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**Leo Azzollini, Richard Breen and Brian Nolan**

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# From Gender Equality to Household Earnings Equality: the role of Women's Labour Market Outcomes across OECD Countries

Leo Azzollini[abc], Richard Breen[cd], Brian Nolan[bc]

[a] Leverhulme Centre for Demographic Science [b] Institute for New Economic Thinking and Department of Social Policy and Intervention; [c] Nuffield College; [d] Department of Sociology, University of Oxford

## Abstract

*How does gender equality in the labour market decrease household earnings inequality? Despite being prominent in the research literature on economic inequality, there is no consensus about the mechanisms underlying this relationship. In this paper, we assess the impact that full gender equality in the labour market would have on earnings inequality, and then decompose that impact by closing separately the gender gaps in employment, hours, and pay. We do so by applying a novel approach that combines reweighting and counterfactual analyses to LIS and OECD data for 26 OECD countries, across North America, Europe, and Australia. We find that full equality in earnings and employment between women and men would decrease household earnings inequality considerably. The most substantial decreases come from closing the gender employment gap, as opposed to gender gaps in pay and hours worked. A 10% counterfactual decrease in the gender employment gap (relative to the country baseline) is associated with an average 1.2% decrease in household earnings inequality. This points to reducing the gender employment gap as the pathway through which greater gender equality may most strongly mitigate overall earnings inequality, with the significant implication that two key goals for contemporary societies can be pursued simultaneously.*

## 1 Introduction

How does greater gender equality in the labour market affect the distribution of earnings and incomes among families and households? This question is highly relevant for the evolution of inequality in contemporary societies (Cancian and Schoeni 1998; Schwartz 2010; Breen and Salazar 2011), with

the key roles played by women's labour market outcomes (Goldin 2006; Esping-Andersen 2007; Sudo 2017; Hook and Paek 2020) and union/marriage patterns (Sweeney and Cancian 2004; Albertini, 2008; Kalmijn 2013; Goñalons-Pons and Schwartz 2017) receiving much attention. While the literature was initially ambivalent regarding the relationship between women's increasing role in the labour market and overall inequality (Mincer 1974; Gronau 1982; Burtless 1999) and some studies (such as Karoly and Burtless (1995), Esping-Andersen 2007) have seen rising women's employment as contributing to greater inequality at household level, recent research for the most part suggests that greater gender equality in the labour market has been a powerful equalizing force for the distribution of earnings across households (Pencavel 2006; Schwartz 2010; Harkness 2010, 2013; Kollmeyer 2013; Larrimore 2014; Grotti and Scherer 2016; Kuhn and Ravazzini 2017; Nieuwenhuis, Kolk, and Need 2017; Blundell *et al.* 2018).

However, there is no consensus on the mechanism underpinning this relationship, on the circumstances in which it is likely to hold, or on how the scale of effects can be expected to vary depending on the initial labour market situation of women versus men. Contributions either focus directly on women's earnings as a share of total household earnings (Nieuwenhuis *et al.* 2016), or on some of the components helpfully distinguished by Gronau (1982): employment rates (Pasqua 2008; Kollmeyer 2013; Grotti and Scherer 2016; Sudo 2017), the gender pay gap (Harkness 2010, 2013; Blundell *et al.* 2018), and hours worked (Larrimore 2014; Kuhn and Ravazzini 2017). Although a few studies have considered two of those three components (Harkness 2010, 2013, covers employment rates and pay gap; Kuhn and Ravazzini 2017 includes employment rates and hours), none (that we know) has considered all three: employment rates, hours worked, and the pay of women versus men. Previous studies have not fully disentangled the individual impact of each mechanism on household earnings inequality, or how the scale of effects of each depend on the initial gaps between women and men in each domain. This is a serious gap in understanding the mechanisms at

work and informing policies that might mitigate overall inequality by promoting greater gender equality in the labour market.

We address this gap in two innovative ways. First, we examine how full gender equality in earnings would affect earnings inequality at the country level, considering both households with couples and single-led households. We do so by employing a novel reweighting and counterfactual approach, simultaneously 'closing' the gender gaps in employment, hours worked, and pay. This approach allows us to almost perfectly decompose the full equality counterfactuals into the contributions made by each of these three mechanisms. This allows us to assess their individual as well as joint potential impacts on household earnings inequality. Secondly, we expand the scope of the analysis beyond the countries typically included in studies on this topic (though Kollmeyer 2013, Nieuwanhuis *et al.* 2016 are exceptions using 16 to 18 countries) to cover 26 countries across North America, Europe, and Australia, using data from the Luxembourg Income Study data. This allows us to characterise how the impact of closing these gaps depends on the initial circumstances of women versus men in the labour market, in a way that has not been possible in previous studies.

The substance of our findings is that equalising men's and women's earnings and employment would consistently decrease earnings inequality. Hypothetically closing the three gender gaps simultaneously (full equality) would change earnings inequality by -15% on average across countries, ranging from -29% (Italy) to -4% (Lithuania). By disentangling the contribution of the three mechanisms, the key proves to be the gap in employment levels: if the proportion of women who worked was the same as the proportion of men, overall earnings inequality would hypothetically change by -12% on average across countries. On the other hand, counterfactually closing the gaps in working hours and in hourly pay would have little impact on overall inequality if employment levels were not also altered. Further analysis shows how even more gradual changes can affect inequality: each 10% reduction in the employment gap is associated with a 1.2% reduction in overall inequality

across the 26 countries in our study. Increasing women's employment rates is the key mechanism by which to pursue simultaneously gender equality in the labour market and economic equality at the societal level. We outline our theoretical framework in Section 2, present the data and methods to be employed in Section 3, report the empirical findings in Section 4, and discuss these further and underline their implications in Section 5.

## 2 Theoretical Framework

### *2.1 Impact of Women's Earnings and Employment on Household Earnings Inequality*

The relationship between gender inequality and earnings inequality has most often been studied in a temporal framework: how has increasing gender equality in the labour market affected household earnings inequality? Thurow (1975), Karoly and Burtless (1995), and Esping-Andersen (2007), among others, find increases in women's employment rates and earnings to be associated with increasing inequality at household level, while Treas (1987), Cancian, Gottschalk and Danziger (1993), Cancian and Reed (1999), and Harkness (2010), Kollmeyer (2013), Larrimore (2014), Grotti and Scherer (2016), Kuhn and Ravazzini (2017), Nieuwenhuis, Kolk, and Need (2017) find the opposite. These apparently discrepant findings can be partly explained by differences in the location of the increases in women's employment and earnings. As Mincer (1974) pointed out, their impact on inequality will be determined by the social strata of the women entering the labour market: with the partners of men in upper and lower strata, respectively, increasing and decreasing household inequality. This empirical ambiguity is substantiated by Bergmann *et al.* (1980) and Sudo (2017), who find a curvilinear relationship between women's employment rates and earnings inequality in both the US and Japan.

In a comparative setting, Esping-Andersen (2007) finds that women's increased participation in the labour market increased inequality between the early 1990s and the early 2000s in France, Germany, Italy, Spain, and the United Kingdom. While taking a more nuanced position than some authors, he argued that "All told…, the profile of female labour supply is now more likely to heighten than to

abate inequality. The conditions required for an equalizing effect are quite stringent: namely, maximum, Nordic-type female participation with a fairly symmetric distribution of work intensity across households." (Esping-Andersen, 2007, p. 646). Among these conditions, the earnings correlation among partners is central, with greater economic similarity among them likely to increase earnings inequality (Layard and Zabalza 1979; Gronau 1982). This pattern was found in research on the topic until the late 1990s (Thurow 1975; Karoly and Burtless 1995). Burtless (1999) estimated that the increase in the husband-wife earnings correlation in the US contributed 13% to the overall increase in inequality between the 1970s and 1990s.

Research finding that increases in women's earnings and employment have had an equalizing effect has an equally long history, but has been dominant in the past decades. In an early review, Treas (1987) pointed to nine different studies concurring that the rise in women's earnings decreases earnings inequality (*e.g.*, Mincer 1974; Treas and Walther 1978). Treas (1987) argued that the main driver of the increase in inequality in the US was the increase in the variance of men's earnings and that, in contrast, the increase in women's earnings ameliorated between-group inequality. She showed that the variance of women's earnings is reduced by higher rates of women's employment because of the fall in the share of women who have no earnings. This argument was substantiated by subsequent studies (Cancian, Danziger, and Gottschalk 1993; Cancian and Reed 1999) which showed how the changing earnings patterns of men and women shaped inequality: inequality was increased by the slow growth of the average of men's earnings and by the rapid growth of their variance, and in contrast decreased by the growth in women's average earnings and by their decreasing variance (driven by higher employment rates). While the rising earnings correlation is still envisaged as disequalising, the increase in women's earnings is found to be a powerful equalizing force. If men's earnings had not changed, increases in women's earnings would have reduced inequality in the United States (Blackburn and Bloom 1987; Gottschalk and Danziger 2005) by as much as 15% (Cancian and

Reed 1999). Rising inequality in men's earnings has been the key driver of the overall rise in inequality in the United States, accounting for 80% of it (Daly and Valletta, 2006).

Most research on this issue has focused on the US but several comparative studies (Cancian and Schoeni 1998; Harkness 2010, 2013; Kollmeyer 2013; Grotti and Scherer 2016; Nieuwenhuis, Kolk, and Need 2016) have found a positive relationship between gender equality and equality in the labour market. Mostly relying on the Luxembourg Income Study and focusing up to 18 countries, these studies show that greater gender inequality in the labour market decreases earnings inequality, with the magnitude of the effect varying across countries.

### *2.2 Mechanisms: Gender Gaps in Employment, Pay, and Hours Worked*

While the recent literature agrees that increasing gender equality in the labour market tends to restrain the growth of earnings inequality, the key point of debate is the mechanism underpinning this relationship. Since Gronau (1982), the literature highlights three key mechanisms: "the labour force participation rate of women, the hours they work, and sex-related wage differentials" (p. 121). However, he did not decompose the change into these three components, only noting that "How does a change in married women's labor force participation or a narrowing of the sex-related gap in wages affect inequality? Unfortunately, these questions have no easy analytical answers." (p. 122).

Unsurprisingly, this theoretical ambiguity is reflected in the literature: most studies focus on a single mechanism, typically the employment rate of women (Cancian and Schoeni 1998; Kollmeyer 2013), with few studies examining two mechanisms at the same time (Harkness 2010 focusing on employment rate and pay, Larrimore 2014 and Kuhn and Ravazzini 2017 on employment rate and hours, Blundell *et al.* 2018 on hours and pay). We summarise the key features of recent studies, together with their analytic approaches and mechanisms, in Table 1.

*Table 1 about here*

To the best of our knowledge, no study has yet disentangled the impact of gender gaps in employment rates, pay gaps, and hours worked at the same time. Failing to do so risks conflating the impacts of two or more mechanisms. The ambiguity about the drivers of gender inequality in the labour market is particularly problematic because high employment rates for women and low gender pay gaps tend to go hand-in-hand in Nordic countries (Olivetti and Petrongolo 2016), but there are countries where this does not occur. Mediterranean countries provide an example (Petrongolo and Olivetti 2008): women who would earn low wages in those countries tend not to work at all, thus decreasing the observed gender pay gap. In other words, there may be a direct trade-off between the gender employment gap and the gender pay gap. Therefore, to understand how full equality in labour market outcomes between men and women may affect earnings inequality, we need to disentangle how each of the gaps in employment rates, pay, and hours worked, affects earnings inequality. While studies such as those by Pasqua (2008) and Harkness (2010) have done this for the employment rate and the gender pay gap, the gap in hours has not been incorporated into the analysis.

The main strand in the literature suggests that inequality is mainly shaped by women's employment rates (Maxwell 1990; Cancian and Reed 1999; Esping-Andersen 2007; Pasqua 2008; Harkness 2010, 2013; Kollmeyer 2013, Grotti and Scherer 2016, Nieuwenhuis, Kolk, and Need 2016). This work provides a clear theoretical explanation: when increases in women's employment rates start at the bottom of the socio-economic hierarchy, the variance of women's earnings will decrease. This is driven by the proportion of women that move from being zero-earners to earners, so reducing the variance of women's earnings (Cancian and Reed 1999; Pasqua 2008). In cross-country analyses relying respectively on the European Community Household Panel and the Luxembourg Income Study, Pasqua (2008) and Harkness (2010, 2013) show this through similar counterfactual approaches. Both show how inequality would increase considerably if no women were to work, and that inequality would decrease considerably if all women were to work (Pasqua 2008; Harkness

2010). While these patterns are consistent across countries, they are particularly marked in countries where women's employment is relatively low, such as Greece, Italy, and Spain. Further counterfactuals by Pasqua (2008) shed light on the link between women's employment rates and within-gender inequality: beyond the mathematical effect on the variance, countries with higher female employment rates have less inequality in earnings among women. Relying again on decompositions and counterfactuals, Kollmeyer (2013) and Grotti and Scherer (2016) find that women's employment rates mitigated inequality, with Kollmeyer estimating that a 1% increase in female labour force participation decreases the Gini coefficient by about one-quarter of a percentage point.

In sum, this stream of research clarifies the ambiguity noted by Gronau (1982): a higher employment rate among women increases their mean earnings (Cancian and Reed 1999) but also decreases their variance, by reducing the proportion of zero-earners in the population, with the strongest gains concentrated in the low-female-employment countries (Pasqua 2008; Harkness 2010). These findings make less stringent Esping-Andersen's (2007) conditions for women's employment to decrease inequality: greater female labour market participation would be more beneficial for countries that are less like the Nordic countries, because they have, potentially, the most to gain (in terms of equality) from shifting women from being non-earners to earners. Therefore, we expect that closing the gender gap in employment by matching women's rates to men's will decrease earnings inequality by increasing the mean earnings of women but decreasing their variance.

