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Single Mothers' Income in Twelve Rich Nations: Differences in Disadvantage across the Distribution

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Abstract

Previous research has shown single mothers to be less well-off and at higher risk of poverty than mothers in couples. In this article, I extend current research by examining how single motherhood affects income at different quantiles of the distribution in twelve rich nations. Using harmonised data from the Luxembourg Income Study (LIS), I first show how the distribution of single mothers' income differs to that of couples with children. Using unconditional quantile treatment effect (QTE) models, I then assess the influence of single motherhood on income at different points of the distribution. I find that, in all countries, single motherhood is associated with large reductions in income across the distribution and that these gaps cannot be explained by differences in single and partnered mothers' individual and family characteristics or employment. I also find striking variations across countries in the effect of single motherhood on income at different points of the distribution. In some countries, such as the United Kingdom, single motherhood has a greater effect on income at the top of the income distribution than the bottom. In other countries, such as the United States, the reverse is true with the effect on income being largest at the bottom of the distribution. I conclude by discussing the role that employment and social policies may play in driving cross-country differences in the income gradient associated with single motherhood across the distribution.

Keywords: single mothers; inequality; quantile treatment effects; tax and benefits; employment.

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Much has been written about single mothers' risk of poverty and how it varies across countries. While single mothers face a high risk of poverty across rich nations (Gornick & Jantii, 2010) those in the United States are thought to be at greater risk than their peers in other advanced economies, with the paucity of public transfers contributing to this difference (Brady, Finnigan & Hubgen, 2017; Rothwell & McEwen, 2019). On the contrary, the same studies show that the United Kingdom stands out for its success in reducing single mother poverty, with the generosity of state benefits playing a critical role in its success.

While cross-national differences in single mother's risk of poverty have been widely studied, much less is known about variations in their wider economic circumstances. Yet, single motherhood is likely to not only affect women's risk of poverty, but their incomes across the distribution. Moreover, while public transfers may help alleviate poverty, their impact further up the distribution is likely to be more limited, particularly if means tested. As a result, countries with low poverty 'penalties' to single motherhood, achieved via redistribution through the tax-benefit system, may at the same time have large income penalties; in other words, cross-country differences in poverty may tell us little about differences in single mothers' relative economic position.

One reason low rates of single mother poverty may be accompanied by high income penalties is because generous state benefits, which protect single mothers from poverty, may come at the cost of reduced financial incentives for paid work. Evidence from the late 1980s and 1990s linked high rates of means testing to the relatively low economic status of single mothers because they were discouraged from working (Wong, Garfinkel, and McLanahan 1993; Dickens and Ellwood 2003). Since then, tax-credits, paid to those in employment on low-incomes, have become an increasingly prominent feature of the tax-benefit system in Anglo-European countries (Kenworthy 2015). Yet, while earning subsidies improve the incentives of those with low earnings potential to enter employment, they are frequently

accompanied by high marginal tax rates, reducing incentives to work longer hours or for greater pay (OECD 2018; Brewer and Hoynes 2019). At the extensive margin, the effect of high marginal tax rates on employment are large (Moffitt, 2022). Moreover, the more generous benefits are, the greater the number of people drawn into means testing (Hoynes, Joyce and Waters, 2022). For example, in the United Kingdom, generous government transfers have been crucial to reducing single-parent poverty, but few single parents escape means testing; in 2019/20, 84% of single parents were estimated to be entitled to universal credit, the main benefit supporting low-income working age families (Waters and Wernham 2021). This tension in the tax-benefit system means that high benefit levels, which protect single from poverty, may be more likely to reduce the financial incentives of single mothers further up the income distribution for paid work. Consequently, in countries such as the United Kingdom, where the benefit system has been effective at reducing single parent poverty, low levels of poverty may not translate into single mothers having higher relative economic status. Instead, generous means-tested benefits may be associated with a more compressed income distribution and, while single mothers may avoid poverty, their incomes may still fall far below those of couples with children. In comparison, in countries where non-means tested benefits are generous there will be fewer distortionary effects on employment and single mothers may have higher earnings and therefore income (Wong, Garfinkel, and McLanahan 1993; D. Brady and Burroway 2012), although there may be greater inequality between single mothers.

While national policies towards employment and taxes and benefits influence single mothers' employment, they are far from the only factors shaping patterns of paid work and care. Wider social processes play an important role in enabling mothers to combine paid work and family life, with countries differing greatly in the extent to which mothers participate in the labour force (Misra et al. 2012; Budig and England 2001; Gonzalez 2004).

Studies have shown that, net of characteristics such as education and age, single mothers' rates of employment resemble those of mothers with partners (Destro and Brady 2011; S.E. Harkness 2016). However, earnings penalties to motherhood -which are a consequence of lower employment rates, paid work hours and wages - remain substantial across countries (Kleven and Landais 2017). Examining data for six rich nations, Kleven et. al. (2019) found annual earnings penalties to motherhood ranging from 21% in Denmark to 61% in Germany. These penalties, and cross-country differences between them, will have a substantial influence on single mothers' incomes (Harkness 2022) and the extent to which they are disadvantaged.

Mothers' position in the labor market and their treatment by the tax-benefit system are, moreover, interrelated. National welfare state policies are based on gendered assumptions about men and women's role in society, and in countries where male breadwinning is the norm, single mothers typically have fewer expectations for paid work placed on them (J.E. Lewis 1997). Past studies have however shown that single mothers are particularly disadvantaged in countries where caregiving is encouraged, and more reliant on social security benefits for income. Conversely, where single mothers are employed their own earnings allow them to achieve incomes closer to the average (Misra et al. 2012) while in countries with greater paid parental leave, single mothers are more likely to be found among the middle class (Byun 2018). While the expectation that single mothers should be in paid work has grown as more mothers have entered the labor market (Millar, 2019) in many Anglo-European countries part-time employment is common and limits single mothers' capacity to provide for their families and to avoid poverty (Pfau-Effinger 2007; Misra et al. 2012; Horemans, Marx, and Nolan 2016; Lewis and Giullari 2005). The norm of part-time paid work also means more single mothers will be drawn into means testing with high

marginal tax rates constraining their incomes further (Dickens and Ellwood 2003; OECD 2018).

In this study I investigate the extent to which single motherhood – which is now common across nations - remains associated with socio-economic disadvantage. Examining data from the Luxembourg Income Study (LIS), I compare the relative economic status of single mothers and couples in opposite-sex households in the late 2010s. The countries I study cover a range of gendered labor market institutions and welfare-state policies and include five English speaking countries (the United States, Canada, Australia, United Kingdom, Ireland), three from Western Europe (France, Germany, Netherlands), two Nordic countries (Finland, Denmark), and two from Southern Europe (Italy and Spain). Unconditional quantile treatment effect (UQTE) models are used to estimate how single motherhood influences income at different points of the distribution. The patterns of disadvantage that emerge allow me to assess whether single motherhood acts an equaliser in some countries, because reductions in income associated with single motherhood are greatest at the top of the distribution, reducing inequality between single mothers but increasing their concentration at low levels of income, while in other countries single motherhood has a smaller influence on income at the top of the distribution meaning single mothers are more likely to be found among the middle class. I conclude by discussing how policy differences, which influence the sources of income on which single mothers draw, may affect their relative economic standing across countries.

DATA AND METHODS

Data and sample

I use the most recently available data, from Wave X (2016-2017) or XI (2018-2019), of the Luxembourg Income Study (LIS) for twelve rich nations. The surveys are all large, nationally representative household surveys. LIS provides harmonised information on income,

employment, earnings, and other socio-economic and demographic characteristics, including age, education, and partnership status, allowing cross-country comparative research. I restrict my sample to women aged 22 to 59 with dependent children 16 or under. I exclude those aged under 22, to avoid including those still in full-time education. Those aged 60 and over are also excluded to avoid including those who have retired from the labour force. This is particularly important for women because in several countries the age at which they retire is lower than that for men (OECD 2017). In practise, however, the number of mothers living with dependent children at age 60 or older is very small. Weights are used to ensure results are representative of the population. The resulting sample sizes are reported in Table 1.

Dependent and explanatory variables

My outcome variable is equivalised annual disposable (post-tax-post-transfer) household income.[1] Income is equivalised by dividing by the square root of household size. I examine how single motherhood affects different quantiles of income distribution and its overall distribution (measured using the Gini coefficient) vis-à-vis the distribution for couples with children. One limitation of the income data is that for all countries except Denmark, Finland and Norway, data comes from household surveys. In survey data, income tends to be underreported at the extremes of the distribution (at or below the 5th percentile, or above the 95th percentile) and estimates at these points will be imprecise and should be interpreted with caution.[2] Single parents are defined as unpartnered household heads with dependent children under 18. Because income is recorded at the household level the earnings of other adults, who are not household heads or their partners, is included in income. One limitation of this measure is that it excludes single mothers who are not household heads, such as those living

[1] This corresponds to the variable disposable household income, DHI, in LIS.

[2] For those on low incomes, benefits tend to be underreported ((Parolin 2019)). Those with the highest incomes also tend to be missing from survey data and/or to underreport their incomes (Lustig 2020; Atkinson, Piketty, and Saez 2011).

with their own parents, who may be particularly economically vulnerable (Moullin and Harkness 2021). However, it is not possibly to identify single mothers who are not household heads in all countries studied. Moreover, including non-heads but measuring income at household level is likely to overstate the economic position of single mothers.

In the models run, which I describe below, I include two sets of explanatory variables. First, I account for differences in single and partnered mothers individual and family characteristics by conditioning on the age of mother (cubic), education (low, middle, or higher attainment), region of residence, number of children (dummy variables for two and three or more children), and age of youngest child (dummy variables for having a youngest child under 5 or age 5-11). The second set of controls adds controls for employment, with dummy variables for being in full or part-time employment. Full-time employment is defined as those working full-time, full-year or, for the United Kingdom where this information is not reported, over 30 hours a week. Part-time employment is defined as working part-time or part-year, or under 30 hours a week. Information on full-time employment is available for all countries except Norway. For Norway, a dummy variable for being in employment is included. To account for heterogeneity in maternal employment by education, interactions between full-time employment and education are included.

Methods

Unconditional quantile treatment effect (QTE) models are used to illustrate how single motherhood affects relative income at different points of the distribution. QTE models compare the estimated potential income distribution of single mothers (the treated) and couples with children (the untreated). Potential income distributions are estimated using inverse probability weights (IPW) to reshape the observed income distributions so that they resemble those that would be observed if the full sample were either treated or untreated. The weights are based on (i) demographic characteristics, and (ii) demographic and employment

characteristics, both of which were described above. Comparing the resulting 'potential outcome' distributions for the treated (single mother households) and untreated (two-parent households) gives the QTE, or distributional treatment effects. Different methods have been proposed for comparing distributions. I estimate reweighted recentred-influence functions (RIF) and conducting RIF regression (S.P. Firpo, Fortin, and Lemieux 2018) using the *rifhdreg* command (Rios-Avila 2020).[3] Further details on the method used are given in the Appendix.

