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Occupations, Workplaces or Jobs?: An Exploration of Stratification Contexts Using Administrative Data*

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Abstract

Occupations have long been held by sociologists, from the older status attainment tradition to the more recent micro-class tradition, to be at the center of stratification writ large. Occupations are specifically argued to be central to shaping wages. Indeed, this has been understood as the comparative advantage of sociology relative to economics in understanding wage setting. However, an undercurrent has for decades existed in sociology that suggests other contexts, mainly workplaces and jobs, may be as important if not more important stratification contexts. Until recently data with the capacity to simultaneously assess all three contexts has been virtually non-existent. In this paper we use administrative data from five countries (Denmark, Finland, Germany, Japan, and South Korea) to assess the relative contributions of occupations, establishments, and jobs to wages. Our core finding is that there is no universal link between occupations and wages, with occupations explaining between 30 and 56 percent of wage variance across country-years. As well, in all countries except Finland establishments explain more of the variance in wages than do occupations. Jobs and establishment figure prominently in the social organization of wages, and must be included in theoretical models and whenever possible in empirical analyses of social stratification.

Occupations, Workplaces or Jobs?: An Exploration of Stratification Contexts Using Administrative Data

Sociologists have variously identified classes, occupations, jobs, and organizations as plausible contexts in which to study labor market stratification (e.g. Weeden and Grusky 2005; Wright 1997; Tomaskovic-Devey 1993; Erickson and Goldthorpe 1992; Baron and Bielby 1980). The original status attainment model used occupation as a structural destination in mobility dynamics (Blau and Duncan 1967). At that time only occupational data were routinely available as indicators of stratification positions. Later, occupations were easily tied to class schemas and became the indicators of "big classes" in more general social theory (e.g. Erikson and Goldthorpe 1992). This has generated a recent debate in sociology on the appropriate level of class analysis, pitting the micro-classes of Weeden and Grusky (2005) against the long standing big class schemas of the Marxian and Weberian traditions (e.g. Wright 1997; Goldthorpe 2000; Erikson and Goldthorpe 1992).

However, much less attention has been given to the influence of occupations in relation to organizations and jobs in structuring wages and other socio-economic rewards. Thus, there is little clarity over the relative contributions of occupations, organizations, and jobs in generating individual identities, collective action, and distributional inequalities. Increasingly, however, social scientists have access to high quality administrative data with precise information on the establishments and even jobs people work in, in addition to occupation, allowing a more expansive investigation into the structure of stratification. With such data it is now possible to interrogate the role of workplaces and jobs, in addition to occupation, in producing life chances. Using high

quality administrative data we focus on the relative empirical impact of occupation, establishment, and jobs to distributional earnings inequalities in multiple countries over the recent quarter century.

Examining the relative roles of occupations, organizations, and jobs is important for multiple reasons. First, sociologists have consistently identified large residual wage variance within even quite detailed occupations, but have to date left them largely unexplored empirically. Second, the theoretical basis of occupation as a site of stratification is arguably weaker than the actual relational sites of production (organizations) and distribution (jobs). Occupation has, however, been the only consistently available indicator of stratification position and so has long served as the default operationalization. Finally, occupational analyses have been largely superseded in the public square by economist's focus on workplace (e.g. Card et al. 2018) and earnings (Sakamoto and Wang 2019) stratification. If the sociological focus on stratification is to reclaim relevance it will do well to demonstrate its relevance for the explanation of earnings inequalities.

In this paper we assess the degree to which the stratification structure is empirically well represented through occupations across countries and over time, while also comparing occupation to workplaces and jobs. Unlike studies that focus on a single firm or a few geographically clustered firms, we use nationally representative administrative data to estimate the degree of wage variation associated with each level of labor market location across two decades and five national economies. We do not resolve the theoretical debate concerning whether stratification is more fundamentally linked to workplaces, jobs, or occupations, but do demonstrate empirically that both workplaces and especially jobs are more fundamental in almost all country-years examined.

Conceptualizing Occupations, Organizations, and Jobs

For sociologists occupations have long been treated as the fundamental stratification position, conditioning individual life chances and transmitting class advantages. In generating inequalities occupations can be conceptualized as having two dimensions. First, they represent collections of similar tasks requiring similar skill-sets (Williams and Bol 2018; Liu and Grusky 2013; le Grand and Tåhlin 2010; Tåhlin 2007). On this dimension occupations are the set of technical positions in the overall division of labor. But there is a second dimension, in which occupations are status groupings infused with shared social valuations (Freeland and Hoey 2018; Treiman 1977). On this dimension incumbents of some occupations are seen as more valuable, powerful, and important, grafting a prestige order onto the occupational skill structure. Via both the skill and status dimensions occupations are understood to generate inequalities in economic outcomes (Freeland and Hoey 2018; Williams and Bol 2018).

Weeden and Grusky (2012; 2005) take the skill and status dimensions a step further, arguing that these occupational dimensions are also potentially institutionalized into coherent, relatively organized social communities. When occupational communities develop their members see themselves as part of the same social group with shared identities, as well as engage in occupational closure strategies to limit labor supply or enhance occupational standing. This line of reasoning then leads Weeden and Grusky to term detailed occupational categories "micro-classes" (see also Jonsson et al 2009; Grusky and Weeden 2001; Grusky and Sørensen 1998). As micro-classes, Weeden and Grusky (2005) demonstrate both that more of the association between occupations and individual-level outcomes occurs at the level of dissagregated occupations in

contrast to occupations aggregated into class schema, and that disaggregated occupations typically do better at predicting those individual outcomes in a causal model.[1]

The "occupations as micro-classes" framework suggests that occupations are fairly well-institutionalized socio-economic groupings that are more or less internally coherent social categories existing in and generating real social worlds. If occupations are internally coherent and represent distinctive communities, this implies that individuals within a given occupation will have roughly similar wages, especially net of individual characteristics, and that within-occupation wage homogeneity should be fairly stable over time and across countries. This does not imply that occupations will have the same (even inflation-adjusted) wage scales over time, just that the degree to which occupations produce particular wage structures will be similar over time and space.

A large body of work provides evidence for this coherence. Occupations are among the strongest predictors of individual wages, and predict wages beyond individual traits (England, Budig, and Folbre 2002; Weeden 2002). Moreover, between-occupation variance has widened in at least the US and UK (Williams 2012; Mouw and Kalleberg 2010; Weeden et al 2007). The view

[1] Treating dissagregated occupations as "micro-classes" may be conceptually slippery, as classes are generally defined by their relationships to one another rather than their positioning in an abstract division of labor. When treated in relational terms, through their authority and ownership dimensions, classes still tend to effect income, life conditions, and political attitudes over and above disaggregated occupations, in some cases with classes having a stronger effect than disaggregated occupations (Wodtke 2017). Weeden and Grusky seem to share this theoretical concern as they have more recently begun to use the terms micro-class and detailed occupation interchangeably (e.g. Weeden and Grusky 2012; Jonsson et al 2009).

of occupations as coherent stratification positions is also consistent with the long history of studies showing remarkable stability in the status ordering of occupations over time and across countries (le Grand and Tåhlin 2010; Nakao and Treas 1992; Treiman 1977).

However, while occupations do appear to be empirically important drivers of wage inequality, there is also a great deal of wage variance within occupations (Sakamoto and Wang 2017; Autor and Handel 2013; Kim and Sakamoto 2008; Carbonaro 2005). In fact, most analyses, from the initial estimates by Jencks et al. (1972) to more recent analyses of the growth of between-occupation inequality (e.g. Kim and Sakamoto 2008; Williams 2012; Mouw and Kalleberg 2010; Weeden et al 2007), find that there is more variation in earnings within occupations than between them. Moreover, Sakamoto and Wang (2017) for a sample of college graduates find that occupational impacts on earnings are small (relative to organizational and job impacts) and declining. So, even while occupations are useful explanations of wage inequality that go beyond individual attributes, within-occupation processes appear potentially more fundamental to the actual levels of inequality.[2]

Often within-occupation wage inequality is assumed to reflect unobserved variation at the individual level. For example, Weeden et al. (2007) treat the occupational and big-class components of wage inequality as structural inequality and assume that within-occupation wage inequality reflects an unstructured inequality gradient connected to individual-level differences.

[2] Kim, Tamborini, and Sakamoto (2018), focusing on long term earnings as a proxy for life chances, find that a single year of earnings early in the career is a better predictor of life chances than even detailed occupation.

There is, however, good reason to think that occupational categories miss important structural aspects of the stratification process.

Several sociologists have pointed to actual workplaces and the social relationships within them as a more precise operationalization of classical theoretical concerns with inequality generating processes (Tomaskovic-Devey and Avent-Holt 2019; Baron and Bielby 1980). In these views both the production of value and its distribution happen in workplace divisions of labor. Occupations are to some extent accounting tools that index the importance of skill (e.g. le Grand and Tåhlin 2010) and perhaps status (e.g. Freeland and Hoey 2018; Treiman 1977) in those distributional processes, but do not embed stratification in the actual division of labor that produces and distributes value. From this point of view organizations and jobs are preferred stratification contexts for the analyses of inequalities.

Following Baron and Bielby (1980), a plethora of studies on the role of workplaces in generating stratification emerged (see reviews in Stainback, Skaggs, and Tomaskovic-Devey 2010; DiTomaso, Post, and Parks-Yancy 2007; Reskin, McBrier, and Kmec 1999). From these literatures Tomaskovic-Devey and Avent-Holt (2019) have argued that inequalities in both the generation of income and its distribution happen within the relational space of organizations. Jobs represent the structural locations in those relational spaces that structure actors' claims on organizational income flows. Similarly, Kim and Sakamoto (2008) treat within-occupation wage inequality as driven by organizational processes.

