

Correction

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Correction for “Rising between-workplace inequalities in high-income countries,” by Donald Tomaskovic-Devey, Anthony Rainey, Dustin Avent-Holt, Nina Bandelj, István Boza, David Cort, Olivier Godechot, Gergely Hajdu, Martin Hällsten, Lasse Folke Henriksen, Are Skeie Hermansen, Feng Hou, Jiwook Jung, Aleksandra Kanjuo-Mrčela, Joe King, Naomi Kodama, Tali Kristal, Alena Křížková, Zoltán Lippényi, Silvia Maja Melzer, Eunmi Mun, Andrew Penner, Trond Petersen, Andreja Poje, Mirna Safi, Max Thaning, and Zaibu Tufail, which was first published April 13, 2020; 10.1073/pnas.1918249117 (*Proc. Natl. Acad. Sci. U.S.A.* **117**, 9277–9283).

The authors note that the affiliation for Silvia Maja Melzer should instead appear as Department of Political and Social Sciences, University Pompeu Fabra, Barcelona 08005, Spain. The corrected author and affiliation lines appear below. The online version has been corrected.

**Donald Tomaskovic-Devey^a, Anthony Rainey^a,
Dustin Avent-Holt^b, Nina Bandelj^c, István Boza^d, David
Cort^a, Olivier Godechot^e, Gergely Hajdu^f, Martin
Hällsten^g, Lasse Folke Henriksen^h, Are Skeie Hermansenⁱ,
Feng Hou^j, Jiwook Jung^k, Aleksandra Kanjuo-Mrčela^l,
Joe King^m, Naomi Kodamaⁿ, Tali Kristal^o, Alena Křížková^p,
Zoltán Lippényi^q, Silvia Maja Melzer^r, Eunmi Mun^k,**

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**Andrew Penner^c, Trond Petersen^s, Andreja Poje^t,
Mirna Safi^e, Max Thaning^g, and Zaibu Tufail^c**

^aDepartment of Sociology, University of Massachusetts, Amherst, MA, 01003; ^bDepartment of Social Sciences, Augusta University, Augusta, GA 30912; ^cDepartment of Sociology, University of California, Irvine, CA, 92617; ^dDepartment of Economics and Business, Central European University, Budapest 1051, Hungary; ^eObservatoire sociologique du changement, MaxPo, Sciences Po, Centre national de la recherche scientifique, Paris 75007, France; ^fDepartment of Economics, Vienna University of Economics and Business, Vienna AU-1020, Austria; ^gDepartment of Sociology, Stockholm University, Stockholm 114 18, Sweden; ^hDepartment of Organization, Copenhagen Business School, Copenhagen DK-2000, Denmark; ⁱDepartment of Sociology and Human Geography, University of Oslo, Oslo N-0851, Norway; ^jSocial Analysis and Modelling Division, Statistics Canada, Ottawa, Canada K1A 0T6; ^kSchool of Labor and Employment Relations, University of Illinois, Urbana-Champaign, Urbana, IL, 61801; ^lFaculty of Social Sciences, University of Ljubljana, 1000 Ljubljana, Slovenia; ^mInstitute for Defense Analyses, Alexandria, VA, 22311-1882; ⁿCollege of Economics, Nihon University, Tokyo 101-8360, Japan; ^oDepartment of Sociology, University of Haifa, Haifa 31905, Israel; ^pInstitute of Sociology, Czech Academy of Sciences, Prague 11000, Czech Republic; ^qDepartment of Sociology, University of Groningen, Groningen 9712 TG, The Netherlands; ^rDepartment of Political and Social Sciences, University Pompeu Fabra, Barcelona 08005, Spain; ^sDepartment of Sociology, University of California, Berkeley, CA, 94720-1980; and ^tAssociation of Free Trade Unions of Slovenia, 1000 Ljubljana, Slovenia



Rising between-workplace inequalities in high-income countries

Donald Tomaskovic-Devey^{a,1}, Anthony Rainey^a, Dustin Avent-Holt^b, Nina Bandelj^c, István Boza^d, David Cort^e, Olivier Godechot^f, Gergely Hajdu^f, Martin Hällsten^g, Lasse Folke Henriksen^h, Are Skeie Hermansenⁱ, Feng Hou^j, Jiwook Jung^k, Aleksandra Kanjuo-Mrčela^l, Joe King^m, Naomi Kodamaⁿ, Tali Kristal^o, Alena Křížková^p, Zoltán Lippényi^q, Silvia Maja Melzer^r, Eunmi Mun^k, Andrew Penner^c, Trond Petersen^s, Andreja Poje^t, Mirna Safi^e, Max Thaning^g, and Zaibu Tufail^c

^aDepartment of Sociology, University of Massachusetts, Amherst, MA, 01003; ^bDepartment of Social Sciences, Augusta University, Augusta, GA 30912; ^cDepartment of Sociology, University of California, Irvine, CA, 92617; ^dDepartment of Economics and Business, Central European University, Budapest 1051, Hungary; ^eObservatoire sociologique du changement, MaxPo, Sciences Po, Centre national de la recherche scientifique, Paris 75007, France; ^fDepartment of Economics, Vienna University of Economics and Business, Vienna AU-1020, Austria; ^gDepartment of Sociology, Stockholm University, Stockholm 114 18, Sweden; ^hDepartment of Organization, Copenhagen Business School, Copenhagen DK-2000, Denmark; ⁱDepartment of Sociology and Human Geography, University of Oslo, Oslo N-0851, Norway; ^jSocial Analysis and Modelling Division, Statistics Canada, Ottawa, Canada K1A 0T6; ^kSchool of Labor and Employment Relations, University of Illinois, Urbana-Champaign, Urbana, IL, 61801; ^lFaculty of Social Sciences, University of Ljubljana, 1000 Ljubljana, Slovenia; ^mInstitute for Defense Analyses, Alexandria, VA, 22311-1882; ⁿCollege of Economics, Nihon University, Tokyo 101-8360, Japan; ^oDepartment of Sociology, University of Haifa, Haifa 31905, Israel; ^pInstitute of Sociology, Czech Academy of Sciences, Prague 11000, Czech Republic; ^qDepartment of Sociology, University of Groningen, Groningen 9712 TG, The Netherlands; ^rDepartment of Political and Social Sciences, University Pompeu Fabra, Barcelona 08005, Spain; ^sDepartment of Sociology, University of California, Berkeley, CA, 94720-1980; and ^tAssociation of Free Trade Unions of Slovenia, 1000 Ljubljana, Slovenia

