.95 confidence interval. For Greece, the Netherlands, Spain, Panama, Colombia, and Ireland, this sample of single working women had higher pre-tax income ratios, which helps explain the deviation of these countries from the regression line in the direction of women's higher post-tax income.

Table 3. Hierarchical Linear Modeling Regression of Post-Tax Ratio of Women's Income to Men's Median Income

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6 <sup>†</sup>
<i>Individual-Level Variables</i>						
Pre-Tax Gender Equality Income <sup>††</sup>		0.919*** (0.011)	0.919*** (0.011)	0.920*** (0.011)	0.920*** (0.011)	0.938*** (0.011)
Dependent Children				0.080*** (0.010)	0.079*** (0.010)	0.074*** (0.011)
<i>Country-Level Variables</i>						
Progressivity	0.699* (0.312)	0.205* (0.101)	0.393*** (0.112)	0.203*** (0.059)	0.206*** (0.059)	0.363*** (0.059)
Median Tax Rate			0.204** (0.062)	0.112** (0.039)	0.116** (0.043)	0.291*** (0.037)
<i>Control Variables</i>						
Regular Worker					-0.010 (0.018)	-0.033* (0.013)
Age					-0.0003* (0.0002)	-0.0005*** (0.0002)
Hours Worked						-0.0004* (0.0002)
Post-Secondary Education						-0.005 (0.004)
Occupation (Manager/Professional Omitted)						
Other Skilled Workers						0.019*** (0.005)
Labourers/Elementary						0.027*** (0.005)
Constant	0.907*** (0.055)	0.064*** (0.019)	-0.010 (0.029)	0.020 (0.018)	0.040* (0.016)	-0.005 (0.024)
<i>Variance Components</i>						
Level 1 Variance	0.189	0.008	0.008	0.007	0.007	0.007
Level 2 Variance	0.005	0.001	0.0004	0.0002	0.0002	0.0003
Random Slope - Dependent Children				0.002	0.002	0.003
Level 1 Observations	70,052	70,052	70,052	70,052	70,052	42,866
Level 2 Observations	26	26	26	26	26	21
AIC	8,606.2	-14,127.6	-14,137.2	-15,696.0	-15,711.1	-12413.30
BIC	8,642.8	-14,081.8	-14,082.2	-15,613.6	-15,610.4	-12283.30
ll	-4,299.1	7,068.8	7,074.6	7,857.0	7,866.6	6221.60
ICC	0.023	0.065	0.042	0.033	0.033	0.038

Exponentiated fixed effects coefficients; Robust standard errors in parentheses

Regressions do not include Taiwan.

<sup>†</sup>Countries without data on additional variables: Hours: Denmark, Norway, Russia, Taiwan; Education: Denmark; Occupation: Canada, Italy, Norway

<sup>††</sup>Pre-tax ratio of women's income to the median men's income in their country

<sup>^</sup>p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Source: Luxembourg Income Study (LIS) Database

## APPENDIX A

Table A1. Descriptive Statistics for Study Subsample on Focal Micro-Level Variables

