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**Couples Division of Paid Work and Rising Home Income
Inequality: A Cross-Country Comparison, 1994-2013.**

Efrat Herzberg-Druker

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**COUPLES DIVISION OF PAID WORK AND RISING INCOME INEQUALITY:
A CROSS-COUNTRY COMPARISON, 1994-2013**

Efrat Herzberg-Druker

Tel-Aviv University
efrather@tauex.tau.ac.il

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ABSTRACT

Scholars remain divided over the association between changes in women's employment patterns and the rise in income inequality in recent decades. Some scholars found that the rise in women's employment has led to a decrease in inequality across households whereas others claimed that women's increased employment has led to increased inequality. By utilizing the Luxembourg Income Study (LIS) dataset and three different counterfactual analyses within cross-country comparative framework approach I examine whether changes in couples' division of paid work (i.e., changes in both spouses' working hours) are associated with increasing income inequality. Moreover, I ask whether the selection of couples into the different types of division of paid work based on their level of education, is the mechanism underlying the growing inequality. Results suggest that the increase in the share of full-time dual-earner households has led to the rising income inequality in most countries investigated. However, although the share of highly educated couples among full-time dual-earner couples has increased, I did not find support to the proposition that selectivity of couples into the different types of division of paid work, based on education level, captures the mechanism behind the association of couples' division of paid work and rising income inequality.

INTRODUCTION

Rising income inequality has taken center-stage in social science research in recent decades. It was explained by different economic and social processes such as changes in institutional and organizational factors (Fortin & Lemieux, 1997; Morris & Western, 1999; Neckerman & Torche, 2007), labor market changes in particular industries (Godechot, 2012; Kristal, 2013; Lin & Tomaskovic-Devey, 2013), changes in occupations (Autor & Dorn, 2013; Mouw & Kalleberg, 2010), and globalization (Harrison et al., 2011; Helpman, 2016; Kurokawa, 2014). Additionally, rising inequality is also explained by new patterns across families and households (Breen & Salazar, 2011; Esping-Andersen, 2007; Gonalons-Pons & Schwartz, 2017; Hyslop, 2001; Kollmeyer, 2013; McCall & Percheski, 2010; Nielsen & Alderson, 1997; Schwartz, 2010; Torche, 2010; Western et al., 2008). Specifically, McCall and Percheski (2010) suggested that in addition to the economic perspective, sociological aspects, especially family-related ones, must be taken into account when examining the rise in income inequality. Esping-Andersen (2007) argues that the rising rates of women's participation in the labor force have also contributed to the growing inequality. This tendency is coupled with an increase in women's educational attainments and consequent changes in their occupational status (McCall & Percheski, 2010).

Previous research has investigated the consequences of women's growing labor market participation for income inequality. The findings, however, have been inconsistent. On the one hand, they suggest that the rise in women's participation in the labor market has led to a decrease in inequality (Albrecht & Albrecht, 2007; Cancian & Reed, 1999; Reed & Cancian, 2001; Western et al., 2008). On the other hand, they suggest that the selective patterns of women's entry into paid employment has intensified income inequality (Esping-Andersen, 2009; Stier &

Lewin, 2002). These studies addressed employment of women as individual units of analysis. More-recent studies focused on the association between assortative mating (based on income or education) and income inequality. The analysis in these studies is based on the couple level however as they fail to establish these associations, they propose considering other factors — such as employment patterns of couples (Boertien & Bouchet-Valat, 2022; Boertien & Permanyer, 2019; Grotti & Scherer, 2016).

A recently published study that examined the extent to which various patterns of the employment and educational composition of households contributed to the rise in income inequality in Israel suggests that considering both these changes can lead to a better understanding of the mechanism underlying the rising income inequality (Herzberg-Druker & Stier, 2019). Building on findings from the Israeli case, and as was suggested considering employment patterns rather than education or income (Boertien & Bouchet-Valat, 2022; Boertien & Permanyer, 2019; Grotti & Scherer, 2016) I argue that understanding changes in the division of paid work within households — i.e., working hours of both spouses among couple-headed households — contributes to the understanding of the rise in income inequality.

Therefore, in this research I contributes to the existing knowledge in three ways: (1) Building on the couple level approach that was previously used in education and income frameworks, I use it in examining employment patterns within couples – i.e, the division of paid work and its effects on the rise in income inequality in order to achieve a better understanding of the rise in income inequality (2) In examining this by means of a cross-country comparison I seek to settle the debate regarding the different contributions of women's employment to income inequality. (3) I investigate education as an explanatory mechanism driving this association. I assess whether there is a selection to engage in full employment based on the education level of

couples, the extent to which these patterns have changed in the time period investigated, and the extent to which these mechanisms underlie the rising income inequality across households.

To empirically test these associations and mechanisms, I utilize LIS (Luxemburg Income Surveys)¹ worldwide data for two different waves (1994~ and 2013~) and 12 different countries. The LIS data are harmonized representative cross-sectional surveys that have been used previously in studies on income inequality (e.g., Boertien & Bouchet-Valat, 2022; Boertien & Permanyer, 2019). I examine, for each country separately, the extent to which the changes observed in the division of paid work of couples have contributed to the rising income inequality by calculating Theil index values, which estimates income inequality. By using standardization and counterfactual analysis, I also test whether changes in levels of couples' education explains the association between changes in couples' division of paid work and income inequality.

The paper is organized as follows: First I describe the mechanisms behind the rise in income inequality and how scholars have tied patterns of women's labor market participation to that rise. Next, I describe the data and methods employed. As I elaborate in the data and methods section, the analysis rests on a decomposed Theil index. By applying three different counterfactual analyses used in prior studies (Boertien & Permanyer, 2019; Breen & Andersen, 2012; Breen & Salazar, 2010; Breen & Salazar, 2011; Grotti & Scherer, 2016; Herzberg-Druker & Stier, 2019; Hu, 2016; Hu & Qian, 2015) I assess the contribution of changes in the division of paid work between couples to explain rising income inequality and identify the role of changing levels of education to the process. My findings indicate that changes in the couples' division of work have contributed to changes in income inequality, however the changes couples' education level does not serve as the explanatory mechanism behind this association.

¹ Luxemburg Income Surveys (LIS) Database, <http://www.lisdatacenter.org> (multiple countries; March 2018 – April 2022). Luxembourg: LIS.

WOMEN'S PARTICIPATION IN THE LABOR MARKET AND INCOME INEQUALITY

Scholars have increasingly addressing changing family patterns in seeking to better understand the rise in income inequality. One strand of research stresses the association of inter-spousal earnings (Boertien & Bouchet-Valat, 2022; Gonalons-Pons et al., 2021; Gonalons-Pons & Schwartz, 2017; Grotti & Scherer, 2016; Hyslop, 2001; Nieuwenhuis et al., 2017; Schwartz, 2010; Shen, 2021). And yet, although earnings strongly correlate with employment patterns, the gender wage gap remains; women's income has therefore been found not to be a consistently accurate proxy for the effort and time invested by women in the labor market. Scholars have consequently focused on employment patterns as a factor in rising income inequality.