The second key dimension of gender outcomes in the labour market is the gender gap in pay (Blau and Kahn 2003, 2020; Mandel and Semyonov 2005, Olivetti and Petrongolo 2016). The literature is unclear on what impact closing the gender pay gap should have on household earnings inequality: matching women's pay to men's pay would decrease inequality within the household, but at the same time increase the variance in women's earnings (Gronau 1982) which, all else equal, will cause

inequality between households to grow. It may also strengthen economic homogamy and this would also tend to increase inequality. Theoretically, then, the possible impact of closing the gender gap in pay without altering employment or hours worked is ambiguous. The evidence is similarly mixed. Jantti (1996), focusing on five North American and European countries, finds that changes in gender gaps in pay and hours played the largest role in accounting for changes in inequality across those countries, whereas female labour force participation had the least impact. However, Jantti (1996) did not clearly identify which was the driver: "Which of these, hours or (relative) wages is more likely to account for the changes is a question yet to be addressed." (Jannti 1996, p. 32).

Some studies do find that a lower gender pay gap decreases inequality. Blau and Kahn (1996), using data from the Panel Study of Income Dynamics for the 1975-1987 period, find that the gender pay gap is associated with greater inequality in the overall wage structure. More recently, Blundell et al. (2018) find that increases in women's earnings relative to men's would have decreased inequality in the US and UK, if not for the powerful increase in the male earnings variance. Harkness (2010, 2013) provides evidence against the pay component of this hypothesis: by conducting counterfactuals closing solely the pay gap without altering women's employment rates, she finds that the equalization effects are relatively small, and in some cases inequality is increased.

A third key dimension of gender outcomes in the labour market is the gender gap in hours, which is typically grouped with the gender gaps in employment rates and pay when assessing women's status in the labour market from a cross-national perspective (Olivetti and Petrongolo 2016; Ferragina 2020). This dimension has been less studied in the context of earnings inequality than the gaps in employment and pay (see Gronau 1982; Jantti 1996; Gornick 2004 for exceptions) but it is considered critical by scholars of gender equality in the labour market (Goldin 2006; Landivar 2015).

While the literature on the gender gap in hours and its determinants is considerable, work on its relationship with earnings inequality is scarce (see Kuhn and Ravazzini 2017 for an exception). Gronau (1982) suggests that equalizing the gap in hours would equalize the variance in earnings between men and women, but he does not disentangle the effect from the gap in pay (similarly to Jantti 1996). In a review of studies on women's labour market outcomes relying on the Luxembourg Income Study, Gornick (2004) highlights how the gender hours gap is mostly conflated with the gender pay gap, and that variations in the former come from two sources: a higher incidence of women in part-time work, and a gender gap in hours among full-time workers. Gottschalk and Danziger (2005) suggest that the impact on inequality of changing the distribution of hours will depend on the source of the increase: if it is high-earners who increase their work hours, this will increase inequality; in contrast, an increase in working hours by the low earners may have a neutral or negative effect on inequality. A similar argument comes from Kuhn and Ravazzini (2017), who find that women's increase in hours worked reduced the variance in earnings, thus decreasing earnings inequality in Switzerland.

In summary, the literature on the relationship between the three gender gaps and earnings inequality presents both theoretical ambiguity and mixed results, with no study considering the combined and separate impacts of closing the gender gaps in employment, pay, and hours. In the following section, we outline the data and methods we employ to disentangle them.

# 3 Data and Methods

## *3.1 LIS Data Description, Sample Selection and Variables*

The Luxembourg Income Study is a cross-national dataset of harmonised micro-data on income, collected from about 50 countries and spanning five decades (LIS User Guide 2019). LIS contains information on household and person-level income and earnings from many sources, including

labour, capital, pensions, taxes and transfers. It also includes data on socio-demographics and labour market participation (LIS User Guide 2019). LIS data has been widely used in research on the relationship between demographic dynamics and earnings inequality (Cancian and Schoeni 1998; Harkness 2010, 2013; Kollmeyer 2013; Zagel and Breen 2019) and it is particularly suited to our research questions, given the individual-level data it provides for many different countries. For the purposes of our comparative analysis, we restrict the sample to 26 developed OECD countries. These are Australia, Austria, Belgium, Canada, Switzerland, Czech Republic, Germany, Denmark, Estonia, Spain, Finland, France, Greece, Ireland, Israel, Iceland, Italy, Lithuania, Luxembourg, Netherlands, Norway, Poland, Sweden, Slovakia, United Kingdom, and the United States. The rationale underpinning this choice is that it allows us to significantly extend the analysis geographically beyond what has been done by the few comparative studies on the topic (Cancian and Schoeni 1998; Esping-Andersen 2007; Pasqua 2008; Harkness 2010; Kollmeyer 2013; Zagel and Breen 2019) while retaining a considerable degree of similarity across the countries in the sample. This will allow us to engage in cross-country counterfactuals that will be less problematic than with a sample that included a more heterogeneous set of countries in terms, for instance, of economic development. Our analysis is also relatively synchronous: we rely on the 2016 wave of the LIS, or on the closest year if 2016 is not available.[1] We do not address within-country variation over time as it has been the focus of several papers in the literature (Breen and Andersen 2012; Breen and Salazar 2010, 2011; Burtless 1999; Cancian and Reed 1998, 1999; Goñalons-Pons and Schwartz 2017; Schwartz 2010). We follow common practice and restrict the analysis to the household 'reference person' and their spouse/partner (if any) in the household (Goñalons-Pons and Schwartz 2017), including same-sex partnerships and we focus on those aged 20 to 65 inclusive (Breen and Salazar 2011; Zagel and Breen 2019).

Our sample thus includes four types of respondents aged between 20 and 65: partnered and single women, partnered and single men. Their earnings are equivalized, dividing the individual earnings by the square root of the household family size. We exclude the earnings and incomes of any adult

children or other earners (*e.g.*, siblings of the reference person) in the household. This choice reflects a precise goal: to go beyond analyses that focus solely on couples (Cancian et al. 1993; Cancian and Schoeni 1998; Cancian and Reed 1999; Esping-Andersen 2007) but to account also for the role of the earnings correlation between spouses, something which is overlooked in papers that focus on individual earnings (Blau and Kahn 1996; Mandel and Semyonov 2005). This expands the scope of our counterfactual analyses as much as possible, while retaining the clear focus on the household head/reference person and their partner (if any) (Goñalons-Pons and Schwartz 2017). Breen and Salazar (2010) highlight the importance of extending the analysis beyond partnered individuals, which is crucial to capture the role of growing proportions of single-headed households (Martin 2006; Albertini, 2008; McLanahan and Percheski 2008) as well as the intertwined decisions of union formation, fertility, and labour supply (Uunk, Kalmijn, and Muffels 2005; Ferragina 2020). This selection is highly salient for the results: as noted by Cancian and Reed (1999), the finding by Karoly and Burtless (1995) that higher women's employment rate increases inequality may be a by-product of their sample selection strategy, where they impute a wife with zero earnings in place of a missing partner for a man.

For each individual, we use the following variables from the Luxembourg Income Study: labour earnings (including from self-employment), marital status (combining marriage, any type of civil union, and cohabitation in the same value), relationship to household reference person (self or spouse/partner), self-reported sex, and number of hours worked. We rely on labour earnings (LIS variable 'pilabour') as the key measure of earnings in our analysis; this includes "cash payments and services received from dependent employment, as well as profits/losses and value of goods from self-employment, including own consumption." (LIS User Guide 2019, p.10). In using labour earnings we are following the literature (Goñalons-Pons and Schwartz 2017), as it most directly reflects earnings coming from labour force participation, as opposed to capital earnings, for example. In LIS, *pilabour* is almost always expressed in gross terms, *i.e.* before tax, but there are some exceptions in

which it is net (Chile, Hungary, Slovenia); we exclude these countries from the analysis to maintain consistency. We transform all earnings to 2017 US$ in terms of Purchasing Power Parity (PPP), obtained by dividing the earnings in the nominal currency by the PPPs provided by the Luxembourg Income Study. Furthermore, we follow common practice in the literature in setting negative earnings (likely from self-employment) to 0 and excluding all earnings above the 99$^{th}$ percentile of the within-country distribution.

As regards the proportions of women and men that are employed and not employed, we rely on the LIS variable *emp.* The four proportions (working women, non-working women, working men, non-working men) add up to 1. For work hours we employ *hourstot*, which is expressed as the number of hours worked in a typical week. We then compute the country average of hours worked for both men and women. Hourly pay is computed by dividing the annual earnings of each individual by 52 weeks, and then by the number of weekly worked hours.[2] Five countries (Denmark, France, Norway, Poland, Sweden) do not report *hourstot* in the LIS dataset, and are therefore excluded from the hours and pay counterfactuals.

## *3.2 Analytic Methods and Strategy*

Our main measure of inequality is one of the class of generalized entropy measures, GE(2), otherwise known as half the squared coefficient of variation (HSCV) given by the formula $\frac{\sigma_X^2}{2\mu^2}$, where X is individual earnings, $\mu$ is the mean of $X$, and $\sigma_X^2$ is its variance. Unlike other GE measures such as GE(0) (the mean log deviation) or GE(1) (the Theil index) HSCV can deal with zero earnings and, unlike measures such as the Gini coefficient, it is decomposable among mutually exclusive and exhaustive groups that are not hierarchically ordered on the basis of earnings (Cowell 2000). The coefficient of variation has been widely used in the literature (e.g., Burtless 1999; Cancian *et al.* 1993; Goñalons-Pons and Schwartz 2017).

In our analyses we implement a set of counterfactuals that change (a) the proportion of women who are working; (b) the average hours of work of women who are working; (c) the average wage of women who are working. We reweight our data to simulate these changes and to generate counterfactual datasets, reflecting the changes, from which we can compute household earnings inequality. A simple approach along these lines to narrowing the gender gap in participation, for example, would involve generating a dataset in which, compared with the actual data, we gave more weight to observations of women who worked outside the home and less weight to those who did not. The participation rate of women would be higher in the weighted data. Then we could compute HSCV, or any other measure, from the weighted data and compare it with HSCV from the original data.

The assumption underlying this method is that, were more women to work outside the home, they would have the same distribution of earnings and the same distribution of partners and partner's earnings as women who were, in fact, working. It is unlikely that this would be true if women's participation rates were really to increase. To address this we employ conditional reweighting, whereby we weight observations of women differentially depending on observed characteristics, such as their age and education. The assumption in this case is that, were more women to work outside the home they would have the same distribution of earnings and the same distribution of partners and partner's earnings as women who were, in fact, working and had the same level of education and were of the same age. This assumption seems more plausible, increasingly so as the set of conditioning variables grows richer.

In our analyses we condition on three variables: age (in categories 20-29, 30-39, 40-49, 50-59, 60-65), education (low, medium, and high), and partnership status, distinguishing between whether the woman was the single head of her household or headed a household alongside her partner. The choice

of these variables is dictated by a desire to capture major relevant dimensions, by the limits of what is available in the LIS data, and by sample sizes. Since our conditioning is non-parametric, we use a weight for each of the 30 combinations of age group, education, and partnership status and these must be estimated from the data, as described below. Small numbers in a combination could lead to unstable estimates.

To give an example: to reduce the gap in participation between women and men of the same age, education and partnership status we weight observations of women working outside the home by $\frac{p_{j,k,l}}{q_{j,k,l}}$ where $p_{jkl}$ is the proportion of men working outside the home who are in age group j, educational level k, and partnership status l, and $q_{jkl}$ is the equivalent for women. We weight observation of women who are not working outside the home by $\frac{1-p_{j,k,l}}{1-q_{j,k,l}}$. To reduce the gap by, say, 10%, we calculate

$$p^*_{jkl} = q_{jkl} + (p_{jkl} - q_{jkl})/10$$

and use it in the weights in place of $p_{jkl}$.

Appendix A1 describes our method in detail and shows how we reweight to change not only the gender gap in participation but also the gaps in pay and hours worked. We also explain its relationship to the widely used reweighting method proposed by DiNardo, Fortin and Lemieux (1996), and we present an algorithm that implements our method.

Unlike counterfactual analyses that change the value of a parameter in an inequality measure (such as changing the relative sizes of groups in a measure decomposed into between- and within-group inequality, as in Breen and Salazar 2012 and many other studies) our counterfactuals are changing

the whole distribution of the data. This means that we are not invoking an "all else remaining constant" assumption: on the contrary, reweighting the data to reduce gender gaps can have consequences for other contributions to inequality, notably the distribution of partnered men's earnings and the correlation between the earnings of men and women in couple households. Investigating these changes could be helpful in understanding how changing gender gaps affects inequality, though we do not do this here.

With this "technology" we employ a three-fold strategy to explore how women's labour market outcomes affect inequality, and through which mechanisms. First, we examine the relationship at the surface level: what would, hypothetically, happen to inequality if women were to have the same employment and earnings as men? This can be achieved through what we term full equality counterfactuals: we assess how inequality would change in each country by simultaneously setting the proportion of women working equal to the proportion of men who are working, and setting their average earnings, and their earnings variance to the level of men's. We do this conditionally: that is, we set these parameters for single women household heads to match those of single male household heads and we likewise match the parameters for women in couples to those for men in couples, based also on characteristics such as education and age.

By matching these three parameters at the same time, we may have an empirical answer to the ambiguity pointed out by Mincer (1974) and Gronau (1982): the rise in women's employment and earnings may decrease or increase inequality, depending on whether the mean effect dominates the variance effect. We express the impact on inequality in percentage terms against the baseline: for example, for the US, a decrease from 0.44 to 0.33 in HSCV corresponds to about -17% of the baseline level. Secondly, we turn to the identification of the mechanisms. Following the counterfactual approaches set out above, we can assess how inequality would change in each country by separately

closing the gender gaps in employment, hours, and pay one at a time, without altering the other two. This strategy will show which of the three gaps drives the changes in inequality.[3]

Counterfactuals of this kind are widely used to study the relationship between demographic dynamics and earnings inequality, starting from the approach developed by Lerman and Yithzaki (1985), but they are much less commonly used in comparative studies. They are not understood as predictions or forecasts of what would be expected to happen if the hypothesised changes were made in reality (even supposing these were possible). They are instead widely used to determine whether and how strongly a given change might potentially affect inequality, and we use them for that purpose too, but we also use them to assess the relative importance of the three mechanisms – employment, hours, and wages – that we consider.