The resulting 'distributional treatment effects' show how the distribution of income shifts in response to treatment (single motherhood).[4] Interpretation of the estimates depend on whether they are estimated for the whole population (the average treatment effect, ATE); for the treated (ATT), or the untreated (ATU). In this paper, as is common in the literature, I report the ATE. The estimates for the ATT, which may also be of interest, give similar results.

RESULTS

Descriptive results

Descriptive statistics for single mothers and mothers in two-parent households, and sample sizes, are reported in Table 1. In all countries, single mothers have lower levels of education, and fewer and older children, than mothers in couples. Employment and full-time employment rates of single and partnered mothers, and partnered fathers, are shown in Table 2. Employment rates of mothers in couples range from 56% in Italy to 84% in Denmark. In the United States and Italy, single mothers are more likely to be employed than those in couples (by 11-ppt in the United States and 27-ppt in Italy) while in Ireland, Australia, the

[3] Weighted quantile regression is an alternative method (Firpo, 2007).
[4] Note the models estimate 'distributional treatment effects.' These are not the same as the 'distribution of individual treatment effects,' which requires further assumptions to be made about where individuals would lie in the distribution if they were (or were not) treated.

Netherlands, and Denmark employment rates are 10- to 15-percentage points lower. For full-time employment, gaps between mothers and fathers are larger again, although some of the observed disparities will reflect differences in the characteristics of single and married mothers that influence their propensity for paid work.

Mean single mother income penalties

Mean differences in single mother and two-parent headed households are shown in Figure 1. Differences are shown without controls and after adjusting for characteristics. The adjusted gaps condition on: (i) mothers' age and education, the number and age of children in the family, and region of residence; (ii) adds controls for mothers' full and part-time employment. Model (iii) includes the same controls as (ii) but this time contrasts the characteristics of single mother household heads with those of fathers in couples (who are typically the head of household). After taking account of differences in the demographic characteristics of single and partnered mothers' average income penalties to single motherhood range from 31% in the United Kingdom to 46% in the United States, with penalties of 34% in Denmark and Finland and 41% in Spain, with other countries lying somewhere between. Accounting for differences in single and partnered mothers' employment has little influence on the size of these penalties although if single mothers' employment resembled that of partnered fathers the mean gap would fall. However, in all countries gaps in income remain. There are two reasons for this: first, pay penalties to motherhood, which mean that the earnings of single mother households will fall behind those with fathers, and second the absence of a potential second earner limits the relative income of all single parent households.

Differences in income across the distribution

Differences in the distribution of income are displayed in Figure 2, which shows kernel density estimates of the distribution of income for single mother and two-parent headed

households. The distributions for single mother and two-parent households are weighted by their population share, with the sum of the distributions giving the overall distribution of income for couple and single mother headed families. The figures also plot the poverty lines for each country, defined as 50% of median equivalised income. Everywhere the distribution of single mothers' incomes lies to the left of that for mothers in couples, but their incomes are particularly concentrated in the left tail of the couples' distribution in the United Kingdom, Ireland, the Netherlands, Germany, and the Nordic countries (Denmark, Norway, and Finland). Relatively low levels of income dispersion in the Nordic countries means that, although incomes are notably lower than for couples, most single mothers are not in relative income poverty but are nonetheless concentrated at the bottom of the distribution. In comparison, in the United States, Canada, Australia, Italy, and Spain single mothers' incomes are more unequally distributed and single mothers are more likely to be found among the middle income. Differences in the incomes of single mother headed households and those headed by couples may reflect differences in characteristics; for example, older single mothers, those with better education, or with fewer or older children may be expected to have a higher standard of living. Cross-country variations in selection into single motherhood may also explain why income differences between single and partnered mothers vary across the distribution in some countries but not in others. In the subsequent analysis I examine the extent to which differences in observable individual and family characteristics and employment influence the relative income of single mothers at different points of the income distribution.

Results from the quantile treatment effec1t models

The unconditional quantile treatment effect models allow me to quantify income differences across the distribution and test their significance. Results are shown in Figure 3. As before, I present the results for models using the three sets of controls described in the

discussion on average income gaps, which I use to reweight the distributions and as controls in the RIF regressions (Rios-Avila 2020). Reweighted estimates, which do not also include these controls in the RIF regressions, give very similar results.

Looking across the distribution, I find that the single motherhood has a heterogenous effect on income at different points of the distribution, the shape of which varies across countries. In the United States, Italy, and Spain income differences are largest at the bottom of the income distribution and widest at the top while in the United Kingdom, Ireland, the Netherlands, and Denmark differences are smallest at the lower end of the income distribution and considerably wider at the top. In Canada, Australia, Germany, Norway, and Finland income differences are constant across the distribution. These patterns are observed in the raw data; after controlling for mothers characteristics (age and education) and for family characteristics (number and age of children); and once further controls for mothers' full- or part-time employment are added. Indeed, while accounting for differences in mothers' personal, family, and employment characteristics typically reduces income gaps associated with single motherhood across the distribution, changes in the estimates are very small. Overall, then, the results suggest that these differences play very little part in explaining single mothers' disadvantage in any of the countries studied.

Conditioning on the characteristics of single mothers household heads and the characteristics of fathers in couples (who are frequently defined as the household head; see Moullin & Harkness, 2021 on gender and household headship) has a more substantial effect, leading to a fall in the estimated income gaps across the income distribution in all countries although there are notable differences in magnitude: while in the United States, United Kingdom, Australia, and Germany single mother penalties would be considerably reduced, particularly at the bottom of the distribution because fathers are much more likely to work, and to work full-time, than mothers (differences in other characteristics, including age,

education and age and number of children have little effect on the estimates). In the Nordic countries, the estimated treatment effects would show only very small reductions if single mothers worked as much as fathers in couples, which may reflect the relatively high levels of gender equality in employment between mothers and fathers in these countries. Nonetheless, even if single mothers worked as much as fathers in couples, earnings penalties associated with motherhood and the absence of a potential second earner mean that income differences would remain in all countries.

The overall treatment effect of single motherhood on the distribution of income (the Gini coefficient) is reported in Table 4. The Gini coefficient (*100) shows, as expected, that family income inequality is relatively high in the United States, Italy, and Spain and low in the Nordic countries. The table also shows the coefficients on single motherhood without controlling for characteristics (column 2) and after adjusting for individual and family characteristics (column 3), and employment (column 4). The results show single mothers' incomes are significantly more *equally* distributed than those of couples in the United Kingdom, Ireland, the Netherlands, and Denmark. In contrast, in Norway, single mothers' incomes are significantly more unequally distributed than for couples. In Italy and Spain, the coefficients on single motherhood also suggest single mothers' incomes are more unequally distributed than those for couples but, although the coefficients are large, they are not statistically significant which may reflect relatively small sample sizes for these countries.

POLICIES, INCOME SOURCES AND SINGLE MOTHERS' INCOME

Since 2000, strategies towards supplementing the incomes of low-income families – including single parents - have shifted considerably with an increasing number of Anglo-European countries introducing earnings supplements for low-wage workers with the aim of increasing employment and income and reducing poverty (Kenworthy 2015). However, there

are substantial differences in how earnings supplements operate with differences in generosity, phase-out rates (and, hence, marginal effective tax rates), conditions of receipt, and targeting. In the United States, there is support for those on low-middle income but little for those with the lowest incomes (McCabe and Popp Berman 2016; Moffitt and Garlow 2018). In contrast, in the United Kingdom awards are generous for those with the lowest incomes but withdrawn rapidly as income rises (Brewer and Hoynes 2019). Canada, Ireland, the Netherlands, and Denmark also offer in-work supplements to single parents on low incomes which are more generous, particularly for those with the lowest incomes, than in the United States, but less substantial than those in the United Kingdom. In Australia, the Netherlands, the United Kingdom, and Ireland eligibility for in-work credits depends on single mothers' part-time employment. In Australia, family tax benefits are paid to families with children who have only a single earner and single parents receive an additional supplement which is phased out at relatively high levels of income (OECD 2019). In addition to in-work support, most countries have child benefits with supplements paid to single parents in Norway, Denmark, Finland, and Germany (Van Lancker, Ghysels, and Cantillon 2012; OECD 2019). In Australia, there are further 'parenting payments' made to those with children under six, or to single parents with children under eight. In Italy and Spain income supplements are far more restricted, with limited child benefit and few additional payments to single parents or low earners (OECD 2019; Van Lancker, Ghysels, and Cantillon 2012).

These policy differences affect the sources of income on which single mother households depend. Figure 4 shows the average share of disposable income received by single mother headed households from earnings (after income tax), public benefits (public assistance benefits, which are means tested; insurance benefits; and universal benefits), maintenance payments, and other sources (pensions and investments) in the twelve countries.

Note that my income variable is disposable income, and therefore net of direct taxation. The same analysis of gross income results in a similar picture, reflecting the fact that in many countries the low income levels of single mother households means that their average effective tax rate is frequently close to zero (OECD 2019). The figure shows that in the United States, Italy, and Spain single mother households are particularly dependent on earnings, which account for around three-quarters of their disposable income. In contrast, earnings make up less than half disposable income in the United Kingdom, where almost 40% of income coming from means-tested benefits. In Ireland, the composition of income in single mother households resembles that in the United Kingdom. These country differences are not just driven by employment; among those in employment, there are also substantial variations in single mothers' income sources, shown in Figure 5. For single mother households where the mother is employed, means-tested benefits substantially supplement earnings in the United States, Canada, the United Kingdom, Ireland, and the Netherlands, accounting for 14% of income in the United States and up to a quarter of income in the United Kingdom. In contrast, in Australia, Germany, Finland, and Denmark universal benefits are an important source of income, with few in employment receiving income from means-tested benefits. Public insurance benefits provide an important income supplement for employed single mother households in Norway. However, in Italy and Spain where single mothers are in paid work, they receive minimal financial support from any kind of public benefits.

Differences in the income packages of single mothers are consistent with the gradients in income gaps between the distribution of single mothers' incomes and those of two-parent households found earlier. On the one hand, greater reliance on earnings in the United States, Italy and Spain allows some single mother households to achieve higher levels of income but leave others at risk of very low income. In the United Kingdom, Ireland and the Netherlands

means-tested benefits comprise an important part of single mother households' incomes and are effective at lifting the incomes of those at the bottom of the distribution. In these countries, single mothers' incomes are more equally distributed than those of couples, but single mothers are concentrated in the lower end of the income distribution. These findings are consistent with studies suggesting that work-conditional benefits are no more effective for raising incomes than other institutional configurations (Kenworthy 2015). In Australia and Germany, universal transfers provide important supplements to earnings, accounting for 22% and 15% of income respectively. However, because in Germany single mothers are concentrated in low-paid sectors (Zagel and Van Lancker 2022) differences in relative income remain large. In Nordic countries, single mothers' earnings are supplemented by a package of public universal, assistance, and insurance transfers which, in Denmark and Finland, tend to reduce income gaps slightly more at the bottom of the distribution than the top.