Economists too have for the last twenty years focused on the importance of workplaces in conditioning earnings distributions (e.g. Lazear and Shaw 2009; Abowd and Kramarz 1999). This literature emerged in response to the availability of linked employer-employee administrative data, and has documented both substantial workplace autonomy in wage setting net of human capital

characteristics and the role of workplace productivity in setting wages (Card et al. 2018). In addition, this literature documents strong ties between rising individual earnings inequalities and between workplace earnings polarization. The majority of rising earnings inequalities in the US, Sweden, and Germany have been linked to the polarization of workplace mean earnings (Song et al. 2019; Barth et al. 2016; Card, Heining, and Klein 2013). We have recently documented this trend toward between workplace wage polarization in twelve of fourteen countries examined (Tomaskovic-Devey et al 2019). Interestingly, the economist's interpretation of these trends is strikingly similar to the original status attainment model, although it is education and skill-based sorting between low and high earnings firms that is the explanation for rising inequalities. Clearly, even for examining inequality trends establishments are an alternative to the occupational analyses common in sociology.

Jobs, conceptualized as the social locations that organizations produce by bundling together particular tasks in an often hierarchical labor process, are a particularly plausible alternative location to occupation alone in the distribution of earnings. If occupations represent the bundles of similar tasks requiring similar skill-sets, then jobs are the actualization of particular tasks requiring particular skills within a given workplace. "Professor" represents an occupation requiring a PhD in order to teach and conduct research at a university. But, as a job some professors are required to teach more than research, some must pursue grant funding to maintain their income, some have loftier research accounts than others, and some are expected to pursue particular teaching techniques or publication records. Even more so, jobs come with defined relationships to concrete other jobs in a workplace, and how these relationships are defined can vary even within the same occupation from cooperative to competitive to abusive (Roscigno, Sauer, and Valet 2018; Roscigno, Lopez, and Hodson 2009; Hodson, Roscigno, and Lopez 2006; Hodson 2001). Jobs then

can be thought of as the intersection of occupations and class relations, with occupations representing work tasks and classes representing the organization of the labor process and its social relations (see also Wright 1980).

One could push this claim (jobs as the intersection of occupations and classes) too far, though as a starting point for conceptualizing jobs this seems reasonable. What is clear is that jobs can vary even when treated as in the same occupational category. Tomaskovic-Devey (1995) provides evidence for the U.S. that the empirically powerful processes are at the job level rather than between occupations. Also for the U.S., Petersen and Morgan (1995) demonstrate that the bulk of the gender wage gap circa 1980 was explained through jobs measured as occupation-establishment pairs rather than either occupations or establishments alone. While tasks are often conceptualized as an attribute of occupations, and then measured at the occupation-level, when tasks are measured at the job level we observe non-trivial variation in tasks within occupations but between jobs (Williams and Bol 2018; Autor and Handel 2013; Tomaskovic-Devey 1995).

We expect that a significant portion of the processes driving within-occupation wage inequality are job-level processes within organizations. We also suspect that establishments, as the location in which earnings are distributed, are plausible alternatives to occupations in any analyses of inequality dynamics.

In what follows, we first compare the impact of occupation on earnings across countries and time. We go on to examine the relative contribution of occupation, establishment and jobs to earnings variations. We then examine the degree to which individual, establishment, and job information helps to explain within-occupation wage variance. In doing so we are estimating across countries and over time the proportion of wage inequality that can be described through occupational relative to organizational and job-level processes. We also examine Weeden et al.'s

(2007) proposal that the within-occupation variance is simply a function of individual variation, extending this explanation to establishments and jobs as well. If the distributional processes are occurring at the job or establishment level, then individual traits should explain a larger proportion of the residual within establishment and job variance than they do at the occupational level.

National Contexts

While occupations, workplaces, and jobs are each plausible candidates for how inequality is organized, it is possible that inequality will be organized on these dimensions differently across countries. In particular, the organization of labor market institutions will shape exactly how inequality gets organized (Bol and Weeden 2014; Soskice and Hall 2001), potentially influencing the degree to which occupations, establishments, and jobs shape inequality outcomes. In the political economy tradition, union power and centralized wage bargaining have been pointed to as the key institutional forces impacting earnings distributions (Rueda and Pontusson 2000). Previous research in sociology, in contrast, has stressed the stability of occupational distinctions across time and space (le Grand and Tåhlin 2010; Goldthorpe 2000; Treiman 1977). Weeden and Grusky (2012; 2005) are more attentive to institutional processes and recognize that at the level of micro-classes particular occupational distinctions can be more or less institutionalized.

We analyze data from Denmark, Finland, Germany, Japan and South Korea, which represent a range of labor market institutions. There is limited prior research on national institutions and variation in occupational and establishment stratification. We rely primarily in this section on comparative political economy theory and research on national labor markets to extrapolate plausible expectations for country variation in levels and trends for occupation,

establishment, and job stratification. Because prior empirical literature is so sparse we treat these expectations as weak predictions at best.

In occupation-centered labor markets, positions and actors' conceptualization of positions are organized around occupational distinctions. What matters most for an individual's life chances are the bundle of skills they possess and the ability to then sell that to any employer on the labor market. In such labor markets which particular employer one sells their labor to is less important than what skills they are able to sell to the employer. Such occupation-centered labor market institutions are often associated with coordinated market economies and map onto nationally coordinated wage bargaining.

In firm-centered labor markets, the labor market is organized through a hierarchy of firms, and what matters most is not what particular skills you are able to sell to an employer but to which employer you sell those skills. Firm-centered labor markets are also likely to map onto coordinated market economies, particularly those with industry-level wage bargaining and a dual labor market structure.

Job-centered labor markets tend to be associated with liberal market economies, where wages are primarily set at the individual or workplace level. Because firms and workers vary in their market power such economies tend to produce high levels of earnings inequalities at the individual level. The U.S. is identified as the preeminent example of such an economy (Soskice and Hall 2001). In a job-centered labor market it not only matters what skills you have to sell to employers, but also which employers purchase those skills. Prior research which demonstrates the empirical superiority of job to occupation analyses have all been undertaken in the US, a liberal

market economy (Petersen and Morgan 1995; Tomaskovic-Devey 1995; Bielby and Baron 1985). Unfortunately, we do not have a liberal market economy among the countries in our analyses.[3]

In Germany, we expect both occupations and firms to play a strong role in accounting for income inequality. The education system is organized around vocational training which funnels individuals into particular occupations, sedimenting occupational distinctions cognitively for individuals and into the broader cultural discourse. At the same time, Germany's apprenticeship system has polarized in recent decades. As such, workers in higher status occupations often have access to high quality apprenticeships and continued vocational training, whereas low-skill workers struggle to find such opportunities (Thelen 2014). It seems plausible that such trends will likely result in the increased importance of occupations over time.

Germany is additionally marked by a set of industrial relations that are strongly segmented along sectoral lines. Manufacturing sectors are characterized by highly coordinated bargaining processes and strong union power. Service industries, such as retail or telecommunications, typically display weak or entirely absent labor unions and a much more uncoordinated wage-

[3] As far as we can tell no liberal market economy collects occupational data from employers. It is possible in the U.S. to link occupational data from labor force surveys to employer reported administrative data, though accessing these data are cumbersome to say the least. In preliminary analyses on Israel, which like the US is both a liberal market economy and permits such linkages, we found that using sampled occupational information strongly reduces our ability to observe establishment and job earnings variation and as a result severely underestimates total wage variance.

setting process (Bechter, Brandl, and Meardi 2011; Doellgast 2009). Such sectoral distinctions are likely to strengthen the influence of firms on wage distributions.

We particularly expect the role of firms to grow over time in the German case because of key trends in their system of industrial relations. Namely, the centrally coordinated wage-bargaining which would suppress firm-driven wage inequality has steadily eroded over the last twenty years as firms increasingly move towards local bargaining processes (Card et al. 2013). As more firms opt out of the centrally-coordinated bargaining process, between-firm wage variation is likely to grow as some firms choose to adopt low-road strategies revolving around cutting labor costs and other firms choose to invest more in their workers (Tomaskovic-Devey, Melzer, Jacobebbinghaus 2019). In recent work, Tomaskovic-Devey et al. (2019) have shown that between-establishment inequality grew among 14 different countries when bargaining decentralization has occurred.

Japan is quite another kind of coordinated market economy. Japan's economy is notably organized *primarily* through membership in particular firms. Skills learned through vocational training are not centered around trades or occupations, but based around the particular needs of the company (Thelen 2004). In this case, rewards and other economic benefits as well as one's economic identity are described as flowing from people's relationship to firms regardless of the occupation one holds within it. We thus expect occupations to be less important in Japan compared to the other countries in this study. The firm component, however, should be quite high.

Much like Japan, in South Korea firms shape a great deal of one's economic identity and material rewards. However, it also matters what specific skills you bring to the firm and thus what tasks you can complete. Thus, we expect that both firms and jobs will be particularly influential in the Korean case.