The usefulness of counterfactuals as a guide to what might happen in reality depends on the plausibility of the size of the hypothetical changes considered. Closing some or all of the gender gaps is something that would be difficult or impossible to achieve in the short or medium term. For this reason, we engage in further counterfactuals. Instead of closing the gender gaps entirely, we simulate relatively feasible short-term scenarios: we counterfactually reduce the gender gap by 10%, 20%, 33%, 50%, 75%, and 100% (which corresponds to the employment counterfactuals), and assess what happens to inequality. So, the 10% reduction means 10% of the baseline gap, and not ten percentage points, in order to make the change equal in relative terms across different countries. Assuming such a relatively small change in each country seems to us to be even more plausible and provides a better demonstration of how such changes might influence inequality in the real world.

For purposes of robustness, we replicate our results using the Gini Coefficient as our inequality measure. These results are similar to the baseline HSCV results in composition and sign (see Table A5 in the Appendix), but smaller in magnitude: the inequality changes measured by the Gini

Coefficient are around half of those measured by HSCV. This discrepancy is likely driven by changes at the top of the distribution, to which HSCV is more sensitive than Gini.

## 4 Results

Turning now to the results, we focus first on the full equality counterfactuals: how would overall inequality hypothetically change if single and partnered women were to have the same employment levels, mean earnings, and earnings variance as single and partnered men respectively? Figure 1 reports these counterfactual results in percentage terms for each country, relative to its actual value of HSCV.

*Figure 1 about here – Impact on Inequality by Country, Full Equality Counterfactuals*

On average, full equality in earnings and employment levels hypothetically reduce inequality by 15% across the selected countries, ranging from 29% in Italy to 4% in Lithuania. The counterfactual decrease in inequality is substantial, being over 15% in 15 out of the 26 countries in the sample, and over 20% in the Czech Republic, Greece, and Italy. These initial results clearly support the argument that increasing women's employment and earnings would reduce inequality. If the impact of full equality is consistently to decrease overall inequality, how does this come about? Is it through closing the gender gap in employment, in work hours, or in hourly pay that makes the major difference? To assess this, we report in Figures 2-4 the changes in inequality driven by closing the gender gaps in employment, weekly hours worked, and hourly pay.

*Figure 2 about here – Impact on Inequality by Country, by Closing the Gender Employment Gap*

Starting from the employment gap counterfactuals: how would overall inequality hypothetically change if women were to have the same employment levels of men with the same marital status, level of education, and age range in the same country, while keeping hours worked and wage constant? Figure 2 reports these counterfactual results in percentage terms for each country, relative to its actual value of HSCV.

Closing the gender employment gap has a consistently negative cross-country effect, and is substantial in most countries. The average change in HSCV is -12.4%, ranging from -25% in Italy to -2% in Lithuania. Inequality declines by more than 10% in most countries (19 out of 26) and by more than twice that in the Czech Republic, Greece, and Italy. As we shall see, the magnitude of the decrease depends on the extent of the gender employment gap in each country.

*Figure 3 about here – Impact on Inequality by Country, by Closing the Gender Hours Worked Gap*

Secondly, how would inequality change if women were to work the same hours as men with the same socio-demographic characteristics in the same country? We depict the results in Figure 3. The average change is -2.5%, ranging from -6% (Netherlands) to 0% (Lithuania, Luxembourg). For some countries, the counterfactual has not been calculated due to the lack of the hours variable in the LIS dataset. While the results are consistently non-positive, inequality is not strongly affected by closing the gender gap in weekly hours worked.

*Figure 4 about here – Impact on Inequality by Country, by Closing the Gender Hourly Pay Gap*

Third, how would inequality hypothetically change if women were to work at the same hourly pay as co-national men with the same characteristics? As shown in Figure 4, the counterfactual impact is, on average, -2.5%, bounded between -6% (Israel) and 0% (Australia, Ireland, Lithuania). While there are no counterfactual increases in inequality, the impact of closing the gender hourly pay gap is again small.

These counterfactual results clearly identify closing the gender employment gap as the key mechanism for the reduction in inequality, while changing the other two gaps independently does not substantially affect inequality in most countries. However, the structure of our counterfactuals is

linearly additive, allowing us to almost perfectly decompose the Full Equality counterfactuals into the three components, and assess their relative importance in each country. In some cases, the Employment counterfactual corresponds to the Full Equality counterfactual because of the lack of LIS data on hours and wages in certain countries. We report the results in Figure 5.

*Figure 5 about here – Impact on Inequality by Country, Decomposing Full Equality Counterfactuals*

Overall, we can see how the Employment counterfactuals are the largest component of the Full Equality counterfactuals in almost all countries, except for Germany where the Employment and Hours counterfactual inequality changes are around -4%. With this exception, these results further emphasise the centrality of changing the gender employment gap for the overall reduction in inequality. Therefore, we now focus on this counterfactual and investigate it further. More specifically, we assess how inequality would hypothetically change in each country by closing the gender employment gaps for single and for partnered women separately, and by closing the gender employment gap gradually, rather than fully. Furthermore, we assess how the national changes in inequality driven by closing the employment gap are shaped by the different gender gaps.

*Figure 6 about here – Impact on Inequality by Country, by closing the Gender Employment Gap for Singles and Couples separately*

As regards the role of marital status, we depict in Figure 6 the counterfactual changes in inequality by country, stacking the impact of closing the gender employment gaps for singles and couples separately. Note how the sum of the two changes for each country is identical to the changes reported in Figure 1 (*e.g.* Italy, Singles: -3%, Couples: -22%, Overall: -25%). Restricting the employment counterfactual to singles, the average impact on inequality is -2%, ranging from -5% (Denmark) to +1% in Estonia and Lithuania; overall the impact is modest. In contrast, counterfactually closing

employment gaps among partnered women has a much greater effect, ranging from -22% (Italy) to -6% (Finland). In all countries, the counterfactual restricted to couples has a stronger impact than that for singles. The only country in which both counterfactuals are similar is Sweden (Singles: -4%, Couples: -5%). Therefore, closing the gender gap for women in couples provides the strongest contribution to the overall hypothetical decrease in inequality depicted in Figure 2.

*Figure 7 about here – Average Impact on Inequality across Countries, by gradually reducing the Gender Employment Gap*

In the counterfactuals presented so far, we have reported the impact on inequality of closing the three gender gaps completely. While this is useful to assess the relative importance of each of the three gaps, for many countries it is not a feasible real-world goal in the short to medium term. Thus, we now address an additional scenario. In Figure 7, we present the results of counterfactually reducing the gender employment gap not only by 100% as we have done before, but also by 10%, 20%, 33%, 50%, and 75%. These results refer to the average cross-country reduction in earnings inequality.
Figure 7 shows that reducing the gender gap in employment has systematically negative average effects: a reduction of 10% in the gap is associated with a 1.3% average decrease in earnings inequality. Afterwards, the effect is almost perfectly linear: each additional 10% reduction in the gender employment gap decreases earnings inequality by 1.24% on average, reaching 12.4% for the complete reduction. These results suggest that reducing the employment gap, even if not eliminating it completely, can have a substantial impact in reducing overall inequality. We report the results of these gradual changes for each country in Appendix Table A2.

*Figure 8 about here – Sensitivity of Impact on Inequality by Closing Gender Employment Gap, by Gaps*

Lastly, we turn to the cross-national variation in the counterfactual change in inequality driven by closing the gender employment gap. In Figure 8, we depict the marginal effects at the means with 95% confidence intervals, computed after regressing the employment counterfactual inequality change in each country on the three gender gaps (results in Appendix Table A3). Figure 8 shows that the larger the existing gender employment gap, the stronger the equality gains from hypothetically closing that gap.

From these results, it is clear that women's employment levels are central to the relationship between gender equality in the labour market and overall earnings inequality, while gender gaps in working hours and hourly pay play a minor role. Furthermore, we find that inequality is much more sensitive to reductions in the employment gaps among partnered, rather than single, women. Together with the results in Figures 1-7, the results in Figure 8 support our argument that changing the proportion of women (especially partnered) who are working outside the home is a potentially important mechanism for reducing earnings inequality.

## 5 Discussion and Conclusion

How does gender inequality in the labour market affect overall earnings inequality among households? Recent research has leaned heavily towards the conclusion that greater gender equality is associated with lower overall earnings inequality, but has for the most part either omitted certain relevant dimensions of gender inequality from consideration or conflated one or more mechanisms, as well as covering a relatively narrow range of countries. In this paper we have developed and applied a new reweighting and counterfactuals approach that allows us to gauge the hypothetical impact of full equality in earnings and employment, and to almost perfectly decompose it into changes in the three mechanisms that underlie gender inequality in annual earnings – gender differences in employment, in hours worked, and in hourly wages – for overall inequality among households. No previous study has been able to do this in a systematic way or to characterise how the effects of closing these gaps vary depending on the circumstances of women versus men in the labour market.

We have applied these methods to data from 26 OECD countries in the second decade of the 21st century. We find that full equality between men and women in terms of annual earnings would, hypothetically, reduce earnings inequality between households in all of the countries in our analyses, and by an average of 15%. This is in line with the findings of the majority of previous studies (Cancian and Reed 1999; Reed and Cancian, 2001; Gottschalk and Danziger 2005; Harkness 2010; Sudo 2017).

If greater gender equality in the labour market reduces overall earnings inequality, our additional counterfactual results clearly show that the dominant mechanism is eliminating the gender employment gap (which would produce a 12% average reduction in overall inequality), whereas the impacts of eliminating the gender gap in pay and the gender gap in hours worked are much more modest (producing changes of around -2% on average). We find that reducing the employment gap among partnered, rather than single, women is by far the main driver of this effect (90% on average)

Counterfactuals that involve reducing rather than eliminating the gender employment gap, show that, on average, even small reductions can decrease earnings inequality. In a final set of counterfactuals, which represent still more feasible degrees of change, we reduced the gender employment gap gradually. The results again mirror those already described in terms of the relative importance of the different elements: reducing the gender employment gap in each country by 10% would counterfactually reduce overall inequality by about 1.2% on average.

Achieving greater gender equality in employment rates, particularly among partnered women, emerges as the key mechanism to mitigate earnings inequality, while the gender gaps in pay and hours, each taken in isolation, play minor roles. Closing the pay and hours gaps would be beneficial for gender equality *per se*; increasing women's employment rates, and particularly partnered women's employment rates, would, however, simultaneously make a real contribution to improving gender equality and reducing overall earnings inequality.

## Notes

[1] Countries for which data is not related to 2016 are: Australia (2014), Switzerland (2013), Estonia (2013), France (2010, Ireland (2010), Iceland (2010), Japan (2013), Luxembourg (2013), Netherlands (2013), Norway (2010), Sweden (2005), Slovakia (2013).

[2] We do not use the LIS variable weeks as missing values mean the sample size would be reduced considerably. The level of hourly pay is not significantly affected, with the grand mean for hourly pay using 52 weeks being 8.85 with 12.17 SD, while the grand mean from using the weeks variable is 8.83, with 12.94 SD.

[3] In practice, the sum of the three individual mechanism counterfactuals does not always equal the full equality counterfactual, due to variations in the sample size caused by the absence of data on hours worked in some countries. We report the full equality counterfactuals and the sum of the three mechanism counterfactuals in Appendix Table A4, showing how the average discrepancy is 1.27 p.p., ranging from -1.5 p.p. (LU) to 3.7 p.p. (DE). These discrepancies do not hamper the goal of relying on the individual counterfactuals to identify the strongest contributors to the change in inequality.

## References

Albertini, M. (2008). Equalizing or not? The effect of changing household characteristics on income inequality. *European Sociological Review*, *24*(3), 285-298.

Bergmann, B. R., *et al.* (1980). "The Effect of Wives' Labor Force Partcipation on Inequality in the Distribution of Family Income." *The Journal of Human Resources* 15(3): 452-455.

Blackburn, M. L., & Bloom, D. E. (1987). Earnings and income inequality in the United States. *Population and Development Review*, 575-609.

Blau, F. D., and Kahn, L.M. (1996). "Wage structure and gender earnings differentials: an international comparison." *Economica* S29-S62.

Blau, F. D., & Kahn, L. M. (2003). Understanding international differences in the gender pay gap. *Journal of Labor economics*, *21*(1), 106-144.

Blau, F. D., & Kahn, L. M. (2020). *The gender pay gap: Have women gone as far as they can?* (pp. 345-362). Routledge.

Blundell, R., Joyce, R., Keiller, A. N., & Ziliak, J. P. (2018). Income inequality and the labour market in Britain and the US. *Journal of Public Economics*, *162*, 48-62.

Breen, R., and Salazar, L. (2011). "Educational assortative mating and earnings inequality in the United States." *American Journal of Sociology* 117(3): 808-843.

Breen, R., and L. Salazar. "Has increased women's educational attainment led to greater earnings inequality in the United Kingdom? A multivariate decomposition analysis." *European Sociological Review* 26.2 (2010): 143-157.

Breen, R., and Andersen, S.H. (2012). "Educational assortative mating and income inequality in Denmark." *Demography* 49(3): 867-887.

Burtless, G. (1999). Effects of growing wage disparities and changing family composition on the US income distribution. *European Economic Review*, *43*(4-6), 853-865.

Cancian, M., & Reed, D. (1999). The impact of wives' earnings on income inequality: Issues and estimates. *Demography*, *36*(2), 173-184.