Country	No. of Subsample Obs.	Subsample as a % of Workers 25-64		% With Dependent Children		Median Income (PPP)	Mean Percent of Income from Each Income Source							
		Men	Women	Men	Women		Labor		Capital		Public Social Benefits		Private Transfers	
							Men	Women	Men	Women	Men	Women	Men	Women
Austria	994	20.4	24.1	1.34	18.34	44142.24	93.43	88.65	1.50	0.68	4.44	7.59	0.63	3.09
Australia	1,764	13.8	17.1	5.01	25.38	42586.47	92.02	86.08	4.73	2.09	2.21	8.67	1.04	3.16
Belgium	979	18.5	22.6	7.15	28.50	44976.54	92.74	88.68	1.56	1.25	5.32	8.49	0.38	1.57
Brazil	15,637	11.4	18.2	9.05	50.85	7386.434	96.59	88.17	0.75	0.79	1.73	5.50	0.93	5.54
Canada	5,205	16.6	17.7	5.57	17.35	40580.22	89.43	86.37	2.20	2.48	7.27	9.52	1.11	1.62
Switzerland	1,014	17.0	21.4	2.06	14.54	57821.52	93.90	87.88	2.10	1.49	3.43	4.76	0.58	5.87
Colombia	31,442	12.9	26.9	12.68	62.30	7057.99	95.73	85.06	1.85	2.20	1.01	2.57	1.40	10.18
Czech Republic	1,003	14.4	19.1	3.43	33.02	23505.5	96.82	88.06	0.65	1.20	1.02	3.21	1.52	7.53
Germany	2,225	13.8	21.4	2.63	17.06	43803.25	93.83	90.27	2.52	0.80	3.25	6.79	0.39	2.14
Denmark	12,184	20.4	19.5	6.55	29.75	48538.36	95.19	90.82	0.94	0.79	3.43	6.47	0.43	1.92
Estonia	457	7.6	15.1	2.24	30.04	19369.66	92.19	90.28	2.13	0.43	5.12	7.29	0.57	2.00
Spain	1,284	10.6	14.6	3.23	23.94	29067.77	90.56	89.44	1.86	1.27	7.42	6.51	0.16	2.79
Finland	804	10.0	11.5	2.89	15.62	38935.31	94.76	91.17	1.73	1.50	2.87	6.03	0.65	1.30
Greece	1,842	13.8	16.2	1.79	19.72	23656.97	96.20	91.51	1.94	1.77	0.85	2.26	1.01	4.45
Ireland	468	10.8	17.1	2.68	54.04	33941.76	88.70	69.59	2.29	0.53	9.01	28.51	0.00	1.37
Israel	599	5.6	10.7	5.65	37.01	25697.90	94.13	86.70	2.03	1.24	2.01	5.44	1.84	6.61
Italy	878	20.5	30.4	2.35	19.02	27235.10	99.09	98.41	0.53	0.31	0.01	0.18	0.37	1.11
Lithuania	502	10.2	20.0	7.12	27.64	21155.92	91.78	88.96	3.99	0.49	4.05	8.23	0.18	2.32
Luxembourg	631	15.8	21.1	4.26	25.25	58826.22	93.62	88.59	2.04	0.81	3.68	8.37	0.66	2.24
Netherlands	1,205	13.4	16.4	3.06	22.80	39040.72	89.72	87.41	1.50	1.69	7.62	7.82	1.16	3.08
Norway	37,037	33.9	25.5	4.94	14.86	44001.81	92.25	90.78	1.93	1.48	5.82	7.75	0.00	0.00
Panama	1,519	13.0	20.0	13.11	62.38	15352.73	94.09	78.30	1.36	0.51	1.12	7.68	3.43	13.51
Russia	6,436	12.8	23.9	1.71	29.79	20430.96	97.29	89.78	0.73	0.77	0.87	3.63	1.11	5.82
Slovakia	374	4.5	12.8	3.33	15.10	15808.70	97.19	95.07	0.35	0.12	2.30	2.56	0.17	2.25
Taiwan	2,389	15.3	18.9	13.81	24.21	18840.09	80.59	77.02	3.20	2.83	9.24	8.62	6.97	11.53
UK	2,522	13.1	21.7	4.52	37.88	32300.47	92.85	76.69	1.35	1.13	4.99	19.71	0.81	2.47
US	9,260	13.7	19.7	9.15	33.40	50000.00	94.86	87.97	2.78	1.88	1.74	7.81	0.62	2.35
Unweighted Mean	5,209	14.2	19.4	5.23	29.25	32372.62	93.32	87.32	1.87	1.20	3.77	7.48	1.04	3.99

Source: Luxembourg Income Study (LIS) Database

Note: Subsample as a % of Workers 25-64 is calculated based on the number of respondents in the age range that indicated they were employed.