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It is well documented that earnings inequalities have risen in many high-income countries. Less clear are the linkages between rising income inequality and workplace dynamics, how within- and between-workplace inequality varies across countries, and to what extent these inequalities are moderated by national labor market institutions. In order to describe changes in the initial between- and within-firm market income distribution we analyze administrative records for 2,000,000,000+ job years nested within 50,000,000+ workplace years for 14 high-income countries in North America, Scandinavia, Continental and Eastern Europe, the Middle East, and East Asia. We find that countries vary a great deal in their levels and trends in earnings inequality but that the between-workplace share of wage inequality is growing in almost all countries examined and is in no country declining. We also find that earnings inequalities and the share of between-workplace inequalities are lower and grew less strongly in countries with stronger institutional employment protections and rose faster when these labor market protections weakened. Our findings suggest that firm-level restructuring and increasing wage inequalities between workplaces are more central contributors to rising income inequality than previously recognized.

inequality | workplaces | administrative data | earnings | institutions

Rising income inequalities are increasingly recognized as social, political, moral, and macroeconomic problems for high-income nations (e.g., refs. 1–3). Using linked employer–employee (LEE) administrative data for 14 countries (Canada, Czechia, Denmark, France, Germany, Hungary, Israel, Japan, the Netherlands, Norway, Slovenia, South Korea, Sweden, and the United States) we describe changes in the initial market income distribution produced by workplaces over roughly the last quarter century. Almost all rising wage inequalities in the United States are between firms (4), with the increased market power of super star firms (5) and outsourcing and subcontracting of production to low-wage employers (6) as the two most plausible mechanisms. We explore the global extent of this trend and the degree to which it is moderated by national labor market institutions.

Although most wages come from employers, most prior research on earnings inequalities rely on self-reported earnings from surveys of individuals (e.g., ref. 7). Increasingly, social scientists have been able to access and develop administrative data collected from employers by national governments, typically as part of their tax and social welfare systems. These data often

have nearly complete, highly accurate information on individual earnings, making it possible to examine the job-level (person–employer match) wage distribution, changes in that distribution, and their association with organizational characteristics. LEE data allow us to locate inequalities in the firms that produce them. An analytic focus on employers is crucial if countries are to develop labor market or industrial policies that focus on the quality of jobs.

In some influential accounts rising inequality is treated as ubiquitous and almost inevitably increasing across high-income capitalist nations (e.g., ref. 3). Others have pointed out that there is considerable national variation in low-wage work, as well as earnings inequality levels and trends (e.g., refs. 8 and 9). The

Significance

Understanding the causes of rising inequality is of concern in many countries. Using administrative data, we find that the share of inequality that is between workplaces is growing in 12 of 14 countries examined, and in no country has it fallen. Countries with declining employment protections see growth in both between- and within-workplace inequalities, but this impact is stronger for between-workplace inequalities. These results suggest that to reduce market income inequality requires policies that raise the bargaining power of lower-skilled workers. The widespread rise in between-workplace inequality additionally suggests policy responses that target the increasing market power of firms in concentrated markets as well as curb the ability of powerful firms to outsource low skill employment.

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The authors declare no competing interest.

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¹To whom correspondence may be addressed. Email: tomaskovic-devey@soc.umass.edu.

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former stress institutional similarities among capitalist countries and the centripetal forces of globalization and technological change, both of which are understood to reduce the demand for routine production roles. The latter stress national variation in institutions that reduce employee's dependence on employers, provide various forms of job security, and put a floor under wages, all of which reduce the possible levels of wage inequalities associated with employee bargaining power. Although both perspectives emphasize the relative bargaining power of employers and employees, neither has typically had access to LEE wage data.

Early LEE studies found for multiple countries that within-workplace wage variance tended to be substantially higher than between-workplace inequalities (10). In contrast, recent studies have shown that most of the rising inequality in the United States (4, 11), West Germany (12), and Sweden (13) has been produced by rising between-workplace (Sweden and Germany) or firm (United States) inequality.

Rising between-workplace inequality occurs when workplaces become more dissimilar in their average pay. This can be produced by some firms becoming more powerful in their market positions and so accumulating larger shares of national (or global) income. Examples of these organizational dynamics include the rise of superstar firms, such as the global dominance of a few technology firms such as Microsoft, Apple, Facebook, Google, and Amazon (5), and the power of financial service firms in some countries to accumulate national and global income (14, 15). Akerman (16) suggests that this process leads to the concentration of more educated workers in higher-wage firms and the less educated in lower-wage firms.

Between-firm earnings polarization can also be propelled by the reconfiguring of organizational boundaries in which firms with market or organizational power specialize in high value-added work and outsource or subcontract routine production. Examples of such organizational reconfigurations include dominant brand manufacturers spinning off supplier functions to lower-wage firms (17), unionized workers being replaced by independent contractors (18), branded companies subcontracting out both production and capital investment while absorbing the profits associated with the brand (6), and global commodity chains in which routine production are sourced from low-wage locales by large retailers or manufacturers in high-income countries (19). Outsourcing of low-skill jobs from high-wage firms has been linked to earnings declines in the range of 10 to 15% in Germany and 4 to 24% in the United States (20, 21).

This package of dynamic shifts in the power, productivity, boundaries, and global scope of dominant firms appears to have been encouraged in some countries by the contemporary policy model of reduced government regulation and employment protections (22), as well as by the reconfiguration of large firms as more narrowly responsible to shareholders rather than other stakeholders, such as employees, communities, customers, and even their nation of origin (23).