Cancian, M., & Schoeni, R. F. (1998). Wives' earnings and the level and distribution of married couples' earnings in developed countries. *Journal of Income Distribution*, *8*(1), 45-61.

Cancian, M., Danziger, S., & Gottschalk, P. (1993). Working wives and family income inequality among married couples. *Uneven tides: Rising inequality in America*, 195-221.

Cowell, F. (2000). "Measurement of inequality." *Handbook of income distribution* 1: 87-166.

Daly, M. C., & Valletta, R. G. (2006). Inequality and poverty in United States: the effects of rising dispersion of men's earnings and changing family behaviour. *Economica*, *73*(289), 75-98.

Danziger, S. (1980). Do working wives increase family income inequality?. *The Journal of Human Resources*, *15*(3), 444-451.

DiNardo, J., Fortin, N. M., & Lemieux, T. (1996). Labor Market Institutions and the Distribution of Wages, 1973-1992: A Semiparametric Approach. *Econometrica*, *64*(5), 1001-1044.

Esping-Andersen, G. (2007). "Sociological explanations of changing income distributions." *American Behavioral Scientist* 50(5): 639-658.

Ferragina, E. (2020). "Family policy and women's employment outcomes in 45 high-income countries: A systematic qualitative review of 238 comparative and national studies." *Social Policy & Administration*.

Goldin, C. (2006). The quiet revolution that transformed women's employment, education, and family. *American Economic Review*, *96*(2), 1-21.

Goñalons-Pons, P. and Schwartz, C.R. (2017). "Trends in economic homogamy: changes in assortative mating or the division of labor in marriage?." *Demography* 54(3): 985-1005.

Gornick, J. C. "Women's economic outcomes, gender inequality and public policy: findings from the Luxembourg Income Study." *Socio-Economic Review* 2.2 (2004): 213-238.

Gottschalk, P., & Danziger, S. (2005). Inequality of wage rates, earnings and family income in the United States, 1975–2002. *Review of Income and Wealth*, *51*(2), 231-254.

Gronau, R. (1982). Inequality of family income: do wives' earnings matter?. *Population and Development Review*, 119-136.

Grotti, R., & Scherer, S. (2016). Does gender equality increase economic inequality? Evidence from five countries. *Research in Social Stratification and Mobility*, *45*, 13-26.

Harkness, S. (2010). *The contribution of women's employment and earnings to household income inequality: a cross-country analysis* (No. 531). LIS Working Paper Series.

Harkness, S. (2013). Women's employment and household income inequality. *Income inequality: Economic disparities and the middle class in affluent countries*, 207-233.

Hook, J. L., & Paek, E. (2020). National family policies and mothers' employment: How earnings inequality shapes policy effects across and within countries. *American Sociological Review*, *85*(3), 381-416.

Jäntti, M. (1996). *Changing inequality in five countries: the role of markets, transfers and taxes*. No. 91. LIS Working Paper Series, Luxembourg.

Kalmijn, M. (2013). The educational gradient in marriage: A comparison of 25 European countries. *Demography*, *50*(4), 1499-1520.

Karoly, L. A., & Burtless, G. (1995). Demographic change, rising earnings inequality, and the distribution of personal well-being, 1959–1989. *Demography*, *32*(3), 379-405.

Kollmeyer, C. (2013). Family structure, female employment, and national income inequality: A cross-national study of 16 western countries. *European Sociological Review*, *29*(4), 816-827.

Kuhn, U., & Ravazzini, L. (2017). The Impact of Female Labour Force Participation on Household Income Inequality in Switzerland. *Schweizerische Zeitschrift für Soziologie/Swiss Journal of Sociology*, *43*(1), 115-135.

Landivar, L. C. (2015). The gender gap in employment hours: do work-hour regulations matter?. *Work, Employment and Society*, *29*(4), 550-570.

Larrimore, J. (2014). Accounting for United States Household Income Inequality Trends: The Changing Importance of Household Structure and Male and Female Labor Earnings Inequality. *Review of Income and Wealth*, *60*(4), 683-701.

Layard, R., & Zabalza, A. (1979). Family income distribution: explanation and policy evaluation. *Journal of Political Economy*, *87*(5, Part 2), S133-S161.

Lerman, R. I., & Yitzhaki, S. (1985). Income inequality effects by income source: A new approach and applications to the United States. *The Review of Economics and Statistics*, 151-156.

Lerman, R. (1996). "The impact of the changing US family structure on child poverty and income inequality." *Economica*, S119-S139.

Mandel, H., and Semyonov, M. (2005). "Family policies, wage structures, and gender gaps: Sources of earnings inequality in 20 countries." *American Sociological Review* 70(6): 949-967.

Martin, M. A. (2006). "Family structure and income inequality in families with children, 1976 to 2000." *Demography* 43(3): 421-445.

Maxwell, N. L. (1990). Changing female labor force participation: Influences on income inequality and distribution. *Social Forces*, *68*(4), 1251-1266.

McLanahan, S., and Percheski, C. (2008). "Family structure and the reproduction of inequalities." *Annu. Rev. Sociol* 34: 257-276.

Mincer, J. (1974). Schooling, Experience, and Earnings. Human Behavior & Social Institutions No. 2.

Nieuwenhuis, R., Van der Kolk, H., & Need, A. (2017). Women's earnings and household inequality in OECD countries, 1973–2013. *Acta Sociologica*, *60*(1), 3-20.

OECD (2015), "Women, work and income inequality", in *In It Together: Why Less Inequality Benefits All,* OECD Publishing, Paris. DOI: https://doi.org./10.1787/9789264235120-8-en

Olivetti, C., and Petrongolo, B. (2017). "The economic consequences of family policies: lessons from a century of legislation in high-income countries." *Journal of Economic Perspectives* 31.1 (2017): 205-30.

Olivetti, C., and Petrongolo, B. (2016). "The evolution of gender gaps in industrialized countries." *Annual Review of Economics* 8: 405-434.

Pasqua, S. (2008). "Wives' Work and Income Distribution in the European Countries." 197-226.

Pencavel, J. (2006). A life cycle perspective on changes in earnings inequality among married men and women. *The Review of Economics and Statistics*, *88*(2), 232-242.

Schwartz, C. R. (2010) "Earnings inequality and the changing association between spouses' earnings." *American Journal of Sociology* 115(5): 1524-1557.

Sudo, N. (2017). "The effects of women's labor force participation: an explanation of changes in household income inequality." *Social Forces* 95(4): 1427-1450.

Sweeney, M. M. & Cancian, M. (2004). The changing importance of white women's economic prospects for assortative mating. *Journal of Marriage and Family*, *66*(4), 1015-1028.

Thurow, L. C. (1975). *Generating inequality*. Basic books.

Treas, J. (1987). The effect of women's labor force participation on the distribution of income in the United States. *Annual Review of Sociology*, *13*(1), 259-288.

Treas, J., and Walther, R. (1978). "Family structure and the distribution of family income." *Social Forces* 56.(3): 866-880.

Uunk, W., Kalmijn, M. and Muffels, R. (2005). "The impact of young children on women's labour supply: a reassessment of institutional effects in Europe." *Acta Sociologica* 48(1): 41-62.

Zagel, H., and Breen, R. (2019). "Family demography and income inequality in West Germany and the United States." *Acta Sociologica* 62(2): 174-192.

**Datasets**

Luxembourg Income Study (LIS) Database, http://www.lisdatacenter.org. Luxembourg: LIS. Accessed in 06.2021-04.2022

## Tables

**Table 1 – Key Features of Selected Relevant Studies**

| Author(s) | Year | Dataset | Geographical Focus | Population Focus | Measure of Inequality | Analytic Approach | Labour Market Dynamic |
|---|---|---|---|---|---|---|---|
| Cancian and Schoeni | 1998 | LIS | 10 countries | couples | Squared CV | Decomposition and Counterfactuals | employment rate |
| Esping-Andersen | 2007 | ECHP, PSID | 8 countries | couples | CV | Decomposition | employment rate |
| Pasqua | 2008 | ECHP | 14 countries | couples+singles | HSCV | Decomposition and Counterfactuals | employment rate |
| Harkness | 2010 | LIS | 17 countries | couples+singles | CV | Decomposition and Counterfactuals | employment rate, pay |
| Kollmeyer | 2013 | LIS | 16 countries | couples+singles | Gini Coefficient | Random Effects Regressions | employment rate |
| Larrimore | 2014 | CPS | US | entire population | Gini Coefficient | Shift-Share | employment rate, hours |
| Grotti and Scherer | 2016 | LIS | 5 countries | couples | Theil Index | Decomposition and Counterfactuals | employment rate |
| Kuhn and Ravazzini | 2017 | SHPS | Switzerland | couples+singles | Theil Index | Decomposition and Counterfactuals | employment rate, hours |
| Nieuwenhuis, Kolk, and Need | 2016 | LIS | 18 countries | couples | Squared CV | Decomposition and Counterfactuals | % earnings of women in household |
| Blundell *et al.* | 2018 | CPS, FES | US, UK | couples+singles, excludes non-earners | Log(Earnings) | Decomposition | hours, pay |