DISCUSSION

While numerous recent studies have examined the link between single motherhood and poverty fewer have looked at their broader economic circumstances. In this paper, I examined the relationship between single motherhood and income, and the extent to which it varies across the income distribution, in twelve rich nations. I found that single motherhood was associated with reduced income everywhere. In line with studies on single parent poverty, after taking account of characteristics, the United States once again stood out as having particularly large average income penalties, of 46%, while in the United Kingdom penalties, at 31%, were relatively small. In other countries, single mother penalties typically sit at between 35% and 40% of income. Single mothers' characteristics made little contribution towards explaining the difference in their and partnered mothers' incomes: even if single mothers were the same age, had the same level of education, number of children, and had

children of a similar age, and lived in the same region as partnered mothers, their income, and its' distribution, would be little changed and they would remain considerably disadvantaged vis-à-vis partnered mothers in all countries considered. This finding echoes that of previous research which showed that single mothers characteristics, and in particular education, played little part in explaining cross-country differences in poverty (Härkönen 2018).

Going one step further and adjusting single mothers' employment patterns so they resemble those of partnered mothers would similarly lead to only small income gains in most countries. However, in the United States, Italy, and, to a lesser extent, Spain single mothers' income would be lower at all points of the income distribution if their employment patterns resembled those of partnered mothers because they are more likely to be employed. To raise their incomes single mothers would instead need to adopt the full- and part-time employment patterns of fathers in couples, with the potential gains from single mothers acting more like fathers in couples being greatest in the United Kingdom, Germany, and the Netherlands, countries where gender differences in parental employment are largest. Yet, even this may be insufficient to eliminate single mother income penalties, as the data for the Nordic countries shows. In these countries, even if single mothers had similar rates of full and part-time employment as fathers, income gaps would persist. There are two potential explanations for this. First, while higher rates of single mother employment would increase their income, their incomes would still fall behind those of dual, full-time earner couple households (Alm, Nelson, and Nieuwenhuis 2019).[5] Second, motherhood earnings penalties are substantial even in countries such as Denmark (Kleven et al. 2019; Kleven, Landais, and Søgaard 2019) and a further, important reason for single mothers disadvantage (S. Harkness 2022).

[5] This is in part because of mechanistic adjustments to income, which assume that couples benefit from economies of scale. For example, if families rely solely on their own earnings, then, compared to couples who are both full-time median wage earners and have 2 children a single mother with one child employed full-time and paid the same would have needs adjusted income that was 29% lower.

I also found striking cross-country variations in differences in the income of single mothers and two-parent households at different points of the income distribution. In both the United States and the United Kingdom, income gaps were strongly graded but in opposite directions. In the United States, single motherhood is most strongly negatively associated with reduced income at the bottom of the distribution but has a more moderate effect at higher levels of income. In the United Kingdom, the opposite is true with single motherhood having a smaller influence at the bottom of the income distribution and a greater effect at the top. In line with past studies, this suggests that social policies may be particularly successful at protecting single mothers most at risk of poverty in the United Kingdom but much less effective in the United States (Rothwell and McEwen 2017; David Brady, Finnigan, and Hübgen 2017; Zagel and Van Lancker 2022). Looking across countries, Ireland, the Netherlands, and Denmark resemble the United Kingdom, with income gaps being smaller at the bottom of the income distribution than the top. In each of these countries, single mothers' incomes are more equally distributed than for couples with children, with their incomes being concentrated at the lower end of the distribution. Italy and Spain bear closer resemblance to the United States, with income differences being larger at the bottom of the distribution than the top. In Canada, Australia, Germany, Finland, and Norway differences in the incomes of single mother headed and two-parent families are large but show less variation with across income.

What can we conclude from these findings? Past research, using data from the 1980s and 1990s, found that in countries where caregiving was encouraged and means testing was common single mothers' incomes were relatively low (Wong, Garfinkel, and McLanahan 1993; Misra et al. 2012). Since then, the policy landscape has changed considerably with more mothers, including single mothers, entering the labor force. While many single mothers are now in paid work, part-time employment remains common and this places single mothers

at heightened risk of poverty (Horemans, Marx, and Nolan 2016; J. Lewis and Giullari 2005). While generous means tested earnings supplements raise income at the bottom of the distribution, their impact further up is far more limited (Dickens and Ellwood 2003; Kenworthy 2015; Brewer and Hoynes 2019). These disincentives in the tax-benefit system, alongside large earnings penalties to motherhood, means that in countries including the United Kingdom, Ireland, and the Netherlands single motherhood acts as an equaliser, compressing single mothers' incomes with most single mothers having relatively low income, regardless of their characteristics or prior circumstances. In contrast, while means tested benefits play an important role in lifting the income of single mothers with the lowest earnings potential incomes in some countries, in others – such as the United States – low levels of support are associated with a high risk of poverty (David Brady, Finnigan, and Hübgen 2017). In these countries, single mothers are particularly dependent on their own earnings, and their incomes are more unequally distributed with some at risk of having very low incomes but more single mothers reaching the middle of the distribution. Among Nordic countries, despite relatively high rates of employment and generous single parent benefits, single mothers' incomes are lower than for those with partners. In these countries, the norm of dual-earner households (Alm, Nelson, and Nieuwenhuis 2019) and the persistence of motherhood pay gaps (Kleven, Landais, and Søgaard 2019) means single mothers remain disadvantaged across the income distribution.

While this study is descriptive and has not directly tested how specific policies influence the economic opportunities of single mothers the results nonetheless shed light on how the experience of single mothers varies across countries and policy context. One limitation of this study is that, because only includes single mothers who are household heads are included, it does not capture the situation of single mothers who co-reside with other adults, including their parents. While in some countries, generous welfare provision and

housing support may enable single mothers to live independently, in countries where welfare support is limited, including the United States, Spain, and Italy, co-residence is likely to be more common and a response to adverse economic circumstances (Pilkauskas and Cross 2018). Because I look only at those single mothers who live independently, the disadvantages associated with single motherhood are likely to be underestimated in countries where co-residence is common. Further, while I have discussed the influence that public transfers may have on single mothers;' relative economic position, I have not explored the role that income tax plays in influencing their relative standing in spite of its important role in shaping the distribution of earnings and income.

While single motherhood has become increasingly common across rich nations it remains strongly associated with disadvantage.[6] Recent research has paid a great deal of attention to the link between single motherhood and poverty. Far less has been written about single mothers' wider economic circumstances. Yet, as the experience of single motherhood continues to grow, it is important to understand to what extent single mothers – even if not poor – remain disadvantaged. I show that anti-poverty strategies may still result in wide gulfs in equality between single mother and two-parent households. For example, although the United Kingdom has been lauded for its success in reducing single mother poverty, low hours of paid work and earnings – which have been encouraged by the design of the system of in-work financial support - continues to hold their income back with few single mothers achieving middle incomes. In the United Kingdom then, while the state has provided single mothers with financial security, this has not been accompanied by economic opportunity. In contrast, in the United States single mothers are more likely to be represented among those on middle incomes, even as those with the lowest income potential remain highly disadvantaged.

[6] For example, in his 2021 talk to students at the London School of Economics, Angus Deaton described the 'terrible scourge' of family breakdown.

In the case of the United States, opportunities for some single mothers have not been accompanied by security for all. Future research should focus on understanding how policy can achieve both.

REFERENCES

Alm, Susanne, Kenneth Nelson, and Rense Nieuwenhuis. 2019. "The Diminishing Power of One? Welfare State Retrenchment and Rising Poverty of Single-Adult Households in Sweden 1988–2011." *European Sociological Review* 36 (2): 198-217. https://doi.org/10.1093/esr/jcz053. https://doi.org/10.1093/esr/jcz053.

Atkinson, Anthony B, Thomas Piketty, and Emmanuel Saez. 2011. "Top incomes in the long run of history." *Journal of economic literature* 49 (1): 3-71.

Belfield, Chris, Jonathan Cribb, Andrew Hood, and Robert Joyce. 2014. *Living standards, poverty and inequality in the UK: 2014*. Vol. R96: IFS Report.

Brady, D., and R. Burroway. 2012. "Targeting, universalism, and single-mother poverty: a multilevel analysis across 18 affluent democracies." *Demography* 49 (2): 719-46. https://doi.org/10.1007/s13524-012-0094-z. https://www.ncbi.nlm.nih.gov/pubmed/22403034.

Brady, David, Ryan M Finnigan, and Sabine Hübgen. 2017. "Rethinking the risks of poverty: A framework for analyzing prevalences and penalties." *American Journal of Sociology* 123 (3): 740-786.

Brewer, Mike, and Hilary Hoynes. 2019. "In-Work Credits in the UK and the US." *Fiscal Studies* 40 (4): 519-560.

Budig, Michelle J, and Paula England. 2001. "The wage penalty for motherhood." *American sociological review*: 204-225.

Byun, Young-hwan. 2018. "Middle-class single parents." *The triple bind of single-parent families*: 223.

Destro, Lane, and David Brady. 2011. "Does European-Style Welfare Generosity Discourage Single-Mother Employment?" In *Comparing European Workers Part B: Policies and Institutions*. Emerald Group Publishing Limited.

Dickens, Richard, and David T Ellwood. 2003. "Child poverty in Britain and the United States." *The Economic Journal* 113 (488): F219-F239.

Firpo, Sergio. 2007. "Efficient semiparametric estimation of quantile treatment effects." *Econometrica* 75 (1): 259-276.

Firpo, Sergio P, Nicole M Fortin, and Thomas Lemieux. 2018. "Decomposing wage distributions using recentered influence function regressions." *Econometrics* 6 (2): 28.

Firpo, Sergio, and Cristine Pinto. 2016. "Identification and estimation of distributional impacts of interventions using changes in inequality measures." *Journal of Applied Econometrics* 31 (3): 457-486.

Gonzalez, Libertad. 2004. "Single mothers and work." *Socio-Economic Review* 2 (2): 285-313.

Harkness, Susan. 2022. "The accumulation of economic disadvantage: the influence of childbirth and relationship breakdown on married and single mothers' income and poverty risk " *Demography*.

Harkness, Susan E. 2016. "The effect of motherhood and lone motherhood on the employment and earnings of British women: A lifecycle approach." *European Sociological Review* 32 (6): 850-863.