In recent decades, women's labor market participation has increased, and women's employment patterns have become more diverse than are men's patterns (Steiber & Haas, 2012). Hence, most previous studies have looked at the relation between women's employment and income inequality. Inconsistent findings have nonetheless emerged. Some research suggests that the changes in women's employment, especially among married women, have had an equalizing effect on income inequality. The increase in female earnings as part of household income was found to contribute to the rise in family income, especially at the bottom of the income distribution, as well as to a reduction in income inequality (Cancian & Reed, 1999; Reed & Cancian, 2001). For example, Albrecht and Albrecht (2007) reported that increased female employment resulted in lower levels of inequality, and Western et al. (2008) found that women's labor force participation had an equalizing effect on income among families with children. In addition, a few recent studies have also suggested that increased female employment has an equalizing effect as well (Grotti & Scherer, 2016; Kollmeyer, 2013; Nieuwenhuis et al., 2017). Sudo (2017), who investigated the Japanese case, suggested a non-linear effect: an increase in

women's labor force participation has a temporary impact on broadening household income inequality. In the long run, however, it leads to a decline in inequality levels.

In contrast, other studies suggest that women's participation in the labor market contributes more to couple income in households belonging to the higher quintiles of income distribution; women's employment is therefore expected to increase income inequality (Esping-Andersen, 2009). Stier and Lewin (2002) found that women's employment in Israel contributes to the generally high poverty level because women expecting potentially higher wages are more likely to enter the labor force than are women with lower potential wages). It thus appears that once women acquire jobs paying higher wages, a country's income distribution changes, median household income rises, and a greater number of lower-income households subsequently fall below the poverty line (Stier & Lewin, 2002). Overall, the inconsistent findings indicate that the effect of changes in women's labor force participation on income inequality should be examined further. A more consistent examination of this relationship and its underlying is therefore needed. This is what I set out to do in this paper.

An additional body of literature focuses on the contribution of educational assortative mating to the rising income inequality. However, these studies have found only a negligible impact of changes in the educational homogamy of spouses (Boertien & Permyer, 2019; Breen & Andersen, 2012; Breen & Salazar, 2010, 2011; Greenwood et al., 2014). An exception to those findings is a study exploring the effect of joint changes in education and employment of households, as contributing to the understanding of income inequality in Israel (Herzberg-Druker & Stier, 2019). These findings suggest that 'who marries whom' (assortative mating) has less explanatory power than the specific division of paid labor of household heads in conjunction with marital matching based on education. Thus, in this paper I will further study couples

division of paid work, its contribution to the rising income inequality and the extent to which education is a mechanism underlying the selection of couples to different types of division of paid work.

Lacunae in the existing literature can be identified in three major areas. First, the inconsistent findings on the relationship between women's employment and income inequality calls for extending the examination to different contexts. I begin to fill this void by investigating whether and how changes in couples' division of paid work have contributed to the rising income inequality level from a comparative perspective. Second, most previous research examines women's participation in the labor market and applies a primarily dichotomist perspective: participation versus non-participation. However, research dealing with gender inequality in the labor market suggests that variations in the number of working hours are crucial to understanding inequalities (Cha, 2013; Cha & Weeden, 2014; Mandel & Semyonov, 2014). Following these previous research, I examine the level of women's labor market participation but also address the division of paid labor among couples. Lastly, previous research has neglected selection to the labor market as the mechanism driving the association of income inequality and women's employment. I fill this gap by considering educational attainment and the extent to which it acts as such a mechanism

METHOD AND DATA

Analytic Strategy

Measuring inequality

The question of how to measure income inequality has been extensively discussed, with different ways proposed to measure its various aspects. The use of the Theil Index has been well-established in the literature on the relationship between family patterns and inequality (Boertien & Permanyer, 2019; Breen & Andersen, 2012; Breen & Salazar, 2010, 2011; Herzberg-Druker & Stier, 2019). The Theil Index is a useful measure of inequality for two reasons. First, it measures overall inequality—unlike, for example, the P90/P10 ratio, which compares earnings of households located in the 90th percentile of the income distribution with those located in the 10th percentile. Second, it is a decomposable index (unlike, for example, the Gini coefficient), which enables researchers to detect changes in inequality between and within specific groups, with the latter feature essential for addressing the association between inequality and the different types of couples based on the division of paid work.

The analyses include an examination of the relation of the Theil Index to couples' division of paid work. This approach is more dynamic than one relying on a comparison of inequality across predetermined groups only. The Theil Index allows us to take into account inequality between and within the different types of couples, as well as calculate the inequality level overall (Bourguignon, 1979; Breen & Salazar, 2011). The Theil Index is calculated according to the following equation:

$$(1) \quad T = \frac{1}{n} \sum_{i=1}^n \frac{x_i}{\bar{x}} \ln \left[\frac{x_i}{\bar{x}} \right]$$

In Equation 1, x_i denotes the i^{th} household income and \bar{x} mean income. This calculation is the average of the ratio between household income and mean income, multiplied by the log of the same ratio. The Theil value for inequality within the j^{th} group (T_j) is defined as follows:

$$(2) \quad T_{j=1} = \frac{1}{n_j} \sum_{i=1}^{n_j} \frac{x_{ij}}{\bar{x}_j} \ln \left[\frac{x_{ij}}{\bar{x}_j} \right]$$

In Equation 2, x_{ij} denotes the i^{th} household income in group j , n_j the number of cases in group j , and \bar{x}_j the mean income of group j . Equation 3 shows the decomposition of the Theil Index into between-group and within-group components:

$$(3) \quad T = \sum_j P_j \frac{\bar{x}_j}{\bar{x}} \ln \left[\frac{\bar{x}_j}{\bar{x}} \right] + \sum_j P_j \frac{\bar{x}_j}{\bar{x}} T_j$$

Groups are defined on the basis of the different types of couples' division of paid work, indexed as j , so that \bar{x}_j denotes mean income in group j , P_j the proportion of each group j in the sample, and \bar{x} the sample's overall mean income. The term T_j represents the Theil value for inequality within the j^{th} group as calculated according to Equation 2. Use of the between-group and within-group inequality components of the Theil index enables estimation of the extent to which different types of couples based on the division of paid work contribute to income inequality.