Median income is the sum of labor income (“hilabour”), capital income (“hicapital”), private transfers (“hiprivate”), and public and social transfers (“hipubsoc”) adjusted using 2017 USD Purchasing Power Parity (PPP) deflators. Values for variables (dependent children, median income, percent of income from various sources) are weighted.

Table A2. Country-Level Indicators

Country	Kakwani Index	Median Tax Rate	Median Gender Difference in Tax Rate (Men's - Women's Rate)	Pre-Tax Gender Income Gap	Post-Tax Gender Income Gap	Difference: Post-Tax - Pre-Tax Gender Income Gap	Pre-Tax Ratio of Women's Income to Median Men's Income	Post-Tax Ratio of Women's Income to Median Men's Income	Ratio of Women's to Men's Median Labor Income
Austria	0.17	0.26	0.03	0.15	0.10	-0.05	0.85	0.90	0.82
Australia	0.25	0.17	0.05	0.09	0.05	-0.05	0.91	0.95	0.81
Belgium	0.17	0.27	0.02	0.07	0.02	-0.05	0.93	0.98	0.93
Brazil	0.20	0.08	0.01	0.10	0.12	0.02	0.90	0.88	0.77
Canada	0.19	0.19	0.03	0.10	0.05	-0.05	0.90	0.95	0.86
Switzerland	0.02	0.29	0.00	0.15	0.16	0.01	0.85	0.84	0.80
Colombia	0.23	0.00	-0.02	-0.04	-0.04	0.00	1.04	1.04	0.93
Czech Republic	0.22	0.19	0.04	0.11	0.05	-0.06	0.89	0.95	0.81
Germany	0.17	0.32	0.03	0.17	0.09	-0.07	0.83	0.91	0.80
Denmark	0.09	0.33	0.01	0.03	0.00	-0.03	0.97	1.00	0.93
Estonia	0.15	0.16	0.01	0.13	0.15	0.02	0.87	0.85	0.82
Spain	0.21	0.15	0.02	-0.00	-0.01	-0.01	1.00	1.01	0.96
Finland	0.16	0.25	0.01	0.11	0.05	-0.06	0.89	0.95	0.90
Greece	0.05	0.31	0.00	0.00	-0.02	-0.02	1.00	1.02	0.98
Ireland	0.31	0.12	0.10	-0.12	-0.26	-0.14	1.12	1.26	0.79
Israel	0.23	0.11	0.04	0.12	0.04	-0.08	0.88	0.96	0.87
Italy	0.20	0.21	0.03	0.09	0.06	-0.03	0.91	0.94	0.91
Lithuania	0.15	0.16	-0.01	0.13	0.11	-0.01	0.87	0.89	0.87
Luxembourg	0.14	0.24	0.02	0.12	0.12	0.00	0.88	0.88	0.84
Netherlands	0.12	0.32	0.01	-0.02	-0.08	-0.06	1.02	1.08	0.99
Norway	0.14	0.26	0.01	0.07	0.06	0.00	0.93	0.94	0.92
Panama	0.22	0.07	-0.02	-0.10	-0.08	0.01	1.10	1.08	0.98
Russia	0.11	0.12	0.01	0.14	0.15	0.01	0.86	0.85	0.78
Slovakia	0.14	0.16	0.01	0.07	0.08	0.01	0.93	0.92	0.95
Taiwan	-0.02	0.13	0.00	0.08	0.09	0.01	0.92	0.91	0.88
UK	0.27	0.15	0.06	0.05	0.00	-0.05	0.95	1.00	0.73
US	0.20	0.18	0.04	0.18	0.12	-0.06	0.82	0.88	0.78
Unweighted Mean	0.17	0.19	0.02	0.07	0.04	-0.03	0.93	0.96	0.87

All indicators are based on authors own calculations. Income for all calculations is defined as the sum of labor income (“hilabour”), capital income (“hicapital”), private transfers (“hiprivate”), and public and social transfers (“hipubsoc”) adjusted using 2017 USD Purchasing Power Parity (PPP) deflators. All country values are weighted.