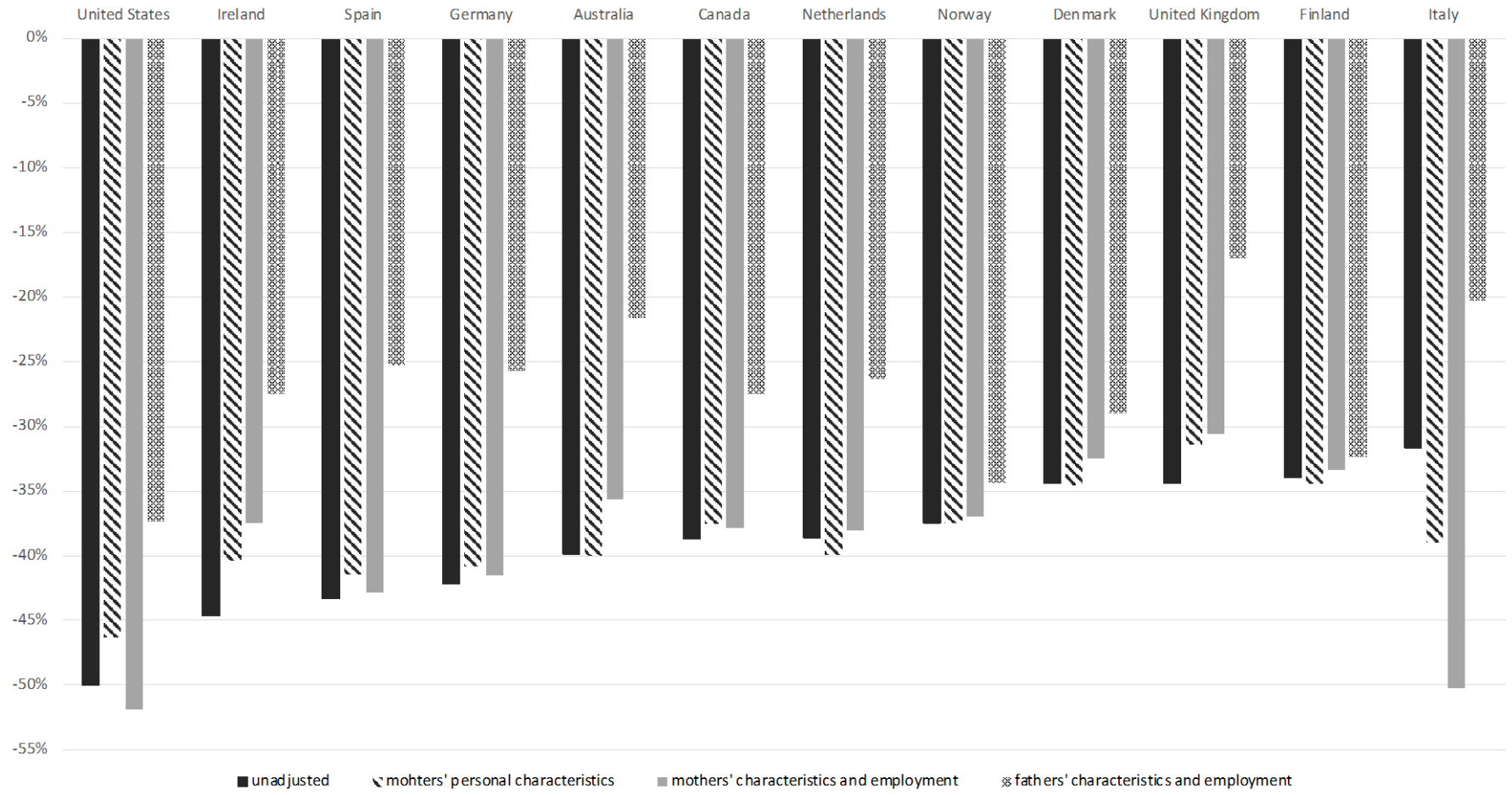
Härkönen, Juho. 2018. "Single-mother poverty: How much do educational differences in single motherhood matter." *The Triple Bind of Single-Parent Families: Resources, Employment and Policies to Improve Wellbeing*: 31-50.

Horemans, Jeroen, Ive Marx, and Brian Nolan. 2016. "Hanging in, but only just: part-time employment and in-work poverty throughout the crisis." *IZA Journal of European Labor Studies* 1 (5): 1-19.

Hoynes, Hilary, Robert Joyce and Tom Waters (2022, forthcoming). “The Transfer System.” *The Deaton Review of Inequality*.
Kenworthy, Lane. 2015. *Do employment-conditional earnings subsidies work?* Herman Deleeck Centre for Social Policy, University of Antwerp.
Kleven, Henrik, and Camille Landais. 2017. "Gender inequality and economic development: fertility, education and norms." *Economica* 84 (334): 180-209.
Kleven, Henrik, Camille Landais, Johanna Posch, Andreas Steinhauer, and Josef Zweimüller. 2019. "Child Penalties across Countries: Evidence and Explanations." *AEA Papers and Proceedings* 109: 122-126. https://doi.org/10.1257/pandp.20191078.
Kleven, Henrik, Camille Landais, and Jakob Egholt Søgaard. 2019. "Children and Gender Inequality: Evidence from Denmark." *American Economic Journal: Applied Economics* 11 (4): 181-209. https://doi.org/10.1257/app.20180010.
Lewis, Jane E. 1997. *Lone mothers in European welfare regimes: Shifting policy logics*. Jessica Kingsley Publishers.
Lewis, Jane, and Susanna Giullari. 2005. "The adult worker model family, gender equality and care: the search for new policy principles and the possibilities and problems of a capabilities approach." *Economy and society* 34 (1): 76-104.
Luxembourg Income Study (LIS) Database, http://www.lisdatacenter.org (multiple countries; March 2022). Luxembourg: LIS.
Lustig, Nora. 2020. *The" missing Rich'" in Household Surveys: Causes and Correction Approaches.* ECINEQ, Society for the Study of Economic Inequality.
McCabe, Joshua T, and Elizabeth Popp Berman. 2016. "American exceptionalism revisited: Tax relief, poverty reduction, and the politics of child tax credits." *Sociological science* 3: 540-567.
Millar, J. (2019). Self-Responsibility and Activation for Lone Mothers in the United Kingdom. American Behavioral Scientist, 63(1),85-99.
Misra, Joya, Stephanie Moller, Eiko Strader, and Elizabeth Wemlinger. 2012. "Family policies, employment and poverty among partnered and single mothers." *Research in Social Stratification and Mobility* 30 (1): 113-128.
Moffit, R. (2022, forthcoming). “Transfers, Tax and Tax Credits at the Bottom: Deaton Review Commentary.” *Deaton Review of Inequalities.*
Moffitt, Robert A, and Stephanie Garlow. 2018. "Did welfare reform increase employment and reduce poverty?" *Pathways*: 17-21.
Moullin, Sophie, and Susan Harkness. 2021. "The Single Motherhood Penalty as a Gender Penalty. ." *American Journal of Sociology*.
OECD. 2017. *Effective age of labour market exit*.
---. 2018. *Special feature: Differences in the disposable incomes of households with and without children*.
---. 2019. *Taxing Wages 2019*.
Parolin, Zachary. 2019. "The effect of benefit underreporting on estimates of poverty in the United States." *Social Indicators Research* 144 (2): 869-898.
Pfau-Effinger, Birgit. 2007. "The relationship between family and employment and the well-being of children." *Wellchi http://esr. oxfordjournals. org*.
Pilkauskas, Natasha V, and Christina Cross. 2018. "Beyond the nuclear family: Trends in children living in shared households." *Demography* 55 (6): 2283-2297.
Powell, David. 2016. "Quantile regression with nonadditive fixed effects." *Quantile Treatment Effects* 1 (28).
Rios-Avila, Fernando. 2020. "Recentered influence functions (RIFs) in Stata: RIF regression and RIF decomposition." *The Stata Journal* 20 (1): 51-94.

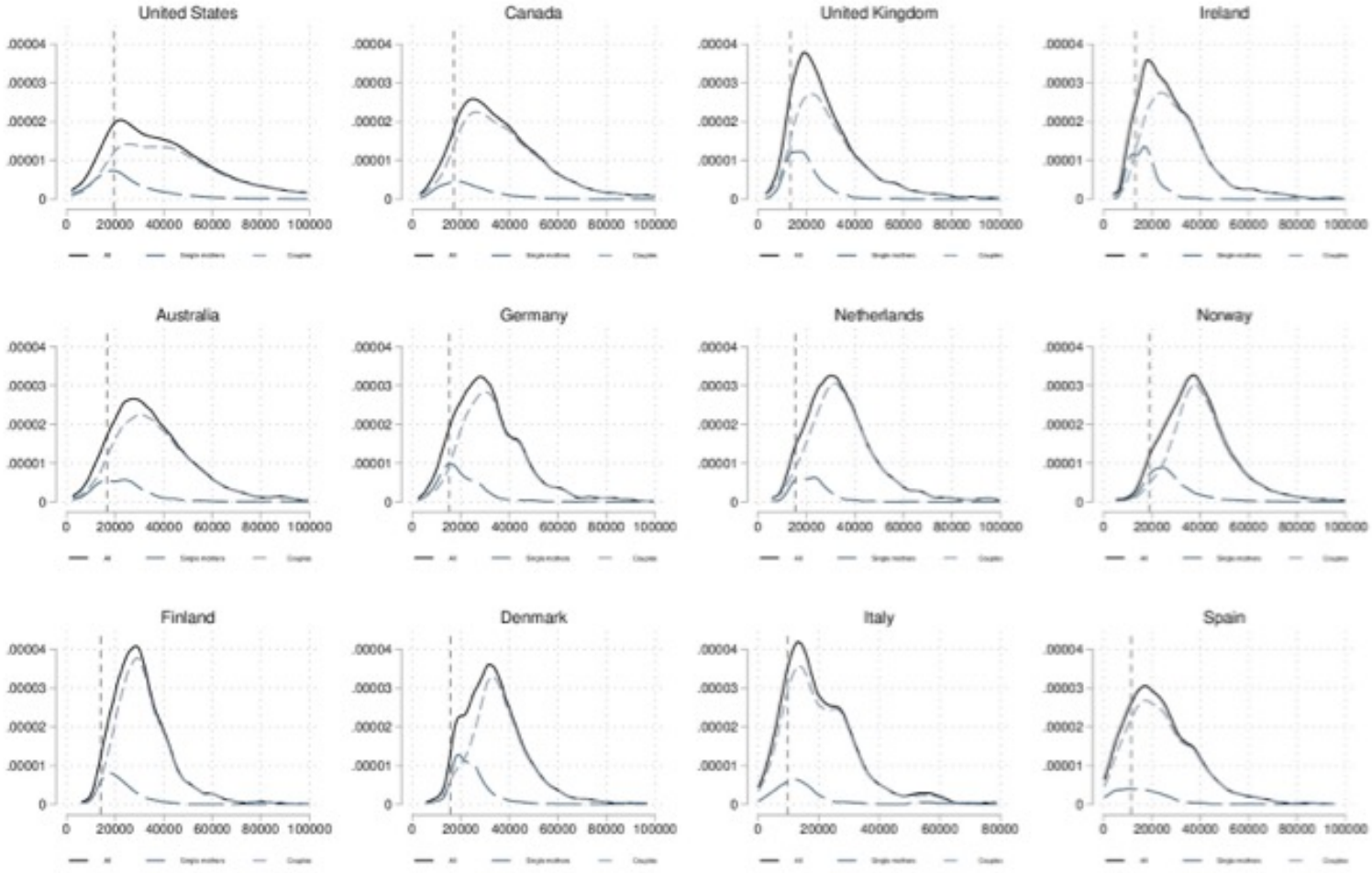
Rios-Avila, Fernando, and Michelle Maroto. 2020. "Moving Beyond Linear Regression: Implementing and Interpreting Quantile Regression Models with Fixed Effects."
Rothwell, David W, and Annie McEwen. 2017. "Comparing child poverty risk by family structure during the 2008 recession." *Journal of Marriage and Family* 79 (5): 1224-1240.
Van Lancker, Wim, Joris Ghysels, and Bea Cantillon. 2012. *An international comparison of the impact of child benefits on poverty outcomes for single mothers.*
Waters, Tom, and Thomas Wernham. 2021. "Budget measures bring number of families entitled to Universal Credit to 7 million." *Observation, Institute for Fiscal Studies*. https://ifs.org.uk/publications/15818.
Wong, Yin-ling Irene, Irwin Garfinkel, and Sara McLanahan. 1993. "Single-mother families in eight countries: Economic status and social policy." *Social Service Review* 67 (2): 177-197.
Zagel, Hannah, and Wim Van Lancker. 2022. "Family policies' long-term effects on poverty: a comparative analysis of single and partnered mothers." *Journal of European Social Policy*: 09589287211035690. https://doi.org/10.1177/09589287211035690. https://doi.org/10.1177/09589287211035690.