Examining the association between employment and income inequality: Counterfactual analyses

The contribution of the changes in the types of couples based on the division of paid work to the rise in income inequality is best estimated by counterfactual analysis. I used three different approaches of this analysis. The first has been commonly employed by most scholars in this field (Boertien & Permanyer, 2019; Breen & Andersen, 2012; Breen & Salazar, 2010, 2011; Grotti & Scherer, 2016; Herzberg-Druker & Stier, 2019), and served here as the main analytic tool. In order to triangulate the findings, two additional counterfactual analysis approaches were used. In the *first*, main approach, the level of income inequality is estimated with the previous (1994) values of two of the three components belonging to the Theil Index held constant and the third is set at its later (2013) value. This method makes it possible to answer the question of what would have

happened if only one component (couples' division of paid work) changed while the two others (income of couples and inequality within couples) remained at their 1994 values. Such an estimation yields an accurate measure of change over time. In the following I demonstrate the counterfactual approach by means of Equation 4.

In Equation 4, below, only p_j (proportion of groups) takes its later value (that for 2013), written as Subscript 2. Subscript 1 indicates the earlier period (1994). Equation 4 calculates the level of inequality in 2013 as if nothing had changed other than the groups' proportions, based on couples' division of work. In this counterfactual, I ask what would have happened to income inequality if changes had occurred only in the couples' division of paid work between the two points in time.

$$(4) \quad T = \sum_j p_{2j} \frac{\bar{x}_{1j}}{\sum_j x_{1j} p_{2j}} \ln \left[\frac{\bar{x}_{1j}}{\sum_j x_{1j} p_{2j}} \right] + \sum_j p_{2j} \frac{\bar{x}_{1j}}{\sum_j x_{1j} p_{2j}} T_{1j}$$

This equation addresses the study's main question: does changes in couples division of paid work have effected changes in income inequality. Because p_j represents the proportion of all couples in the j^{th} type, changes in the p_j values reflect the changing distribution of couples across the defined types of couples. By doing so, the contribution of these changes to income inequality can be estimated.

The *second* counterfactual approach, proposed by Hu (2016), allows comparing the actual level of income inequality in 2013 with the counterfactual level under the condition that the proportion of groups did not change since 1994 but the other components (mean income and Theil within-group value) have changed. This version was employed to investigate what would the income-inequality level have been in 2013 had the proportions of groups had remained at their 1994 value. This counterfactual approach, contrary to the first one, attempts to examine each country in 2013 while taking into account what would have happened in terms of groups' mean

income and within-group inequality and asks what the income-inequality level would have been had the level of couples' division of paid work remained at its 1994 value.

The *third* approach involves cumulative counterfactual decomposition. It allows estimating the contribution of all three Theil Index components (groups' mean income, within-group inequality, and proportion of groups) to the rise in income inequality through a series of steps. The first step examines the difference between the observed Theil Index for 2013 and the counterfactual level for 1994, in which the proportion as well as the mean income of the groups were at their 2013 value, and only the Theil within-group value remained at its earlier (1994) value. In the second step, the counterfactual Theil Index, where the proportion of the groups was at its 2013 value, and the mean income and the Theil within-group value were at their 1994 values was estimated. Finally, in the third step, the difference between the second counterfactual result and the level of the observed 1994 Theil value was examined, a step enabling estimation of the contribution of the changes in the proportion of groups to the rise in income inequality. Applying this approach enabled isolation of the contribution of each Theil Index component to the level of change in income inequality or, more specifically, the contribution of the proportion of groups based on couples' division of paid work to rising income inequality.

Investigating the contribution of education and family structure to the association between employment and income inequality

At this stage, I applied counterfactual analysis and standardization strategies to investigate the mechanism underlying the association between changes in couples' division of paid work and the trend of rising income inequality. More specifically, a counterfactual analysis was employed to estimate the contribution of changes in the partners' level of education to the association between changes in couples' division of paid work and income inequality. First, the Theil Index

was calculated with two of its components (mean income and Theil within-group value) at their 1994 value, but only the proportions of each group based on the couples' division of paid work at the 2013 level. At the next step, the level of education achieved by the couples within each type of couple (based on division of paid work) was standardized for 1994, as the share of each group (on the basis of couples' division of paid work) remained at its 2013 value. In this way, we controlled for changes in education in a situation of changing employment.

Comparing the two indices suggests the extent to which changes in education within the different types of couples based on division of paid work led to the rise in income inequality. For example, suppose the Theil Index calculation, based on the p_j in 2013, does not differ from the Theil Index calculation based on p_j , standardized to the 1994 level of education. Such an outcome would suggest that the changes observed in education between the 1994 and 2013 within the different types of couples did not contribute to the association between couples' division of paid work and increasing income inequality.

Data

Data was extracted from the Luxembourg Income Study (LIS), a project conducted in Walferdange, Luxembourg, which collects comparable micro-data from a range of countries, stored in one accessible location. I used waves IV (~1994) and IX (~2013) of the data. I selected the early 1990s as the starting point of this research because female labor force participation rates have stabilized by then. It therefore appears to be an appropriate starting point for examining the actual working hours (patterns of couples' division of paid work). The data for the year 2013 was the most updated wave in the LIS database when the study was conducted while

embracing the same countries covered at the earlier year². The 12 countries included in the analysis were: Austria (AT), Canada (CA), Germany (DE), Spain (ES), Finland, (FI), Greece (GR), Israel (IL), Italy (IT), the Netherlands (NL), Luxemburg (LU), the United Kingdom (UK) and the US (US)³. The data were restricted to couple-headed⁴ opposite sex couples, ages 25 to 54⁵. All households lacking data on any of the model's variables were excluded.

Variables

Income –Income inequality was calculated on the basis of household disposable income⁶. In all inequality estimations, I used standardized income, dividing household income by the square root of the number of people in the household⁷. The decision to use household income rather than income from work was essential because I examine division of paid work within couples, with the sample including couples with only one spouse participating in the labor market⁸.

Couples' division of paid work – Based on total weekly working hours, I defined three levels of participation in paid employment for each spouse (full-time: 35 or more weekly working hours; part-time: 1 to 34 weekly working hours; and unemployed). Analysis of the sample according to

² Most of the countries but not all of them were available in the 2016 point in time. To ascertain the sensitivity of the time period I examined the data for 2016 in those countries where they were available. I did not find any difference in the patterns.

³Countries were selected on the basis of the availability of data on the selected variables as well as their availability in the investigated time period).

⁴ Although this paper deals with couple-headed households, to examine the extent to which changes that occurred in the selectivity of the couple-headed household population an analysis was employed that includes single-headed households as well. These results appear in Appendix 2.

⁵ Same-sex couples were excluded because this paper addresses patterns in couple-headed households and, especially, changes in women's employment patterns. In order to avoid different retirement ages in different countries, couples were chosen in which both spouses were in the 25 to 54 age range.

