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## Within-Group Inequality in Cross-National Perspective

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# Within-Group Inequality in Cross-National Perspective

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**Abstract**

In this research I assess within-group inequality—inequality occurring among otherwise similar individuals based on observed characteristics—in a cross-national comparative perspective. While scholarly interest in the within-group portion of inequality has grown over the past 25 years, virtually all studies focus on the US case. The current research shifts focus by assessing within-group inequality in a cross-national comparative study. I do so by constructing a unique dataset of country-level measures of within- and between-group inequality for annual market earnings using LIS microdata from 1.36 million full-time prime-age male and female workers nested in 143 country-years, drawn from 28 countries spanning 40 years. I then document and describe basic between-country and longitudinal trends in the relationship between total inequality and within-group inequality. I find that in nearly all countries in the LIS, within-group inequality is the primary driver of levels and trends in inequality. As inequality increases, so too does the relative importance of within-group inequality. However, institutional contexts matter, as continental European countries have lower relative and absolute levels of within-group inequality, independent of a variety of economic and human capital factors. Theoretical and substantive implications are discussed.

The nature of inequality growth provides a fundamental challenge to sociological thinking. Many high-income countries have experienced rising earnings inequality in recent decades (Alderson and Nielsen, 2002; Atkinson, 2008; Forster et al., 2014; OECD, 2015). In the United States, scholars have found not only that inequality has risen in absolute levels, but that important distributional properties have changed as well. Most earnings inequality growth since the 1970s has occurred among workers who are otherwise similar along sociodemographic, human capital, and occupational characteristics typically studied by sociologists, that is, *within-group inequality* (Levy and Murnane, 1992; McCall, 2000; Lemieux, 2006; Freeman, 2007; Autor et al., 2008, Leicht, 2008, Kim and Sakamoto, 2008; Western et al., 2008; Western and Bloome, 2009; Mouw and Kalleberg, 2010; Western and Rosenfeld, 2011; Mishel et al., 2012; Cheng, 2014; Zhou, 2014; MacLean and Kleykamp, 2016; Xie et al., 2016; Leicht, 2016; Liao, 2016; VanHeuvelen, 2018). While scholars have increasingly placed within-group inequality at the center of theoretical and analytical attention, many questions about the nature of this dimension of inequality remain unanswered.

Research on within-group inequality overwhelmingly focuses on the US case (but see Williams, 2012). While within-group inequality has played a central role in American inequality trends and been used to make theoretical sense of the contemporary upswing of inequality, it remains unknown whether its importance is a unique feature of the American labor market, among similar Liberal regime institutional contexts (Esping-Andersen, 1999), or whether the importance of within-group inequality to inequality growth applies in general across high-income countries. Cross-national comparison provides an ideal opportunity to better understand the relationship between within-group inequality and total inequality change. The macrocomparative stratification literature illustrates the benefits of assessing inequality across

countries with a wide variety of inequality legacies, institutional arrangements, policy systems, and sociodemographic compositions (Bollen et al., 1993; Alderson and Nielsen, 2002; Bradley et al., 2003; Kenworthy, 2004). I apply these insights to the study of within-group inequality.

This study uses 10 waves of Luxembourg Income Study (LIS) microdata from 768,549 full-time prime-age male and 591,008 full-time prime-age female workers to construct a unique dataset of 285 macrolevel within-group inequality distributions in an unbalanced sample of 28 countries spanning 40 years. Within-group inequality is computed from identical variance function regression models on identical sets of microlevel grouping variables used in previous studies on market earnings measures, yielding the most extensive collection of country-level within-group inequality observations used in a study to date. Two main conclusions are drawn. First, I find that total inequality levels, and inequality growth, are *primarily* due to within-group inequality. Second, despite the general importance of within-group inequality to total inequality levels and changes, there exists substantial heterogeneity across institutional contexts. Continental European countries tend to have not only lower overall levels of within-group inequality compared to English speaking, Liberal regimes, but within-group inequality contributes less to total inequality levels..

This study has important implications. First, it clarifies the relationship between within-group inequality and inequality growth, revealing that most inequality change in high-income countries has occurred through the within-group component. Second, it helps explain variation in the relationship between total inequality and within-group inequality, showing that institutional differences produce sizable variation in the levels and relative importance of within-group inequality. Third, it highlights the heterogeneity of the sources of inequality across country contexts, even those with the same absolute level of inequality. Two countries with the same

absolute level of inequality likely have substantially different *types* of inequality, which can be revealed by focusing on within-group inequality.

**Background**

Within-group inequality (henceforth WGI)—the variance of earnings net of sociodemographic, human capital, and occupational characteristics that sociologists and economists typically study—has been the subject of scholarly attention for over 25 years (Levy and Murnane, 1992; Juhn et al., 1993; Card and Dinardo, 2002; Lemieux, 2006; Autor et al., 2008; Western and Bloome, 2009; Zhou, 2014; VanHeuvelen, 2018). Suppose that one could "level" the average pay difference between those attaining secondary and tertiary levels of education, workers of different experience levels, and across different industries and occupational categories, so that the average pay difference across these social categories were indistinguishable from zero. Inequality would necessarily decline. Yet beginning in the early 1990s, scholars began to observe that even under these conditions—and even when applied across all the usual suspects of worker characteristics observable to the analyst—upwards of 2/3 of inequality levels and 70% of inequality change over time would remain (Levy and Murnane, 1992; Juhn et al., 1993; Freeman, 2007; Lemieux, 2006; Autor et al., 2008; Liu and Grusky, 2013; but see Mouw and Kalleberg, 2010).[1] These patterns motivated the following question: why would inequality grow independently of observable worker characteristics? The answer to this question has led to distinct interpretations of the nature of the contemporary upswing of inequality. Indeed, interpretation of empirical patterns and substantive meaning of WGI has been used to adjudicate across major theories of the inequality upswing.[2]

[1] While studies diverge in how a "group" is to be defined (cf. VanHeuvelen, 2018), groups typically use some combination of human capital, occupation, sex, and demographic characteristics. In this study, I use all available microlevel data in the LIS that has been used in previous research.
[2] See VanHeuvelen (2018) for a more in-depth discussion of the major theoretical interpretations of WGI.

Without too much loss of precision, explanations of WGI fall into three main theoretical camps. First, some consider it to reflect returns to skills and talents observable to employers, but not to analysts (Juhn, Murphy, and Pierce, 1993; Autor, Katz, and Kearney, 2008; Goldin and Katz, 2008; Mouw and Kalleberg, 2010; Autor 2015). Technological innovation has complemented the job duties of highly skilled workers, largely concentrated among professional and managerial occupations, allowing them to enhance productivity and manage increasingly complex organizations. WGI thus reflects growth in economic returns to highly skilled, highly educated workers in cognitively-demanding occupations who have increased their productivity, and thus, pay. Second is deinstitutionalization, or the decline of institutional protection and stability of pay due to broadly shared changes in labor market policies, pay-setting institutions, and declines in internal, firm-level job security, mobility, full-time employment, and benefits (McCall, 2000; Western et al., 2008; Western and Rosenfeld, 2011; Western et al., 2012). In the US context, much attention has been paid to [1] the decline of internal labor markets and the fissuring of employees across an increasingly complex organizational landscape (Bidwell, 2011; Weil, 2014) and [2] falling union density and political power. Union decline, pronounced in the United States but broadly experienced across high-income countries (Visser and Checchi, 2009), has resulted in well-documented declines in wage attainment and increases in wage inequality, and has also been shown to increase WGI (Western and Rosenfeld, 2011; Jaumotte and Buitron, 2015; Kristal and Cohen, 2016). This perspective conceptualizes WGI as an indicator of *insecurity*, or the risk of economic loss in the face of unpredictability (Western et al., 2012) and *flexibility*, the ease and ability of management to create insecurity among labor. Third is methodological. Some scholars explicitly assume WGI to indicate luck and free will (Jencks et al., 1973), random error (Cheng, 2014), or omitted variables, such as occupational differentiation