Denmark and Finland are both emblematic of the Scandinavian model often invoked in the political economy literature. Both countries feature low total inequality and very high collective bargaining coverage. The typical Scandinavian emphasis on egalitarianism and wage solidarity means that occupations and firms are both likely to play less important roles in income inequality compared to the other four countries in this paper. On the firm side, both Denmark and Finland display centrally-coordinated bargaining at the sectoral level, though in both cases there is a non-trivial degree of firm-level bargaining as well that has been growing since the 1990s (Dahl, le Maire and Munch 2013; Uusitalo and Vartiainen 2009). In practice these firm-level bargains are closely constrained by centralized mechanisms and association, but some have argued that a stronger presence of firm-level bargaining in Denmark may lead to a larger firm component of inequality in Denmark compared to Finland (Andersen, Dølvik, and Ibsen 2014). Neither country, however, possesses the dualized character of industrial relations found in countries like Germany or Japan. In Germany, industrial relations are sharply divided between strongly coordinated/uncoordinated and regulated/unregulated industries (e.g. manufacturing/services) and in Japan the chief distinction is between large companies and smaller enterprises. Scandinavian countries tend to be much more sectorally homogenous, especially Finland (Bechter, Brandl, and Meardi 2011). Both Denmark and Finland have been institutionally quite stable since at least the mid-1990s, so we do not expect the relative importance of either occupations or firms to change significantly.

Data and Methods

A key reason for sociologists not directly comparing occupations to organizations and jobs is that data containing all three components, especially across an entire country, has in the past been rare.

However, as administrative data across countries have become more widely available it is now possible in a range of national contexts to examine the relative roles of occupations, establishments, and jobs in structuring income inequality across whole economies.

Data Structure

We use administrative data from Denmark, Finland, Germany, Japan and South Korea, beginning in 1993 and continuing through circa 2015. The structure of the data vary across these countries. For Denmark the administrative data include all employees and all establishments in the national economy. Finland has both population and sample data sources for our analyses. Finland's population data have measures of earnings but not wages, but Finland also has a survey of firms that has good measures of wages. We use both data sources in our analyses. For Germany we have samples of establishments. For establishments with less than 1,000 employees we have the full population of employees but for larger firms we have a sample of up to 1,000 employees. For Japan and South Korea we have samples of both establishments and employees in those establishments, with higher sampling frequencies in smaller organizations. The Japanese and South Korean samples are limited to private sector employees, while the South Korean sample is further limited to full-time employees.[4] All estimates for all countries, except Denmark for which we have the population, are produced with year specific sampling weights. Appendix 1 gives more detail on country data characteristics.

[4] We also have estimates for Korea for 1990 and 1992, but decided for comparability with other countries to begin our analysis for Korea in 1993. Also for Korea 2005 data are not available.

Compared to similar analyses based on labor force surveys our data are of very high quality. All occupation and earnings data are reported by the employer from personnel records and so are not subject to the typical survey-based measurement error. Survey-based earnings estimates have high levels of misreporting as well as inequality-muting underestimates by high earners and overestimates by low earners (Valet, Adriaans, Liebig 2019; Kim and Tamborini 2014). Similarly, occupational coding from surveys contain substantively large errors in both reporting (Perales 2014) and coding (Speer 2016). Administrative data describe the incumbent's occupation from the point of view of their employer's personnel records and so are much less error prone.

This is not to say there are no sources of error in administrative data. We pay particular attention to very low reported earnings, which are most likely the result of very short job spells as well as occasional recording errors. Employer reports of occupations are also prone to errors in updating occupational codes in company personnel records (see discussion in Tomaskovic-Devey, Hällsten, and Avent-Holt 2015). No systematic comparison of errors in employer and employee reports of occupations are available at this point, but we are confident that survey self-report and coding errors are much higher than errors in employer personnel records for both earnings and occupation.

All estimates come from very large samples of individuals, with the exception of Denmark for which we have the full population and thus no sampling error. The smallest sample is for South Korea in 2002, in which we observe 364,124 individuals. This produces a 95 percent confidence interval around the occupational explained variances estimate for that year (45%) of 0.16 percent. Sampling error is in all cases trivially small and for this reason we do not report tests of statistical significance, focusing instead on effect sizes.

Measurement

Our analyses focus on the decomposition of wage variances associated with occupation, establishment, and jobs. Earnings is therefore our core external criterion for examining the structure of stratification. Our earnings measures include all earnings, including overtime and bonuses, from the current job. If someone holds more than one job we limit analyses to the highest paying job. There are some country-specific variations in the earnings concept and measurement, which are outlined in Appendix 1.

With the exception of Germany, two earnings concepts were examined: logged total yearly earnings and logged hourly wages. For Germany we lack a measure of hourly wages, but have a highly accurate measure of daily earnings which we use instead of hourly wages. The relative levels and trends in occupation, establishment, and job associations with both wages and earnings were substantively equivalent and so we focus on logged wages in all reported analyses. In addition to being the most common earnings measure in both sociology and economics, wages in all samples and country years were more strongly associated with occupation, establishment, and jobs than were yearly earnings, and our secondary analyses including individual covariates also consistently displayed higher explained variance for wages than for earnings.

We examined results for three employment definitions: all person-employer records, only non-marginal records, and only full-time records. Full-time jobs were defined with country specific definitions of hours worked or employment contract. For non-marginal employment we dropped observations with very low earnings. Administrative records include all formal economy job spells, including those that lasted only a few days or even hours, so these records tend to include some very low earnings jobs for people with marginal labor force attachment. The definition of

marginal jobs varied across countries (see Appendix 1). Inequality and variance component levels and trends were substantively the same in all samples.

We focus on the non-marginal records, since this most closely resembles those samples used in previous work in both sociology and economics. This sample is probably closest to the survey based samples in most prior research, which for sampling reasons would tend to miss very short job spells, for measurement reasons would exclude unusually low earners, and would include part-time as well as full-time workers. Levels of explained variance for occupation tended to be highest for the non-marginal samples as well.

In all countries occupation is measured using the national three digit occupational codes. In Japan a single code, 999 office worker, accounts for more than 40% of all employment. We experimented with three alternative operationalizations of occupation for Japan: the original code, dropping all 999 cases, and splitting office workers into three education-occupation classes defined in terms of secondary, intermediate, or tertiary education at the individual level. Not surprisingly, the latter coding increased explained variances, but only marginally. For Japan we use this expanded office worker/education coding scheme.

The other noteworthy aspect of occupation is that the number of occupations changes over time and varies between countries. Germany begins with the fewest occupational distinctions (92), but rises to 120 after 2010. Korea enters the data with 105, rises to 156 in 2000, but drops to 88 in 2005, and finally increases to 95 occupational codes in 2008. Japan begins with 124 occupations, rising to 137 in 2005. Finland begins with 126 in 1995, peaks at 131 in 2000, but falls to 105 by 2016. Denmark begins with 132 in 1994, rises to 144 the next year, rises further to 149 in 2003, and increases again to 174 in 2010. Country and temporal variation in the number of occupational codes reflects national accounting distinctions.

---Table 1 About Here---

Establishments are defined as the physical location in which individuals work, and are measured with a workplace identifier. Establishments are distinct from firms, representing a particular location of work even if it is part of a broader legal firm.[5] Following Petersen and Morgan (1995) jobs are measured as the three digit occupation nested within establishment, also referred to as an occupation-establishment pair.

To examine the sources of any residual wage variance beyond occupation, establishment, and job, we also estimate a series of models that add individual age, sex, and education, variables typically associated with earnings, to the respective occupation, establishment, and job fixed effect models. Per the classic Mincerian wage equation, age is measured as both age and its square. Education is converted to indicator variables consistent with national educational distinctions, making it a categorical measure of educational credentials. Sex is a simple dichotomy between male and female. In general, we find that sex and age tend to add explanatory power beyond occupation, establishment, and job. Education is always marginal in its impact, sorting people into stratification positions but making little difference within them.

There are, of course, many more establishments and jobs than there are occupations. Thus, there is a certain mechanical tendency for these finer grained observations to explain a higher proportion of the wage variance than occupation alone. The core issue in our analysis then is not simply explained variance, but what is the value added from moving from an occupational to an

[5] In Germany two establishments owned by the same firm in the same industry and locality are reported as one establishment.

organizational or job or individual conceptualization of the stratification process. Since there is essentially no measurement error in our dependent variable our focus on explained variance and variance components is not vulnerable to the normal problem of measurement error in reaching comparative inferences as to model fit.

We report both estimates of adjusted explained variances (aR^2) as has been common in prior research in sociology (Williams 2013; Weeden and Grusky 2012; Mouw and Kalleberg 2010; Grusky and Weeden 2001) and variance components, the preferred approach in economics (Song et al. 2019; Barth et al. 2016; Card, Heining, and Klein 2013). Explained variance approaches are more sensitive to additional degrees of freedom than variance component estimates, so we lean more heavily on the variance component analysis for our direct comparison of occupations, establishments, and jobs (Vanneste 2017). For our analysis of individual increments to explained variance we work within the sum of squares framework.

Analytical Strategy

To assess the relative extent of occupational, establishment, and job-level variance in wages we adopt a method from the literature on the gender wage gap. Petersen and Morgan (1995) developed an analytical method to assess how much of the gender wage gap is a function of occupational, establishment, and job segregation between men and women. They do this by first calculating the raw gender wage gap, and then calculating the proportion of the gap that remains after accounting for occupations, then separately after accounting for establishments, and finally after accounting for occupation-establishment pairs, which are conceptualized as jobs (for further uses of this method see Smith-Doerr et al. 2019; Křížková, Penner, and Petersen 2009; Petersen, Penner, and

Høgsnes 2014; 2010). We do the same, although we focus on total earnings variance, rather than the gender specific component.