Our analyses document substantial variation between countries in inequality trends. Total inequality is rising in nine countries, declining in three, and stagnant in two. Most strikingly, we find in 12 of the 14 countries examined that the organizational structure of production is shifting toward increasing between-workplace wage dispersion. In all of those 12 countries this process is more pronounced in the private sector, but we also find rising between-workplace inequality in the public sector in eight countries. Finally, we show that trends in rising between-workplace wage dispersion are closely aligned with declining national labor market institutions, institutions that in some countries once protected the bargaining power of employees relative to employers.

In what follows we first establish country variation in the levels and trends in earnings inequalities for all job-person matches

and for subsamples of full-time job-person spells. We then decompose each country's inequality levels and trends into between- and within-workplace variance components. Next, we compare levels and trends in the proportion of inequality attributable to the between-workplace component across countries in terms of their shifting labor market institutions. We then discuss results, followed by a presentation of *Materials and Methods*. The paper is followed by *SI Appendix*, organized as five appendices.

Results

We present results for both the levels and trends in total and between-workplace earnings inequality as well as the proportion of total inequality that is between workplaces. There is substantial variation across countries in both the levels and trends in total inequality. In contrast, between-workplace inequality is rising in 10 countries. Additionally, because in some countries the within-workplace inequality component falls, the proportion of inequality that is between firms is rising in 12 of 14 countries.

Trends in Total Inequality. Fig. 1 presents trends in the total variance in logged earnings and the between-workplace variance estimates for all jobs for 14 countries. There are striking disparities in the levels of inequalities, with the United States, Canada, and Israel more and the Nordic countries less unequal in their initial market distribution of income.

Rising wage inequality is not an international constant. There is substantial variation across countries, with strong growth rates between the first and last observation in Czechia (+26.0%), Germany (+62.6%), Korea (+35.0%), Norway (+43.6%), and Sweden (+32.0%); slower growth rates in Denmark (+8.5%), Israel (+8%), the Netherlands (+8%), and the United States (+10.8%); declines in France (−21.7%), Hungary (−4.5%), and Slovenia (−11.5%); and relatively stable distributions in Canada and Japan. There is also a tendency in several countries, most notably Germany and Slovenia, for inequality declines after the great recession of 2008 to 2010.

In five of the countries examined, job-level wage inequalities are either roughly stable or falling. Trends for full-time jobs largely mirror those of the entire economy for every country, with only minor discrepancies (see *SI Appendix, Appendix 2*, for full-time estimates).

Trends in Between-Workplace Inequality. Variance in between-workplace wage inequalities for all jobs are rising absolutely in 10 of 14 countries. At the high end, Germany has experienced a 92.5% growth in between-workplace inequality. Other countries range between a growth rate of 66.5% (Sweden) and 7.9% (Japan). Countries which have seen absolute declines in between-workplace inequality are France (−11.6%), Slovenia (−14.9%), and Hungary (−3.9%). Canada has experienced essentially no change.

Initially, the proportion (rather than the level) of between-workplace inequality ranges from a low of 18.5% in the Netherlands to over 50% in Germany, Hungary, and Japan. Canada and Denmark show relatively low initial between-establishment inequality shares (*SI Appendix, Appendix 2*, and *Table S1.4*). Czechia, Israel, Korea, Norway, France, Slovenia, Sweden, and the United States are sandwiched in the middle of these distributions. By the end of the period in seven countries (Czechia, Israel, Japan, Hungary, Germany, Norway, and South Korea), half or more of their total wage variance is produced by between-workplace wage dispersion.

Fig. 2 provides the trends in the proportion of inequality attributable to the between-workplace component for the total economy, as well as for the private and public sectors. The proportion of total inequality attributable to the between-workplace component has grown in every country except