(Mouw and Kalleberg, 2010).[3] From this viewpoint, WGI is beyond the scope of analytical focus, or else is to be corrected with a more accurate micolevel model.[4]

Given its central theoretical importance to understanding inequality, sociologists have recently developed new methodologies that situate WGI in the center of analysis (Western and Bloome, 2009; Cheng, 2014; Zhou, 2014; Liao, 2016), elaborated theories of the causes of WGI (McCall, 2000; Western et al., 2008; Western and Bloome, 2009; Western et al., 2012; Cheng, 2014; Zhou, 2014), and called for further examination of dimensions of inequality beyond one-number measures of overall inequality such as the Gini coefficient and between-group gaps (Kenworthy, 2007; Leicht, 2008; 2016). However, virtually all studies that have examined WGI have restricted focus to a single-country study, predominantly the United States (but see Zhao, 2014 for the Chinese case and Williams, 2012 for the British case).

The extension of WGI studies from single-country cases to a cross-national sample is useful for at least two reasons. First, a cross-national focus has routinely yielded insights into basic features of inequality in the modern era. For example, scholars have shown the substantial influence of tax and transfer policies on cross-national variation in inequality reduction (Gornick and Milanovic, 2015). Others have shown the importance of labor market institutions and egalitarian policies in compressing pay dispersion, even prior to taxes and transfers. Economists have discovered substantial differences in historical inequality trajectories between English speaking nations, continental Europe, and Scandinavia (Atkinson et al., 2011). Similarly,

[3] The precise relationship between an omitted microlevel variable and WGI is unclear. Consider, for example, the loss of a union job. Results from Western and Rosenfeld (2011) suggest such a change would increase WGI. Yet an omitted variable approach suggests that a more precise microlevel variable is needed for the subsequent wage attainment model.

[4] Perhaps the most common critique from this third camp comes from the argument that micro-class occupations or jobs represent the bulk of WGI. This critique, and similar arguments that WGI primarily reflects occupational differentiation, has been used to reinforce both skill- and deinstitutionalization-based explanations of inequality (Goos and Manning, 2007; Williams, 2012).

sociologists and political scientists have documented the wide variation of social policies and labor market institutions that help account for different levels of inequality (Bradley et al., 2003; Kenworthy, 2004). Others have used a comparative lens to scrutinize theories of inequality developed in the United States, but argued as general causes. For example, Blau and Kahn (2005) showed that the variation of test scores, a proxy for the skill distribution of a workforce, fared poorly to explain between-country variation in inequality. More generally, one of the key benefits of cross-national research is the ability to shed light on general features of stratification processes that are not fully reducible to idiosyncratic features of a single country context (Brady et al., 2010). Such analytical approaches have not been incorporated into the study of WGI. Yet to properly understand this component of inequality, one must situate it in a comparative perspective.

Second, analysis of WGI can shed light on variation in the distributional properties of inequality. Across the many studies of cross-national inequality, an implicit assumption is that country-level inequality measures at the same level imply equivalent "types" of inequality.[5] Yet a focus on the relationship between total inequality and WGI can reveal meaningful variation across countries with similar levels of inequality. The substantive reality of inequality may vary markedly depending on how tightly wage setting is conducted in relation to human capital and occupational characteristics.

In total, while WGI has played a central theoretical and empirical role in US debates over the current rise of inequality, no empirical study has situated an analysis of this component of inequality in a cross-national framework. Thus, the many well-documented benefits of cross-national comparative analyses remain uncollected in the WGI literature. The current research

[5]For example, Atkinson et al. (2011) group countries into similar inequality patterns based on shares of income going to the top 1%.

resolves this gap in the literature by documenting and describing the basic relationship of WGI to total inequality trends in high-income countries.

## DATA AND METHODS

WGI is calculated from national surveys collected in the LIS, widely considered to be the gold standard of comparable cross-national income data. The LIS includes harmonized and nationally-representative microdata on a variety of individual-level measures, including income, sociodemographic, human capital, and work characteristics. The high quality of income measurements and rigorous harmonization of microdata undertaken by the LIS are crucial for this research: WGI can be computed on the same earnings measure using an identical set of individual-level covariates across countries over a long period of time. I use all country surveys with available microdata that are either (1) high income countries or (2) on the European continent.

### Samples

Country samples are listed in Table 1. Following standard practice of WGI research, I conduct separate analyses for men and women (Lemieux, 2006; Autor et al. 2008, Western and Rosenfeld, 2011), which accounts for the different historical socioeconomic attainment trajectories and barriers of employment and wage attainment faced by men and women during the period studied (Esping-Andersen, 1999). I restrict samples to full-time workers to minimize potential bias introduced from cross-national differences in the frequency of part-time employment.[6] Samples are restricted to prime-age workers aged 25 to 54. Although this decision

[6] This restriction also assists with overcoming difficulties associated with unavailable microlevel data, such as union coverage, fine-grained occupation information, and annual work hours, all of which may influence the rate of individuals in part-time employment. Note too that these results should provide a conservative estimate of cross-national variation in WGI, as individuals most sensitive to labor market flexibility are excluded from samples.

is more conservative than other studies using LIS microdata (Mandel and Shalev, 2009; Brady et al., 2010), it guards against potential confounding selection effects related to decommodification—such as educational training and retirement—which may occur unevenly between countries. Following similar studies, self-employed individuals are dropped (Autor et al., 2008). Microlevel analyses are conducted using survey weights provided by the LIS. In total, samples include 768,549 male and 591,008 female workers. Microdata are nested in an unbalanced sample of 143 country-year inequality observations per gender, nested in 28 countries spanning 40 years.[7] Country-year observations of WGI are the unit of analysis in results below.

**Dependent Variable**

The dependent variable is logged annual earnings: monetary and non-monetary payments received in counterpart for dependent employment.[8] This measure excludes self-employment, capital, and transfer income, avoiding confounding country differences in state institutions, capital markets, and self-employment opportunities. I apply the logic of LIS household income top- and bottom-coding strategies to this measure of individual-level earnings. Low earnings are bottom-coded at one percent of the mean, and high values are top-coded at 10 times the median income, separately by country and survey.

[Table 1 About Here]

[7] Female results for Israel in 1986 do not converge due to a very small sample size (n=140). This country-year is therefore excluded from analyses, lowering the female sample to 138.
[8] This variable is labeled as paid employment labor income in the LIS.

I analyze individuals rather than households to align with most previous WGI studies. Many WGI studies examine individual hourly wages, weighted by working hours (Autor et al., 2008; VanHeuvelen, 2018), but necessary microdata for hourly wages are not widely available.[9] Note that the outcome measure of inequality reflects *market* earnings before taxes and transfers.

**Individual Grouping Variables**

I separate the variance of logged annual earnings into between- and within-group components using eight human capital, occupational, and sociodemographic characteristics commonly used in WGI research and widely available in the LIS. I use all and the most specific microlevel data that are available and comparable across LIS high-income and European countries.