## Figures

**Figure 1 – Impact on Inequality by Country, Full Equality Counterfactuals**

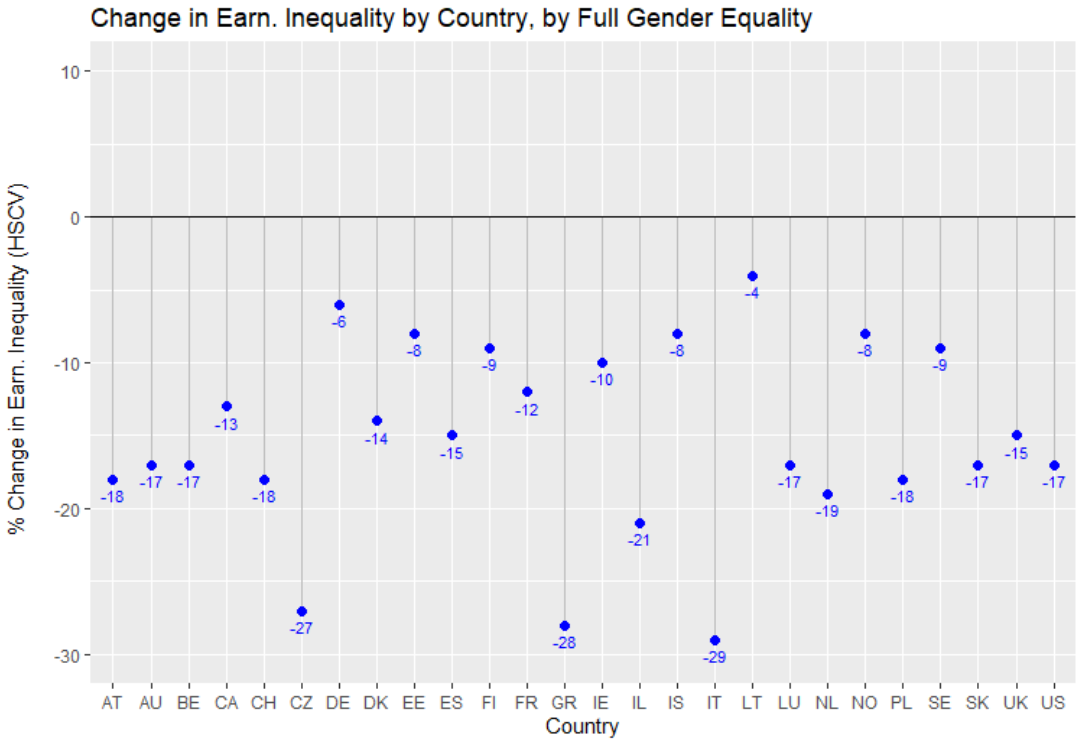



**Figure 2 – Impact on Inequality by Country, by Closing the Gender Employment Gap**

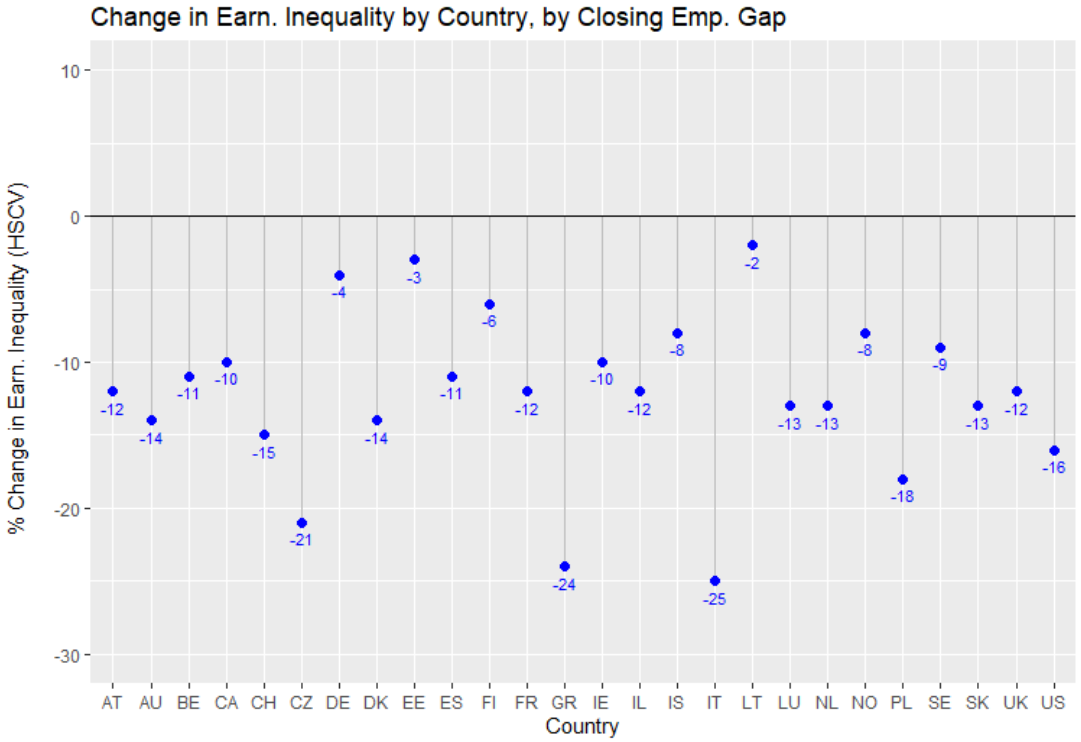


**Figure 3 – Impact on Inequality by Country, by Closing the Gender Hours Gap**

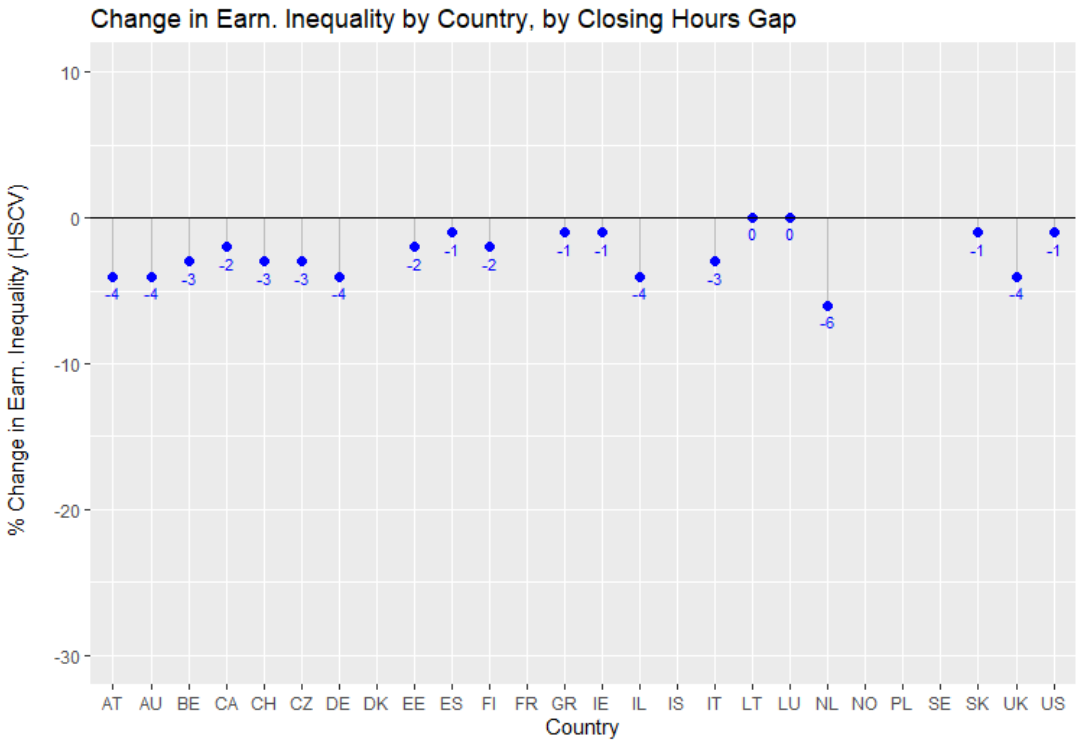



**Figure 4 – Impact on Inequality by Country, by Closing the Gender Hourly Pay Gap**

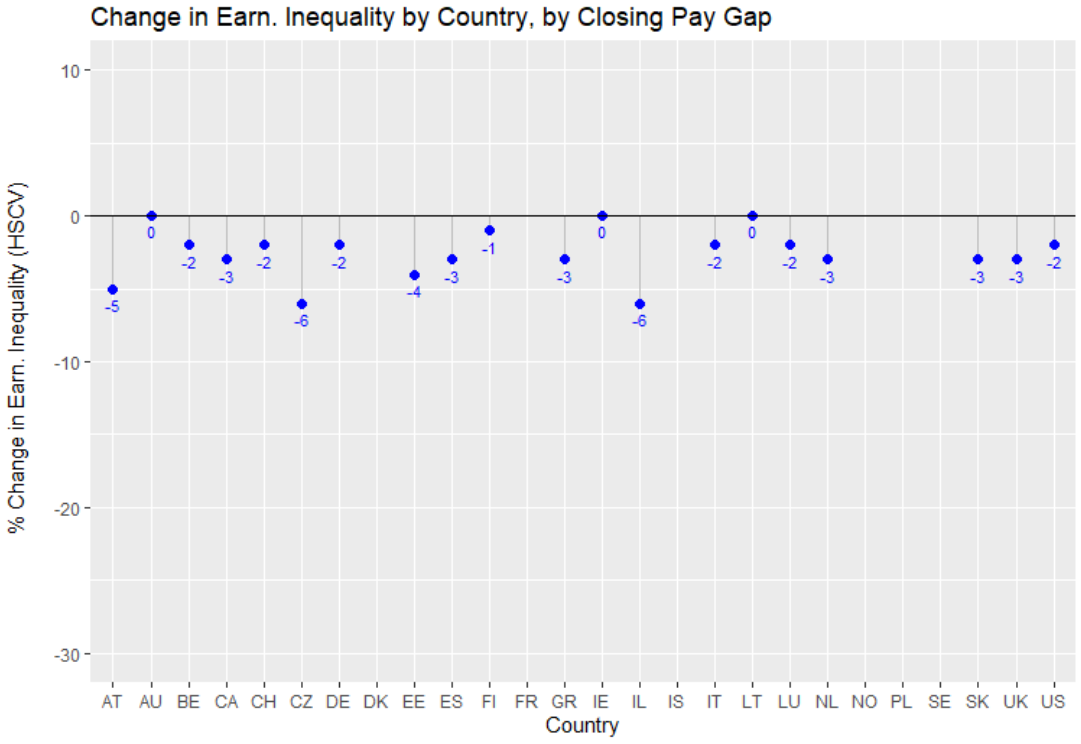


**Figure 5 – Impact on Inequality by Country, Decomposing Full Equality Counterfactuals**

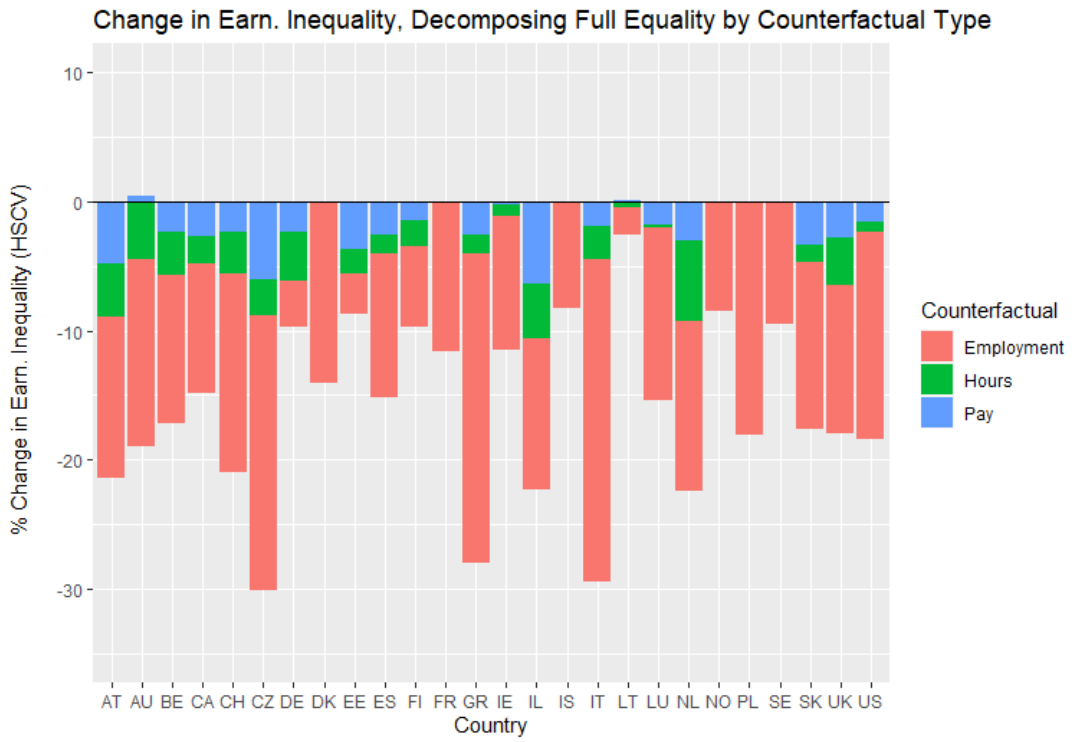



**Figure 6 – Impact on Inequality by Country, by closing the Gender Employment Gap for Singles and Couples separately**

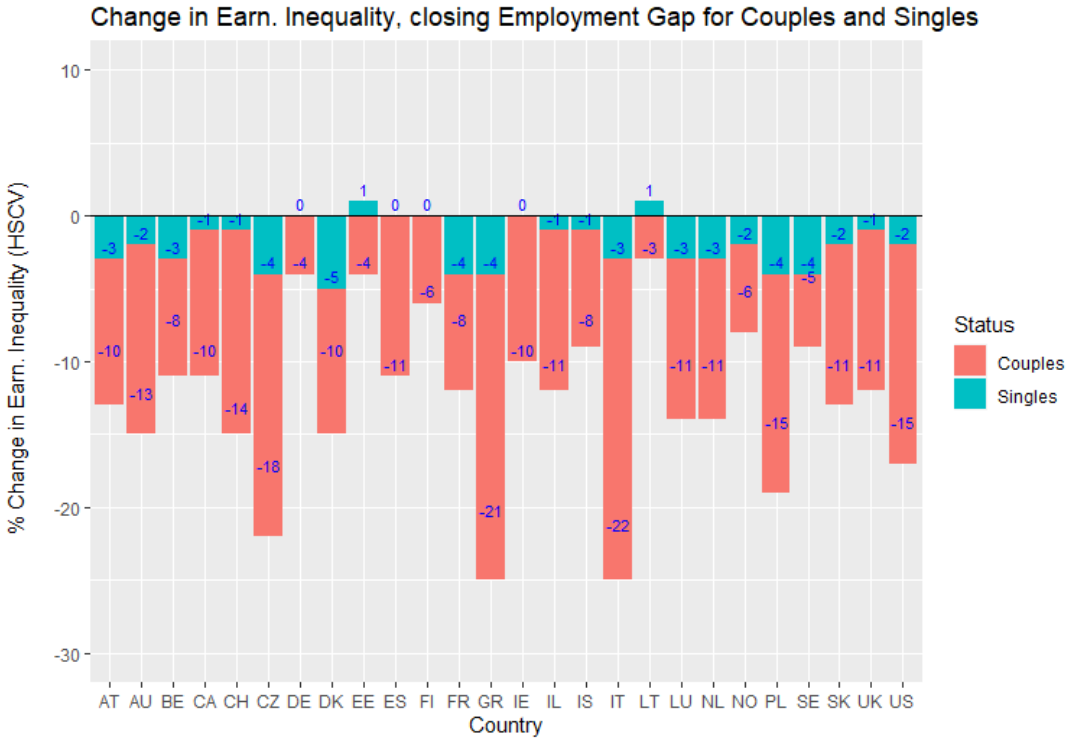


**Figure 7 – Average Impact on Inequality, by gradually reducing Employment Gap**

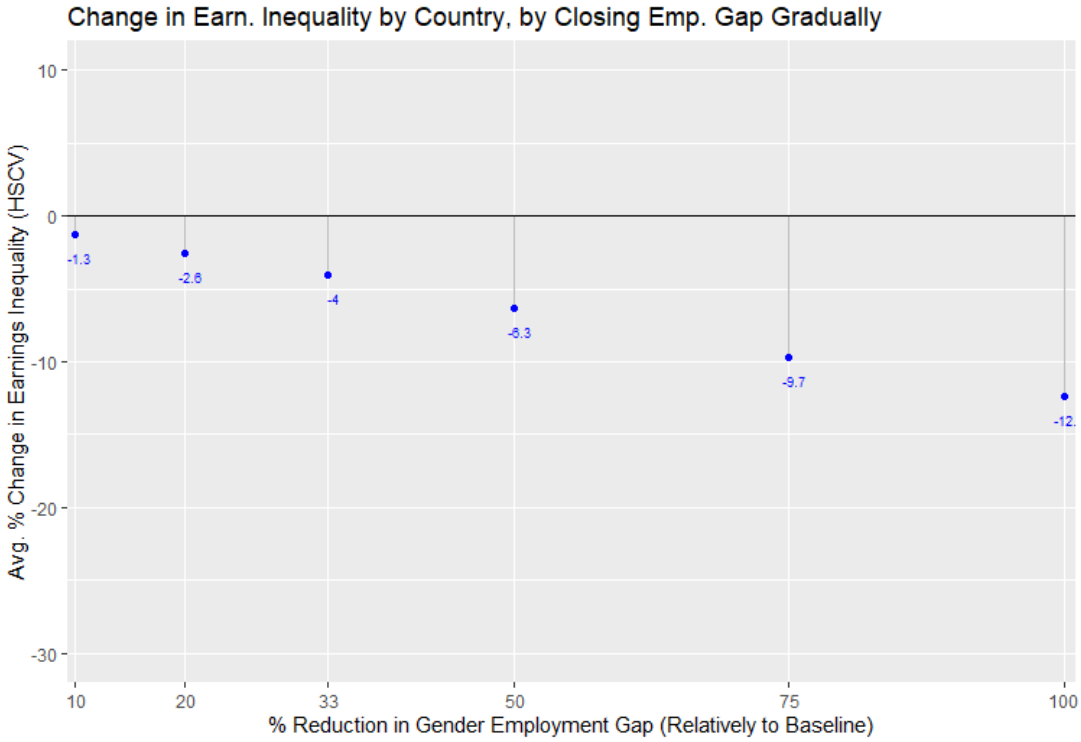
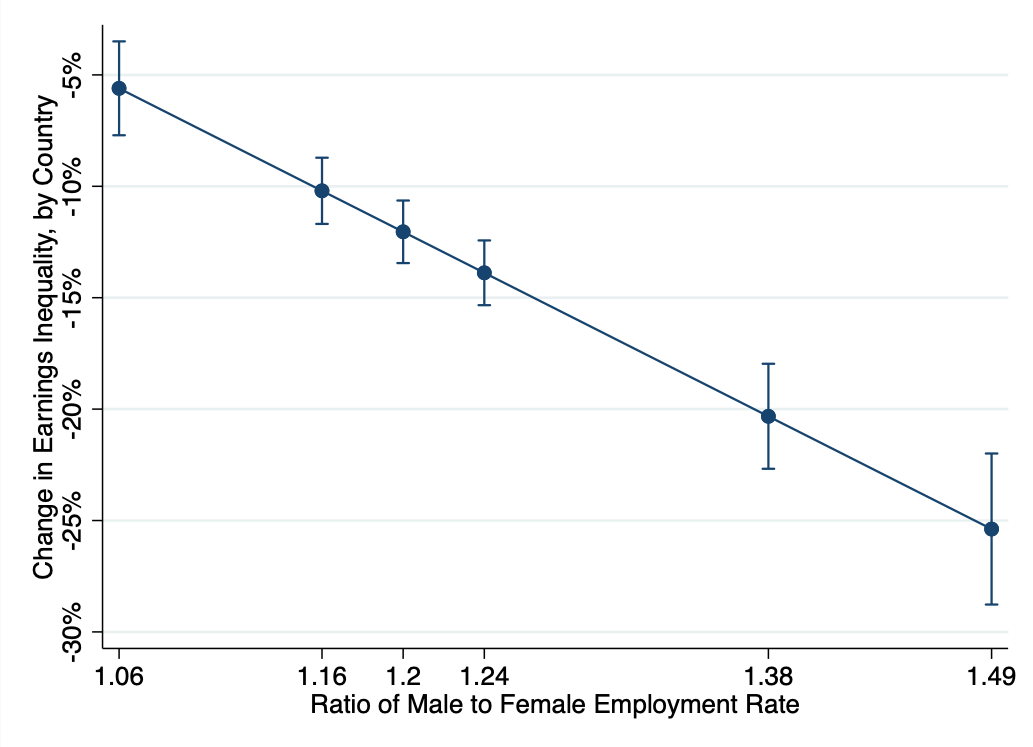