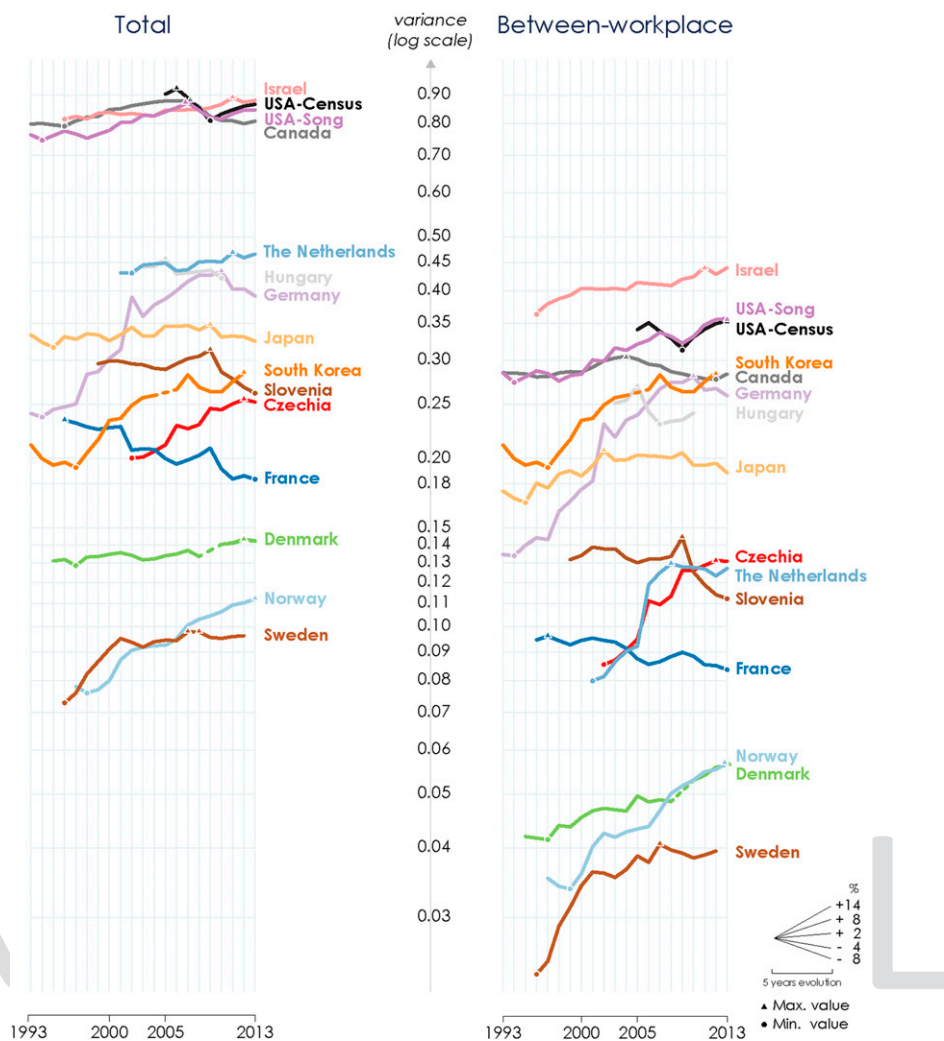


Fig. 1. National trends in the total variance of log wages (*Left*) and between-workplace variance for all jobs (*Right*). USA-Song denotes Song et al. (4) estimates, which span 1993 to 2013. USA-Census denotes estimate from the US Census, which begin in 2005 and end in 2013. South Korea's estimates are limited to full-time jobs only, and 2005 estimates are missing.

Hungary and Canada. Between-workplace wage dispersion occurs even in countries which have very high initial proportions. Germany and Japan's between-workplace inequality proportion grew from 55.9 to 66.2% and 52.4 to 58.0%, respectively. Czechia, Germany, the Netherlands, and Sweden all show the largest increases in the between-workplace component, growing by 9% or more. Denmark, France, Israel, Norway, South Korea, and the United States all experienced growth of 5% or more in the between-workplace inequality component. Although between-workplace inequality declined over Slovenia's entire economy, their private sector experienced a rise in between-workplace inequality of about 2.5%.

The between-workplace component in both Canada and Hungary, on the other hand, has remained stable overall. Importantly, not a single country experienced a decline in either the level or proportion of the between-workplace component of inequality. Wage inequality dynamics in the last 2 decades have been driven increasingly by the relative importance of between-workplace earnings dispersion in most countries examined.

If between-workplace earnings dispersion is driven primarily by market pressures, it should be confined largely to the private sector. On the other hand, if public sectors are responding to institutional pressures to look more like the private sector, we

might find that this pattern happens there as well. In all countries, between-workplace dispersion is larger in the private sector than in the public sector. For six of these countries, between-workplace wage dispersion has also grown at a faster rate in the private sector. In 8 of the 14 countries, dispersion is occurring in the public sector as well. Only in Hungary and Slovenia do we observe declines in the between-workplace component in the public sector (around 5% for both countries).

Institutional Variation. Much prior research has shown that wage inequalities and particularly the prevalence of low wages tend to be lower in countries with national or industrial institutions that increase the bargaining power of employees relative to employers (e.g., refs. 24 and 25). We ranked each country in terms of six labor market institutional protections: the centralization of collective bargaining units and worker's councils; the level at which businesses, labor, and government engage in wage coordination (national, industry, workplace, and individual); the proportion of the economy that is affected by corporatist arrangements, such as industry-wide wage bargaining; the percentage of workers covered by collective bargaining agreements; regular contract individual's legal employment protections; and

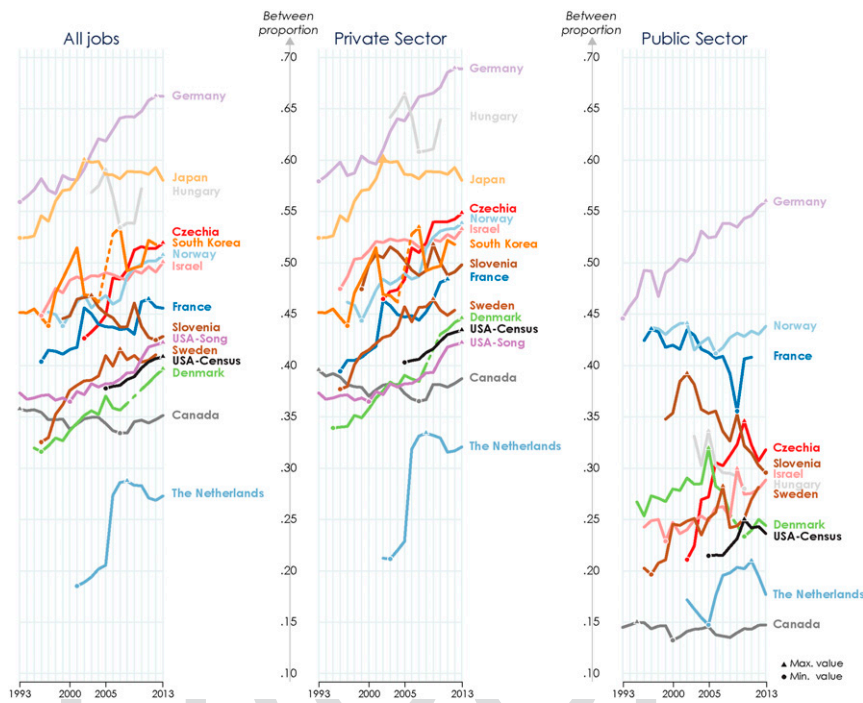


Fig. 2. The proportion of total inequality that is between firms for the total (Left), private (Middle), and public sectors (Right). Estimates are for all jobs except for South Korea, which are full-time jobs only. Japan, South Korea, and USA-Song only have private sector estimates. South Korea is missing for 2005.

temporary contract individual's legal employment protections (see *SI Appendix, SI Appendix 3*, for full details).

Fig. 3 shows trends in institutional protections for each country, as well as trends in the between-workplace share of total wage inequality. At the beginning of our period, the countries fell into three distinct institutional groupings: The United States and Canada both had very low scores, reflecting an almost total absence of institutional employment protections. These two countries also remain stably low through our time period. The

next set of countries, Sweden, Norway, Germany, Slovenia, the Netherlands, France, and Denmark, all began with quite high institutional employment protections. Of these, Germany, Sweden, and Norway all experienced strong declines. France, the Netherlands, and Denmark maintained their robust institutional labor market protections. Slovenia's protections collapsed in the early 1990s, only to be built back up to their former strength by the early 2000s. Czechia, Hungary, Israel, South Korea, and Japan start in between the extremes of the two former groups.