⁶ According to LIS documentation, this variable includes the sum of cash and non-cash income from labor, capital, pensions (public and private) and non-pension public social benefits stemming from insurance, universal or assistance schemes (including in-kind social assistance transfers), as well as cash and non-cash private transfers.

⁷Income standardization is a commonly used technique (see for example Breen & Andersen, 2012; Breen & Salazar, 2010, 2011).

⁸ Calculations of income inequality based on total household income rather than disposable household income, together with other analyses yielded similar findings. They are available upon request from the author.

these levels produced 9 types of breadwinner couples (e.g., both spouses work full-time, the man works full-time and the woman works part-time, etc.). To estimate the robustness of types of paid work based on working hours, I employed the variable ‘part/full time employment’ (when applicable)⁹.

Education – This variable is based on a both spouses' level of education, according to two categories for each spouse: 1) low: less than tertiary education (ISCED 2011 levels 0-4); 2) high: tertiary education completed (ISCED 2011 levels 5 to 8). This categorization resulted 4 groups based on couples' joint level of education.

⁹ The variable ‘total weekly working hours’ refers to hours worked at all jobs currently held. This variable was used because it allows identification of overall work hour patterns among couples. However, the variable ‘part-time employment’ refers to the primary job only; it was therefore used solely as a sensitivity check that appears in appendix 3.

RESULTS

To what extent did patterns of employment of couples and income inequality change?

During the period in question, changes occurred in couples' division of paid work in all of the countries included in this research. As can be seen in Table 1 (columns a and b), although a pronounce share of couples in the sample were dual earners already in 1994, we still detect an increase by 2013 in all countries (excluding Finland). For example, the share of dual-earner couples in the US, which was 58.9% in 1994, rose to 61.9% in 2013. However, an examination of the division of paid work among couples revealed a more diverse pattern. An increase in the share of full-time dual-earner households was observed in Canada, Spain, Greece, Israel, Luxemburg, UK, and the US. In Germany, and the Netherlands, there was a marginally detectable increase between the two time periods. A decrease in the share of households in which both spouses work full-time did occur in Austria, Finland and Italy. However, in most countries that did not experience an increase in the share of full-time dual-earner couples, we detected an increase in the share of more-traditional employment patterns in which men were engaged in full-time and women in part-time employment.¹⁰

¹⁰ The figure in Appendix 1 presents the different employment patterns of couple-headed households as well as the share of full-time dual-earner households. This figure suggests a more complex picture of employment patterns between countries and times.

Table 1 about here

Table 2 shows the Theil index and its decomposition into within-group and between-group components, based on calculations of the data on couple-headed households in the countries. This analysis addressed the contribution of couples' division of paid work to our understanding of income inequality at a single point in time. Total income inequality among couples grew between the two periods in Austria, Canada, Germany, Finland, Greece, Israel, Luxemburg, the Netherlands, and the UK. However, a decrease in the level of income inequality among couples was observed in Spain, Italy, and the US. Although the share of income inequality results mainly from increasing within-group inequality, the between-group component, increased in the investigated period in most of the countries studied (the exceptions: Germany, Israel, Luxemburg and the Netherlands). That is, the share of couples' division of paid work on total inequality grew. These findings suggest that changes in the division of paid work contributed to the explanation of income inequality. I therefore considered it appropriate to examine changes in those patterns as well.

Table 2 about here

Is there an association between income inequality and changes in couples' patterns of employment? Counterfactual analysis – 3 approaches

In the next stage of the study, I examined the extent to which changes in couples' division of paid work contributed to the rise in income inequality during the period in question. Table 3 presents the results of the first, second and re-weighting approaches. The first counterfactual approach, that is, what would have happened to the level of income inequality had two of the three Theil Index components had remained at their 1994 values, with the third component set at its 2013 value is displayed in columns 1-3.

This counterfactual addressed the question *what contribution the changes couples' division of paid work make to the level of income inequality*. It generated the expected level of inequality for 2013 as compared to the 1994 inequality level. In most countries, with the exception of Finland, Austria and Greece, the level of counterfactual income inequality (column 3, Table 3) is higher than that observed in 1994. For example, the counterfactual income inequality in the US was 0.234, which is higher than the observed 1994 income inequality level, 0.224. That is, changes in couples' division of paid work contributed to a rise in income inequality.

Table 3 about here

Based on previous research (Boertien & Permanyer, 2019; Breen & Andersen, 2012; Breen & Salazar, 2010, 2011; Grotti & Scherer, 2016; Hu & Qian, 2015), one component of the Theil Index was changed to the later value (2013) so as to examine the level of counterfactual income inequality against the level of observed inequality in the earlier period (1994). The main purpose of this step was to observe the change in the proportions of groups in 1994 as compared to their 2013 values and its contribution to the counterfactual income inequality level. The counterfactual findings indicate what might have happened to each countries in 1994 if the level of couples' employment had changed to the 2013 level. We should note, however, that these counterfactuals did not take into account the interaction between the groups' mean income and within-group inequality (T_j). To compensate for the absence of such results, the data was again analyzed using the counterfactual approach suggested by Hu (2016). The results of this estimation appear in Table 3 (column 4).

Table 4 about here

Hu's approach answers the question of what would have happened to the level of inequality if all the components of the Thiel Index, excluding the proportions of the groups, had changed to the 2013 levels from their 1994 levels. For example, the level of the Theil Index for the US within this scenario is 0.190, lower than the observed Theil Index for 2010 (0.208). This finding suggests that changes couples' division of paid work contributed to the rise in inequality. If the types of couples had remained at their 1994 levels, inequality would have been substantially lower. The same trend was observed in most of the sample, again with the exception of Austria, Finland and Greece. In these countries, if the changes that had occurred in couples' division of paid work were the only changes that occurred between the two points in time, level of income inequality would have decreased.

The third counterfactual approach used three steps to address the contribution of each change in each component of the Index separately, as described in the methods section. As the results in Table 4 indicate, the contribution of changes in the proportions of groups to the rise in income inequality is positive in all of the countries (again, with the exception of Austria, Finland and Greece). Put differently, changes in couples' division of paid work have contributed to the rise in income inequality. For example, the contribution of changes in the share of the different types of couples in the US reached 0.011 (column 3, table 4). The difference between the two (column 2 and 3, table 4) is positive, which implies a rise in income inequality. This implies, again, that changes in couples' division of paid work contributed to the rise in income inequality in most countries in the investigated period.

Table 4 about here

The results of the three counterfactual approaches are the same, a finding stressing their robustness – in most countries, changes in couples' division of paid work are associated with increases in income inequality. The three exceptions are Austria, Finland and Greece. However, in Finland and Austria, I found a decrease in the share of full-time dual-earner couples, changes that led to decreases in income inequality. That is, the association between couples' division of paid work and income inequality in these two countries is in line with what was found in the countries that had experienced a rise in the share of full-time dual-earner couples. As to Greece, that country is actually the only exception, exhibiting as it does a rise in the share of full-time dual-earner couples associated with a decrease in the level of income inequality.