**Figure 8 – Sensitivity of Inequality Change (Employment Counterfactual), to Gender Employment Gap**



# From Gender Equality to Household Earnings Equality: the role of Women's Labour Market Outcomes across OECD Countries

## Appendix/Supplementary Materials

### *APPENDIX A1: Details of our reweighting method*

In general terms our method can be written as follows. Let the distribution of earnings among women be $f(Y)$. We can write this conditional on whether the woman works outside the home ($W = 1$) or not ($W = 0$) and on the values of age, indexed by *j*, education, indexed by *k*, and partnership status, indexed by *l*. We denote these three variables by the vector *X*.

$$f(Y) = \sum_{jklw} f\left(Y \middle| X_{jkl} = x_{jkl}, W = w\right) p(W = w | X_{jkl} = x_{jkl}) p(X_{jkl} = x_{jkl}) \quad \text{(A1)}$$

A counterfactual distribution of $Y$, $Y^*$, based on hypothetically changing the share of women who work outside the home, can be generated by setting the middle term of (A1) to have a different conditional probability distribution, $p^*$

$$f(Y^*) = \sum_{jklw} f\left(Y \middle| X_{jkl} = x_{jkl}, W = w\right) p^*(W = w | X_{jkl} = x_{jkl}) p(X_{jkl} = x_{jkl}) \quad \text{(A2)}$$

Then, using (A1) and (A2) we have

$$f(Y^*) = f(Y) \frac{p^*(W = w | X_{jkl} = x_{jkl})}{p(W = W | X_{jkl} = x_{jkl})} \quad \text{(A3)}$$

That is, counterfactual earnings are equal to observed earnings, reweighted by the ratio of the proportion of women who would be working under probability distribution $p^*$ to the proportion of

women who are actually working based on distribution $p$. In counterfactuals where we set women's participation, conditional on $X$, equal to men's, $p^*$ is the conditional distribution of $W$ for men.

To counterfactually change the hours of women who are working we can write the distribution of women's hours as

$$f(H) = \sum_{jkl} f\left(H \middle| X_{jkl} = x_{jkl}, W = 1\right) p\left(W = 1, X_{jkl} = x_{jkl}\right) \qquad \text{(A4)}$$

Now $W$ is fixed to 1. In this case we want to hypothetically change the distribution of $H$ in the first term on the right side of (A4), so that, for example, working women's hours, conditional on their $X$ values, are the same as the hours of working men who have the same $X$ values. We have the distribution of the counterfactual hours:

$$f(H^*) = f(H) \frac{f^*\left(H|X_{jkl}=x_{jkl}, W=1\right)}{f\left(H|X_{jkl}=x_{jkl}, W=1\right)} \qquad \text{(A5)}$$

In this case, $f^*$ is the conditional distribution of $H$ among men – or, in general, any hypothetical distribution of $H$. The expression for counterfactual wages is derived in a similar way.

Our approach has close links to that of DiNardo *et al.* (1996). The major difference is that DiNardo *et al.* (1996) focus on how changing the distribution of the $X$ variables affects the distribution of income or earnings; this involves reweighting based on the final term of (A1). Applied to our data this would tell us, for example, what the counterfactual distribution of women's earnings would be if women had the same distribution of education as men. This is not a question we pursue.

***Algorithm for modelling counterfactuals via reweighting***

*1 Change the proportion of women who are working*

1.1 Define 5 age groups (20-29, …., 50-59, 60 – 65), three education categories, low, medium, high, and two partnership statuses (a single person heading a household and a couple heading a household) to give 30 groups indexed by j (age), k (education) and l (partnership. Let $p_{jkl}$ be the proportion of single men working in group j,k,l and let $q_{jkl}$ be the same thing for single women.

1.2 Form weights for women defined as $\frac{p_{jkl}}{q_{jkl}}$ for women who are working and $\frac{1-p_{jkl}}{1-q_{jkl}}$ for women who are not working. The weights therefore will vary depending on a woman's own age and education and whether she is working or not. Intuitively we are giving more weight to women who are working and less to those who are not.

1.3 To reduce the gap between men and women by 10%, rather than fully, we calculate

$$p^*_{jkl} = q_{jkl} + (p_{jkl} - q_{jkl})/10$$

then use $p^*_{jkl}$ in place of $p_{jkl}$in step 1.2 above.

1.4 We can repeat this process for women and men in couples. This will generate a full set of weights for all women.

1.5 Use the weighted data to estimate hscv and this will tell us what hscv would be if the proportion of women in each age/education group who were working was the same as the proportion of men in the same age/education group who are working.

1.6 We need to check whether any of the weights are implausibly large or small. This would most likely be the result of small numbers of men or women in one or more of the *j,k,l* groups.

*2 Change the average hours of women who are working*

For women-only households we set the average working hours for women in women-only households who are working equal to the average hours for men in men-only households who are working. But again, we do this for our 30 groups.

2.1 Let $\bar{h}_{jkl}$ be the average hours worked by single men who are working in group j,k,l and let $\bar{g}_{jkl}$ be the same thing for single women.

2.2 Compute the adjusted average hours for the i[th] single working woman in group j,k,l by

$$g^{*}_{ijkl} = g_{ijkl} \times \frac{\bar{h}_{jkl}}{\bar{g}_{jkl}}.$$

2.3 To reduce the hours gap by 10%, rather than fully, we define the adjusted hours as

$$g^{\dagger}_{ijkl} = g_{ijkl}[1 + \frac{\bar{h}_{jkl} - \bar{g}_{jkl}}{10\bar{g}_{jkl}}]$$

2.4 We repeat this process for women and men in couples to generate adjusted hours for women in couples.

2.5 We form a new dataset in which we replace each woman's observed hours with her adjusted hours. Using this new dataset, we calculate hscv and any other statistics we might want such as the correlation of men's and women's earnings, the variance of women' earnings, etc.

*3 Change the average wages of women who are working*

This is the same procedure as in 2 but replacing hours with wage.

## A.2 Supplementary Results and Graphical Materials

**Table A1 – LIS Parameters for HSCV Decomposition**

| Country | Inequality (HSCV), by Counterfactual Type | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Baseline** | **Full** | **Hours** | **Pay** | **Emp. (100%)** | **Emp. (10%)** | **Emp. (20%)** | **Emp. (33%)** | **Emp. (50%)** | **Emp. (75%)** | **Emp. (Couple)** | **Emp. (Singles)** |
| **AT** | **0,42** | 0,35 | 0,41 | 0,40 | 0,37 | 0,42 | 0,41 | 0,40 | 0,40 | 0,38 | 0,38 | 0,41 |
| **AU** | **0,48** | 0,40 | 0,46 | 0,48 | 0,41 | 0,47 | 0,46 | 0,45 | 0,44 | 0,42 | 0,42 | 0,47 |
| **BE** | **0,43** | 0,35 | 0,41 | 0,42 | 0,38 | 0,42 | 0,42 | 0,41 | 0,40 | 0,39 | 0,39 | 0,41 |
| **CA** | **0,50** | 0,44 | 0,49 | 0,49 | 0,45 | 0,50 | 0,49 | 0,49 | 0,48 | 0,46 | 0,45 | 0,50 |
| **CH** | **0,29** | 0,24 | 0,29 | 0,29 | 0,25 | 0,29 | 0,29 | 0,28 | 0,27 | 0,26 | 0,25 | 0,29 |
| **CZ** | **0,41** | 0,30 | 0,39 | 0,38 | 0,32 | 0,40 | 0,39 | 0,38 | 0,36 | 0,34 | 0,33 | 0,39 |
| **DE** | **0,38** | 0,36 | 0,37 | 0,38 | 0,37 | 0,38 | 0,38 | 0,38 | 0,38 | 0,37 | 0,37 | 0,39 |
| **DK** | **0,31** | 0,27 | | | 0,27 | 0,31 | 0,30 | 0,30 | 0,29 | 0,28 | 0,28 | 0,30 |
| **EE** | **0,65** | 0,60 | 0,64 | 0,62 | 0,63 | 0,65 | 0,64 | 0,64 | 0,64 | 0,63 | 0,62 | 0,65 |
| **ES** | **0,58** | 0,50 | 0,58 | 0,57 | 0,52 | 0,58 | 0,57 | 0,56 | 0,55 | 0,53 | 0,52 | 0,58 |
| **FI** | **0,38** | 0,35 | 0,37 | 0,38 | 0,36 | 0,38 | 0,38 | 0,37 | 0,37 | 0,36 | 0,36 | 0,38 |
| **FR** | **0,51** | 0,45 | | | 0,45 | 0,51 | 0,50 | 0,49 | 0,48 | 0,46 | 0,47 | 0,49 |
| **GR** | **0,76** | 0,55 | 0,75 | 0,74 | 0,58 | 0,74 | 0,72 | 0,69 | 0,66 | 0,61 | 0,60 | 0,72 |
| **IE** | **0,72** | 0,65 | 0,72 | 0,72 | 0,65 | 0,72 | 0,71 | 0,70 | 0,69 | 0,66 | 0,65 | 0,72 |
| **IL** | **0,48** | 0,38 | 0,46 | 0,45 | 0,43 | 0,48 | 0,47 | 0,46 | 0,45 | 0,44 | 0,43 | 0,48 |
| **IS** | **0,30** | 0,28 | | | 0,28 | 0,30 | 0,29 | 0,29 | 0,29 | 0,28 | 0,28 | 0,30 |
| **IT** | **0,60** | 0,43 | 0,59 | 0,59 | 0,45 | 0,58 | 0,57 | 0,55 | 0,52 | 0,48 | 0,47 | 0,58 |
| **LT** | **0,60** | 0,57 | 0,59 | 0,60 | 0,58 | 0,59 | 0,59 | 0,59 | 0,59 | 0,59 | 0,57 | 0,60 |
| **LU** | **0,45** | 0,38 | 0,45 | 0,44 | 0,39 | 0,45 | 0,44 | 0,43 | 0,42 | 0,40 | 0,40 | 0,44 |
| **NL** | **0,42** | 0,34 | 0,39 | 0,40 | 0,36 | 0,41 | 0,40 | 0,40 | 0,39 | 0,37 | 0,37 | 0,40 |
| **NO** | **0,30** | 0,28 | | | 0,28 | 0,30 | 0,30 | 0,30 | 0,29 | 0,28 | 0,29 | 0,30 |
| **PL** | **0,69** | 0,56 | | | 0,56 | 0,68 | 0,66 | 0,64 | 0,62 | 0,59 | 0,59 | 0,66 |
| **SE** | **0,33** | 0,30 | | | 0,30 | 0,33 | 0,33 | 0,32 | 0,32 | 0,31 | 0,31 | 0,32 |
| **SK** | **0,49** | 0,41 | 0,49 | 0,48 | 0,43 | 0,49 | 0,48 | 0,47 | 0,46 | 0,44 | 0,44 | 0,48 |
| **UK** | **0,47** | 0,40 | 0,45 | 0,45 | 0,41 | 0,46 | 0,46 | 0,45 | 0,44 | 0,42 | 0,42 | 0,46 |
| **US** | **0,44** | 0,36 | 0,43 | 0,43 | 0,37 | 0,43 | 0,42 | 0,41 | 0,40 | 0,38 | 0,37 | 0,43 |