Analyses are conducted separately by *gender*. I measure *education* following Brady et al. (2010). Education categories are based on the International Standard Classification of Education (ISCED) and include three groups: low (less than secondary education: levels 0, 1, and 2), medium (secondary or some tertiary education: levels 3 and 4), and high (completed tertiary education or more: levels 5 and 6).[10] Potential experience is the respondent's age minus potential years of education minus six.[11] A main effect includes four categories: 0-9, 10-19, 20-29, and 30 or more years (Autor et al. 2008). A continuous measure and its squared term are interacted with education categories.[12] *Industry* includes: (1) agriculture, forestry, and fishing, (2) mining and quarrying, manufacturing, and utilities (3) construction (4) wholesale and retail trade, repair, hotels and restaurants (5) transport, storage, and communications (6) financial intermediation (7)

[9] I replicate main analyses controlling for average annual work hours drawn from OECD data and reach the same conclusions.
[10] Early samples from the United Kingdom measuring education in years are transformed to align with the categorical measure.
[11] Most previous studies of WGI use potential experience, and actual experience is not widely available.
[12] These two measures of human capital follow the logic of Autor et al. (2008) and allow for fine-grained nonlinear patterns of WGI across the age distribution while using relatively small samples.

real estate, renting and business activities (8) public administration, education, health and social work and (9) other community, social/personal services, activities of household, and extra-territorial.[13] *Occupation* is based on major groups of the International Standard Classification of Occupations (ISCO): (1) managers and professionals (ISCO 1 and 2) (2) other skilled workers (ISCO 3-8 and 10) and (3) labourers / elementary (ISCO 9).[14]

**Methods**

WGI is computed using variance function regression models (VFR). VFRs estimate between- and within- portions of an outcome's variance (for extended discussion, see Western and Bloome, 2009). The first portion of the VFR is a linear regression of logged income $y_i$ on variables $W_i$ (education, potential experience, industry, occupation, partnership status, young children in household):

$$y_i = \beta W_i + \epsilon_i \quad (1)$$

The second portion of the VFR is a gamma regression with a log-link function estimated on the squared residuals, $\varepsilon^2$, predicted from equation (1). This second portion estimates the systematic component of residuals occurring among observed characteristics:

$$log\ \hat{\epsilon_i}^2 = \pi W_i \quad (2)$$

[13] All categories are unavailable in at94, at97, at00, gr95, gr00, il79. In these cases, I use a three-category industry variable: (1) agriculture (2) industry and (3) services. Results are substantively similar if these cases are excluded.

[14] Many studies of within-group inequality contrast results against models including fine-grained occupations, or even more specific industry-by-occupation contrasts (e.g. Goos and Manning 2007; Williams 2012). Such information is not available in the LIS microdata. The implications of this missing occupational information are discussed in the Conclusion.

Predicted values from equation (2) are used as weights to re-estimate equation (1). Squared residuals are recomputed and equation (2) is re-estimated. The process reiterates until model parameters stabilize.[15]

Following standard practice, VFRs are estimated separately by year (Lemieux, 2006; Autor et al., 2008; Western et al., 2008; Mouw and Kalleberg, 2010; Western and Rosenfeld, 2011). I assume that countries have distinct earning regimes and so estimate VFRs by country (Hauser and Xie, 2005). In total, I compute 285 country-year distributions for both WGI and BGI in main analyses.[16] These macrolevel distributions are used as the main dependent in all analyses below, and so the country-year is the base level of analysis.

In addition to using absolute levels of WGI, I also use the relative proportion of WGI to total inequality, which is simply the ratio of these two measures, multiplied by 100. This measure indicates the relative importance of WGI to total inequality in a particular country-year.[17] In order to descriptively assess the relative variation of WGI across countries, I include two sets of country-year measures. The first is mean human capital attainment. This measure is the country-specific average of the three educational categories drawn from the LIS microdata samples discussed above. I also compute measures of mean work experience, and the variance of work experience. I also compute the percentage of prime-aged workers who have completed tertiary educational attainment, and educational attainment heterogeneity (Moller et al., 2009) using the Barro-Lee Educational Attainment Data (Barro and Lee, 2010). Second, I sort country-years into

[15] Individual-level coefficients are not the main focus of this study. Stata do-files are available by request which can reproduce individual country-year results through the LIS job submission system.
[16] IL86 has a small sample of female workers and so VFR models cannot converge. This sample is dropped from analyses.
[17] This measure largely represents the $R^2$ of the microlevel model. I prefer examining this measure following the VFR instead of a standard linear regression because of the benefits and logics outlined by VanHeuvelen (2018).

five regime types that have been frequently used to identify general institutional differences across state policies and labor market institutional arrangements: Liberal, Continental European,[18] Scandinavian, Eastern European, and Taiwan. Table 2 includes country-level descriptive statistics

[Table 2 About Here]

## RESULTS

### How Has Within-Group Inequality (WGI) Grown in Rich Countries?

No previous research has assessed WGI cross-nationally using high quality, comparable measurements. This study therefore provides a general, descriptive assessment of the contribution of WGI to total inequality patterns of market income in the LIS data series.

How widely does WGI vary across countries, and what is the relative contribution of WGI to total earnings inequality? Figure 1 shows the relationship between the absolute level of annual earnings WGI (x-axes) and the percentage of total earnings inequality attributable to WGI (y-axes). The panels show results separately by gender, and markers are labeled by country-year.

[Figure 1 About Here]

I observe substantial variation in both absolute levels of WGI and the relative contribution of WGI to total inequality. Absolute levels of WGI range by a factor of eight for men (maximum=0.58, minimum=0.06) and ten for women (maximum=0.55, minimum=0.05).

[18] This category combines Conservative and Mediterranean regimes due to small numbers of Mediterranean countries. Results are similar if Conservative and Mediterranean countries are separated.

For both male and female samples, Denmark, Italy, and Luxembourg tend to have lower absolute levels of WGI, while the United States, Canada, Russia, and Lithuania tend to have higher absolute levels. This finding simply reflects the wide range of inequality levels across high-income countries that has drawn scholars to the cross-national level (Alderson et al., 2005). Such cross-national variability exists among the within-group portion of inequality as well.

WGI varies substantially not only in its absolute levels, but also in its *relative contribution* to total earnings inequality. In some countries—the Slovak Republic, Australia, Austria, and Canada, for example—WGI accounts for upwards of 85% of total earnings inequality. In other words, standard mircolevel grouping categories—education, work experience, occupational and demographic characteristics—do little to explain market earnings inequality in these countries. In other countries—Luxembourg and Taiwan, for example—WGI is relatively less important for inequality trends, accounting for 40% to 60% of total inequality. Put differently, *I observe substantial variation in the contribution of the exact same microlevel models across country contexts*.

What is the relationship between *levels* of WGI and its *relative contribution* to total inequality trends? The results in Figure 1 suggest a positive association. For both men and women, WGI tends to be relatively more important in country-years where absolute levels of WGI are higher. The correlations between these dimensions of WGI are 0.55 for men and 0.57 for women (both $p < 0.001$, two-tailed tests). I find similar positive associations between the relative contribution of WGI and total earnings inequality for both samples, but with smaller correlations (around 0.33 for both samples). In total, Figure 1 provides preliminary evidence that WGI tends to play a larger role for inequality where inequality levels are higher. These findings

help explain why WGI has played a central role in inequality debates in the United States (Lemieux, 2006; Autor et al. 2008).