In addition to the different sensitivity analysis and robustness check that are presented in the online appendix (including single-headed households in the sample (appendix 2) and defining couples' division of paid work based on part/full time variable, separate analysis for men and women were also conducted to check robustness (couple-headed households). These analyses (appendix 4) suggest that the changes in women's working hours were indeed the operating mechanism behind the results as women have experienced major changes in working hours between the two time points in all the investigated countries.

Overall, all the findings, robustness checks and sensitivity analyses highlight the association between couples' division of paid work, changes in that division, and the rise in income inequality. As the mechanism suggested explaining this association was selection to different types of couples based on level of education (Herzberg-Druker & Stier, 2019) I suggest an empirical investigation of it in the next set of analysis.

Understanding the mechanism – Does education matter?

In this section I describe the changes that occurs in the distribution of education among full-time dual-earner couples between 1994 and 2013. It has been well-demonstrated that educational attainment expanded in all countries investigated (Boertien & Permanyer, 2019; DiPrete & Buchmann, 2013), and that the share of couples in which both spouses have an academic education has increased between 1994 and 2013. For example, in the US, the share of couples in which both spouses had attained academic degrees in 1994 was 0.29, a figure that increased to 0.45 by 2013.

Figure 1 about here

However, the crucial question remained who increased their education and participation in the labor market. A closer look at the joint distribution of education and employment among dual-earner couples suggests that there has been an increase in the share of full-time dual-earner couples where both partners are highly educated. In the entire sample, as shown in Table 5 (with Austria the only exception), the share of highly educated full-time dual-earner couples has increased. To illustrate, only 12.75 percent of the couples in the US were both academically educated and employed on a full-time basis in the labor market in 1994. This percentage reached 21.68 percent of all couples by 2013.

Table 5 about here

The identified patterns of joint distribution of education and employment imply an increase in the share of dual-earner couples when both partners are highly educated and employed full time. In order to determine the contribution of these changes and whether the association between couples' division of paid work and income inequality is mediated by the

changes in education, a re-weighting technique was employed that allowed keeping the level of education among full-time dual-earner couples constant, as if it had stayed at the 1994 value at the same time that the percentage of full-time dual-earner households was set to the 2013 level (column 5, table 3). By means of this technique, I could compare the levels of calculated inequality when education and labor market participation were the only variables that had changed between 1994 and 2013 (column 3, table 3) with the level of calculated inequality in the scenario lacking any increase in education but exhibiting changes in couples' division of paid work (column 5, table 3). If differences in estimation between the two indexes had been substantial, it would suggested that the rise in highly educated full-time dual-earner couples did contribute to the rise in income inequality. However, as the results in Table 3 (column 6) suggest, the rise in the share of highly educated couples in which both spouses work full-time was not responsible for the association between the changes in income inequality and the changes in the intensity of employment among couple-headed households.

In the US, for instance, the level of estimated income inequality in the scenario where changes occur in couples' division of paid work, the level of education remained at its 1994 value, 0.234. The level of estimated income inequality in the scenario where the couples' division of paid work and level of education both changed, the estimated value for 2013 remained 0.234. This result negates the assumption that changes in the level of education of full-time dual-earner couples was the mechanism behind the association between changes in couples' division of paid work and changes in income inequality. These results are consistent among all the countries investigated here, a conclusion clearly arising from the changes in percentages when comparing the two calculated indexes (see column 6, Table 3). In all the countries in our sample, the difference between the two estimated indices is consistently less than 1.5 percent.

DISCUSSION AND CONCLUSIONS

This research address two main questions. The first focuses on the association between employment and income inequality. I therefore examined the extent to which changes in the level of income inequality that had occurred among different countries was related to changes in couples' division of paid work. The results of the three different counterfactual analyses confirm this association. In most countries, the rise in full-time dual-earner couples was found to be associated with the rise in income inequality. The comparative cross-country approach in this research revealed that although the countries investigated were different in terms of labor market characteristics, regulation and welfare systems, an association between changes in couples' division of paid work and changes in income inequality was found.

I suggest that the couples' division of paid work, i.e., the number of hours worked weekly by both spouses rather than income or a dichotomist characterization of employment, as utilized in this research, distinguishes this from previous studies (Albrecht & Albrecht, 2007; Cancian & Reed, 1999; Reed & Cancian, 2001; Western et al., 2008). As the increase in women's participation in the labor market became more prevalent, it was more common to find dual-earner couples within the different types of couples. The validity of the approach taken (i.e. measuring couples' division of paid work on the basis of working hours) was shown to contribute a better understanding of the changes that had occurred in couples' division of work and therefore the association with rising income inequality in each country.

The second question explored addressed the underlying the association between changes in couples' division of paid work and changes in income inequality. Rising educational attainment has been suggested as the mechanism behind this association. Although the

descriptive results might suggest that education and the selection to full employment of highly educated couples is the mechanism driving changes in income inequality, the use of re-weighting techniques and counterfactual analysis revealed that changes in the level of education of both partners was not, in fact, the mechanism underlying the association between changes in employment and income inequality.

One possible explanation for the research findings is that the dichotomist definition of education (holding an academic degree versus not holding one) does not fully capture the selectivity to full-time dual-earner couples that increased income inequality. I suggest that breaking down the level of education into more-specific levels of education or by different fields of study, especially due to the rise in women's educational attainment in recent years and the gender segregation by fields discipline (DiPrete & Buchmann, 2013; England, 2010; van de Werfhorst, 2017), would be a more-accurate method to apply when measuring the selectivity of couples to engage in full-time dual-earner patterns of employment. However, one limitation of the LIS data is that due to relatively small sample sizes in most countries and lack of specific data on education, it is not possible to identify these mechanisms therefore it remains out of the scope of the current research.

An additional selection approach to be considered could be based on labor market structures such as occupations and industries. Research including the characteristics of the couples participating in the various segments of the labor market may better capture the changes that have occurred in couples' labor market behavior. Once again, unfortunately, the LIS data does not allow such a differentiation for two main reasons. First, to the small sample sizes in most countries and second, the consolidation of data suggests a less-detailed categorization of both occupations and industries. As education was found to be unrelated to changes in the

process researched, I stress turning to other possible and more-refined mechanisms, such as specific educational categorization, occupations and industries and the use of different datasets.