Source: Luxembourg Income Study (LIS) Database

Table A3. Sensitivity Analyses of Hierarchical Linear Modeling Regressions of Tax Payment (Tax Rate for Models 1-3, Tax Amount for Models 4-5)

	Model 1	Model 2	Model 3	Model 4	Model 5
	Including Ireland	Additional Control Variables	Transfers Removed <sup>†</sup> from Income	Tax Amount (PPP) <sup>††</sup> as Dependent Variable	
<i>Individual-Level Variables</i>					
Female	1.002 (0.002)	1.002 (0.002)	1.000 (0.001)	0.959*** (0.009)	0.998 (0.014)
Dependent Children	0.984*** (0.002)	0.987*** (0.002)	0.991*** (0.004)		0.909*** (0.017)
<i>Country-Level Variables</i>					
Progressivity	0.871 (0.091)	0.698*** (0.062)	0.811** (0.064)	0.196** (0.616)	0.251* (0.668)
Gender Income Gap	0.940 (0.173)	0.808* (0.100)	0.803 (0.148)	0.867 (0.319)	0.289 (1.548)
<i>Cross-Level Interaction Variables</i>					
Female*Gender Income Gap	1.008 (0.014)	1.016 (0.017)	1.017 (0.012)		1.103 (0.130)
Female* Progressivity	0.977* (0.009)	0.973* (0.013)	0.997 (0.007)		0.908 (0.073)
Gender Income Gap*Progressivity	1.776 (0.811)	5.909*** (0.476)	5.071* (0.745)		23247.5 (7.661)
Female*Gender Income Gap*Progressivity	0.833** (0.067)	0.768** (0.102)	0.794*** (0.065)		0.200** (0.614)
<i>Control Variables</i>					
Income (PPP)				1.000*** (7.82E-07)	1.000*** (7.79E-07)
Regular Worker	1.010* (0.005)	1.017*** (0.004)	1.007* (0.004)		1.088* (0.035)
Age	1.000*** (0.00005)	1.000*** (0.00005)	1.000** (0.00004)		1.002*** (0.0004)
Hours Worked		1.000*** (0.00001)			
Post-Secondary Education		1.008*** (0.001)			
Occupation (Manager/Professional Omitted) Other Skilled Workers		0.990*** (0.002)			

Labourers/Elementary		0.980***			
		(0.002)			
Intercept	3.108***	3.130***	4.824***		14861.793***
	(0.020)	(0.015)	(0.013)		(0.140)
Variance Components					
Level 1 Variance	0.0008	0.0008	0.0007	0.0577	0.0548
Level 2 Variance	0.0005	0.0002	0.0002	0.0286	0.0201
Random Slope - Gender	5.83E-07	1.99E-12	1.20E-17	9.25E-04	1.27E-05
Random Slope - Dependent Children	0.0001	0.0001	4.14E-05		0.0063
Level 1 Observations	140,654	75,208	140,186	140,186	140,186
Level 2 Observations	27	20	26	26	26
AIC	-64,154.3	-47,061.1	-65,555.8	-33.3	-748.4
BIC	-64,006.5	-46,885.8	-65,408.0	55.3	-590.8
Log Likelihood	32,092.1	23,549.6	32,792.9	25.7	390.2
ICC	0.367	0.230	0.210	0.268	0.268

Exponentiated fixed effects coefficients; Robust standard errors in parentheses

Models 1, 2, 3, and 5 used structured covariance to enable model convergence

^p<0.10, \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

† Subtracting the “hpub\_a” variable in the LIS data from the income definition used throughout the paper

†† Measured as the “hxitsc” variable converted using a purchasing power parity (PPP) conversion to 2017 USD

Source: Luxembourg Income Study (LIS) Database