We start by estimating the total variance in (logged) earnings and wages. We then introduce 3-digit occupational dummies to estimate how much between occupation distinctions explain (the R^2) and reduces (the variance component) the total variance in earnings. Here we directly assess the claim in the occupational literature that income inequality is increasingly organized through occupations, as suggested by the disaggregated structuralism of the micro-class approach (Williams 2013; Weeden and Grusky 2012; Mouw and Kalleberg 2010; Grusky and Weeden 2001). This analysis also informs prior research that asserts that occupational stratification structures are largely invariant over time and place (Treiman 1977).

We next asses the relative contribution of occupation, establishment, and job to national wage variance. We first introduce establishment dummies to estimate how much organizations explain and reduce the total variance in earnings and then introduce jobs, measured via occupation-establishment pairs, to estimate how much total wage inequality is explained and reduced as a result of individuals working in different jobs in the same workplace. In assessing relative contributions we start by comparing the most recent year available, then examining their overtime trends. In all cases our goal is to compare the three units in terms of their explanatory power.

We then repeat this exercise in a hierarchical modeling framework, first estimating the impact of occupation, establishment, and job, and then estimating the additional impact of sex, age, age-squared, and education on the residual within-unit earnings variance to assess the marginal additional contribution of individual characteristics to explaining within unit residual

wage variance.[6] We compare individual augmented wage models to the total explained variance associated with job alone, as well as the degree to which within context residuals are a function of observed individual traits.

If the long history of occupational analyses in sociology culminating in the micro-class approach is correct and occupations are relatively coherent and institutionalized socio-economic groupings, then we would expect little additional variance to be explained by establishment or job-level models and that occupation with the addition of individual-level controls would explain comparable variance to jobs or establishments alone. However, if jobs are a more reasonable socio-economic grouping, as the workplace literature suggests, or if establishments are more central to setting wages, as the recent research on between-workplace wage polarization suggests, we would expect substantive gains in explained variance with a focus at the establishment and job levels. Moreover, the closer wage variance is to zero within occupation-establishment pairs the more coherent jobs are as core stratification locations.

Results

Occupations as Micro-Classes

Our first analysis investigates the degree to which occupations should be thought of as coherent categories as argued in the micro-classes literature, and temporally invariant as in the occupational

[6] We do not have individual panel data for most countries and so there are no doubt additional individual level sources of residual earnings variance that we do not observe. Our point, however, is not to understand individual level earnings dynamics, but to compare the explanatory utility of occupation, establishment, and job units.

prestige literature. Figure 1 reports the evolution of the occupational adjusted R^2 and variance component over time for each country.

---Figure 1 About Here---

Across country-years occupations account for between 30 percent (Denmark and Germany in early years) and 56 percent (Finland 2016) of wage variance. In four countries the link between occupation and wages has increased at least somewhat. In contrast, in South Korea the occupational variance component peaked at 46 percent in 2003, after which it steadily decreased to 33 percent in 2012. The sharpest increases happened in Japan, with its variance component for occupation increasing from roughly 35 percent in the 1990s to a peak of 46 percent in 2013.

Finland consistently has the strongest occupation-wage linkage among these five countries, explaining between 42 and 56 percent of wages across the observation period. Germany and Denmark each have lower and fairly stable relationships between occupations and wages. Germany experiences an increase in the late 1990s, from just under 30 percent in 1995 to a stable 34 percent from roughly 2000 onward. Denmark, on the other hand, hovers around 30 percent from the beginning of the observation period, but experiences a notable increase beginning in 2010 to peak at 35 percent by 2013.

It is important to note that all countries display some instability in the relationship between occupation and earnings. Finland is unusual for its large drop in the early 2000s, but stability before and after. Denmark, Germany, and Japan show secular trends towards stronger relations between occupation and earnings, similar to prior research on the US and UK (e.g. Williams 2013; Mouw and Kalleberg 2010). South Korea displays a marked decline in the association between occupation and logged wages.

Country instability in occupational explained variance is to some extent tied to changes in the occupational coding systems. For example, in 2010 Denmark switches from 148 to 170 occupational codes and explained variance rises. Similarly, in 2005 Japan moved from 123 to 137 codes and explained variance rises. Most dynamically, Korea has a large jump in occupational categories between 1999 (n=110) and 2000 (n=163) and an even larger decline between 2004 (n=150) and 2005 (n=88), followed by a rise in 2008 to 95. Korea is both the most dynamic country in terms of its occupational accounting system and explained variance. There is after 2005 a pattern of declining occupation-linked explained variance in Korea even within the smaller occupational accounting system. Germany had a stable 92 codes until 2011, when it jumps to 120, although this appears to have had no impact on explained variance.

Occupations, Establishments, and Jobs

We now focus on the relative variance explained by occupation, employing establishment, and job. In Figure 2 we compare the explained variance and variance components associated with occupation, establishment, and job for the most recent year in each country for which we have estimates. Countries are arrayed from lowest to highest occupation-linked explained variance. In all analyses the variance component is higher than the R^2, so we focus in the following on variance components. Patterns are always substantively equivalent between the two measures.

---Figure 2 About Here---

In every country, except Finland, establishment is a better predictor of wages than is occupation. In Finland the occupational variance component is about 20 percent higher than the establishment component. In all of the other countries the establishment component is larger than the occupational component, ranging from 13 percent higher in Denmark to 59 percent higher in

South Korea. Germany is closer to Denmark in this regard (24 percent larger establishment component), while in Japan the establishment component is 33 percent larger than the occupational variance component.

Treating occupation as a more fundamental stratification context than workplace is, at least for four of these five countries, a mistake. Only in Finland is occupational context consistently more influential on wages than workplace in terms of its explanatory power. We also observe occupational effects in Denmark that are marginally larger than establishment effects in the initial observation year, although establishment becomes increasingly stronger than occupation over time. Only in Finland does occupation explain more than 50 percent of wages. In contrast, in Germany, South Korea, and Japan establishment explains more than 50 percent of wages.

In all countries jobs are more influential stratification contexts than either establishment or occupation. The job component is impressively high by any standard, from a low of 67 percent in Germany, followed by Denmark (70 percent), South Korea (72 percent), and at the high end Finland and Japan (78 and 79 percent, respectively).

The general pattern is that the vast majority of wage variance is associated with jobs everywhere. That jobs are more influential than occupation or establishment alone is not surprising from a statistical point of view. Substantively, however, the strong explanatory power of occupations in a specific workplace context also supports an interpretation of stratification processes, at least for wages, as lodged at the intersection of skill and status hierarchies (occupation), organizational resources (establishment), and local relations of production (job).

We next compare all countries in terms of the trends in their relative levels of inequality and in their occupation, establishment, and job variance components. Figure 3 tracks changes in

total wage variance (top panel) and the occupation, establishment, and job variance components (bottom panel).

---Figure 3 About Here---

Wage inequality in Denmark appears remarkably stable, while in both Germany and South Korea total inequality rises rapidly until 2010 and then drops. Finland displays declining inequality until the mid-2000s, while Japan first increases and then drops after 2010. In all countries, except Finland, the great recession is associated with an inequality dip, either small (Denmark) or large (Germany, Japan, South Korea).

Turning to the variance components, prior to 2010 the establishment variance component rises in all countries. This is consistent with the recent research on the rising importance of between-workplace inequality in many countries reviewed earlier. Perhaps as a result of the Great Recession, after 2010 this trend appears to have reversed in Germany and South Korea, while stalling in Japan. Denmark and Finland, on the other hand, continue apace with a secular increase in the establishment variance component. The job level variance components, on the other hand, are more stable over time, rising in Finland and Japan, rising and then falling in South Korea, and remaining relatively stable with local fluctuations in Denmark and Germany.

Comparing Occupation, Establishment, and Job to Individual Traits

Weeden et al. (2007) speculate that within occupational wage variance is primarily a function of individual characteristics. The previous analysis suggests that this is not the case, but that workplace and job locations are important structural sources of wage variation in their own rights. At the same time it seems useful to investigate whether within these structural locations individual characteristics explain additional variation in wage rates. In the absence of linked

employer-employee data many analysts will only have information on occupation in addition to individual characteristics. These individual characteristics can be thought of as sorting people between the unobserved establishments and jobs in such data, or generating career workplace and job inequalities within occupations. We examine these possibilities in two stages.

First, we compare the explained variation associated with occupations and establishment in models that also contain individual education, sex, age and age squared with that associated with jobs alone, allowing us to estimate the degree to which adding individual covariates to occupation and establishment fixed effects approximates the explanatory power of job context alone. In other words, this allows us to see the degree to which sorting into jobs can be proxied with individual level observables. We focus on age, sex, and education since they are the ones most commonly available in surveys of individuals, and we model this for the first and last year of observation in each country.

We can see this comparison by comparing column 1 in Table 2 to columns 2 and 3, respectively. In general adding education, age, and sex to occupation and establishment models closes the gap with a jobs only model, but does so much more effectively for establishment than it does for occupation. Only in Germany toward the end of the time series does an occupation model with further individual controls approach the explained variance associated with job information alone. In contrast, in all country years an establishment model, supplemented with individual characteristics, produces explained variance quite similar to a jobs only model. In Japan early in the observation period and Germany late in the observation period the establishment plus individual traits model actually predicts more wage variance than the jobs model alone.