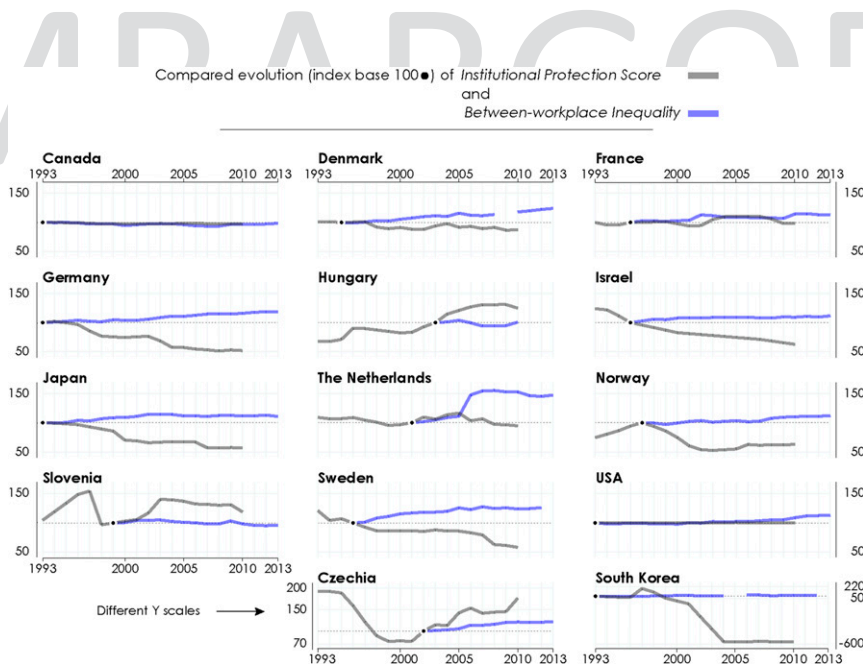


Fig. 3. The relationship between institutional employment protections and the between-workplace component. All estimates are on all job samples, except for South Korea, which is full-time jobs only. US (4), Japanese, and South Korean estimates are private sector only and missing for 2005.

Czechia and Japan both remain relatively stable, whereas Hungary steadily increased the strength of its institutional protections, and Israel and South Korea weakened theirs.

Fig. 3 displays a general pattern of association between shifts in institutional protections and changes in the between-workplace inequality share. When labor market institutions weaken, between-workplace inequalities tend to rise. In Denmark, France, Germany, Israel, Japan, the Netherlands, Norway, Sweden, and South Korea, when labor market institutions weakened, workplace inequalities rose. In Canada and the United States where institutions remain stably weak, we see little change. Institutional protections strengthen in Czechia, Hungary, and Slovenia. In Hungary the between-workplace share of inequality is flat; in Slovenia it declined overall but grew in the private sector. Czechia is the anomaly, with a strong rise in between-workplace inequality despite strengthening labor market institutions.

To more formally investigate this process, we estimated a series of error correction statistical models to explore the potential impact of institutional change on rising within- and between-workplace inequalities. The first stage of the error correction model takes the following form:

$$\Delta Y_t = \alpha_0 + \alpha_c + \alpha_1 Y_{t-1} + \beta_0 \Delta X_{t-(t-1)} + \beta_1 X_{t-1} + \varepsilon_t.$$

The model estimates the impact of levels and change in institutional protections on change in inequality, controlling for both the lagged value of inequality and a country fixed effect to absorb stable unobserved country attributes. See ref. 26 for more information.

From the first stage model we can directly estimate the short-term coefficient and SE of ΔX (institutional change). In a second stage, the long run effect of institutional change is calculated as $\beta_1 X_{t-1}$ divided by the error correction rate ($\alpha_1 Y_{t-1}$). We then use the Bewley model (27) to estimate the SE of the long-run effect of X . Code for these estimations is provided in *SI Appendix, Appendix 5*.

To rule out the most prominent alternative explanations we control for changes in unemployment, labor force participation, and female labor share. We do not have country year measures of concentrated economic power, and so our models remain vulnerable to omitted variable bias. The ability of powerful firms to outsource production is likely to be restricted when countries have strong labor market institutions. The focus on logged earnings and models that include lagged dependent variables and country fixed effects, as well as jackknife estimations to rule out influential case explanations, increase confidence that our estimates are likely to be reasonable, if not definitive.

We hypothesize that declining institutional protections will be associated with a rising proportion of between-workplace inequality. We also estimate models of the total, between, and within inequality components. None of these models are strictly speaking causal models as we think that the mechanisms that produce rising between-workplace inequality are primarily organizational. Rather, shifts in institutional protections are indicators of an economic environment that is more or less conducive to organizational strategies of outsourcing, franchising, subcontracting, and the like, as well as more individual and firm-level wage bargaining.

Table 1 reports the results. In no case do we see instantaneous inequality responses, which rules out the interpretation that rising between-firm inequality encourages declining institutional protections. We do see long-term shifts in inequalities accompanying changes in institutional labor market protections in all models. Rising proportions of country between-workplace inequalities respond most strongly to declining institutional protections, and this result is on average stronger in the private sector than in the public sector. In response to declining

employment protections, between-workplace variance in inequality rises in both the private and public sectors. The same is true for within-workplace inequalities, although the estimated effect sizes are relatively weaker, as is model fit.

Discussion

Market wage inequalities are not rising in all countries. The pattern of rising between-workplace wage dispersion, however, is more ubiquitous. In 12 of 14 countries examined, between-workplace inequalities are rising in the private sector. In eight this pattern is also present in the public sector. No country shows a clear decline in the between-workplace proportion of wage inequality.