Figure 1: Mean single mother income gaps across countries



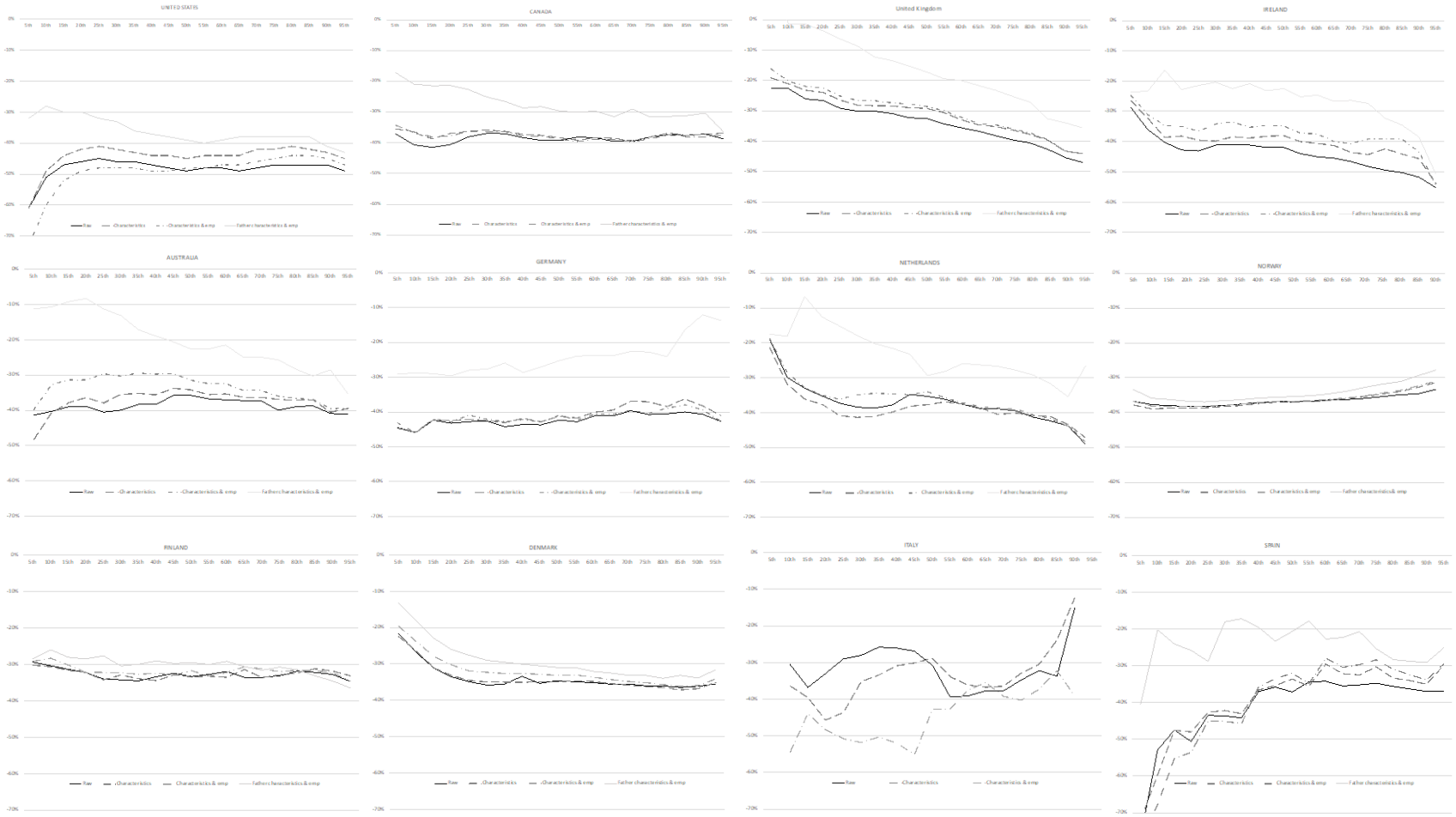
Note: Gaps in equivalised income between single and partnered mothers. Plots are for (i) raw income gaps; (ii) adjusted for mothers' characteristics; (iii) adjusting for mothers' characteristics and rates of full- and part-time employment; (iv) adjusting for single mothers' and partnered fathers characterisitics and full-and part-time employment.

Figure 2: Kernel density estimates of equivalised household income: all, single and partnered mothers



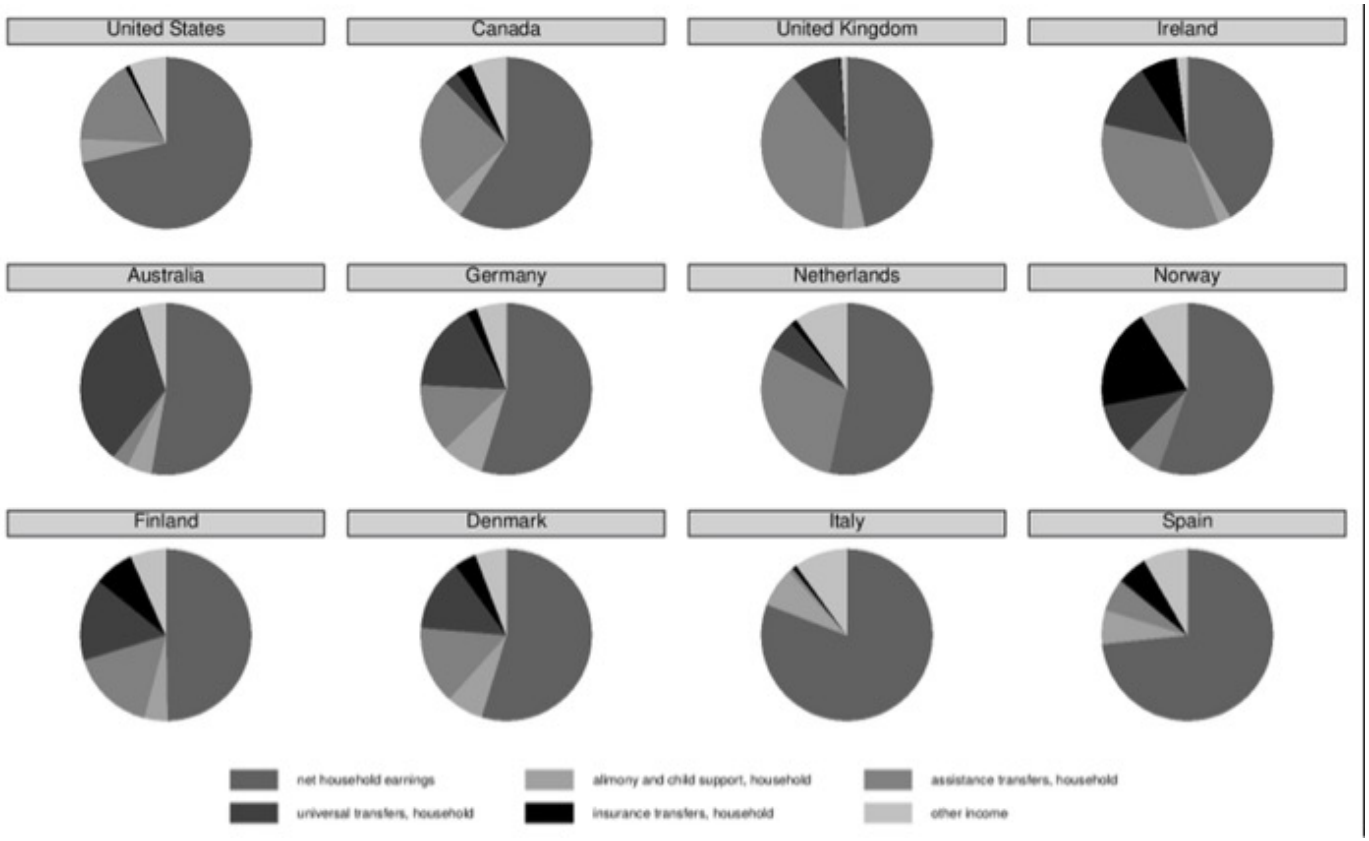
Notes: the densities for single mother and two-parent households are weighted by their share of households. The density for all households is the sum of the weighted densities.