**Table A2 – Change in Earnings Inequality (HSCV) by Country, by Gradual Reduction of Gender Employment Gap**

| | | Change in HSCV, by Reduction in Emp. Gap | | | | | |
|---|---|---|---|---|---|---|---|
| | Country | 10% | 20% | 33% | 50% | 75% | 100% |
| 1 | AT | -1.31 | -2.6 | -4.31 | -6.41 | -10.1 | -12.49 |
| 2 | AU | -1.53 | -3.03 | -5.01 | -7.44 | -11.68 | -14.43 |
| 3 | BE | -1.2 | -2.39 | -3.96 | -5.89 | -9.27 | -11.46 |
| 4 | CA | -1.04 | -2.07 | -3.43 | -5.11 | -8.07 | -10 |
| 5 | CH | -1.63 | -3.24 | -5.35 | -7.95 | -12.52 | -15.48 |
| 6 | CZ | -2.31 | -4.57 | -7.52 | -11.11 | -17.29 | -21.22 |
| 7 | DE | -0.36 | -0.73 | -1.21 | -1.8 | -2.86 | -3.56 |
| 8 | DK | -1.48 | -2.94 | -4.87 | -7.24 | -11.39 | -14.09 |
| 9 | EE | -0.32 | -0.65 | -1.08 | -1.61 | -2.56 | -3.19 |
| 10 | ES | -1.18 | -2.35 | -3.88 | -5.76 | -9.05 | -11.19 |
| 11 | FI | -0.64 | -1.28 | -2.13 | -3.18 | -5.05 | -6.28 |
| 12 | FR | -1.25 | -2.47 | -4.08 | -6.04 | -9.44 | -11.62 |
| 13 | GR | -2.74 | -5.4 | -8.82 | -12.89 | -19.74 | -23.98 |
| 14 | IE | -1.1 | -2.18 | -3.6 | -5.34 | -8.39 | -10.36 |
| 15 | IL | -1.23 | -2.45 | -4.04 | -6.01 | -9.45 | -11.68 |
| 16 | IS | -0.85 | -1.7 | -2.82 | -4.21 | -6.67 | -8.28 |
| 17 | IT | -2.86 | -5.63 | -9.19 | -13.44 | -20.56 | -24.96 |
| 18 | LT | -0.21 | -0.43 | -0.71 | -1.06 | -1.7 | -2.12 |
| 19 | LU | -1.41 | -2.8 | -4.63 | -6.87 | -10.8 | -13.34 |
| 20 | NL | -1.38 | -2.74 | -4.54 | -6.77 | -10.68 | -13.23 |
| 21 | NO | -0.87 | -1.73 | -2.87 | -4.28 | -6.78 | -8.43 |
| 22 | PL | -1.98 | -3.92 | -6.44 | -9.49 | -14.74 | -18.07 |
| 23 | SE | -0.98 | -1.95 | -3.24 | -4.83 | -7.65 | -9.5 |
| 24 | SK | -1.38 | -2.74 | -4.51 | -6.69 | -10.48 | -12.91 |
| 25 | UK | -1.21 | -2.41 | -3.99 | -5.92 | -9.32 | -11.52 |
| 26 | US | -1.73 | -3.43 | -5.65 | -8.37 | -13.09 | -16.12 |

**Table A3 – Change in Earnings Inequality (HSCV) by Closing Employment Gap, regressed on National Gender Gaps**

| **Independent Variables** | **Dependent Variable** |
|---|---|
| | Delta(HSCV) |
| Ratio of Male to Female Employment Rate | -0.460*** |
| | (0.065) |
| Ratio of Male to Female Weekly Hours Worked | 0.013 |
| | (0.023) |
| Ratio of Male to Female Hourly Pay | 0.021 |
| | (0.076) |
| Constant | 0.393 |
| | (0.131) |
| Observations | 20 |
| Adjusted R-squared | 0.73 |

**Table A4 – Comparison of Full Equality Counterfactuals vs. Sum of Gender Gap Counterfactuals, by Country and Inequality Measure**

| | | HSCV | | | Gini Coefficient | | |
|---|---|---|---|---|---|---|---|
| | Country | Full Equality | C.factuals Sum | Delta | Full Equality | C.factuals Sum | Delta |
| 1 | AT | -18.36% | -21.42% | 3.06% | -9.27% | -9.81% | 0.54% |
| 2 | AU | -17.18% | -18.52% | 1.34% | -8.49% | -8.73% | 0.24% |
| 3 | BE | -16.82% | -17.2% | 0.38% | -7.98% | -7.91% | -0.07% |
| 4 | CA | -13.09% | -14.79% | 1.7% | -5.71% | -5.99% | 0.28% |
| 5 | CH | -18.33% | -21.01% | 2.68% | -10.64% | -11.03% | 0.39% |
| 6 | CZ | -27.34% | -30.06% | 2.72% | -14.45% | -14.98% | 0.53% |
| 7 | DE | -5.98% | -9.69% | 3.71% | -3.49% | -4.53% | 1.04% |
| 8 | DK | -14.09% | | | -7.2% | | |
| 9 | EE | -7.86% | -8.73% | 0.87% | -2.81% | -2.95% | 0.14% |
| 10 | ES | -14.88% | -15.19% | 0.31% | -6.18% | -6.09% | -0.09% |
| 11 | FI | -9.21% | -9.72% | 0.51% | -4.42% | -4.51% | 0.09% |
| 12 | FR | -11.62% | | | -5.54% | | |
| 13 | GR | -27.7% | -27.95% | 0.25% | -11.7% | -11.36% | -0.34% |
| 14 | IE | -10.16% | -11.52% | 1.36% | -4.29% | -4.42% | 0.13% |
| 15 | IL | -20.76% | -22.26% | 1.5% | -9.8% | -9.87% | 0.07% |
| 16 | IS | -8.28% | | | -7.52% | | |
| 17 | IT | -29.29% | -29.43% | 0.14% | -13.47% | -13.13% | -0.34% |
| 18 | LT | -3.56% | -2.43% | -1.13% | -1.34% | -1% | -0.34% |
| 19 | LU | -16.91% | -15.4% | -1.51% | -7.92% | -7.32% | -0.6% |
| 20 | NL | -19.45% | -22.45% | 3% | -9.83% | -10.26% | 0.43% |
| 21 | NO | -8.43% | | | -4.26% | | |
| 22 | PL | -18.07% | | | -8.55% | | |
| 23 | SE | -9.5% | | | -4.87% | | |
| 24 | SK | -17.06% | -17.59% | 0.53% | -8.7% | -8.93% | 0.23% |
| 25 | UK | -15.4% | -17.98% | 2.58% | -7.88% | -8.39% | 0.51% |
| 26 | US | -17.04% | -18.44% | 1.4% | -8.46% | -8.7% | 0.24% |

**Table A5 – Mechanism Contribution to Counterfactual Reduction in Inequality, by Inequality Measure**

| | | HSCV | | | | Gini Coefficient | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Country | Emp. | Hours | Pay | Sum | Emp. | Hours | Pay | Sum |
| 1 | AT | 58.31 | 19.11 | 22.58 | 1 | 60.04 | 20.2 | 19.76 | 1 |
| 2 | AU | 77.91 | 24.19 | -2.1 | 1 | 77.11 | 20.52 | 2.37 | 1 |
| 3 | BE | 66.62 | 20.02 | 13.36 | 1 | 67.66 | 19.52 | 12.82 | 1 |
| 4 | CA | 67.61 | 14.03 | 18.36 | 1 | 74.4 | 11.03 | 14.58 | 1 |
| 5 | CH | 73.69 | 15.03 | 11.28 | 1 | 72.1 | 17.08 | 10.81 | 1 |
| 6 | CZ | 70.58 | 9.27 | 20.15 | 1 | 77.7 | 7.18 | 15.12 | 1 |
| 7 | DE | 36.77 | 39.46 | 23.76 | 1 | 38.04 | 40.34 | 21.62 | 1 |
| 8 | DK | 100 | | | | 100 | | | |
| 9 | EE | 36.5 | 21.34 | 42.16 | 1 | 50.27 | 18.62 | 31.11 | 1 |
| 10 | ES | 73.66 | 9.72 | 16.62 | 1 | 82.3 | 6.73 | 10.97 | 1 |
| 11 | FI | 64.63 | 20.65 | 14.72 | 1 | 67.15 | 18.21 | 14.64 | 1 |
| 12 | FR | 100 | | | | 100 | | | |
| 13 | GR | 85.81 | 5.08 | 9.11 | 1 | 90.28 | 2.67 | 7.05 | 1 |
| 14 | IE | 89.95 | 8.24 | 1.81 | 1 | 91.41 | 7.25 | 1.34 | 1 |
| 15 | IL | 52.46 | 19.07 | 28.47 | 1 | 62.77 | 14.81 | 22.42 | 1 |
| 16 | IS | 100 | | | | 100 | | | |
| 17 | IT | 84.82 | 8.74 | 6.44 | 1 | 90.18 | 5.8 | 4.02 | 1 |
| 18 | LT | 87.16 | 16.63 | -3.8 | 1 | 124.91 | 3.02 | -27.92 | 1 |
| 19 | LU | 86.64 | 1.74 | 11.63 | 1 | 83.85 | 5.11 | 11.04 | 1 |
| 20 | NL | 58.94 | 27.8 | 13.27 | 1 | 62.23 | 25.81 | 11.96 | 1 |
| 21 | NO | 100 | | | | 100 | | | |
| 22 | PL | 100 | | | | 100 | | | |
| 23 | SE | 100 | | | | 100 | | | |
| 24 | SK | 73.44 | 7.4 | 19.16 | 1 | 78.34 | 7.5 | 14.16 | 1 |
| 25 | UK | 64.07 | 20.64 | 15.29 | 1 | 67.11 | 19.82 | 13.07 | 1 |
| 26 | US | 87.39 | 4.18 | 8.43 | 1 | 88.6 | 3.75 | 7.64 | 1 |