Along with the variation noted in the above paragraph, two points of similarity across country contexts are notable. First, most centrally, most inequality in the LIS data series—routinely understood as the gold standard of cross-national stratification research—is within-group inequality. In only 38 of the 285 country-year observations (13%) in the LIS sample does WGI contribute less than 60% to total earnings inequality. For comparison, WGI contributes over 2/3 of total earnings inequality in 199 of the country-years in the study (70% of country-years) and over ¾ of total inequality in 29% of the country-year samples (84 country-years). Put simply, *most of the cross-national inequality that researchers have studied in high-income, postindustrial societies occurs in the within-group component of inequality*. Second, supplemental analyses show similarity of the variables from Figure 1, and their rank orderings, between male and female samples. That is, male WGI tends to be high where female WGI is high as well, and male WGI tends to be relatively important in country-years female WGI is relatively important. The correlations in rank orderings between genders are 0.68 for WGI percentage and 0.82 for absolute ranks. The relative similarities across gender samples cast doubt on the argument that WGI represents simple randomness: why would randomness be so orderly across worker samples within country-year pairs?

Does the United States have atypical WGI? Yes and no. On the one hand, the United States has large absolute levels of WGI, as I observe US country-year observations clustering on the right-side of x-axis in both panels. This finding reinforces previous research that shows the United States to have particularly high levels of inequality, inclusive of inequality both pre- and post-tax and transfer redistribution (Gornick and Milanovic, 2015). This fact is simply reflected

in the within-component of inequality. On the other hand, the United States is typical in terms of WGI's relative contribution to total male inequality. For example, the contribution of WGI to total male earnings is similar across American, Germany, and Danish contexts, around 70%. The three countries differ in terms of their absolute levels of WGI. Yet WGI is relatively more important to total earnings inequality in some countries—the Slovak Republic, Canada, and Australia—and is relatively less important in others—Finland, Greece, and Hungary, for example. In total, I observe United States WGI to be atypical in its high levels for both men and women, and to be typical in its relative contribution to male earnings inequality.

Figure 2 shifts focus from *levels* to *change* in inequality within countries over time. It shows the contribution of WGI change and BGI change to total changes in earnings inequality (left panels, e.g. change between us74 and us13), and two adjacent country-year observations (right panels, e.g. change between us74 and us79). X-axes represent change in total logged earnings variance between time periods. Y-axes represent change attributable to WGI and BGI. Markers include country codes (see Table 1) and are prefixed "W" for WGI change and "B" for BGI change. Lines show the simple linear fit between either WGI (solid) or BGI (dashed) change and total inequality change. A steeper association between total inequality and either WGI or BGI change would indicate a greater relative importance of change in one of these components to total inequality change.

[Figure 2 About Here]

Figure 2 clearly shows that inequality change in high income LIS countries is due primarily to WGI change. The correlations of WGI change and total inequality change range

from 0.94 to 0.97, whereas the equivalent correlations for BGI are lower, 0.58 to 0.74. Additionally, I tested the x-standardized regression coefficients of total inequality change on WGI and BGI change in simple linear regression models with robust standard errors. The coefficients for WGI change are significantly larger than the coefficients for BGI change across all samples from Figure 2, with the WGI slope 100 to 300% larger compared to the BGI slope ($p < 0.05$, two-tailed tests, in all tests conducted).[19] In total, I conclude that in addition to its importance to overall *levels* of earnings inequality, *change* in WGI is primarily responsible for *change* in total inequality in high income countries. No prior research has revealed this basic empirical finding, yet it is critical for understanding recent inequality trends.

How might these descriptive findings be conditioned by time-invariant differences across countries, or by patterns occurring across historical eras? To assess these possibilities, I estimated a set of six regression models per gender sample, shown in Table 3. In each model, the outcome is the percentage of inequality attributable to WGI. Total earnings variance is the main independent variable. Models 2, 3, 5, and 6 include country fixed-effects, and models 2, 3, 5, and 6 include time as either a continuous measure (models 2 and 5) or year fixed-effects (models 3 and 6).

[Table 3 About Here]

Across models, and for both men and women, a similar conclusion is reached: higher levels of inequality are significantly and positively associated with a larger contribution of WGI to total inequality. Models 3a and 3b show that a standard deviation increases in total earnings

[19] An alternative comparison using BIC scores also favored simple regression models predicting total inequality change that include only WGI change in comparison to models that only include BGI change.

inequality (.1298 for men, .1353 for women) is associated with a 2.8% (men) and 3.6% (women) increase in the total share of inequality attributable to WGI. Not only are these associations found in model 1, where between- and within-country variation are assumed to be equivalent, but they are also found in models 2 and that include country-fixed effects. Time-invariant between country heterogeneity, as well as any associations due to simple time trends, are accounted for in these models, leaving only the association between within-country change in inequality and within-country change in the relative contribution of WGI. In these models as well, a statistically significant and positive association is found ($p<0.001$ male, $p<0.05$ female). Of course, the inverse is found as well, as additional sensitivity analyses confirm that higher levels of total inequality associate significantly and negatively with the relative contribution of BGI. In total, both the average differences in country inequality, as well as within country change in inequality, are primarily due to changes in WGI.[20]

As suggested in Figure 1, results do not rely on particularities of the United States. Models 4 through 6 replicate models 1 through 3, but excluding the United States from analyses. Substantive conclusions remain unchanged. These findings reinforce those from Figure 1: the United States is exceptional in its high levels of WGI, but it follows a broadly shared pattern across high-income countries in the relationship between WGI and total inequality.[21]

To provide a substantive illustration of the results above, Figure 3 displays trajectories of male WGI, BGI, and total logged earnings variance for five countries: the United States, Canada, Germany, Finland, and Luxembourg. I examined equivalent figures for all countries included in

[20] Results are robust to a variety of sensitivity analyses. These include (1) predicting total inequality using percentage of WGI and (2) bootstrapping standard errors.
[21] Results are the same when controlling for human capital variables discussed in the Data section.

analyses. These five countries were selected because they represent the range of inequality patterns.[22] Panels show trends for WGI (left), BGI (center) and total income (right).

[Figure 3 About Here]

Markers indicate LIS waves. The trajectory of American WGI (hollow circles) generally follow patterns from previous studies (Lemieux 2006, Autor et al. 2008, Western and Rosenfeld 2011). WGI rose rapidly through the 1980s, stabilized for the next two decades, and began to rise again at the end of the 2000s.

As suggested in Figures 1 and 2, the divergent trajectories and levels of inequality in these five countries are qualitatively due to WGI. Although America and Luxembourg have higher BGI than Germany, Finland, and Canada, overall BGI does little to distinguish country inequality trends. Turning to WGI, Canadian and American patterns closely resemble one another. The difference in total inequality between the two countries stems primarily from higher American BGI. German WGI spiked after reunification in 1990, and grew slowly afterwards. Finnish WGI remained unchanged for nearly two decades, then doubled in the mid-2000s. Luxembourg WGI increased slightly, but its importance pales in comparison to BGI, which doubled over the period of study to end up resembling American BGI. While WGI increased in all five countries, the nature of WGI change varied widely, and it is primarily these WGI trends that distinguish the trends in total inequality in the rightmost panel.

From the many findings of the descriptive analyses in this section, I draw one general conclusion: *within-group inequality primarily drives cross-national differences in total*

[22] Replication of Figure 3 using female earnings inequality provides substantively similar conclusions (available upon request).