---Table 2 About Here---

In our second stage we compare the addition of individual traits to explained variance for occupations, establishments, and jobs. This allows us to examine the Weeden et al. (2007) assumption that individual traits explain remaining variance beyond occupation. We can observe this by comparing columns 2-4 in Table 2. In all cases, with the exception of Finland, the establishment model with individual covariates is superior to the occupation model with individual covariates. In Finland the occupational and establishment models with individual covariates explain almost the same amount of variance in wages.

In all country years the jobs model with individual covariates is substantially superior to the other two. In addition, in all country-years the addition of individual covariates substantively increases total explained variance relative to a job fixed effect model only, increasing explained variance from a low of 5.3 percentage points in Japan in the last year observed to a high of 15.4 percentage points in Germany also in the last year observed. In all cases, except Denmark in the first year observed, jobs capture at least three-fifths of the explained variance, and in most country-years roughly two-thirds or more of the variance. At the same time, the value-added of individual covariates varies substantially across countries. Treating within-occupation variance in wages as socially unstructured individual variation is not a reasonable assumption as much of within occupation variance is associated with the workplace context of employment.

Discussion

Our task in this paper is to assess the value of an occupation-centered study of social stratification relative to a sociology that incorporates the stratification dimensions of job and establishment. Our punchline is that jobs and establishments figure prominently in the social organization of wages, and must be included in theoretical models and whenever possible in

empirical analyses of social stratification. Stratification is not a story about occupations untethered from their workplace contexts. While occupations do form an independent basis of stratification, they provide a weaker input into the stratification process than do either workplaces or jobs.

We provide three distinctive analyses to empirically assess the relative contributions of occupations, organizations and jobs to earnings inequalities across five countries. First, we assessed the power of occupations in explaining wage variance. This cross-national assessment of occupations found substantial variation across countries in both the levels and trends in the occupation-wage linkage. Finland has the strongest occupation-wages link and is the only country where occupation alone explained more than 50 percent of the variation in wages across individuals. This is followed by Japan at 44 percent, with all other countries hovering in the mid-30 percent range of explained variance. The trends are also not uniform. Japan experienced a growth in the occupation-wage link after 2004, while Demark and Germany experienced increases in the occupation-wage link in the late 2000s and mid-1990s, respectively. And South Korea experienced a steep decline in the effect of occupation on wages after 2004.

Thus, occupation varies in its impact on wages over time and across countries. There is also no simple cross-country temporal pattern of increased or decreased institutionalization of occupational distinctions. While it does seem to be the case that changes in occupational coding schemes are associated with changes in explained variance, even this pattern is not universal.

Although Denmark and Finland share many institutional similarities, occupations seem to play substantially different roles. Finland had the strongest occupation-wage linkage of any of the countries examined, whereas Denmark fell in the middle of the pack. Inconsistently with our institutional expectations, it is in Japan where occupation, at least in the early 1990s through the late 2000s, has consistently the second highest explanatory power. To the extent that there is a

clear pattern across countries, occupation tends to explain 30-35% of the variance in logged wages in Europe, Japan (in the early years) and South Korea (more recently).

This finding has important implications for the literature on occupations and wages. In general, the literature suggests a secular increase in the link between occupations and wages in the post-1980s world. However, this is based almost exclusively on data from the US and UK (e.g. Williams 2013; Mouw and Kalleberg 2010). When we bring in more countries this story falls apart, suggesting a cross-national empirical agenda in occupational sociology is necessary theoretically rather than simply an added bonus when data are available.

Our second analysis directly compared the relative value of the three bases of stratification: occupations, establishments, and jobs. In this case, occupation appears in most cases as the weakest stratification context. In four of five countries establishments explain more variance than do occupations, with Finland as the exception. Moreover, in South Korea and Japan establishments alone explain more than 50 percent of the variance in wages in the last year observed. Even more telling, prior to 2010 all countries experienced an increase in the establishment-wage linkage. Perhaps the great recession reduced this effect in Germany, South Korea, and Japan, but these trends speak to the importance of cross-national research in studying the sources of wage inequality.

More importantly bringing establishments into the analysis of wages identifies jobs as the fundamental unit of economic stratification. It is not just what skills and general tasks one performs (e.g. occupation) that matters, but where and with whom we work as well.

In our final analysis we focus on the importance of individual traits. While individual traits matter in all countries, their explained variance beyond sorting is never anywhere near the impact of simply identifying the occupation, the establishment, or the occupation-establishment pair in

which one works. Individual traits add somewhere between a few percentage points to about 15 percentage points to a job fixed effect. This is not trivial, but when a job accounts for roughly three-fifths to two-thirds of wage variance in most contexts this suggests position matters much more to earnings variance than do individual traits.

The addition of individual traits to the establishment only model produces explanatory power more nearly equivalent to a jobs only model, but less so with the addition of individual traits to an occupation only model. Occupational information without establishment context is consistently a weaker explanatory context than job. In four countries knowing establishment and individual traits produces explained variance almost as high as knowing people's jobs.

Conclusions

Our findings present a critical challenge for sociologists studying occupations, and especially the occupation-wage link. It is not sufficient to analyze occupations and be done with it. Occupations matter, but must be located in their specific establishment contexts in order to adequately observe their stratification consequences. That is, what you do matters, but where you do it and the conditions under which you do it provides critical information as well. This leads us to organizations and jobs as fundamental units of analysis for stratification. In contrast to occupations, earnings are more closely tied to organizations than to occupations, and jobs as the nexus of occupations and organizations provide a stably high predictor of earnings.

We organized this paper with a set of weak expectations about the role of national political economic institutions in generating levels and trends in occupational, establishment, and job-level variance in wages. The most consistent result emanating from these expectations is that countries with sharply dualized industrial relations systems (namely, Germany, Japan, and South Korea)

tend to have high establishment components of wage inequality, and this component has grown as these countries have experienced further dualization, declining union density, and decentralization of wage bargaining. Even among the more sectorally homogenous Nordic countries, Denmark possesses both more decentralized wage bargaining and a higher establishment component of wage inequality than Finland. While this paper both provides some evidence for the institutional expectations we derived from prior literature and rejects the lack of institutional expectations in the occupational stratification tradition, we think that we are a long way from having a reasonable handle on the role of national institutions in workplace wage setting. Clearly they are important, but how they work at the organizational level is not so clear. More work is then needed to link organizations to political economic institutions (e.g. Avent-Holt 2019).

The analyses presented here suggest an even more urgent need to focus our research agenda on the role of establishments in generating stratification. If one had to choose between occupation and workplace to index stratified social locations, in four of the five countries we examine here, workplace would be the better choice. In addition, there is also much existing evidence that inequalities between workplaces are rising, not only in the countries examined here, but in many others as well (Tomaskovic-Devey et al. 2019; Song et al. 2018). This suggests that empirically occupation will become a weaker basis for distribution over time.

Even more so, to the extent that the growth in between-establishment inequality is driven by the polarization of workplaces by skill distinctions, the distinction between workplaces and occupations becomes irrelevant in practice. We do not have the space to fully articulate what an establishment-centered research agenda for stratification should look like (for direction see Avent-Holt and Tomaskovic-Devey 2019; Tomaskovic-Devey and Avent-Holt 2019; Stainback, Skaggs, and Tomaskovic-Devey 2010). But, it must be one that takes seriously both the role of what

happens in organizations and the relations between organizations in configuring labor market institutions and outcomes.

References

Abowd, John M., and Francis Kramarz. 1999. "The analysis of labor markets using matched employer-employee data." *Handbook of labor economics* 3: 2629-2710.

Autor, David H. and Michael J. Handel. 2013. "Putting Tasks to the Test: Human Capital, Job Tasks, and Wages." *Journal of Labor Economics* 31: S59-S96

Andersen, Søren Kaj, Jon Erik Dølvik, and Christian Lyhne Ibsen. 2014. *Nordic Labour Market Models in Open Markets*. Brussels: ETUI.

Avent-Holt, Dustin. 2019. "The Class Dynamics of Income Shares: Effects of the Declining Power of Unions in the U.S. Airline Industry, 1977-2005." *Socio-Economic Review*

Avent-Holt, Dustin and Donald Tomaskovic-Devey. 2019. "Organizations as the Building Blocks of Social Inequalities." *Sociology Compass* e12655

Baron, James N. and William T. Bielby. (1980). Bringing the firm back in: Stratification, segmentation, and the organization of work. *American Sociological Review* 45, 737-65.

Barth, Erling, Alex Bryson, James C. Davis, and Richard Freeman. 2016. It's where you work: Increases in the dispersion of earnings across establishments and individuals in the United States." *Journal of Labor Economics*. 34, S2:67-S97.

Bechter, Barbara, Bernd Brandl, and Guglielmo Meardi. 2011. *From national to sectoral industrial relations: Developments in Sectoral industrial relations in the EU*. Office for Official Publ. of the Europ. Communities.

Bielby, William T. and James N. Baron. 1986. Men and women at work: Sex segregation and statistical discrimination. *American Journal of Sociology* 91, 759-99.

Blau, Peter and Otis Dudley Duncan. 1967. *The American Occupational Structure*. Free Press.

Bol, Thijs, and Kim A. Weeden. 2014. "Occupational closure and wage inequality in Germany and the United Kingdom." *European Sociological Review* 31: 354-369.

Carbonaro, William. 2005. "Explaining Variable Returns to Cognitive Skill across Occupations." *Social Science Research* 34: 165-88.

Card, David, Jörg Heining, and Patrick Kline. 2013. "Workplace Heterogeneity and the Rise of West German Wage Inequality." *The Quarterly Journal of Economics* 128 (3): 967-1015.