Notwithstanding these data limitations, this study makes a number of important contributions to research on rising inequality, changes in couples' division of paid work and the conduct of cross-country comparisons in this field. First, for the first time the association between the rise in income inequality and changes in couples' division of paid work, specifically of women, has been thoroughly documented. Couples' working hours was recently suggested as a possible mechanism for better understanding rising income inequality (Boertien & Bouchet-Valat, 2022; Gonalons-Pons et al., 2021; Herzberg-Druker & Stier, 2019). The research indeed confirms the importance of addressing those patterns. Moreover, use of LIS data enabled a systematic cross-country comparison of the variables, a type of research that is crucial if we are to achieve better understanding of the association between couples' division of paid work and the global rise in income inequality.

Second, by showing that the changes that occurred in the level of education of the partners was not the mechanism underlying the association of the employment of breadwinner types of couples and income inequality, contrary to expectations, the necessity of searching for a different stratifying mechanism with respect to understanding rising income inequality was demonstrated.

The changes in couples' division of paid work demonstrate a decrease in gender inequality in terms of labor market participation and working hours within families. However, this study suggests that this particular decrease in gender inequality is associated with increased income inequality. This is, of course, only one dimension of gender inequality; therefore, future

research should pursue attempts to identify how changes in one dimension of inequality affect other dimensions.

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Tables

Table 1: Changes in employment patterns and income inequality among couple-headed households, 1994-2013

	Percent of dual-earners		Percent of full-time dual-earners	
	1994	2013	1994	2013
Austria	59.4%	66.0%	39.4%	26.6%
Canada	63.7%	71.9%	40.2%	48.5%
Germany	56.9%	69.0%	30.2%	30.4%
Spain	33.5%	50.6%	22.7%	34.6%
Finland	77.6%	68.5%	66.7%	53.5%
Greece	42.4%	43.7%	28.6%	30.2%
Israel	52.8%	61.5%	28.6%	40.1%
Italy	47.8%	53.4%	32.6%	29.2%
Luxemburg	47.4%	71.2%	26.1%	37.6%
Netherlands	59.4%	73.6%	14.6%	14.8%
United Kingdom	66.4%	74.3%	29.4%	40.0%
United States	58.9%	61.9%	43.5%	47.7%

Note: 'Dual-earners' is the share of all couple-headed households in which both spouses worked at least one weekly hour at the two points in time, based on the LIS dataset. 'Both work full-time' was calculated as the share of all couple-headed households in which both spouses worked at least 35 weekly hours. Theil Index was calculated based on disposable income. All calculations included couple-headed households in the age range of 25-54.

Table 2: Theil Index and its components, 1994-2013

Country	Year	Between	Within	Total	% of between of total
AT	1994	0.023	0.096	0.119	19.4%
	2013	0.025	0.100	0.125	20.2%
CA	1994	0.021	0.093	0.115	18.7%
	2013	0.029	0.119	0.149	19.7%
DE	1994	0.021	0.087	0.108	19.6%
	2013	0.021	0.105	0.126	16.8%
ES	1994	0.056	0.167	0.223	25.1%
	2013	0.049	0.133	0.182	26.8%
FI	1994	0.005	0.047	0.052	9.9%
	2013	0.016	0.081	0.097	16.1%
GR	1994	0.026	0.170	0.196	13.3%
	2013	0.058	0.150	0.207	27.8%
IL	1994	0.043	0.089	0.132	32.8%
	2013	0.063	0.138	0.201	31.3%
IT	1994	0.043	0.152	0.194	22.0%
	2013	0.080	0.094	0.174	46.0%
LU	1994	0.025	0.065	0.090	27.8%
	2013	0.022	0.118	0.141	15.9%
NL	1994	0.020	0.059	0.079	25.8%
	2013	0.012	0.089	0.101	11.9%
UK	1994	0.032	0.182	0.213	14.9%
	2013	0.081	0.170	0.251	32.2%
US	1994	0.015	0.209	0.224	6.6%
	2013	0.035	0.173	0.208	16.8%

Table 3: Counterfactual analyses results (first, second and re-weighting approaches).

	(1) 1994	(2) 2013	(3) P in 2013	(4) P in 1994	(5) P in 2013; education standardized to 1994, all else in 2013	(6) change in percent between (3) and (5)
AT	0.119	0.125	0.092	0.179	0.092	-0.265
CA	0.115	0.149	0.151	0.109	0.151	0.018
DE	0.108	0.126	0.142	0.104	0.142	0.128
ES	0.223	0.182	0.333	0.104	0.333	0.829
FI	0.052	0.097	0.026	0.139	0.026	-0.732
GR	0.196	0.207	0.191	0.213	0.191	-0.08
IL	0.132	0.201	0.195	0.149	0.195	-0.03
IT	0.194	0.174	0.229	0.169	0.229	0.317
LU	0.09	0.141	0.197	0.061	0.197	0.401
NL	0.079	0.101	0.111	0.086	0.111	0.1
UK	0.213	0.251	0.258	0.204	NA	NA
US	0.224	0.208	0.234	0.19	0.234	0.126

Table 4: Counterfactual analysis results of the third approach

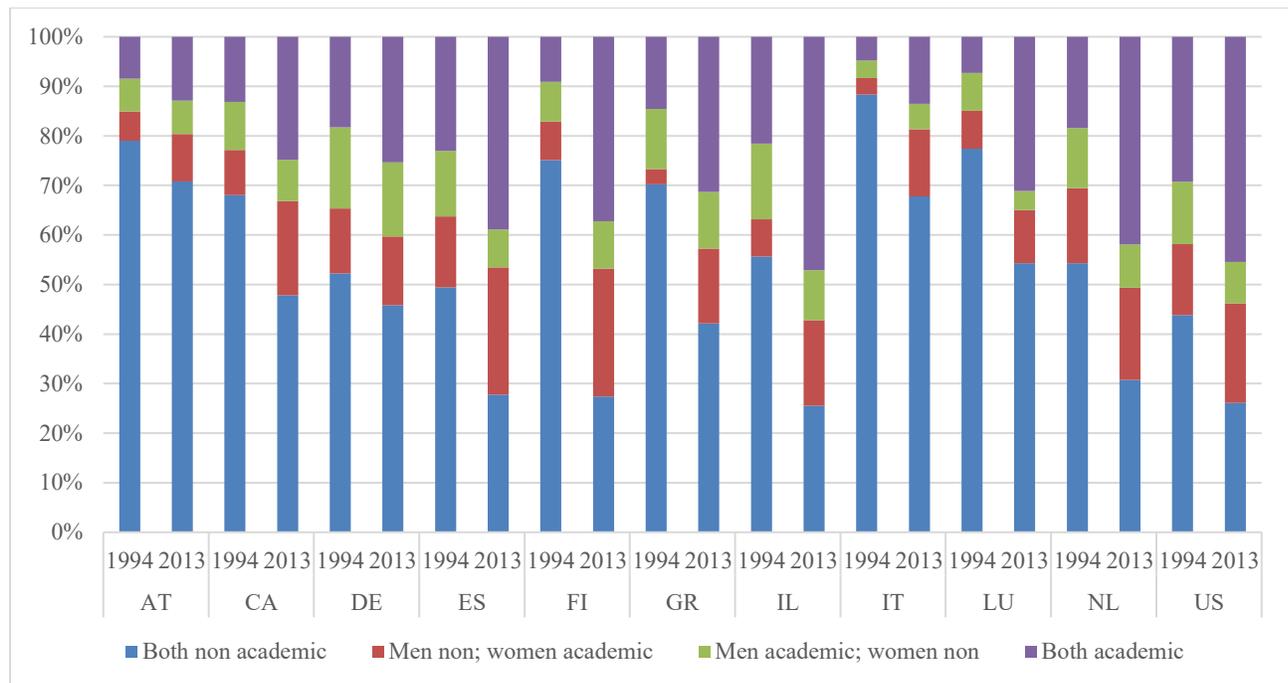
	Contribution of T	Contribution of X	Contribution of P
AT	0.004	0.029	-0.027
CA	0.029	-0.032	0.037
DE	0.018	-0.034	0.034
ES	-0.026	-0.125	0.110
FI	0.033	0.038	-0.026
GR	-0.017	0.034	-0.005
IL	0.052	-0.046	0.063
IT	-0.050	-0.005	0.034
LU	0.054	-0.111	0.108
NL	0.032	-0.042	0.031
UK	-0.006	0.000	0.044
US	-0.025	-0.001	0.011