Figure 3: Single mother inequality treatment effects in twelve countries (% change in income, equivalised income)



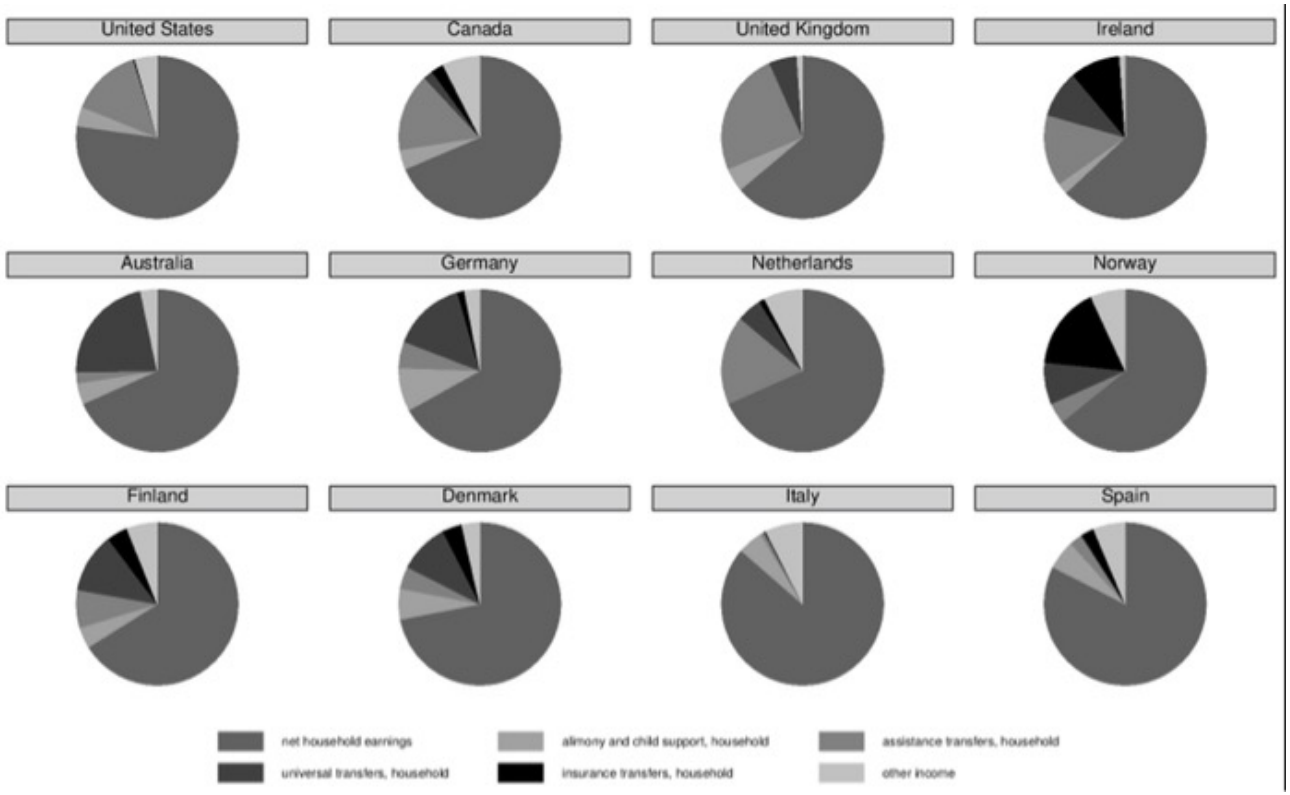
Notes: Average treatment effects reported. The first set of adjustments, used to derive IPW and as controls, are for age, education, number and age of children, region. Maternal employment (full and part-time) interacted with education are added to the second set of controls. The third set of controls include controls for characteristics of single mothers' vis-a-vis partnered fathers, including employment controls.

Figure 4: Single mother headed households' income sources in twelve countries



Notes: the figure shows income from different sources as a share of net household income.

Figure 5: Employed single mother headed households' income sources in twelve countries



Notes: As figure 5.

Table 1: Descriptive statistics, single mother and two-parent headed household

	% single mothers	Age youngest child		Number kids		Education: Low			Education: middle			Education: high			Sample size
		Single	Couple	Single	Couple	Single mothers	Couple, mother	Couple, father	Single	Couple, mother	Couple, father	Single	Couple, mother	Couple, father	
United States	20%	8.8	7.1	1.8	2.0	12%	8%	10%	49%	34%	40%	39%	58%	51%	21,091
Canada	11%	6.9	5.1	1.7	2.0	9%	6%	7%	25%	18%	20%	67%	77%	74%	9,072
United Kingdom	21%	8.2	6.4	1.7	1.8	28%	15%	18%	36%	33%	33%	36%	52%	49%	5,024
Ireland	19%	9.4	7.4	1.8	1.9	24%	10%	17%	38%	28%	25%	38%	62%	58%	1,409
Austalia	15%	0.1	6.3	1.9	1.9	25%	13%	10%	34%	29%	44%	41%	58%	46%	3,855
Germany	17%	9.3	7.0	1.5	1.7	21%	14%	11%	56%	53%	47%	23%	33%	42%	5,254
Netherlands	11%	9.6	6.9	1.6	1.9	21%	14%	14%	56%	53%	39%	23%	33%	47%	2,777
Norway	17%	9.2	6.9	1.5	1.8	21%	14%	14%	47%	36%	45%	32%	50%	41%	54,999
Finland	13%	8.9	6.7	1.6	1.9	16%	9%	14%	45%	37%	48%	39%	54%	38%	2,761
Denmark	19%	8.9	6.9	1.5	1.8	21%	11%	13%	40%	37%	46%	39%	52%	41%	20,445
Italy	11%	10.3	8.3	1.4	1.6	36%	29%	38%	45%	48%	45%	19%	23%	17%	1,074
Spain	11%	10.6	7.5	1.4	1.5	41%	30%	37%	27%	37%	23%	32%	33%	40%	3,424

Note: share of single mother headed household as a percentage of all households age 22-59 with dependent children (16 and under).

Table 2: Employment of fathers and mothers by partnership status

	Employment			Diff mothers v	Diff. single v	FT employment			Diff mothers v	Diff. single v
	Father, couple	Mother, couple	Mother, single	fathers, couples	partnered mothers	Father, couple	Mother, couple	Mother, single	fathers, couples	partnered mothers
United States	93%	68%	78%	-26%	11%	82%	47%	56%	-36%	10%
Canada	91%	71%	69%	-20%	-2%	77%	50%	50%	-27%	0%
United Kingdom	93%	69%	63%	-24%	-6%	89%	39%	32%	-50%	-7%
Ireland	88%	68%	54%	-20%	-14%	78%	39%	25%	-39%	-14%
Austalia	93%	75%	60%	-18%	-15%	88%	42%	35%	-46%	-6%
Germany	93%	73%	70%	-21%	-2%	79%	15%	27%	-64%	12%
Netherlands	95%	83%	71%	-12%	-12%	71%	12%	11%	-59%	-1%
Norway	91%	82%	78%	-9%	-4%	-	-	-	-	-
Finland	89%	72%	65%	-17%	-7%	59%	45%	39%	-14%	-6%
Denmark	92%	84%	69%	-8%	-15%	69%	53%	46%	-16%	-7%
Italy	93%	56%	83%	-37%	27%	87%	38%	61%	-49%	23%
Spain	89%	66%	69%	-23%	3%	79%	48%	46%	-31%	-2%

Note: share of single mother headed household as a percentage of all households age 22-59 with children. No information on full-time employment is given for Norway. For all other countries full-time employment is defined as employed full-time, full year, or where this information is not available, employed for more than 30 hours a week.

Table 3: Estimation of overall treatment effect of single motherhood on inequality (Gini Coefficient * 100)

	Sample mean	(i) no controls	(ii) control for characteristics	(iii) adds employment controls
United States	34.8	-0.1	0.1	-0.1
Canada	28.6	-0.6	0.2	-0.7
United Kingdom	28.0	-6.6**	-5.7**	-7.0**
Ireland	25.8	-3.8**	-4.3**	-6.2**
Austalia	28.0	-1.1	0.0	-2.2
Germany	25.2	-0.5	2.1	1.2
Netherlands	22.7	-5.3*	0.2	0.0
Norway	20.6	1.1**	3.6**	3.3**
Finland	21.0	-1.9	-0.9	-2.1
Denmark	20.0	-1.9**	0.0	-1.8
Italy	33.4	4.7	4.7	5.1
Spain	34.2	2.5	1.5	1.0

Notes: ** denotes statistical significance at 1%, * significance at 5%. The sample includes all single mother and couple headed households where the mother is age 22-59. Controls for characteristics (ii) include age (cubic) and dummy variables for education (low, medium, high), region, number of children (2 and 3+ children) and age of youngest child (under 5, 5-11); (iii) adds controls for full and part-time employment, interacted with education. For Norway, information on full-time employment is not given. Samples sizes are in Appendix Table A1.

Appendix 1: Quantile Treatment Effect Models

Unconditional quantile treatment effect (QTE) models are used to illustrate how single motherhood affects relative income at different points of the distribution (S. Firpo 2007; S. Firpo and Pinto 2016; Powell 2016). QTE models allow the estimation of inequality treatment effects even when the variable of interest is binary (S. Firpo 2007; S. Firpo and Pinto 2016; Rios-Avila and Maroto 2020). If all potential outcomes could be observed for the population, then quantile treatment effects can be found by comparing the distribution of the treated (y_1) and the untreated (y_0) at different quantiles (τ):

$$(1) \qquad \mathrm{QTE}^{\tau} = \mathrm{Q}^{\tau}_{y1} - \mathrm{Q}^{\tau}_{y0}$$

However, potential outcomes are not fully observed. To account for this, treatment is assumed to depend on a set of observed characteristics, Z. Under the assumption that the potential outcomes are independent of the treatment after conditioning on Z, QTE are estimated using the two-step procedure proposed by Firpo (2007), and Firpo and Pinto (2016). First, propensity scores, $\hat{p}(z)$, which indicate the probability of an observation belonging to the treated group, are estimated using logit models, such that:

$$(2)\ \mathrm{SM_i} = \mathrm{f(Z_i)}$$

where SM_i is a dummy variable for being a single mother. From the propensity scores, inverse probability weights (IPW) are constructed, which match the distribution of characteristics (Z) of the treated and untreated samples. The weights are given by ω_0 for the untreated, and ω_1 for treated, where:

$$(3) \qquad \omega_o = \frac{1-\overline{SM}}{1-\hat{\mathrm{p}}(\mathrm{z})}; \quad \omega_1 = \frac{\overline{SM}}{\hat{\mathrm{p}}(\mathrm{z})}$$

Applying IPW reshapes the observed distribution of outcomes for the treated (or untreated) so that it resembles that which would be observed for the full sample, allowing me to compare potential outcomes.

what the distribution of single mothers' income would look like if they: (i) had the same demographic characteristics as partnered mothers; (ii) had the same demographic and employment characteristics as partnered mothers; and (iii) had the same demographic and employment (full- and part-time) characteristics as partnered fathers.

The second step involves estimating QTE, by comparing the weighted distributions for the treated and untreated. Different methods have been proposed for comparing distributions.[7] I follow the method proposed by Rios-Avila (2020), comparing distributions by estimating the reweighted recentred-influence functions (RIF) and conducting RIF regression (Firpo, Fortin and Lemieux 2018).