*inequality among high-income countries*. I observe WGI to be central to inequality levels, trends in inequality change, and to drive substantive inter-country inequality patterns. Although US-based studies have shown WGI to be important for total inequality trends, it was unknown whether these American inequality dynamics were unique, or whether WGI was more generally important for contemporary trends of rising inequality among high income countries. My results point to the latter, suggesting that cross-national studies of inequality have implicitly been studies of WGI.

**WGI and Institutional Contexts**

Thus far, results point towards the general importance of WGI to total inequality. I next how WGI varies across institutional contexts. To do so, I assess how WGI levels and contributions to total inequality vary across welfare regimes. Results are shown in Table 4. The top panel shows results for absolute levels of WGI, while the bottom panel shows results for the relative contribution of WGI to total inequality. Both panels include results net of average education and human capital levels, as well as total levels of earnings inequality.

[Table 4 About Here]

Across all modeling specifications, and for outcomes in both the top and bottom panels, I observe a consistent difference between Liberal and continental European (Conservative and Mediterranean) countries. For both male and female samples, continental European countries have significantly lower proportions of total inequality due to WGI. In terms of absolute levels, WGI tends to be 0.1 lower for both men and women ($p<0.001$, both samples, model 1). While the magnitude of the coefficient decreases by approximately 80% after controlling for total

inequality levels and human capital composition (Models 7 and 8), differences across regime types nevertheless remain statistically significant at the 0.01 level.

Regarding the relative contribution of WGI to total inequality, I observe a difference of around 7% ($p<0.001$) for men and 5% for women ($p<0.001$) between continental Europe and Liberal regimes that remains relatively stable across modeling specifications. Substantively, these are large differences, as they are equivalent to an 80% and a 63% standard deviation in the sample's distribution of relative WGI. Notably, results are largely unaffected by control variables, suggesting that institutional contexts meaningfully influence the relative importance of WGI.

Few differences are found across other regimes. For example, in both top and bottom panels, model 1 shows Scandinavian regimes to have lower absolute and relative levels of WGI, compared to Liberal regimes. However, these differences are largely attributable to differences in total inequality and human capital attainment across these institutional contexts. Similarly, while some differences emerge between Liberal and East European countries, these occur only sporadically and are uniformly removed with the addition of inequality and human capital controls.

In total, results from Table 4 provide an important addendum to results from Table 3. Although WGI tends to be central to inequality across high-income countries, the magnitude of this fact is channeled through a country's institutional context. Similar to comparisons of the United States over time and growing labor market flexibility (Lemieux, 2008; Western and Rosenfeld, 2011; VanHeuvelen, 2018), workers in the more flexible and insecure Liberal regime tend to have higher WGI compared to the system of stronger labor protection on continental Europe. Note too that these results do not simply reflect inequality-reducing tax and transfer

policies, nor more protective decommodification practices at the tails of the age distribution, as these findings come from market earnings of prime aged workers.

## CONCLUSION

In this research, I examined cross-national macrolevel within-group inequality. I applied the logic of decomposing individual-level annual earnings inequality into within-group (WGI) and between-group (BGI) components, predominantly done in the American context, to a sample of full-time prime-age workers from LIS microdata from 28 countries spanning 40 years. Results from this research help to clarify the nature of the contemporary rise of individual market earnings inequality in high income countries.

The major descriptive finding of this research is that *cross-national differences in individual earnings inequality largely stem from within-group differences*. Simply put, if one could "level" major occupational, human capital, and sociodemographic characteristics which sociologists typically study in relation to earnings inequality, cross-national patterns of earnings inequality and their changes over time would remain similar. This basic empirical fact was hitherto unknown, and the current study represents the first in sociology to apply the logic of decomposing overall earnings inequality into within- and between-group components beyond a single country case. Nor were there a priori reasons to suspect that the importance of WGI would be broadly shared across national and historical contexts of high income countries. My findings therefore provide an important contribution to the understanding of the basic distributional properties underlying contemporary patterns of earnings inequality in high income countries.

At the same time, results reveal heterogeneity in the relative importance of WGI across countries in different institutional contexts, with continental European countries having

significantly lower levels of WGI and proportions of inequality attributable to WGI than Liberal countries, independent of inequality levels and human capital composition. These results are suggestive that a deinstitutionalization explanation of WGI does well in the cross-national context, given that WGI is a more central feature of inequality in the residual, inequality-tolerant Liberal welfare institutional context (Esping-Andersen, 1999). On the one hand, these findings make intuitive sense, as they follow related stratification literature on the importance of institutional variation across high income countries (Esping-Andersen, 1999; Mandel and Shalev, 2009). And previous research has documented the many ways that institutional differences translate into inequality and wage attainment differences (e.g. Gangl, 2004). WGI is another inequality dimension aligning with this research tradition. On the other hand, these findings extend comparative stratification research. They show that institutional contexts affect not only redistribution and inequality *levels*, but basic *distributional properties* of inequality. Simply put, labor market institutions and policy bundles lead to not only different levels of inequality, but different *types* of inequality across similar levels. Of course, substantial heterogeneity exists within the Conservative and Mediterranean regimes (DiPrete, 2007). Future research is needed to extend understanding of how these heterogeneous labor market institutions and social policies affect WGI within the European case.

A natural next step for future research is to assess macrolevel associations between WGI and country level characteristics to assess the causes of WGI. For example, do alternative measures of skill (such as test scores), deinstitutionalization (union density, wage setting coordination, and regulation of temporary contracts), globalization, or demographic shifts better explain variation in WGI than the broad welfare regime typology? Do country-level associations for WGI simply mirror those for total inequality? These questions are beyond the scope of the

current project, as they necessarily build upon the empirical centrality of WGI to cross-national inequality. However, now that the importance of WGI for cross-national inequality has been documented, future research would do well to determine the macrolevel causes of this dimension of inequality.

This paper is not without limitations. Perhaps most importantly, the LIS does not provide fine-grained microlevel occupational information. Studies of occupational polarization and wage inequality typically sort individuals into at least 300 occupational groups, or even 300 occupation-by-300 industry groups.[23] To what extent are results biased from omitting such fine-grained *Gemeinschaft* occupational communities (Liu and Grusky, 2013)? The current research cannot say. However, if such an omission were to level differences of WGI across country contexts, this result itself would be a valuable piece of knowledge. For occupational contrasts to run counter to findings of this study, occupational polarization would need to be of greater relative importance in Liberal Regimes than on continental Europe, and among high-inequality country-years compared to low inequality ones. Such a finding would reinforce a deinstitutionalization explanation of WGI, as the importance of fine-grained occupational differentiation would then be secondary to cross-national variation of labor policies and institutions that compress pay differences between workers. Yet future work on the relationship between occupational polarization, WGI, and cross-national stratification is needed.

More generally, the assessment of WGI in a cross-national context highlights the central importance of a seemingly simple question: what is a *group*? Does it reflect a substantively

[23] It is unlikely that cross-national variation fully reduces to omitted occupation variables. For example, I conducted supplementary analyses using US Census microdata and estimated models with and without 82,000 occupation-by-industry groups in 2010, in addition to standard education-by-work experience interactions. Including these 82,000 occupational groups decreased the relative contribution of WGI in this dataset from 65% to 55%.

meaningful concept that can be similarly assessed across country and historical contexts? Cross-national research has shown the widely variable and context-specific nature of groups based on educational and occupational attainment, for example (Bol and Weeden, 2014). In sensitivity analyses, I found that results in this paper were robust against alternative modeling decisions at the microlevel with different conceptual approaches to the idea of group. Nevertheless, greater theoretical attention to the concept of *group* as it relates to economic inequality is clearly needed. Practicality guided this project's definition of group, as definitions were based on previous US studies and data availability in the LIS. While this study provides a contribution to knowledge of WGI at the macrolevel, much more work on this topic is needed.