Table 5: Percent of full time dual earner in which both spouses has academic education

	1994	2013
AT	3.57%	3.42%
CA	5.29%	12.24%
DE	5.58%	7.96%
ES	5.23%	13.46%
FI	6.06%	19.91%
GR	4.15%	9.49%
IL	6.18%	18.93%
IT	1.57%	3.96%
LU	1.81%	11.74%
NL	2.40%	5.96%
US	12.75%	21.68%

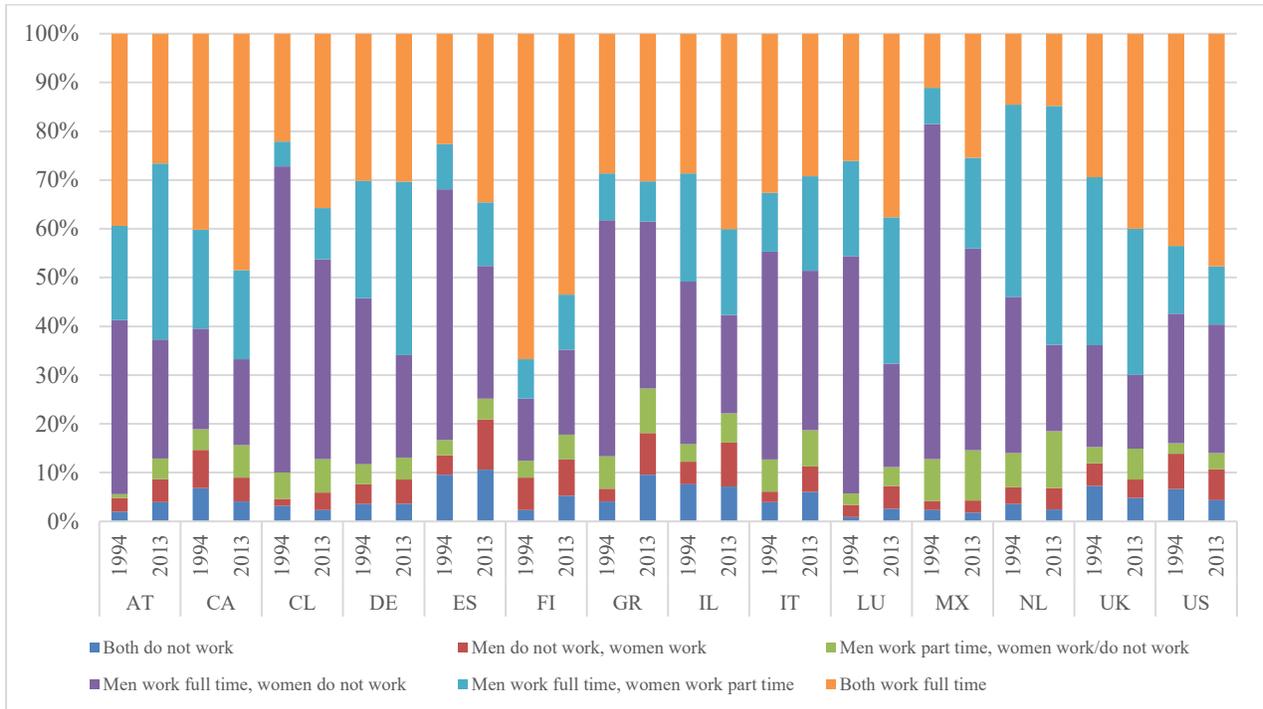
Figures

Figure 1: Educational composition among the full time dual earner couples, 1994-2013



Appendices

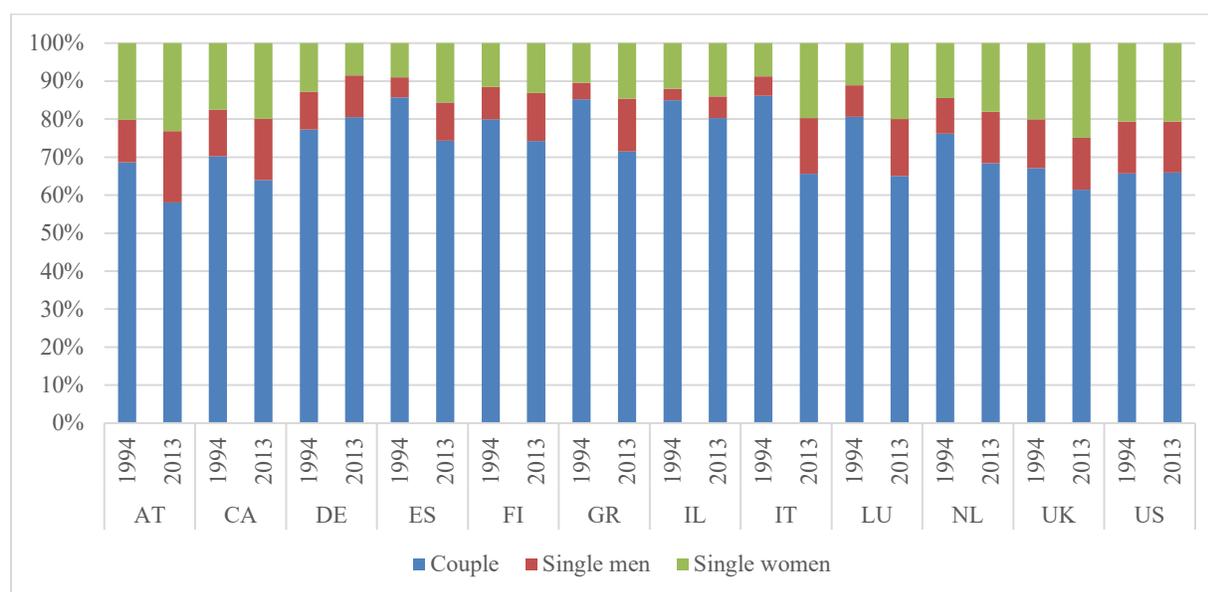
Appendix 1: Patterns of employment among couple headed households, 1990's -2010's



Appendix 2: Is there selection to couple headed households?