RIFs capture changes in distributional statistics when there is a marginal change in the underlying variable's distribution. For the p-th quantile of variable y, $\mathrm{q_y(p)}$, is given by:

$$(3) \qquad \mathrm{RIF\big(y, q_y(p)\big) = q_Y(p) + \frac{p - 1(y \le q_y(p))}{f(q_y(p))}}$$

where $q_y(p)$is p-th percentile of the income distribution. In QTE models, the RIF is weighted by ω_0 to obtain the expected distribution for the untreated, v_0, and by ω_1 for the treated, v_1. The re-weighted expected distribution can be written:

$$(4) \qquad v_0 = E(RIF\left(y_i; v\left(F_y^0\right)\right); \qquad v_1 = E(RIF\left(y_i; v\left(F_y^1\right)\right);$$

Unconditional treatment effects, at different percentiles of the distribution, are then given by:

$$(5) \quad v_c = \quad v_1 - v_0$$

Finally, regressing v_c on a set of characteristics, X, captures the partial impact of a unit change in the explanatory variables on the unconditional QTE. The specification takes the form:

$$(4) \qquad \mathrm{v_c^p = \beta^p Z_i + \varepsilon_i}$$

In this case, $\mathrm{Z_i}$ is the same vector of characteristics used to reweight the distribution. Further details on the methods are described in Rios-Avila and Marato (2020).

[7] Alternative methods of estimation include weighted quantile regression (S. Firpo 2007)

I use the *rifhdreg* command described by Rios-Avila (2020). As IPW estimates are sensitive to values close to 0 or 1, I follow Rios-Avila and Maroto (2020) and exclude observations with predicted propensity scores of less than 0.025 and above 0.975. The resulting 'distributional treatment effects' show how distribution of the outcome shifts in response to treatment.[8] Interpretation of the estimates depend on whether they are estimated for the whole population (the average treatment effect, ATE); for the treated (ATT), or the untreated (ATU). In this paper, as is common in the literature, I report the ATE. The estimates for the ATT, which may also be of interest, give similar results.

[8] Note the models estimate 'distributional treatment effects.' These are not the same as the 'distribution of individual treatment effects,' which requires further assumptions to be made about where individuals would lie in the distribution if they were (or were not) treated. A commonly made assumption is of rank preservation between the potential outcome distribution, regardless of treatment status (i.e. that individuals have a certain "proneness" to being located at a certain point of the distribution that does not change with the treatment) with estimates obtained using instrumental variables (Melly & Wüthrich, 2016; Firpo & Ridder, 2019).

Appendix 2: Replication programmes for LIS using STATA

Program 1: Data Creation

```
global hhvars "iso2 year did hid hwgt nhhmem nhhmem17 hpartner  dhi hi31 hi311 hi312 hi32 hi33 hi41 hi42 hi421 hi422 hi43 hi44 hi45 hi46 hi47 hi471  hitotal hilabour hifactor hitransfer hipension hipubsoc hiprivate hpublic hpub_i hpub_u hpub_a hi521 hicapital hxitsc hpopwgt "

global ppvars "hid  relation sex age educ nchildren  marital partner parents ageyoch pitotal pilabour pipension pxitsc ppub_i emp fyft hourstot net1 gross1 ppopwgt"
global ppvars2 "hid  region_c"
program drop _all
**************************
*** SET UPS
**************************
program define setups
*** select only records if dhi filled
drop if dhi==. | dhi==0
* select only if there is a weight
drop if hwgt==. | hwgt==0
* generate mi
// factor income plus penssion and private transfers
generate mi=hifactor+hi33+hiprivate
// Non labour income exc =l tax transfers
g other=mi-hilabour
// Net tax and benefits
g nettax=hipubsoc-hxitsc
* set equivalence scale as square root of household member
generate ey=(dhi/(nhhmem^0.5))
* set equivalence scale as square root of household member
generate ey_mi=(mi/(nhhmem^0.5))
* create person weight as hwgt times number of household member
generate wt=hwgt*nhhmem
* create child weight as hwgt times number of household members 17 or younger
generate ct=hwgt*nhhmem17
end

****************************
***Bottom and Top Coding***
****************************
program define bottop
setups
quietly sum ey [w=wt]
generate botlin=0.01*r(mean)
replace ey=botlin if ey<botlin
quietly sum dhi [w=wt], de
generate toplin=10*r(p50)
replace ey=(toplin/(nhhmem^0.5)) if dhi>toplin
replace mi=0 if mi<0
drop if ey<botlin
drop if ey>toplin
end

**********************************
// DEFLATING  2017 US PPP and CPI
**********************************
program define deflate
merge m:1  iso2 year using $myincl/ppp_2017.dta     , nogen
end

*********************************************************
***Poverty Lines Equal to 50%, 60% of Median ey***
*********************************************************
program define povl
quietly sum ey [w=wt], de
generate povl2=r(p50)*.5
generate povl3=r(p50)*.6
g poor50=ey<povl2          if ey<.
g poor60=ey<povl3    if ey<.
xtile quintile =ey [w=wt], nq(5)
end

*********************************************************
*** SINGLE MUM OR DAD INCLUDING NON-HEAD
```

```
*************************************************************
prog define demographics
g headspouse=relation<300 if relation<.
g notheadspou=relation>=3000 if relation!=.   &age>17
g female=sex==2 if sex!=.
g depkids=0
replace depkids=1 if ageyoch<18    &(age-ageyoch>15)
g single=partner==0    if partner<.
g singleparent=single*depkids
replace singleparent=0 if age>59|age<17
g coupleparent=partner*depkids
replace coupleparent=0 if age>59|age<17
g singlemom=singleparent*female
g singledad=singleparent*(-1*(female-1))
tabstat singlemom  [w=ct], stat(mean)
tabstat singledad [w=ct], stat(mean)
tabstat singlemom parents [w=ct], stat(mean)
tabstat singledad parents [w=ct], stat(mean)
g twoparent=hpartner==1 & nhhmem17>0 & nhhmem>2

// DEFINED BY HOH STATUS
gen kidsm=0
replace kidsm=1 if hpartner==0 & nhhmem17>0
g kidsc=0
replace kidsc=1 if hpartner==1 & nhhmem17>0   & nhhmem>2
end

*****************************************
// EXPLANATORY VARIABLES
*****************************************
program define explanatory
g age2=age*age
tab educ, g(ed)
g nch1=nchildren==1
replace nch1=0 if ageyoch>16
g nch2=nchildren==2
replace nch2=0 if ageyoch>16
g nch3=nchildren>2 &nchildren<.
replace nch3=0 if ageyoch>16
g nad=nhhmem-nchildren
g ych5=ageyoch<5
g ych11=ageyoch<12&ageyoch>4
g ych16=ageyoch<17&ageyoch>11

// Employment status
g empstat=.
replace empstat=3 if fyft==1
replace empstat=3 if hourstot>=30&hourstot<. &empstat==.
replace empstat=2 if fyft==0&emp==1
replace empstat=2 if hourstot>0&hourstot<30&empstat==.
replace empstat=1 if emp==0
label define emptat 1 "not employed" 2 "part time" 3 "full time"
label values empstat empstat
g status1=.
g status2=.
g status3=.
replace status1=empstat==1
replace status2=empstat==2
replace status3=empstat==3
replace status1=emp==0 if did==626
replace status3=emp==1 if did==626
label var status1 "Not employed"
label var status2 "Part-time employed"
label var status3 "Full-time employed"

// No hours data for Norway, assume FT
g ft=empstat==3   if empstat<.
replace ft=1 if emp==1 & did==626
g pt=empstat==2   if empstat<.
replace pt=0 if did==626
end

*************************************************************
 // RUN
*************************************************************
```

```
foreach ccyy in au18 ie16 ca17 uk18 us18 de18 nl18 no16 dk16  fi16 it16 es16 {
use $hhvars using $`ccyy'h, clear

// CREATE POVERTY LINES BEFORE DEFLATION - BASED ON HH DATA
bottop          // note bottop runs setups
povl

**************************
 // Deflate all     income vars, create PPP
**************************
deflate // merges ppp cpi
 // deflate hh vars
foreach var in  ey mi ey_mi dhi hi31 hi311 hi312  hi32 hi33 hi41 hi42 hi421 hi422 hi43 hi44 hi45 hi46 hi47 hi471  hitotal hilabour hifactor
hitransfer hipension hipubsoc hiprivate hxitsc hpublic hpub_i hpub_u hpub_a povl2 povl3 povl2mi ///
 povl3mi hi521 hicapital  other nettax {
 replace `var'= (`var'*(100/cpi)  )
 g `var'ppp=`var'/(ppp)
 }
 // add individual data and deflate
drop if did==. |hid==. |year==.
merge 1:m year did hid using $`ccyy'p, keepusing ($ppvars)  nogen
foreach var in   pitotal pilabour pipension pxitsc ppub_i net1 gross1 {
replace `var'= (`var'*(100/cpi)  )
g `var'ppp=`var'/(ppp)
 }

label var eyppp "Equivalised  income, USD 2017 PPP, £'000s"

// create log of main income vars
g ldhippp=log(dhippp)
g lmippp=log(ey_mippp)

*******************************************
// DEMOGRAPHICS AND POVERTY SHARE
*******************************************
demographics
explanatory
save ${mydata}/m`ccyy', replace
}

// add region
foreach ccyy in  au18 ie16 ca17 uk18 us18 de18  dk16  fi16 it16 es16 {
u    ${mydata}/m`ccyy'    , clear
merge m:1 year did hid using $`ccyy'h, keepusing ($ppvars2)  nogen
save ${mydata}/m`ccyy', replace
}

u ${mydata}/mau18   , clear
foreach ccyy in ie16 ca17 uk18 us18 de18 nl18 no16 dk16  fi16 it16 es16 {
append using ${mydata}/m`ccyy'
}

// region missing NO and NL
replace region_c=1 if did==626|did==658

label define did  107 "US 2000" 229 "US2010" 510 "US 2018" 606 "UK 2000" 240 "UK 2010" 619 "UK 2018"  ///
 121 "DE 2000" 252 "DE 2010" 465 "DE 2016" 123 "IT 2000" 326 "IT 2010" 472 "IT 2016" 447  ///
"ES 2016"      142 "ES 2000" 237 "ES 2010" 124  "NO 2000" 267  "NO 2010" 626 "NO 2016" ///
108 "FI 2000" 255 "FI 2010" 450 "FI 2016"  170 "DK 2000"  278 "DK 2010" 457 "DK 2016" ///
134 "CA 2000"  274 "CA 2010"  484  "CA 2017" 489 "IE 2016"   583  "AU 2018" 619 "UK 2018" 685 "US 2018" 689 "DE 2018" 658 "NL
2018"
label values did   did
tab did
save ${mydata}/working, replace

// some extra vars / labels
u ${mydata}/working, clear
g leyppp=log(eyppp)
label var leyppp "Log equivalised income"
label var povl2ppp "Poverty line (50% median)"

******************
//  KEEP ONLY HOH AND SPOUSE, FAMILIES WITH KIDS
******************
keep if relation>=1000&relation<3000
```

```
// redefine singlemom as single HOH
drop singlemom twoparent
g singlemom=kidsm
g twoparent=kidsc
g couple=twoparent==1
keep if twoparent==1|singlemom==1

**********
// SET SAMPLE
**********
svyset [pw=hwgt] , psu(hid) strata(year)
keep if age>21&age<55
drop if educ==. | age==.
drop if eyppp<0 | eyppp>.
drop if sex==. |sex==3
drop if missing(emp)
drop if depkids==. | partner==.

**********
// Explanatory variables
**********
// create vars to match to male partner
g age3=age2*age
g xpage=age if relation<3000     &(singlemom==1|sex==1)
g xpage2=age2 if relation<3000   &(singlemom==1|sex==1)
g xpage3=age3 if relation<3000     &(singlemom==1|sex==1)
g xped1=ed1 if relation<3000     &(singlemom==1|sex==1)
g xped2=ed2 if relation<3000     &(singlemom==1|sex==1)
g xped3=ed3 if relation<3000     &(singlemom==1|sex==1)
g xpft=ft if relation<3000     &(singlemom==1|sex==1)
g xppt=pt if relation<3000    &(singlemom==1|sex==1)
g xpemp=emp if relation<3000      &(singlemom==1|sex==1)

egen hohage=max(xpage), by(did hid)
egen hohage2=max(xpage2), by(did hid)
egen hohage3=max(xpage3), by(did hid)
egen hohed1=max(xped1), by(did hid)
egen hohed2=max(xped2), by(did hid)
egen hohed3=max(xped3), by(did hid)
egen hohemp=max(xpemp), by(did hid)
egen hohft=max(xpft), by(did hid)
egen hohpt=max(xppt), by(did hid)
drop xpag* xped* xpft xppt

// Predict SM
global X "age age2 age3 ed2 ed3  nch2 nch3 ych5 ych11   i.region_c"
// Income covariates incl work
global Y "age age2 age3 ed2 ed3   nch2 nch3 ych5 ych11  i.region_c ft pt ed1##ft ed2##ft"
// match to male
global Z "hohage hohage2 hohage3 hohed2 hohed3   nch2 nch3 ych5 ych11  i.region_c hohft hohpt   "
// reorder did for graphs  and tables
//  countries in data - au18 ie16 ca17 uk18 us18 de18 nl18 no16 dk16  fi16 it16 es16

replace did=1 if did==510
replace did=2 if did==484
replace did=3 if did==619
replace did=4 if did==489
replace did=5 if did==583
replace did=6 if did==689
replace did=7 if did==658
replace did=8 if did==626
replace did=9 if did==450
replace did=10 if did==457
replace did=11 if did==472
replace did=12 if did==447

label define did 1 "United States" 2 "Canada" 3 "United Kingdom" 4 "Ireland" 5 "Australia " 6 "Germany" 7 "Netherlands"  8 "Norway"   9
"Finland" 10 "Denmark" 11 "Italy" 12 "Spain", add
label values did  did
sort did
**********
** only one member of hh - mothers
**********
********* define hoh sex couples
tab did sex if relation==1000&twoparent==1
```

```
keep if sex==2
save ${mydata}/temp, replace
```