Institutions that support the bargaining power of labor and the employment security of individuals strongly condition the levels of potential inequality both between and within firms. These institutions include collective bargaining through labor unions, national-level wage bargains, high minimum wages, the existence and power of worker's councils in the workplace, and employee protections from dismissals. The United States and Canada stand out for their low levels of employment protection and high levels of wage inequalities. However, even in the United States, there is evidence from the 1970s, prior to the 1980s collapse of unionization, that collective bargaining was associated with lower between-workplace inequality (28). The erosion of institutional protections in multiple countries appears to have given individual firms greater leeway to engage in organizational practices which generate increased wage inequalities, presumably via such mechanisms as outsourcing, franchising, independent contractors, and labor subcontracting, all of which decouple less powerful workers from dominant firm production and silence their potential claims on the lead firm's income.

Prominent research on Germany suggests that weakening labor market institutions and union bargaining power are linked to rising between-workplace inequalities (12). Other research has found that when institutional protections weaken, organized labor is less able to extend protection to low-skilled workers, leaving those workers increasingly vulnerable to outsourcing and independent contracting (29–31). It is the linkage between these institutional processes and rising between-firm inequality that we have the strongest confirmatory evidence. We strongly suspect that weak or declining institutional employment protections increase high-wage firms' incentive to restructure production via outsourcing and other forms of externalized production. Conversely, weak institutional protections enable the creation of low-wage firms to absorb this work. Doellgast (30), for example, shows that declining union power in the German telecommunications industry facilitates labor outsourcing. Similarly, Weil (6) for the United States stresses the absence of union and other employment protections for the outsourcing of production and risk to dependent supplier firms.

We do not observe rising firm market power in this paper. There is evidence elsewhere of rising product market concentration in our study period in Europe, the United States, and Japan (5, 32, 33). The rising market power of firms has been found to raise wages in those firms (5, 14, 15). We suspect that this market power also makes it easier for those firms to source or outsource risk and production to dependent supplier and franchisee firms (6, 19). There is good evidence for the United States, at least, that the concentration of revenue in the largest firms has increased even as employment has shrunk (34). It is also possible that these and other market processes have led to a rising economic return to educated labor (16). Other research has suggested that sectoral and industrial change, which is clearly implicated by the outsourcing mechanism, may also be important drivers of between-country inequality trajectories (35).

This paper has not adjudicated between these various mechanisms but has shown that rising between-workplace inequality is

Table 1. Error correction times series estimates regressing change in inequality on lagged inequality, lagged institutional protections, and changes in institutional protections

	Short-term impact of institutional protections	Long-term impact of institutional protections	P value: long-term impact	Model fit (adj. r ²)	Country years
Proportion of total inequality between workplaces					
All sectors	-0.032 (0.039)	-0.071 (0.014)	0.000	0.732	162
Private sector	-0.044 (0.043)	-0.104 (0.012)	0.000	0.739	161
Public sector	0.015 (0.039)	-0.069 (0.023)	0.014	0.490	117
Between-workplace variance					
All sectors	-0.021 (0.019)	-0.182 (0.009)	0.000	0.881	162
Private sector	-0.023 (0.024)	-0.195 (0.009)	0.000	0.868	161
Public sector	-0.005 (0.013)	-0.129 (0.009)	0.000	0.810	117
Within-workplace variance					
All sectors	0.001 (0.018)	-0.068 (0.009)	0.000	0.736	162
Private sector	0.005 (0.020)	-0.061 (0.009)	0.000	0.738	161
Public Sector	0.013 (0.031)	-0.059 (0.012)	0.001	0.514	117

Table reports coefficients, with SEs in parentheses. The institutional scale is available until 2010, and so our analyses begin with the first observation for a country and end in 2010. Israel was not included because of missing information on employment protection legislation. For all sectors and private sector estimations, Song et al. (4) estimates were used; for public sector models, US Census estimates were used. All models control for yearly unemployment rates and labor force participation and are robust to additional statistical control for changes in female labor force participation as well as jackknife estimations.

widespread. We look forward to the next round of research to unpack the (likely) nationally contingent impact of institutional, firm market power, and business strategy mechanisms.

Our results suggest that policies aimed at reducing rising inequalities in national production systems might focus on between-firm and workplace inequalities via mechanisms that strengthen the bargaining power of employees and address the ability of powerful firms to outsource risk while absorbing revenue. Strengthening institutional protections for lower-skilled workers will not only improve their wages and job security but also reduce the ability of more powerful firms to outsource production to lower-wage firms. Policies to limit the market power of dominant firms may moderate both the earnings going to the top of those firms and their ability to externalize labor costs.

Materials and Methods

Data Availability. Source data for this paper are highly confidential and available only under license from the country of origin. We provide country-year aggregate data for all data points discussed in the paper in *SI Appendix, Appendices 2 and 3*.

Data Harmonization. We endeavored to harmonize all measurement and sampling decisions, excepting only the definition of full, part-time, and marginal job wage; in those cases, national definitions were given priority. *SI Appendix, Appendix 1*, details country-specific sampling, operationalizations of all variables, and the consequences of sample restrictions for final sample size and describes country-specific variation in sample coverage.

In all analyses we exclude marginal jobs with very low wages, individuals below age 16, and workplaces with only one employee after the prior two exclusions.

Samples. For Canada, Denmark, France, Israel, the Netherlands, Norway, Slovenia, Sweden, and the United States we have population or near-population administrative data covering nearly all workplaces and nearly all employees. In Czechia, Germany, Japan, and Korea we analyze very large random samples of workplaces and their employees. In Hungary we have a random sample of 50% of all employees with firm identifiers.

Japan and South Korea only have private-sector estimates available. The other 12 countries have both public and private sector estimates. We begin in the early 1990s because that is when most national economies began to generate LEE data. More detail on country-specific data descriptions can be found in *SI Appendix, Appendix 1*.

In all countries we excluded jobs with earnings so low that they might represent reporting error or extremely short job spells. In the United States, Canada, and Israel these were done with income cutoffs and produced substantial exclusions, presumably of short-duration job spells. In the other

countries, low-income cutoffs were also used, but these identified very few marginal jobs, which we suspect represent employer reporting error (*SI Appendix, Appendix 1*).

In all countries, informal economic activity is not captured.