Card, David, Ana Rute Cardoso, Joerg Heining, and Patrick Kline. 2018. "Firms and Labor Market Inequality: Evidence and Some Theory." *Journal of Labor Economics*. 36, no. S1, S13–S70.

Dahl, Christian M., Daniel Le Maire, and Jakob R. Munch. 2013. "Wage Dispersion and Decentralization of Wage Bargaining." *Journal of Labor Economics* 13: 501-33.

DiTomaso, Nancy, Corinne Post, and Rochelle Parks-Yancy. 2007. "Workforce Diversity and Inequality: Power, Status, and Numbers. *Annual Review of Sociology* 33: 473-501.

Doellgast, Virginia. 2009. "Still a coordinated model? Market liberalization and the transformation of employment relations in the German telecommunications industry." *ILR Review* 63.1: 3-23.

England, Paula, Michelle Budig, and Nancy Folbre. 2002. "Wages of Virtue: The Relative Pay of Care Work." *Social Problems* 49: 455-73.

Erikson, Robert and John Goldthorpe. 1992. *The Constant Flux: A Study of Class Mobility in Industrial Societies.* Oxford University Press.

Freeland, Robert E. and Jesse Hoey. 2018. "The Structure of Deference: Modeling Occupational Status using Affect Control Theory." *American Sociological Review* 83: 243-77.

Goldthorpe, John. 2000. *On Sociology: Numbers, Narratives, and the Integration of Research and Theory.* Oxford University Press.

Grusky, David B., and Gabriela Galescu. 2005. "Foundations of a neo-Durkheimian class analysis." Pages 51-81 in Erik Olin Wright (ed.) *Approaches to class analysis. Cambridge University Press.*

Grusky, David and Jesper Sørensen 1998. "Can Class Analysis Be Salvaged?" *American Journal of Sociology* 103: 1187-1234.

Grusky and Weeden. 2001. "Decomposition without Death: A Research Agenda for a New Class Analysis." *Acta Sociologica* 44: 203-18.

Hodson, Randy. 2001. *Dignity at Work*. Cambridge University Press.

Hodson, Randy, Vincent Roscigno, and Steven Lopez. 2006. "Chaos and the Abuse of Power: Workplace Bullying in Organizational and Interactional Context." *Work and Occupations* 33: 382-416.

Jencks, Christopher, Marshall Smith, Henry Acland, Mary Jo Bane, David Cohen, Herbert Gintis, Barbara Heyns, Stephanie Michelson. 1972. *Inequality: A reassessment of the effect of family and schooling in America*. New York: Basic Books.

Jonsson, Jan, David Grusky, Matthew Di Carlo, Reinhard Pollak, and Mary Brinton. 2009. "Microclass Mobility: Social Reproduction in Four Countries." *American Journal of Sociology* 114: 977-1036.

Kim, ChangHwan, and Christopher R. Tamborini. 2014. "Response error in earnings: An analysis of the survey of income and program participation matched with administrative data." *Sociological Methods & Research.* 43: 39-72.

Kim, ChangHwan, Christopher R. Tamborini, and Arthur Sakamoto. 2018. The Sources of Life Chances: Does Education, Class Category, Occupation, or Short-Term Earnings Predict 20-Year Long-Term Earnings?. *Sociological Science*, 5:206-233.

Kim, ChangHwan, and Arthur Sakamoto. 2008. "The rise of intra-occupational wage inequality in the United States, 1983 to 2002." *American Sociological Review* 73: 129-157.

Křížková, Alena, Andrew Penner, and Trond Petersen. 2009. "The Legacy of Equality and the Weakness of Law: Within-Job Gender Wage Inequality in the Czech Republic." *European Sociological Review* 26: 83-95.

Lazear Edward P. and Kathryn L. Shaw (editors). 2009. *The Structure of Wages: An International Comparison*. University of Chicago Press.

le Grand, Carl, and Michael Tåhlin. 2013. "Class, Occupation, Wages, and Skills: The Iron Law of Labor Market Inequality." *Comparative Social Research* 30: 3-46.

Liu, Yujia and David Grusky 2013. "The Payoff to Skill in the Third Industrial Revolution." *American Journal of Sociology* 118: 1330-74.

Mouw, Ted and Arne Kalleberg. 2010. Occupations and the structure of wage inequality in the United States, 1980s-2000. *American Sociological Review* 75, 402-31.

Nakao, Keiko and Judith Treas. 1994. "Updating Occupational Prestige and Socioeconomic Scores: How the New Measures Measure Up." *Sociological Methodology* 1: 1-72.

Perales, Francisco. 2014. "How wrong were we? Dependent interviewing, self-reports and measurement error in occupational mobility in panel surveys." *Longitudinal and Life Course Studies* 5: 299-316.

Petersen, Trond and Laurie Morgan. 1995. Separate and unequal: Occupation-establishment sex segregation and the gender wage gap. *American Journal of Sociology* 101, 329-65.

Petersen, Trond, Andrew Penner, and Geir Høgsnes. 2014. "From Motherhood Penalties to Husband Premia: The new Challenge for Gender Equality and Family Policy, Lessons from Norway." *American Journal of Sociology* 119: 1434-72.

_____. 2010. "The Within-Job Motherhood Wage Penalty in Norway, 1976-1996." *Journal of Marriage and Family* 72: 1274-88.

Reskin, Barbara Debra McBrier, and Julie Kmec. 1999. "The Determinants and Consequences of Workplace Sex and Race Composition." *Annual Review of Sociology* 25: 335-61.

Roscigno, Vincent, Carsten Sauer, and Peter Valet. 2018. "Rules, Relations, and Work." *American Journal of Sociology* 123: 1784-1825.

Roscigno, Vincent, Steven Lopez, and Randy Hodson. 2009. "Supervisory Bullying, Status Inequalities, and Organizational Context." *Social Forces* 87: 1561-89.

Rueda, David, and Jonas Pontusson. 2000. "Wage inequality and varieties of capitalism." *World Politics* 52: 350-383.

Sakamoto, Arthur and Sharron Xuanren Wang. 2019. "The Declining Influence of Occupational Contingency Tables in the Study of Intergenerational Mobility." Working paper.

Sakamoto, Arthur, and Sharron Xuanren Wang. 2017. "Occupational and Organizational Effects on Wages among College-educated Workers in 2003 and 2010." *Social Currents* 4: 175-195.

Schweiker, Michael, and Martin Groß. 2017 "Organizational environments and bonus payments: Rent destruction or rent sharing?." *Research in Social Stratification and Mobility* 47: 7-19.

Skans, Oskar Nordtröm, Per-Anders Edin, and Bertil Holmlund. 2009. "Wage Dispersion Between and Within Plants: Sweden 1985-2000." in Lazear Edward P. and Kathryn L. Shaw.

(editors), *The Structure of Wages: An International Comparison*. University of Chicago Press.

Smith-Doerr, Laurel, Sharla Alegria, Kaye Husbands Fealing, Debra Fitzpatrick, and Donald Tomaskovic-Devey. 2019. "The Value of Women's Work in Science Policy: Occupational Sex Segregation in US Science Agencies and Effects on Pay, 1994-2008." *American Journal of Sociology*.

Song, Jae, David J. Price, Fatih Guvenen, and Nicholas Bloom. 2019. "Firming Up Inequality". *The Quarterly Journal of Economics* 134, no. 1 (2018): 1-50.

Soskice, Peter A and David W. Hall. 2001. *Varieties of capitalism: The institutional foundations of comparative advantage*. Oxford University Press.

Speer, Jamin D. 2016. "How bad is occupational coding error? A task-based approach." *Economics Letters* 141: 166-168.

Stainback, Kevin, Sheryl Skaggs, and Donald Tomaskovic-Devey. 2010. "Organizational Approaches to Inequality: Inertia, Relative Power, and Environments." *Annual Review of Sociology* 36: 225-47.

Tåhlin, Michael. 2007. "Class Clues." *European Sociological Review* 23: 557-72.

Thelen, Kathleen. 2014. *Varieties of Liberalization and the New Politics of Social Solidarity.* Cambridge University Press.

Tomaskovic-Devey, Donald. 1995. "Sex Composition and Gendered Earnings Inequality: A Comparison of Job and Occupational Models."

Tomaskovic-Devey, Donald and Dustin Avent-Holt. 2019. *Relational Inequalities: An Organizational Approach*. Oxford University Press.

Treiman, Donald. 1977. *Occupational Prestige in Comparative Perspective*. Academic Press.

Uusitalo, Roope and Juhana Vartiainen. 2009. “Firm Factors in Wages and Wage Changes.” Pp in *The Structure of Wages: An International Comparison* Edward P. Lazaer and Kathryn L. Shaw (eds). University of Chicago Press.

Valet, Peter, Jule Adriaans, and Stefan Liebig. 2019. "Comparing survey data and administrative records on gross earnings: nonreporting, misreporting, interviewer presence and earnings inequality." *Quality & Quantity* 53: 471-491.

Vanneste, Bart S. 2017. “How Much Do Industry, Corporation, and Business Matter, Really? A Meta-Analysis. *Strategy Science*. 2:121-139.

Weeden, Kim. 2002. “Why do some occupations earn more than others? Social closure and earnings inequality in the United States.” *American Journal of Sociology* 108, 55-101.

Weeden, Kim and David Grusky. 2012. “Three Worlds of Inequality.” *American Journal of Sociology* 117: 1723-85.

_____. 2005. “The Case for a New Class Map.” *American Journal of Sociology* 111: 141-212.

Weeden, Kim, Young-Mi Kim, Matthew Di Carlo, and David Grusky. 2007. “Social Class and Earnings Inequality.” *American Behavioral Scientist* 50: 702-36.