Program 2: Descriptive results (Tables 1 and 2, Figures 2, 4, 5)

```
set scheme  plotplain

u ${mydata}/temp, clear
************
**  TABLE 1 and 2: DESCRIPTIVES
***************
table did  [aw=hwgt], c(mean singlemom )
table did  [aw=hwgt], c(n singlemom )
table did singlemom [aw=hwgt], c(mean emp mean ft mean hohemp mean hohft)
table did singlemom [aw=hwgt], c( mean ageyoch mean nhhmem17 mean age mean hohage)
table did singlemom [aw=hwgt], c(mean hohed1mean hohed2 )

******************
// FIGURE 1 - NESTED DENSITIES
******************
sort did
levelsof did, local(countries)
foreach i of local countries {
u ${mydata}/temp, clear
keep if did==`i'
local t : label (did) `i'

// Set range
qui su eyppp , detail
range xgrid `=r(p1)/2' `=r(p99)*1.1' 199 // sets the points to evaluate density at

// run densities
kdensity eyppp if  did==`i'   [aw=hwgt] ,   at(xgrid) g(f01)
kdensity eyppp if singlemom==1&  did==`i'  [aw=hwgt] ,   at(xgrid) g(f02)
kdensity eyppp if singlemom==0 & did==`i' [aw=hwgt]   ,   at(xgrid) g(f03)

// nest densities - Weight by share of pop.
quietly sum singlemom [w=hwgt], de
generate share=r(mean)
gen f0 = 0
gen scf01 = f01
gen scf02 = f02*share
gen scf03 = f03*(1-share)
replace f0 = f0 + scf02 +scf03 // density for all

label var f0 "All"
label var f01 "All"
label var f02 "Single"
label var f03 "Couple"
label var scf01 "All"
label var scf02 "Single mothers"
label var scf03 "Couples"

su povl2ppp , meanonly
tw line f0 scf02 scf03 xgrid if xgrid<100000,  legend(pos(6) row(1) size(*.5))  title(" `t' ")       xline(`r(mean)')    xtitle("", size(*.5)) ytitle("",
size(*.5))    saving(kd`i'.gph, replace )         lcol(black edkblue emidblue  )       lpattern(l _ -)
cap drop share f0 f01  scf*
}

graph combine kd1.gph kd2.gph kd3.gph kd4.gph kd5.gph kd6.gph kd7.gph kd8.gph kd9.gph kd10.gph kd11.gph kd12.gph   , ycommon
graphexportpdf $mypdf/nestedall , replace

*****************
** FIGURE 4 and 5 single mom income composition
*****************
u ${mydata}/temp, clear
table did [aw=hwgt], c( mean singlemom)

// INCOME AS SHARE OF DISPOSABLE INCOME
// Net earnings
g pilabournet=pilabour-pxitsc
g hilabournet=hilabour-hxitsc
g hiothernet=hilabournet-pilabournet
replace pilabournet=0 if pilabournet<0
replace hilabournet=0 if hilabournet<0
```

```
replace hiothernet=0 if hiothernet<0
label var hilabournet "net household earnings"
label var pilabournet "own earnings, net"
label var hiothernet "other earnings"

// Captial, pension    minus maintenance
g otheri=hicapital+hipension-hi521
replace otheri=0 if otheri<0
label var otheri "other income"
// Maintenance
// hi521

// Public transfers (excl pensions)
replace hpub_i=hpub_i - hi32
replace hpub_u=hpub_u - hi311
replace hpub_a=hpub_a - hi312
replace hpub_a=0 if hpub_a<0
replace hpub_i=0 if hpub_i<0
replace hpub_u=0 if hpub_u<0

g hpub_o=hpublic-hpub_i-hpub_a-hpub_u-hi31-hi32  // other public net of pensions
replace hpub_o=0 if hpub_o<0
label var hpub_o "other public transfers"

g hidisab=hi43+hi44
label var hidisab "illness/disability"
g hiink=hi47-hi471
label var hiink "other in kind"

// Canada other public = tax credits - assume assistance
replace hpub_a=hpub_a+hpub_o

// Figure 4 - Net income, all single mothers
graph pie /* pilabournet hiothernet */ hilabournet hi521  hpub_a hpub_u hpub_i    otheri  if singlemom==1 [aw=hwgt], by(did)  /*
plabel(_all percent) */       legend(pos(6) col(3) size(*.5))
graphexportpdf $mypdf/fig4pie, replace

// Figure 5   - EMPLOYED
graph pie /* pilabournet hiothernet */ hilabournet hi521  hpub_a hpub_u hpub_i    otheri  if singlemom==1&emp==1 [aw=hwgt], by(did)  /*
plabel(_all percent) */       legend(pos(6) col(3) size(*.5))
graphexportpdf $mypdf/fig5pie, replace
```

Program 3: QTE+ Models (Table 3, Figures 1 and 3)

```
u ${mydata}/temp, clear
sort did
levelsof did, local(countries)
// Predict SM
global X "age age2 age3 ed2 ed3  nch2 nch3 ych5 ych11   i.region_c"
// Income covariates incl work
global Y "age age2 age3 ed2 ed3   nch2 nch3 ych5 ych11  i.region_c ft pt ed1##ft ed2##ft"
// Match to male
global Z "hohage hohage2 hohage3 hohed2 hohed3   nch2 nch3 ych5 ych11  i.region_c hohft hohpt   "
```

// Figure 1 – mean effects

```
foreach i of local countries {
u ${mydata}/temp, clear
keep if did==`i'
rifhdreg leyppp singlemom [w=ppopwgt], rif(mean) over(singlemom) ate       vce(robust)
est store raw`i'
rifhdreg leyppp singlemom $X [w=ppopwgt], rif(mean) over(singlemom) ate       vce(robust)               rwlogit($X)
est store X`i'
rifhdreg leyppp singlemom $Y [w=ppopwgt], rif(mean) over(singlemom) ate       vce(robust)               rwlogit($Y)
est store Y`i'
rifhdreg leyppp singlemom $Z [w=ppopwgt], rif(mean) over(singlemom) ate       vce(robust)               rwlogit($Z)
est store Z`i'
   }
foreach i of local countries {
est table raw`i' X`i' Y`i' Z`i', keep(singlemom) b(%7.3f) se(%7.3f)
}
```

```
// Figure 3 - QTE
// Note that sys memory will not hold all results at once - do by country

foreach i of local countries {
u ${mydata}/temp, clear
keep if did==`i'
forvalues j = 5(5)95 {
rifhdreg leyppp singlemom [w=hwgt], rif(q(`j')) over(singlemom) ate       vce(robust)
est store raw`j'
rifhdreg leyppp singlemom $X [w=hwgt], rif(q(`j')) over(singlemom) ate       vce(robust)              rwlogit($X)
est store X`j'
rifhdreg leyppp singlemom $Y [w=hwgt], rif(q(`j')) over(singlemom) ate       vce(robust)              rwlogit($Y)
est store Y`j'
 rifhdreg leyppp singlemom $Z [w=hwgt], rif(q(`j')) over(singlemom) ate       vce(robust)              rwlogit($Z)
est store Z`j'
}
forvalues j = 5(5)95 {
est table raw`j' X`j' Y`j' Z`j', keep(singlemom) b(%7.3f) se(%7.3f)
}
est drop _all
  }

// Table 3 - Gini
u ${mydata}/temp, clear
foreach i of local countries {
rifhdreg eyppp singlemom if did==`i' [w=ppopwgt], rif(gini) over(singlemom) ate       vce(robust)
rifhdreg eyppp singlemom $X if did==`i' [w=ppopwgt], rif(gini) over(singlemom) ate       vce(robust)          rwlogit($X)
rifhdreg eyppp singlemom $Y if did==`i'  [w=ppopwgt], rif(gini) over(singlemom) ate       vce(robust)          rwlogit($Y)
rifhdreg eyppp singlemom $Z if did==`i' [w=ppopwgt], rif(gini) over(singlemom) ate       vce(robust)          rwlogit($Z)
}
```