We use two sets of estimates for the United States. Estimates provided by Song et al. (4) range from 1993 to 2013 and include only the private sector. We supplement the Song et al. estimates with estimates provided by J.K. while employed by the US Census Bureau. These Census Bureau estimates cover only 2005 to 2013 but provide information on both the private and public sectors, as well as estimates for the subset of full-time jobs.

Statistical Significance. Because we have population data or very large samples we do not test for statistical significance in our trend analyses. Our smallest country-year sample is for Korea in 2003 with 362,789 jobs and 52,085 workplaces. We do test for statistical significance in country-year models that examine the relationship between changes in labor market institutions and inequality components. We provide the statistical code used to produce these estimates in *SI Appendix, Appendix 5*.

Units of Observation. Our core observational units are jobs within establishments. A job is a person-workplace match in a specific year. We focus on all jobs, which includes part-time and part-year job spells, as well as the subsample of full-time only jobs. Our focus on jobs highlights the output of the economy in terms of the employment opportunities that individuals and households confront.

Job Earnings Measurement. All earnings data are based on personnel records and reported by employers and so have very little measurement error. Our preferred earnings concept is logged hourly earnings. We include all earnings associated with a job spell including regular, overtime, and bonus earnings.

In nine countries we observe hourly earnings. For Germany and Hungary we observe daily earnings. In the United States, Canada, and Israel we observe yearly earnings associated with a job spell and have no information on hours or days worked. For these countries we use low wage cutoffs to define both marginal and full-time jobs (see *SI Appendix, Appendix 4*, for more detail). In these three countries we cannot clearly distinguish between jobs that are not full-time including both year-long part-time, low-earning part-year jobs, and some combinations of the two. For these countries we ran robustness checks for different definitions of marginal jobs and trends for total inequality and between and within components were very similar.

Organizational Units. For 12 countries we observe establishments, that is, actual workplaces. In Canada we use firm within state as a proxy for establishment. In the United States we use simply firm identifiers as our data lack state-identifying information. For those countries for which we have both firm and establishment identifiers, we are able to show that establishment and firm-level estimates track quite closely, and the inequality trends of the countries do not differ substantively between establishment and firm organizational concepts.

Earnings Inequality Measurement. We measure earnings inequality as the variance in logged wages, computed as $\sigma^2 = (\sum (X - \mu)^2 / N)$, where σ^2 is the variance, X is the observed logged wage for each job match, μ is the mean logged wage for all job matches, and N is the total number of job matches. The variance in log wage is scale invariant, directly decomposable into component parts, and particularly sensitive to income transfers lower in the income distribution (36). Thus, it is particularly useful for comparisons across time and countries, can be directly decomposed into between- and within-firm components, and is most appropriate when the normative concern is the social welfare of those with less income (37, 38, 39).

We follow Lazear and Shaw (10) in decomposing the logged earnings variance into within-workplace and between-workplace inequality with the following formula:

$$\sigma^2 = \sum_{j=1}^J p_j \sigma_j^2 + \sum_{j=1}^J p_j (\bar{w}_j - \bar{w})^2,$$

where p_j is the share of workers in the economy who are working in firm j , σ_j^2 is the variance of wages in firm j , \bar{w}_j is the mean wage for firm j (across its workers), and \bar{w} is the mean wage for the entire economy across its workers and firms (ref. 10, pp. 7–8).

Because wages in all countries are right skewed, with more people below the mean than above, variance measures are particularly sensitive to the levels and shifts in inequality among the majority of working people who earn less than or near to their country's mean wage. Most social welfare and labor market policies are focused on this population of earners. Our analyses do not inform debates about earnings trends for top earners, CEOs, or movie or sporting stars.

Institutional Protection Measure. Prior research in industrial relations (22) and comparative political economy (8) have stressed the importance when explaining national variation in employment outcomes to focus on the packages of policy configurations that employers and employees confront.

We follow this practice, measuring the strength of national institutional employment protections with a six-item scale. The first indicator is collective bargaining coverage [taken from the Database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (40)]. Collective bargaining coverage measures the percentage of all workers under a collective bargaining contract and functions as a measure of union bargaining strength across the national economy. The next two components of the scale both concern the levels of legal protection employees have from collective or individual dismissals. One concerns employees working “regular” contracts, the second temporary employees. These are primarily indicators of individual bargaining power and job security. The final three items come from Jahn's corporatism scale (41) which includes indicators of the organizational structure and power of collective bargaining groups and worker's councils, the functional level at which the government engages in wage coordination with interest groups, and the level (cross-industry, sectoral, and firm) of wage bargaining. We weight each of the six items equally in a standardized scale. All of the items are strongly positively correlated with each other, and the scale Cronbach alpha is 0.892. The items are described in depth, and their values for each country year can be found in [SI Appendix, Appendix 3](#).