In total, WGI is central to cross-national patterns of inequality, and is of growing importance to high-income countries. Yet substantial institution-based heterogeneity exists. This study provides insights into the basic distributional properties of inequality in high-income countries, and reveals the promises of examining the relationship between total inequality and WGI in a cross-national perspective.

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**FIGURES and TABLES**

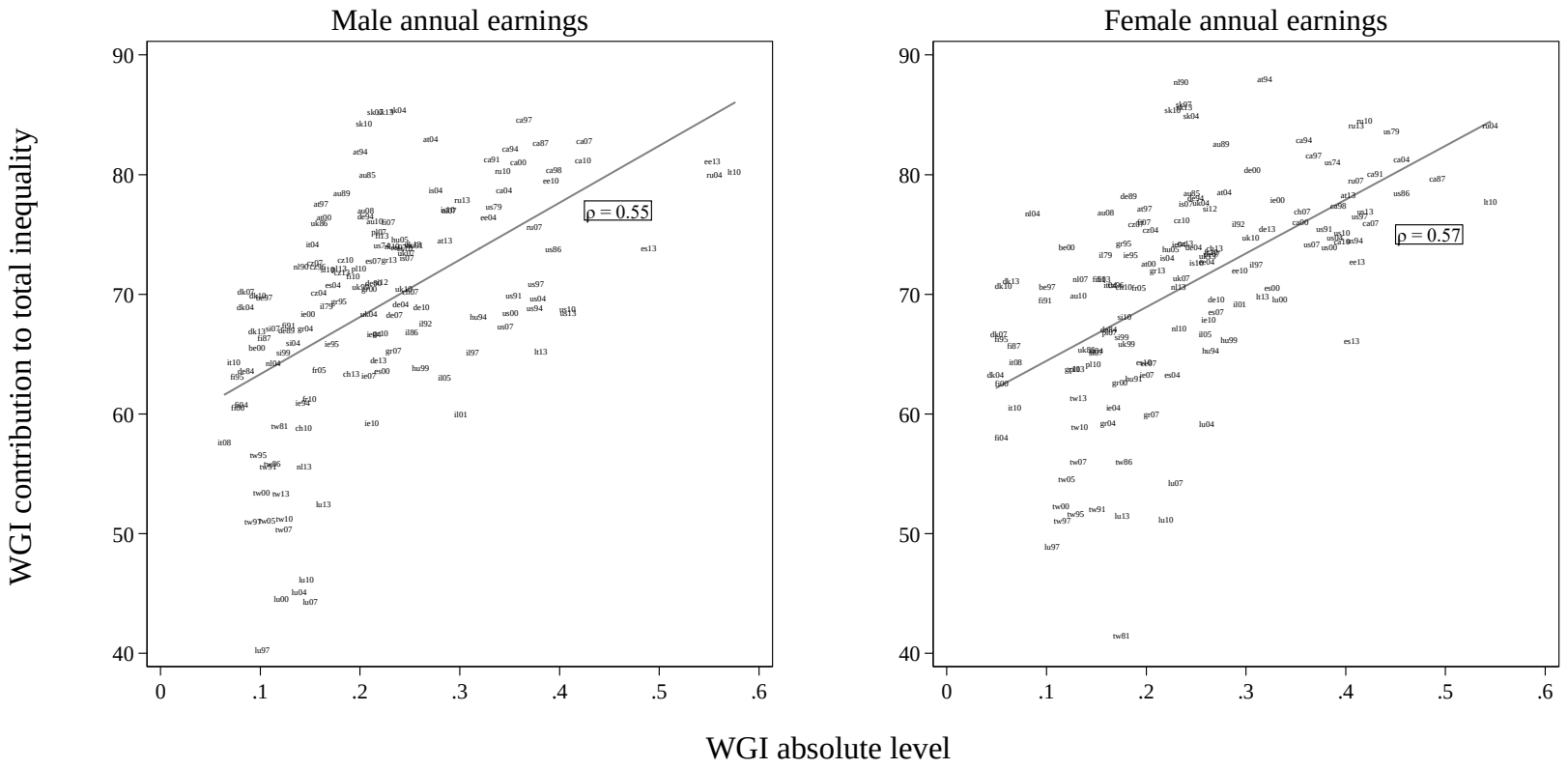


**Figure 1: Relationship between absolute level of within-group inequality (WGI) and relative contribution of WGI to total inequality**

Note: country codes are listed in Table 1

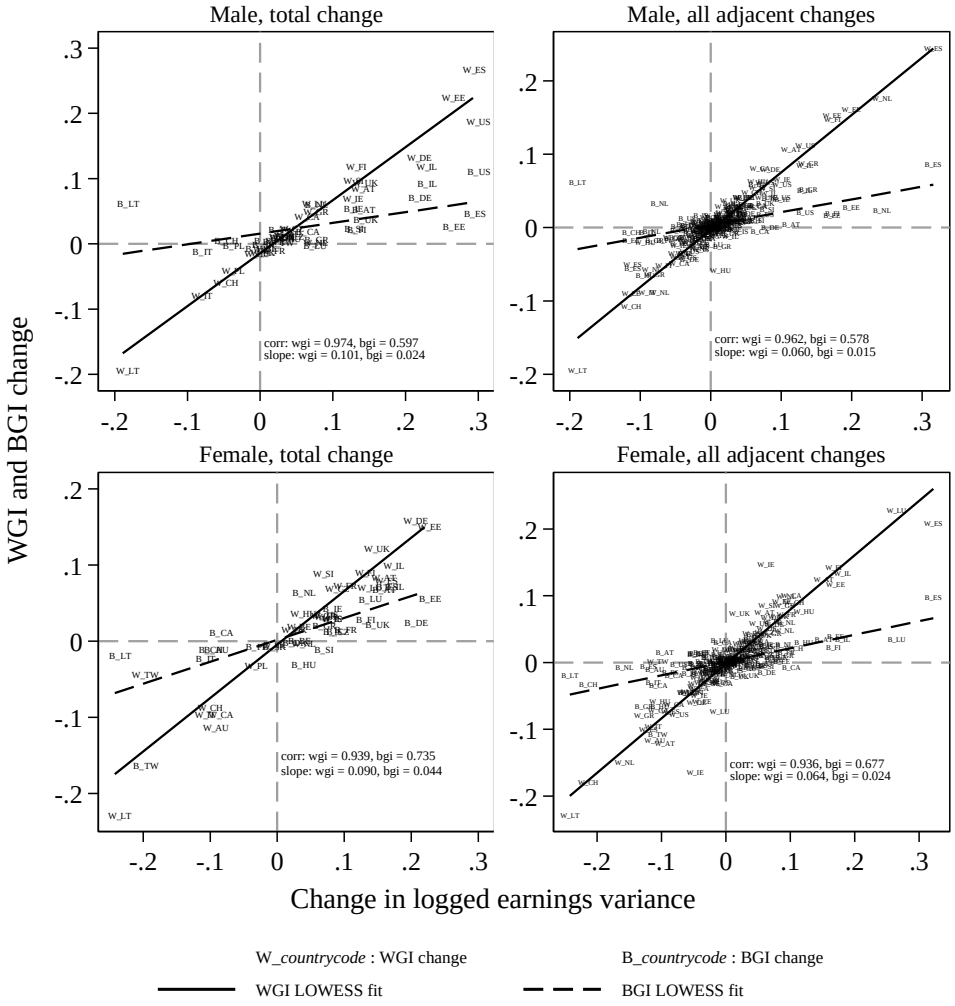


**Figure 2: Scatterplot and slop of within-group inequality (WGI) change and between-group inequality (BGI) change against total inequality change**

Note: Country codes listed in Table 1.