Williams, Mark. 2012. “Occupations and British Wage Inequality, 1970s-2000s.” *European Sociological Review* 29: 841-57.

Williams, Mark and Thijs Bol. 2018. “Occupations and the Wage Structure: The Role of Occupational Tasks in Britain.” *Research in Social Stratification and Mobility* 53: 16-25.

Wodtke, Geoffrey. 2017. “Social Relations, Technical Divisions, and Class Stratification in the United States: An Empirical Test of the Death and Decomposition of Class Hypotheses.” *Social Forces* 95: 1479-1508.

Wright, Erik O. 1997. *Class counts.* Cambridge: Cambridge University Press.

Table 1. Three Digit Occupation Counts for Years Observed

	Denmark	Finland	Germany	Japan	South Korea
1993			92		105
1994	132		92		106
1995	144	126	92	124	105
1996	144	123	92	124	106
1997	144	124	92	124	110
1998	144	128	92	124	106
1999	144	129	92	124	113
2000	144	131	92	124	163
2001	144	127	92	123	156
2002	144	122	92	122	152
2003	149	120	92	121	150
2004	148	121	92	122	150
2005	149	122	92	137	88
2006	149	127	92	137	88
2007	144	125	92	137	88
2008	148	127	92	137	95
2009	148	126	92	137	95
2010	174	119	92	137	95
2011	174	110	119	137	95
2012	174	110	119	137	
2013	173	110	119	137	
2014	172	109	119		
2015	171	109	120		
2016		105	120		
2017			119		

NOTE: Japanese occupation 999 (office worker) recoded into three educational levels.

Table 2. Comparison of Job Only Fixed Effect Explained Variance to Occupation, Establishment and Job Models that Include Individual Level Predictors, Primary Job, Non-Marginal Person-Employer Records, First and Last Year Observed

		Adding Individual Age, Age2, Sex, Education to Context Fixed Effect		
	Job Fixed Effect Only	Occupation	Establishment	Job
First Year Observed				
Denmark	53.6%	46.4%	52.1%	63.1%
Finland	64.6%	59.0%	57.0%	71.3%
Germany	66.6%	44.1%	64.2%	74.1%
Japan	67.8%	53.5%	73.0%	79.6%
South Korea	75.2%	63.2%	77.8%	86.1%
Last Year Observed				
Denmark	60.0%	49.4%	63.3%	66.8%
Finland	69.7%	61.0%	69.8%	76.9%
Germany	61.0%	58.4%	69.4%	76.4%
Japan	74.7%	55.3%	71.1%	80.0%
South Korea	67.9%	47.9%	67.8%	78.5%

NOTE: Japanese occupation 999 (office worker) recoded into three educational levels. South Korea and Japan, Private Sector Only. South Korea full-time only.

Figure 1. Trends in three digit occupational adjusted explained variance and variance components for logged wages; non-marginal person-employer matches, circa 1993-2015.

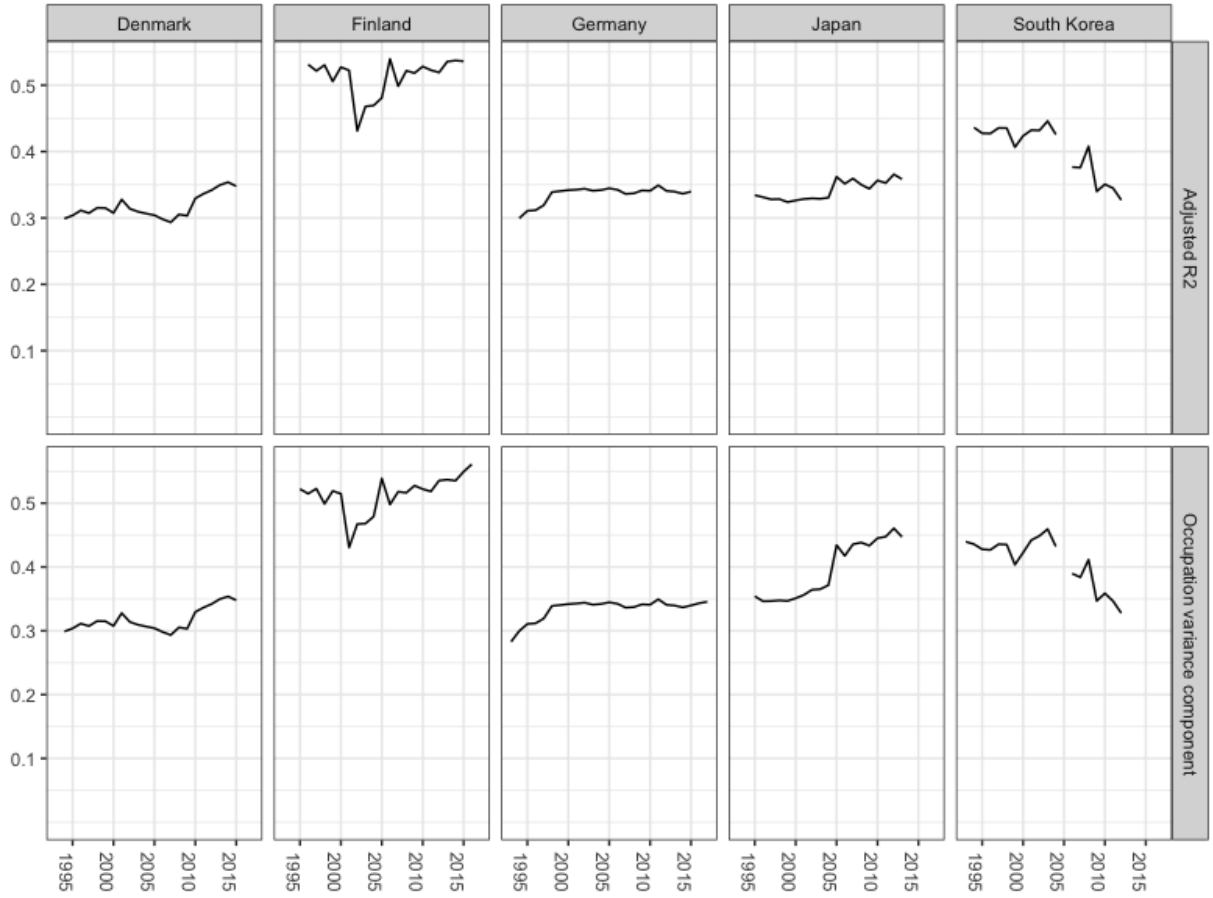


Figure 2. Explained Variance and Variance Components for Logged Wages and Stratification Context, Primary Job, All Non-Marginal Person-Employer Matches, circa 2013-2017.