Although this paper deals with couple-headed households, to examine the extent to which changes that occurred in the selectivity of the couple-headed household population I employed analysis that includes single-headed households as well. In appendix 2a I present the descriptive changes in households composition in each country between 1994 and 2013. In most countries, there has been a decrease in the share of couple-headed household.

Appendix 2a: changes in households types, 1994-2013



Furthermore, the results of a counterfactual analysis for changes in employment patterns of households and income inequality in each country are presented next. These analyses suggest that like the results of the analysis couple-headed households, when single-headed households are included, the association between employment changes and changes in income inequality are the same.

Appendix 2b: Results of the first counterfactual analysis to all households (single and couple headed)

	1994	2013	P in 2013
AT	0.132	0.172	0.105
CA	0.129	0.219	0.179
DE	0.153	0.198	0.160
ES	0.229	0.209	0.306
FI	0.106	0.189	0.076
GR	0.193	0.192	0.206
IL	0.139	0.204	0.197
IT	0.182	0.197	0.226
LU	0.108	0.150	0.183
NL	0.094	0.168	0.129
UK	0.209	0.145	0.224
US	0.259	0.263	0.266

Appendix 3: Analysis of couples' division of paid work based on part/full time variable

To validate the similarity of findings in addition to using the three different counterfactual approaches, I have examined the level of participation in the labor market after replacing the working hours' variable for with part/full time work in the countries in which data on this variable are available. However, since the part/full time variable addresses only the subject's main job, whereas weekly working hours includes the number of hours worked in all jobs, the latter was used in the main analysis. I begin with showing the share of full-time dual earner couples. The descriptive findings presented in 3a suggest that an increase in the share of full-time dual-earner couples have increased in most countries (Austria, Germany and Finland are exceptions).

Appendix 3a: share of full-time dual-earner couples in 1994 and 2013 based on the variable part time/full time

	1994	2013
Austria	35.6%	27.8%
Canada	39.8%	60.3%
Chile	18.3%	34.4%
Germany	33.9%	20.8%
Spain	23.4%	35.2%
Finland	69.7%	63.4%
Greece	28.4%	36.8%
Israel	NA	NA
Italy	29.3%	34.9%
Luxemburg	27.3%	37.8%
Mexico	11.3%	22.4%
Netherland	18.0%	23.4%
United Kingdom	31.5%	43.7%
United States	47.7%	48.1%

In appendix 3b I present results of the first counterfactual approach that was employed in the main analysis. The overall results followed the same pattern as the main findings from the analysis based on couples' division of paid work based solely on working hours.

Appendix 3b: Results of the first counterfactual analysis, couples' division of paid work is based on the variable part/full time rather than weekly working hours.

	1994	2013	P in 2013
AT	0.101	0.134	0.100
CA	0.105	0.164	0.183
CL	0.493	0.414	0.844
DE	0.112	0.113	0.099
ES	0.226	0.184	0.339
FI	0.054	0.110	0.033
GR	0.191	0.198	0.205
IL	NA	NA	NA
IT	0.174	0.176	0.229
LU	0.093	0.147	0.191
MX	0.483	0.390	0.936
NL	0.069	0.103	0.124
UK	NA	NA	NA
US	0.221	0.208	0.212

Table 3c is showing the share of married men and women holding more than one job between the different countries. Only Germany and the US made these data available in 1994. However, by 2013, more countries published these data. As can be seen from, the share of married women and men holding more than one job varies rather substantially between countries; hence, utilizing weekly working hours, that includes working hours from all jobs, was a more reliable measure of couples' division of paid work.

Appendix 3c: Percent of married men and women holding more than one job, 1994-2013

	1994		2013	
	Men	Women	Men	Women
Austria	NA	NA	6.81%	5.94%
Canada	NA	NA	NA	NA
Germany	4.19%	3.10%	4.84%	4.87%
Spain	NA	NA	2.57%	1.95%
Finland	NA	NA	15.81%	14.51%
Greece	NA	NA	3.17%	1.61%
Israel	NA	NA	NA	NA
Italy	NA	NA	2.64%	1.88%
Luxemburg	NA	NA	1.34%	3.50%
Netherland	NA	NA	5.49%	7.64%
United Kingdom	NA	NA	2.80%	4.29%
United States	5.88%	5.90%	5.18%	4.82%

Appendix 4: Analysis of men and women separately

Appendix 4a: the share of full-time employees, men and women separately, 1994-2013

	Men		Women	
	1994	2013	1994	2013
AT	95.00%	89.36%	36.77%	33.07%
CA	79.49%	86.49%	45.52%	57.86%
DE	87.78%	84.97%	37.68%	31.17%
ES	84.20%	75.64%	26.55%	42.51%
FI	87.33%	84.50%	74.10%	64.02%
GR	86.50%	71.12%	31.41%	38.47%
IL	84.09%	77.63%	30.62%	47.08%
IT	86.24%	81.62%	31.96%	33.44%
LU	93.58%	88.38%	29.40%	42.59%
NL	87.14%	83.08%	14.94%	15.99%
UK	84.58%	85.06%	31.97%	43.10%
US	82.32%	85.33%	50.46%	54.47%

Appendix 4b: results of the first counterfactual approach, separately for men and women

	Men			Women		
	1994	2013	P in 2013	1994	2013	P in 2013
AT	0.112	0.103	0.154	0.112	0.154	0.146
CA	0.148	0.176	0.161	0.148	0.161	0.194
DE	0.137	0.142	0.169	0.137	0.169	0.171
ES	0.227	0.186	0.185	0.224	0.181	0.383
FI	0.106	0.100	0.139	0.106	0.139	0.091
GR	0.194	0.144	0.200	0.192	0.202	0.234
IL	0.187	0.156	0.253	0.187	0.253	0.282
IT	0.190	0.175	0.174	0.178	0.165	0.243
LU	0.090	0.093	0.140	0.092	0.145	0.194
NL	0.111	0.109	0.128	0.112	0.128	0.158
UK	0.216	0.232	0.205	0.216	0.205	0.264
US	0.272	0.280	0.267	0.272	0.267	0.278