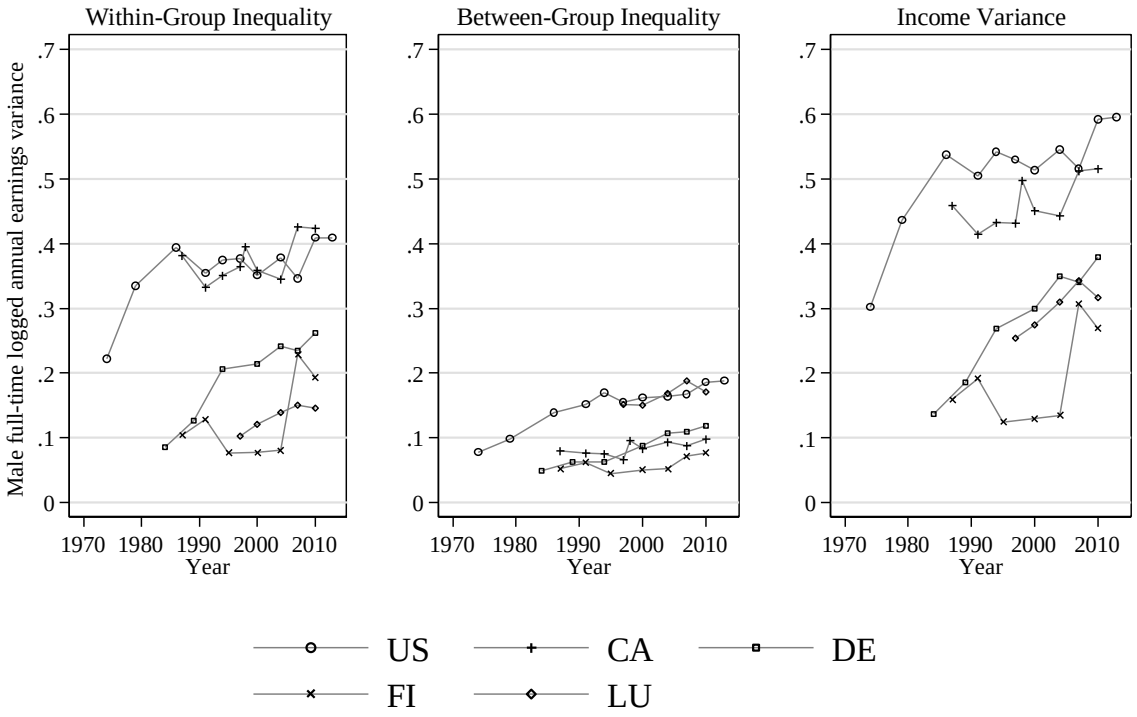


**Figure 3: Male within-group, between-group, and total inequality of logged annual earnings over time in five countries**

Note: Country codes listed in Table 1

Table 1: Country Samples

| Country | Years | Observations |
|---|---|---|
| Austria (AT) | 1994,1997,2000,2004,2013 | 5 |
| Australia (AU) | 1985,1989,2008,2010 | 4 |
| Belgium (BE) | 1997,2000 | 2 |
| Canada (CA) | 1987,1991,1994,1997,1998,2000,2004,2007,2010 | 9 |
| Switzerland (CH) | 2007,2010,2013 | 3 |
| Czech Republic (CZ) | 1996,2004,2007,2010,2013 | 5 |
| Germany (DE) | 1984,1989,1994,2000,2004,2007,2010,2013 | 8 |
| Denmark (DK) | 2004,2007,2010,2013 | 4 |
| Estonia (EE) | 2004,2007,2010,2013 | 4 |
| Spain (ES) | 2000,2004,2007,2010,2013 | 5 |
| Finalnd (FI) | 1987,1991,1995,2000,2004,2007,2010,2013 | 8 |
| France (FR) | 2005,2010 | 2 |
| Greece (GR) | 1995,2000,2004,2007,2010,2013 | 6 |
| Hungary (HU) | 1991,1994,1999,2005 | 4 |
| Ireland (IE) | 1994,1995,2000,2004,2007,2010 | 6 |
| Israel (IL) | 1979,1986,1992,1997,2001,2005 | 6 |
| Iceland (IS) | 2004,2007,2010 | 3 |
| Italy (IT) | 2004,2008,2010 | 3 |
| Lithuania (LT) | 2010,2013 | 2 |
| Luxembourg (LU) | 1997,2000,2004,2007,2010,2013 | 6 |
| Netherlands (NL) | 1990,2004,2007,2010,2013 | 5 |
| Poland (PL) | 2007,2010,2013 | 3 |
| Russia (RU) | 2004,2007,2010,2013 | 4 |
| Slovenia (SI) | 1999,2004,2007,2010,2012 | 5 |
| Slovakia (SK) | 2004,2007,2010,2013 | 4 |
| Taiwan (TW) | 1981,1986,1991,1995,1997,2000,2005,2007,2010,2013 | 10 |
| United Kingdom (UK) | 1986,1999,2004,2007,2010,2013 | 6 |
| United States (US) | 1974,1979,1986,1991,1994,1997,2000,2004,2007,2010,2013 | 11 |
| Total | | 143 |

Table 2: Descriptive statistics

| Variable | Mean | SD | Minimum | Maximum |
|---|---|---|---|---|
| Male sample | | | | |
| Within-group inequality (WGI) | 0.224 | 0.106 | 0.064 | 0.576 |
| Within-group inequality | 0.241 | 0.112 | 0.049 | 0.546 |
| Relative contribution of WGI to total inequality: male | 68.640 | 9.421 | 40.008 | 86.601 |
| Relative contribution of WGI to total inequality: female | 70.174 | 9.380 | 41.151 | 96.342 |
| Logged variance of annual earnings: male | 0.320 | 0.129 | 0.116 | 0.709 |
| Logged variance of annual earnings: female | 0.333 | 0.135 | 0.079 | 0.689 |
| Percent high education category (ISCED 5 and 6, LIS) | 0.311 | 0.115 | 0.089 | 0.618 |
| Potential experience, mean (LIS) | 21.103 | 1.220 | 18.693 | 24.952 |
| Potential experience, standard deviation (LIS) | 8.938 | 0.373 | 8.087 | 9.872 |
| Percent high education category (ISCED 5 and 6, LIS) | 0.381 | 0.147 | 0.098 | 0.703 |
| Potential experience, mean (LIS) | 20.426 | 1.678 | 15.874 | 25.282 |
| Potential experience, standard deviation (LIS) | 9.221 | 0.436 | 8.091 | 10.306 |
| Percent tertiary educational attainment (Barro-Lee) | 0.176 | 0.071 | 0.063 | 0.337 |
| Educational heterogeneity (Barro-Lee) | 0.925 | 0.130 | 0.509 | 1.096 |
| Percent tertiary educational attainment (Barro-Lee) | 0.165 | 0.076 | 0.022 | 0.342 |
| Educational heterogeneity (Barro-Lee) | 0.918 | 0.115 | 0.511 | 1.098 |
| Female sample | | | | |
| Within-group inequality | 0.241 | 0.112 | 0.049 | 0.546 |
| Relative contribution of WGI to total inequality: female | 70.174 | 9.380 | 41.151 | 96.342 |
| Logged variance of annual earnings: female | 0.333 | 0.135 | 0.079 | 0.689 |
| Percent high education category (ISCED 5 and 6, LIS) | 0.381 | 0.147 | 0.098 | 0.703 |
| Potential experience, mean (LIS) | 20.426 | 1.678 | 15.874 | 25.282 |
| Potential experience, standard deviation (LIS) | 9.221 | 0.436 | 8.091 | 10.306 |
| Percent tertiary educational attainment (Barro-Lee) | 0.165 | 0.076 | 0.022 | 0.342 |
| Educational heterogeneity (Barro-Lee) | 0.918 | 0.115 | 0.511 | 1.098 |
| Welfare regime | | | | |
| Liberal | 0.25 | | | |
| Continental Europe | 0.36 | | | |
| Scandinavia | 0.10 | | | |
| Eastern Europe | 0.22 | | | |
| Taiwan | 0.07 | | | |
| Male observations: 143 Female observations: 142 | | | | |