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1. A. B. Atkinson, *Inequality: What Can Be Done?* (Harvard University Press, Cambridge, MA, 2014).
2. J. Stiglitz, *The Price of Inequality: How Today's Divided Society Endangers Our Future* (WW Norton & Company, New York, NY, 2012).
3. T. Piketty, *Capital in the Twenty-First Century* (Harvard University Press, Cambridge, MA, 2014).
4. J. Song, D. J. Price, F. Guvenen, N. Bloom, T. von Wachter, Firming up inequality. *Q. J. Econ.* **134**, 1–50 (2018).
5. D. Autor, D. Dorn, L. F. Katz, C. Patterson, J. van Reenen, Concentrating on the fall of the labor share and the rise of super star firms. *Q. J. Econ.* **107**, 180–185 (2017).
6. D. Weil, *The Fissured Workplace* (Harvard University Press, Cambridge, MA, 2014).
7. L. Chauvel, A. Hartung, *Challenging Inequalities: Pathways to a Just World* (UNESCO, 2016).
8. D. Brady, *Rich Democracies, Poor People: How Politics Explain Poverty* (Oxford University Press, Oxford, UK, 2009).
9. L. Kenworthy, *Egalitarian Capitalism: Jobs, Incomes, and Growth in Affluent Countries* (Russell Sage Foundation, NY, 2004).
10. E. P. Lazear, K. L. Shaw, Eds., *The Structure of Wages: An International Comparison* (University of Chicago Press, Chicago, IL, 2009).
11. E. Barth, A. Bryson, J. C. Davis, R. Freeman, It's where you work: Increases in the dispersion of earnings across establishments and individuals in the United States. *J. Labor Econ.* **34**, S67–S97 (2016).
12. D. Card, J. Heining, P. Kline, Workplace heterogeneity and the rise of West German wage inequality. *Q. J. Econ.* **128**, 967–1015 (2013).
13. O. N. Skans, P.-A. Edin, B. Holmlund, “Wage dispersion between and within plants: Sweden 1985–2000” in *The Structure of Wages: An International Comparison*, E. P. Lazear, K. L. Shaw, Eds. (University of Chicago Press, Chicago, IL, 2009), pp. 217–260.
14. O. Godechot, Is finance responsible for the rise in wage inequality in France? *Soc. Econ. Rev.* **10**, 447–470 (2012).
15. D. Tomaskovic-Devey, K.-H. Lin, Income dynamics, economic rents, and the financialization of the US economy. *Am. Sociol. Rev.* **76**, 538–559 (2011).
16. A. Ackerman, The relative skill demand of super star firms and aggregate implications, Stockholm University, Department of Economics, 2018. http://www2.ne.su.se/paper/wp18_02.pdf. Accessed 26 March 2020.
17. J. Whitford, *The New Old Economy: Networks, Institutions, and the Organizational Transformation of American Manufacturing* (Oxford University Press, Oxford, UK, 2005).
18. S. Viscelli, *The Big Rig: Trucking and the Decline of the American Dream* (University of California Press, Berkeley, CA, 2016).
19. G. Gereffi, Global commodity chains: New forms of coordination and control among nations and firms in international industries. *Compet. Change* **1**, 427–439 (1996).
20. D. Goldschmidt, J. F. Schmeier, The rise of domestic outsourcing and the evolution of the German wage structure. *Q. J. Econ.* **132**, 1165–1217 (2017).
21. A. Dube, E. Kaplan, Does outsourcing reduce wages in the low-wage service occupations? Evidence from janitors and guards. *Ind. Labor Relat. Rev.* **63**, 287–306 (2010).
22. L. Baccaro, C. Howell, *Trajectories of Neoliberal Transformation: European Industrial Relations Since the 1970s* (Cambridge University Press, Cambridge, UK, 2017).
23. W. Lazonick, M. O'Sullivan, Maximizing shareholder value: A new ideology for corporate governance. *Econ. Soc.* **29**, 13–35 (2007).
24. Organization for Economic Cooperation and Development, *Employment Outlook* (Organization for Economic Cooperation and Development, Paris, 1993).
25. D. Brady, A. Blome, H. Kleider, “How politics and institutions shape poverty and inequality” in *The Oxford Handbook of the Social Science of Poverty*, D. Brady, L. M. Burton, Eds. (Oxford University Press, Oxford, UK, 2016).
26. S. de Boef, L. Keele, Taking time seriously. *Am. J. Pol. Sci.* **52**, 184–200 (2008).
27. R. Bewley, The direct estimation of the equilibrium response in a linear dynamic model. *Econ. Lett.* **3**, 357–361 (1979).
28. N. Wilmers, Solidarity within and across workplaces: How cross-workplace coordination affects earnings inequality. *RSF Russell Sage Found. J. Soc. Sci.* **5**, 190–215 (2019).
29. P. Emmenegger, S. Häusermann, B. Palier, M. Seeleib-Kaiser, Eds., *The Age of Dualization: The Changing Face of Inequality in Deindustrializing Societies* (Oxford University Press, Oxford, MA, 2012).
30. V. Doellgast, Still a coordinated model? Market liberalization and the transformation of employment relations in the German telecommunications industry. *Ind. Labor Relat. Rev.* **63**, 3–23 (2009).
31. B. Palier, K. Thelen, Institutionalizing dualism: Complementarities and change in France and Germany. *Polit. Soc.* **38**, 119–148 (2010).
32. M. Bajgar, G. Berlingieri, S. Calligaris, C. Criscuolo, J. Timmis, Industry concentration in Europe and North America. OECD Working Papers. 2019. https://www.oecd-ilibrary.org/economics/oecd-productivity-working-papers_24139424. Accessed 26 March 2020.
33. Y. Honjo, Y. Doi, Y. Kudo, “Consideration on changes of market structure of major industries in Japan by the use of mobility index, and the applicability to the competition policy: An analysis based on the degree of concentration of production and shipment” (Japanese Fair Trade Commission, Competition Policy Research Center Report, 2014).
34. K.-H. Lin, The rise of finance and firm employment dynamics. *Organ. Sci.* **27**, 972–988 (2016).
35. A. Sakamoto, M. D. Chen, Earnings inequality and segmentation by firm size in Japan and the United States. *Res. Soc. Stratif. Mobility* **12**, 185–211 (1993).
36. P. D. Allison, Measures of inequality. *Am. Sociol. Rev.* **43**, 865–880 (1978).
37. A. B. Atkinson, On the measurement of inequality. *J. Econ. Theory* **2**, 244–263 (1970).
38. H. R. Hyatt, J. R. Spletzer, The recent decline of single quarter jobs. *Labour Econ.* **46**, 166–176 (2017).
39. J. M. Abowd, K. L. McKinney, N. L. Zhao, Earnings inequality and mobility trends in the United States: Nationally representative estimates from longitudinally linked employer-employee data. *J. Labor Econ.* **36**, S183–S300 (2018).
40. J. Visser, “Database on institutional characteristics of trade unions, wage setting, state intervention, and social pacts, 1960–2014 (ICTWSS)” (Institute for Advanced Labour Studies). <http://uva-aias.net/en/ictwss>. Accessed 26 March 2020.
41. D. Jahn, Changing of the guard: Trends in corporatist arrangements in 42 highly industrialized societies from 1960 to 2010. *Soc. Econ. Rev.* **14**, 47–71 (2014).