**Figure A1 – Impact on Inequality (Gini) by Country, Full Equality Counterfactuals**

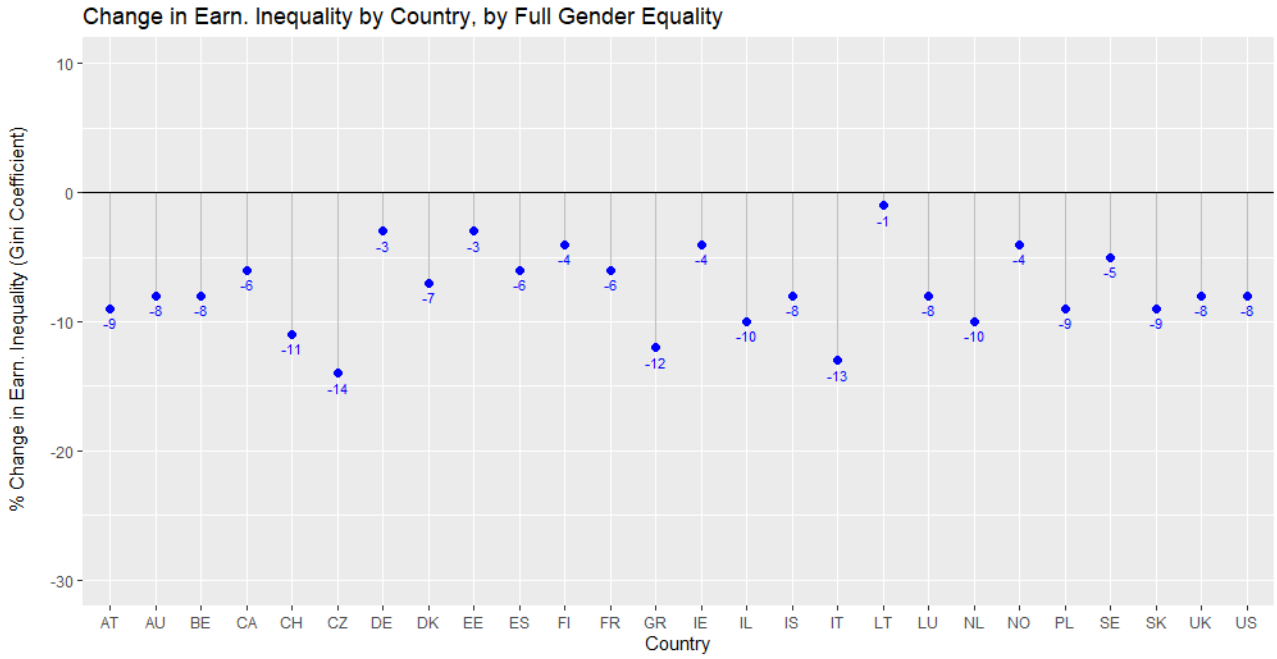



**Figure A2 – Impact on Inequality (Gini) by Country, by Closing the Gender Employment Gap**

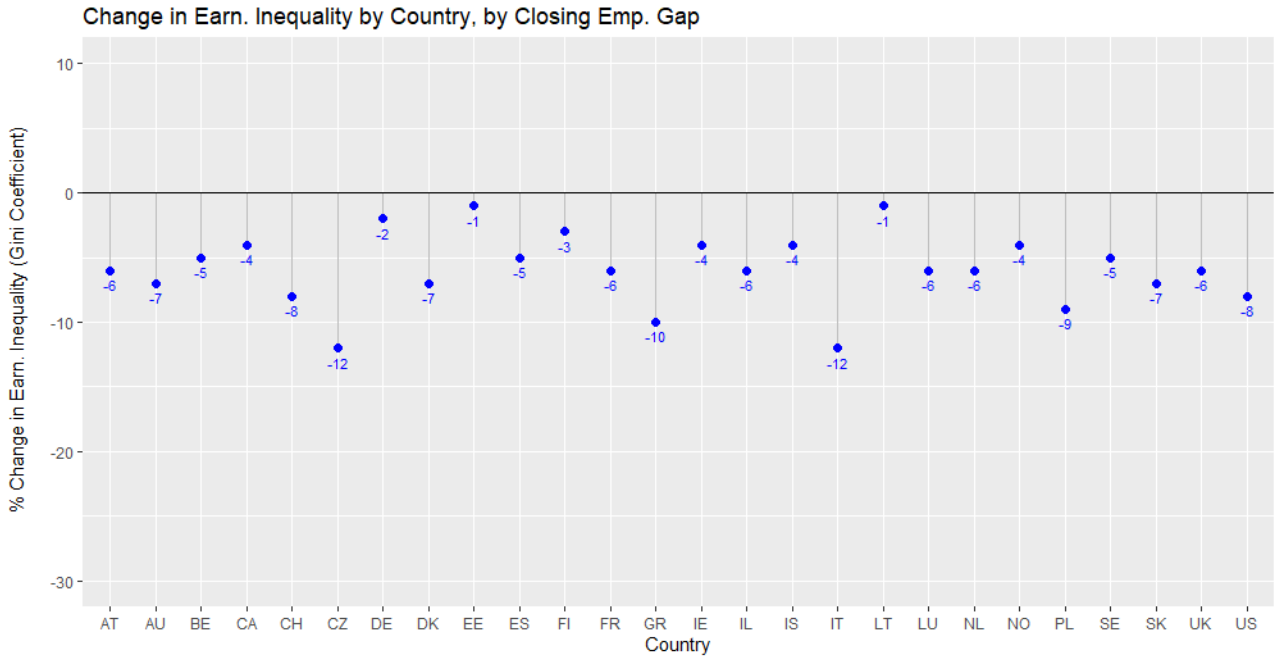



**Figure A3 – Impact on Inequality (Gini) by Country, by Closing the Gender Hours Gap**

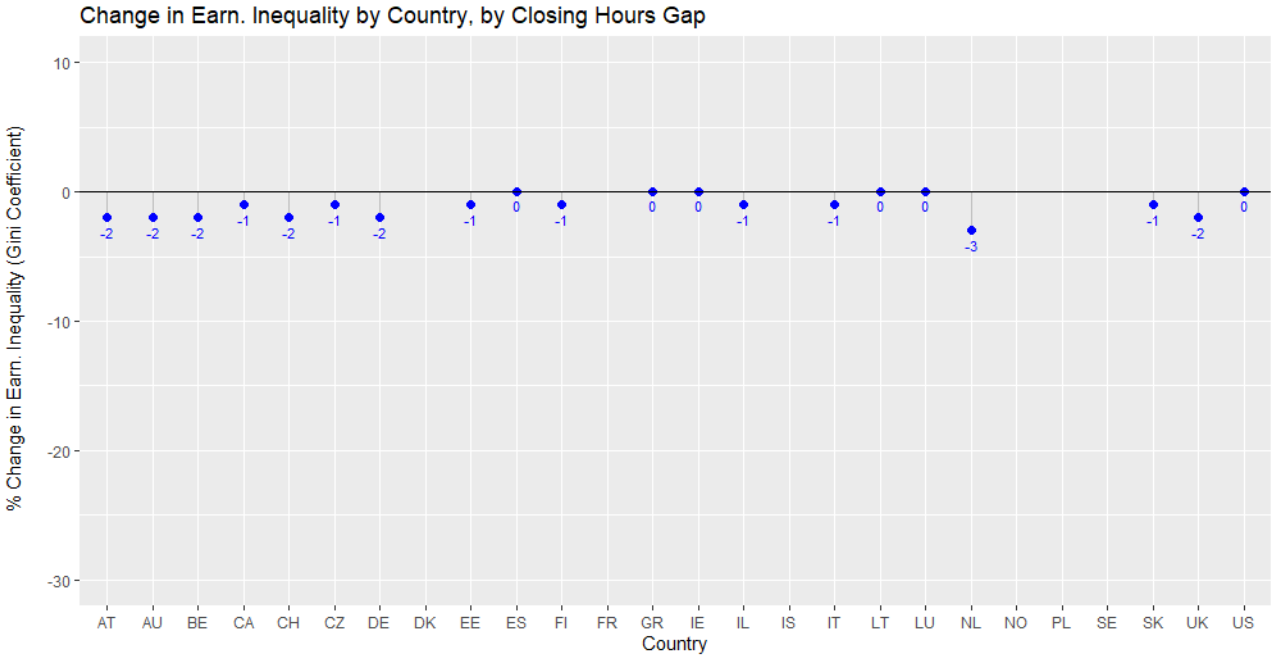



**Figure A4 – Impact on Inequality (Gini) by Country, by Closing the Gender Pay Gap**

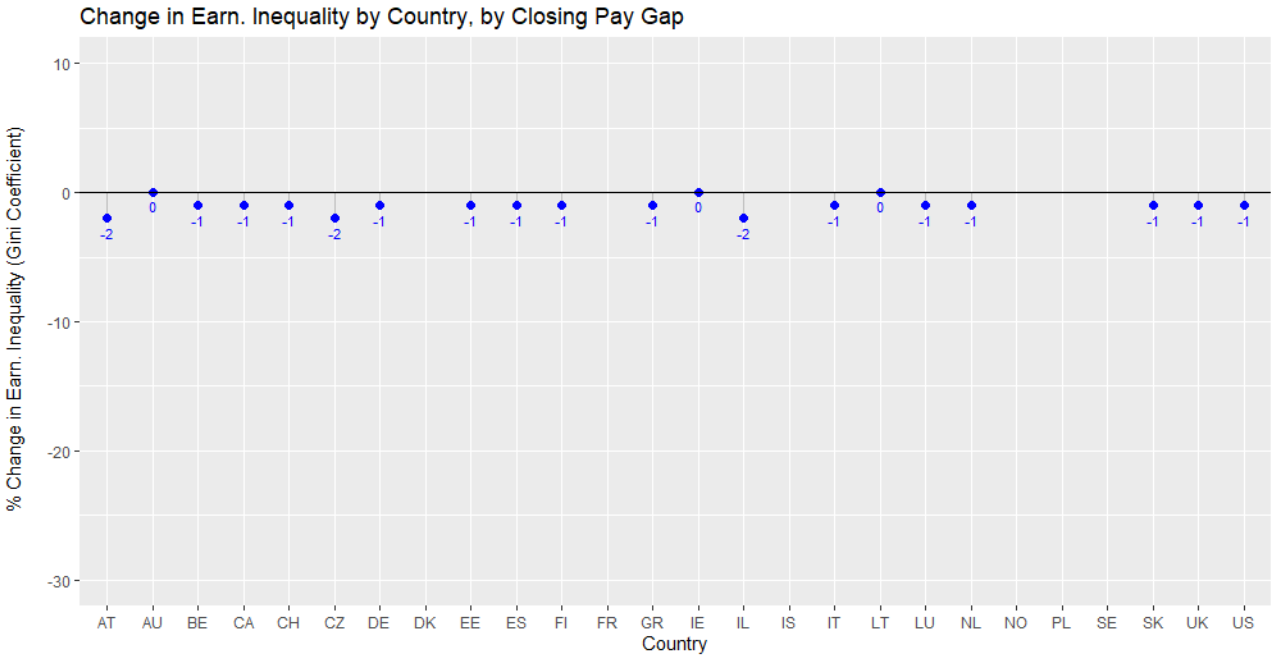


**Figure A5 – Impact on Inequality (Gini) by Country, Decomposing Full Equality Counterfactuals**

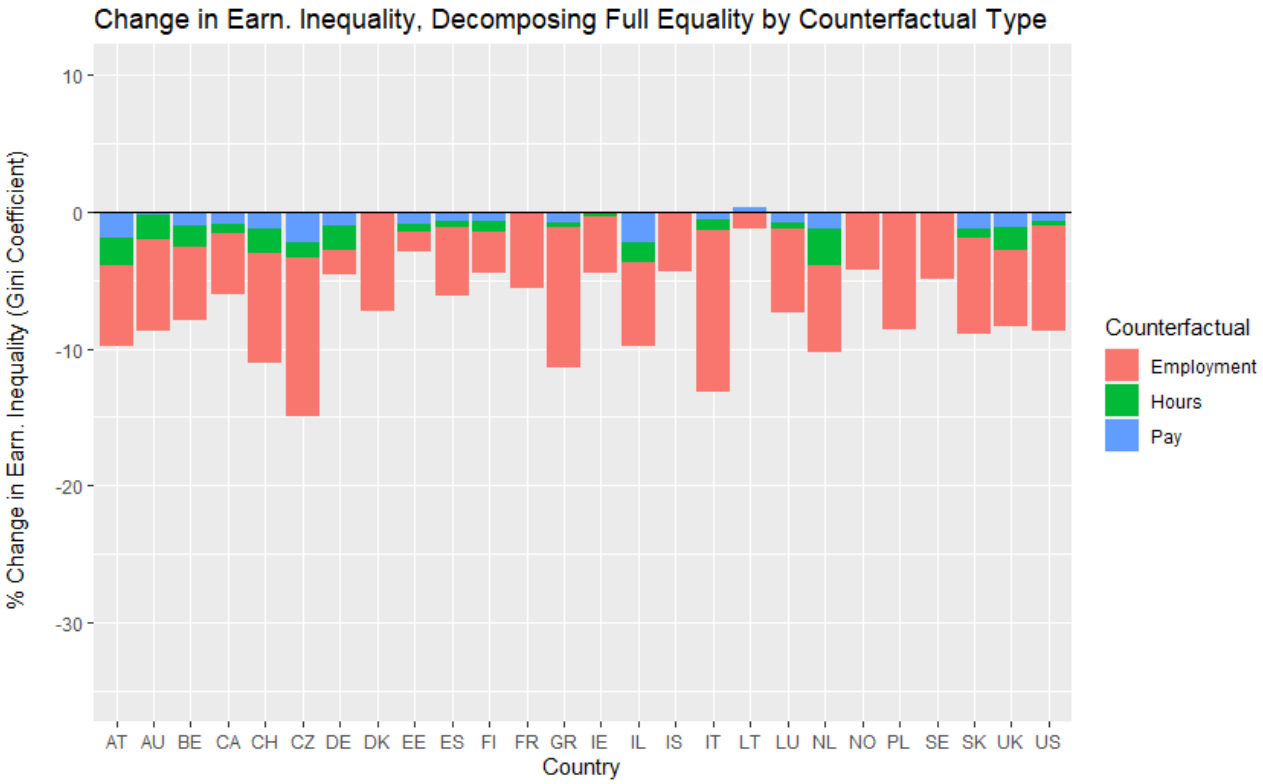



**Figure A6 – Impact on Inequality (Gini) by Country, by closing the Gender Employment Gap for Singles and Couples separately**

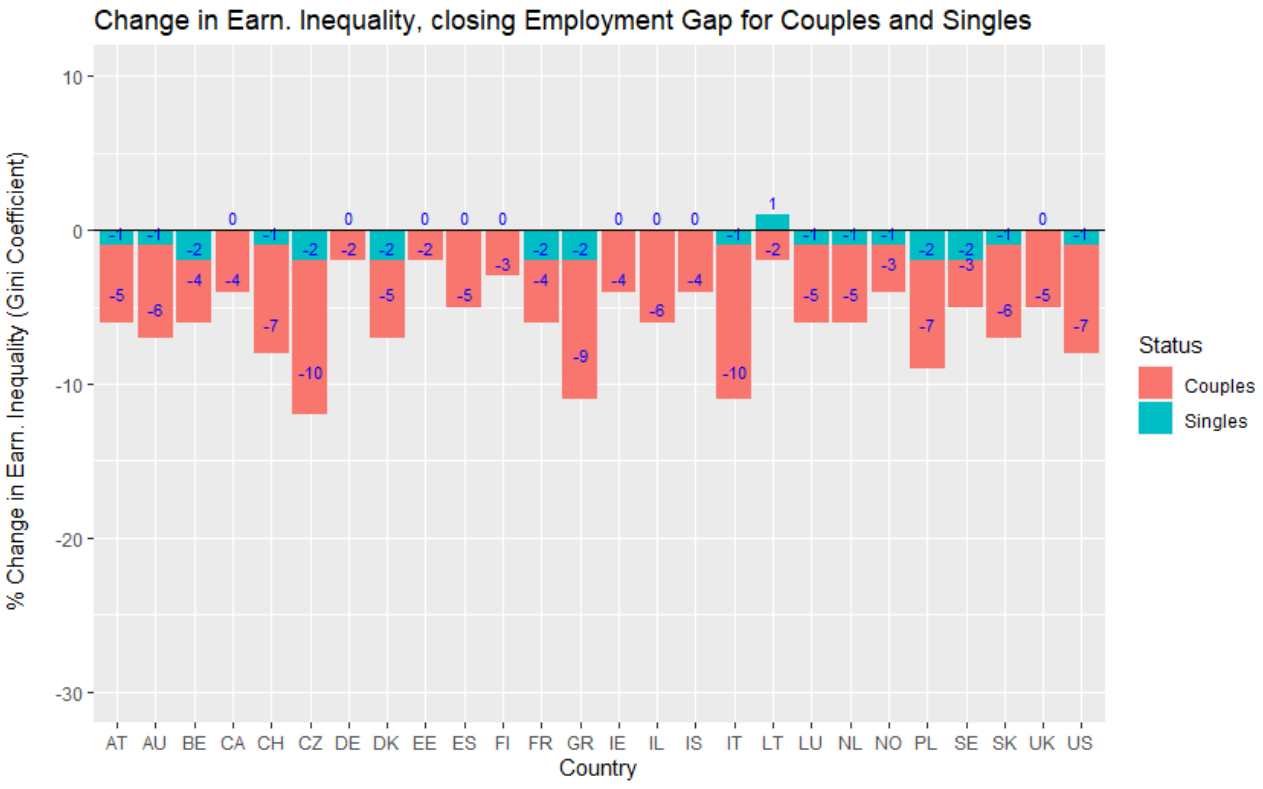


**Figure A7 – Average Impact on Inequality (Gini), by gradually reducing Employment Gap**