Israel-1986 dropped from female sample due to small sample size

Table 3: Relationship between relative importance of within-group inequality (WGI) and total inequality

| | Male WGI | | | | | | Female WGI | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Whole sample | | | US dropped | | | Whole sample | | | US dropped | | |
| | (1a) | (2a) | (3a) | (4a) | (5a) | (6a) | (1b) | (2b) | (3b) | (4b) | (5b) | (6b) |
| Earnings inequality | 26.028*** | 20.473*** | 21.507*** | 31.567*** | 21.155*** | 21.606*** | 22.093*** | 20.745* | 26.476** | 20.740*** | 20.199* | 27.856** |
| | (4.158) | (5.462) | (5.963) | (4.618) | (5.736) | (6.193) | (4.490) | (9.539) | (7.832) | (5.306) | (9.852) | (8.726) |
| Country fixed effects? | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes | No | Yes | Yes |
| Continuous year? | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes | No |
| Year fixed effects? | No | No | Yes | No | No | Yes | No | No | Yes | No | No | Yes |
| N | 143 | 143 | 143 | 132 | 132 | 132 | 142 | 142 | 142 | 131 | 131 | 131 |

Robust standard errors, t-statistics in parentheses

+ p<0.10, * p<0.05, **p<0.01, ***p<0.001, two-tailed test

Dependent variable is the percentage of total earnings inequality due to either within-group inequality (WGI) or between-group inequality (BGI). "Earnings inequality" is the absolute level of total earnings inequality.

Table 4: Welfare regime variation in within-group inequality (WGI) levels and relative importance

| | WGI absolute level: Male sample | | | | | | WGI absolute level: Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1a) | (2a) | (3a) | (4a) | (5a) | (6a) | (1b) | (2b) | (3b) | (4b) | (5b) | (6b) |
| Continental Europe[1] | -0.10*** | -0.02** | -0.06*** | -0.07*** | -0.02** | -0.02*** | -0.10*** | -0.02** | -0.09*** | -0.07** | -0.02** | -0.02** |
| | (-5.23) | (-2.99) | (-3.50) | (-3.80) | (-2.81) | (-3.53) | (-4.81) | (-2.71) | (-4.79) | (-2.98) | (-2.63) | (-3.09) |
| Scandinavia | -0.14*** | 0.01 | -0.12*** | -0.10*** | 0.01 | -0.01 | -0.21*** | -0.01 | -0.24*** | -0.17*** | -0.01 | -0.01 |
| | (-5.51) | (0.16) | (-4.98) | (-3.50) | (0.39) | (-0.22) | (-7.92) | (-1.55) | (-8.49) | (-5.93) | (-0.65) | (-1.45) |
| Eastern Europe | -0.03 | 0.01* | 0.02 | 0.04 | 0.01 | 0.01 | -0.06* | -0.01 | -0.08** | -0.07** | -0.00 | -0.01 |
| | (-1.05) | (2.29) | (0.54) | (1.45) | (1.52) | (0.53) | (-2.38) | (-0.96) | (-2.78) | (-2.66) | (-0.30) | (-1.21) |
| Taiwan | -0.18*** | -0.03*** | -0.18*** | -0.06** | -0.03*** | -0.05*** | -0.19*** | -0.07*** | -0.17*** | -0.15*** | -0.07*** | -0.07*** |
| | (-11.57) | (-5.87) | (-10.83) | (-2.76) | (-5.41) | (-7.02) | (-10.00) | (-5.32) | (-7.89) | (-5.68) | (-5.16) | (-5.82) |
| Total inequality control? | No | Yes | No | No | Yes | Yes | No | Yes | No | No | Yes | Yes |
| Human capital controls? | No | No | LIS | B-L | LIS | B-L | No | No | LIS | B-L | LIS | B-L |
| | Percent-Male | | | | | | Percent-Female | | | | | |
| | (7a) | (8a) | (9a) | (10a) | (11a) | (12a) | (7b) | (8b) | (9b) | (10b) | (11b) | (12b) |
| Continental Europe | -7.4*** | -6.0** | -6.7*** | -7.8*** | -5.7** | -6.1*** | -5.4** | -4.4* | -5.4** | -6.0** | -4.0+ | -5.1* |
| | (-4.09) | (-3.28) | (-3.43) | (-4.28) | (-2.93) | (-3.52) | (-2.89) | (-2.05) | (-2.91) | (-3.07) | (-1.90) | (-2.44) |
| Scandinavia | -4.1* | -1.7 | -3.5+ | -4.9* | -0.6 | -1.7 | -8.4*** | -5.8* | -6.3** | -8.7*** | -1.9 | -5.7* |
| | (-2.19) | (-0.92) | (-1.69) | (-2.24) | (-0.32) | (-0.94) | (-4.20) | (-2.11) | (-2.89) | (-3.84) | (-0.65) | (-2.03) |
| Eastern Europe | 2.8+ | 3.5* | 2.5 | 1.2 | 2.4 | -0.1 | -2.3 | -1.5 | -0.6 | -3.8+ | 0.7 | -2.6 |
| | (1.76) | (2.30) | (1.33) | (0.62) | (1.35) | (-0.03) | (-1.19) | (-0.77) | (-0.27) | (-1.73) | (0.33) | (-1.20) |
| Taiwan | -19.3*** | -16.7*** | -19.7*** | -21.8*** | -16.3*** | -21.4*** | -22.9*** | -21.3*** | -23.5*** | -25.6*** | -21.7*** | -24.2*** |
| | (-13.98) | (-10.19) | (-14.79) | (-9.22) | (-10.13) | (-9.43) | (-11.33) | (-8.09) | (-10.06) | (-9.37) | (-7.48) | (-7.95) |
| Total inequality control? | No | Yes | No | No | Yes | Yes | No | Yes | No | No | Yes | Yes |
| Human capital controls? | No | No | LIS | B-L | LIS | B-L | No | No | LIS | B-L | LIS | B-L |
| N | 143 | 143 | 143 | 143 | 143 | 143 | 142 | 142 | 142 | 142 | 142 | 142 |

Robust standard errors in parentheses
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001, two-tailed test
LIS=education and potential experience means from Luxembourg Income Study samples. B-L=percent of individuals age 25-55 with a tertiary degree, and educational heterogeneity