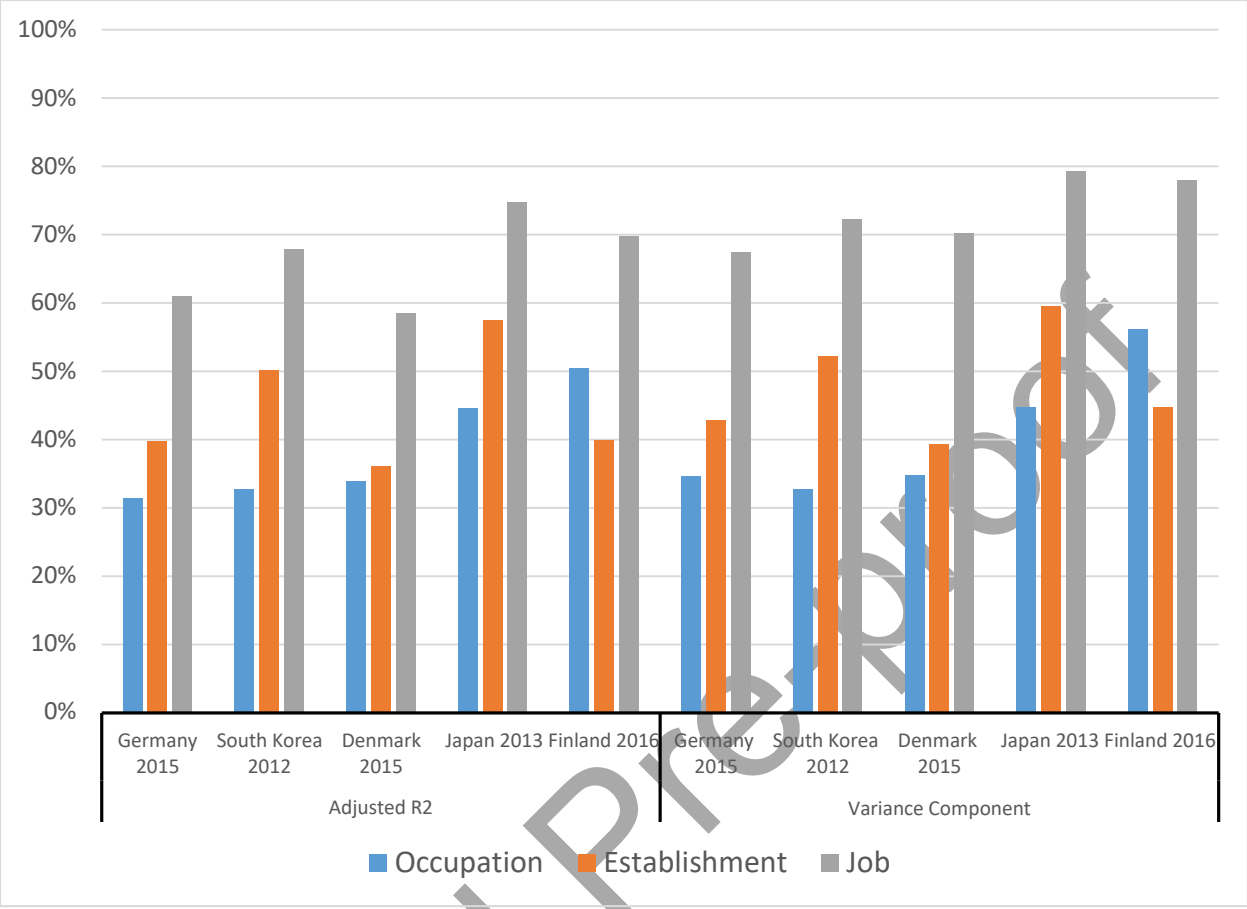
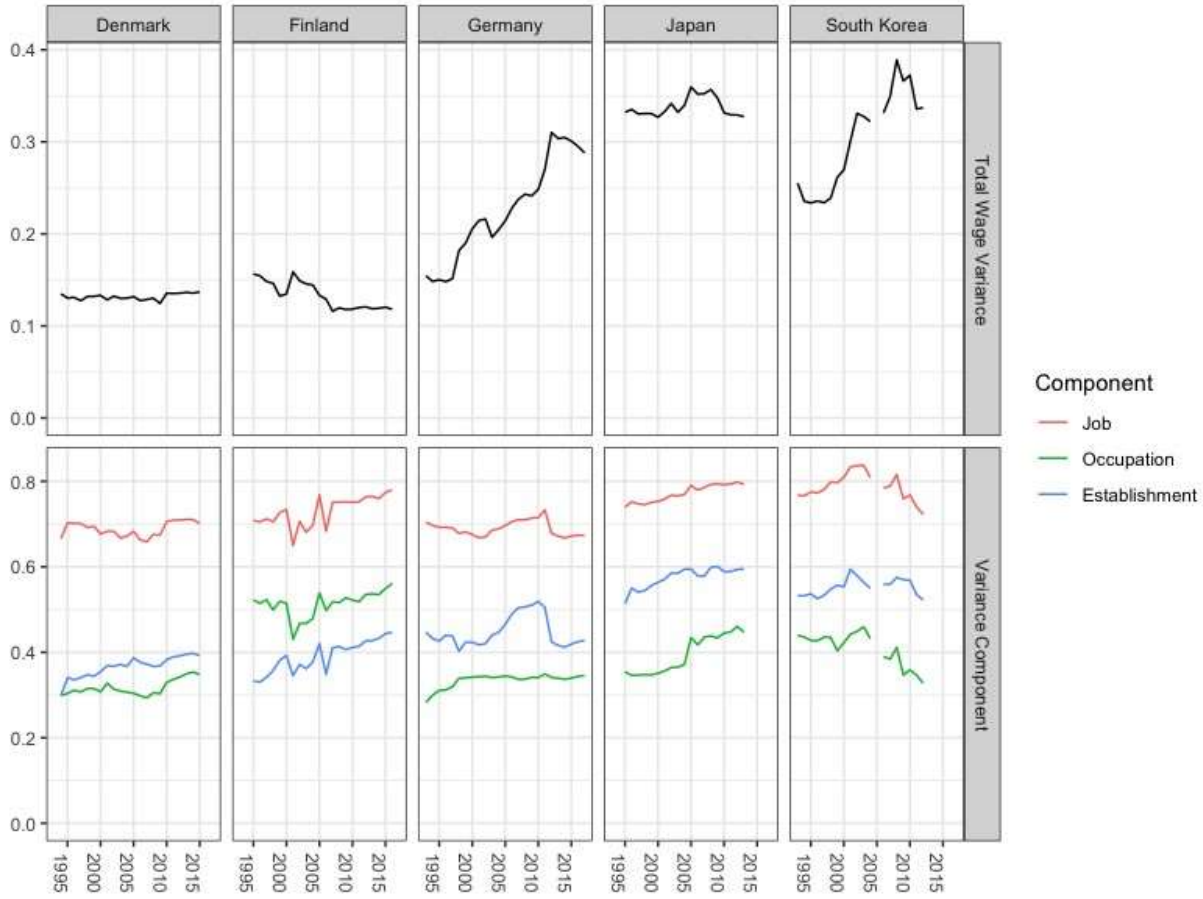


Figure 3. Total logged wage variance and variance components associated with occupation, establishment and job, non-marginal person-employer matches, circa 1993-2015.



Appendix 1: Country Specific Data Sources and Measurement

Denmark. The data consists of population-level observations of both private and public sector workplaces. All industries are included. The analytic sample includes all employed individual's primary jobs as registered in November. Estimates are based on both annual and hourly earnings. Because Denmark does not have a national minimum wage, the bottom 5% of jobs were considered marginal jobs. The full-time job variable is defined by the registrar as any job that exceeds 26 hours a week. This information stems in part from unemployment insurance records and in part from the mandatory ATP pension records which contain categorical information on hours worked. This variable relates to the job held by a worker late November each year. The occupational codes DISCO are a national adaptation of the International Standard Classification of Occupations. Revisions roughly follow revised ISCO releases.

Data were purchased from Statistics Denmark. The core of the data is the Register-based Labor Market Statistic RAS and the Integrated Database for Labor Market Research IDAN, which identifies workers and establishments consistently over time including annual and hourly earnings as well as the occupation of the workers. We have access to information about individual characteristics for the full population of workers for 1994–2015 including level of education from the education registers.

The quality of earnings records improves marginally after 2008 when the earnings are drawn from the so-called e-income register which contains even more rigorous earnings accounts than the previously used tax records. This shift does not appear to substantially impact total earnings variance or earnings component estimates.

Finland. We have employed two data sources. Analyses of yearly earnings were generated using the workforce registry-based Finnish Longitudinal Employer-Employee data (FLEED). These are administrative data with complete coverage of all jobs and industries. The FLEED does not, however, collect data on hours worked. Once a year in October-November hours worked information is collected from employers for a large fraction of the labor forces for Finish Structure of Earnings Statistics (FSES). All analyses reported in the text utilize (FSES), where both wages, hours or work, and full-time status are measured with precision.

FSES includes all public sector employees and private sector coverage (depending on the year and industry) ranges from 55 to 75% of all private sector employment during the last quarter of the year, though the vast majority of small firms are excluded. Agriculture, forestry and fisheries, employers and their households, international organizations, as well as job spells that both begin and end during the reference month are excluded.

In the FLEED yearly earnings are available as are the number of months employed. Earnings is measured as total earnings from all sources divided by months employed. Marginal jobs are defined as the bottom 10 percent of the income distribution. To approximate fulltime wages, the monthly earnings of full-time workers in the Structure of Earnings Data were analyzed and the fifth percentile identified. All individuals in the FLEED data, whose monthly earnings were below the fifth percentile (as identified among full-time workers in the SES data) were excluded.

In the FSES there is precise information on monthly earnings and hours worked. Hourly wage is calculated by dividing monthly earnings by actual hours worked. In the FSES marginal jobs are defined as hourly wages below the first percentile. Following Statistics Finland, individuals, whose regular working hours are more than 90% of the potential maximum as

stipulated by the Working Hours Act or in the appropriate collective agreement, are considered full-time employees.

Both FLEED and SES entail information on firm and establishment number, but establishment ID missingness is high in SES. Therefore, information on establishments is based on the FLEED data for both data sources. Since wage information in the SES is collected in Oct-Dec, and the firm and establishment number in the FLEED is collected in December, by construction we are assuming that employees do not switch employers across these three months. To test this assumption we compared estimates yielded by the firm number in FLEED and firm number in SES (which has substantially less missingness) and found almost identical results.

Germany. Data come from a customized sample for the project "Dynamics of organizational earnings inequality: Investigation within the Comparative Organizational Inequality International Network (COIN)" of the Integrated Employment Biographies Sample (IEBS) combining records of the employment history (BeH) and benefit recipient history (LeH) of the Federal Employment Agency was used. The customized sample of the IEBS was drawn in 2017 and roughly covers 5% of the German employed population and 20,000 establishments over the time. The data spans from 1990 to 2015. East Germany is included from 1992 onwards in the data. The East German data reaches the West German quality level in 1993. In very large workplaces, a sample of 1,000 workers were collected while in smaller workplaces we have the full population of employees. The data provide information on private and public-sector establishments from all industries.

The basis for the data is the integrated notification procedure for health, pension and unemployment insurance, which came into effect as of 1 January 1973 and was extended to cover Eastern Germany on 1 January 1991. Under this procedure employers are required to

submit notifications to the responsible social security agencies concerning all their employees covered by social security at least once a year. Thus, the data includes only workers liable to social security contributions (civil servants [Beamte] and self-employed are excluded), which covers around 80% of the entire workforce.

These data represent a sample of firms and their employees. In the first step 20,000 randomly selected establishments in all years of their existence and their employees were chosen. The basis for the first step of the selection were all establishments, which existed in Germany between 1993 and 2013 independently from the duration of their existence or their region. The establishments were drawn proportionally to their size. Smaller establishments are selected with a decreasing probability. For reasons of data protection, we limit the maximum of the sampling probability to 0.3, as otherwise, due to the skewness of the workplace size distribution, large workplaces would be drawn nearly completely into the sample.

Based on this selection, in the second step, employees of the selected 20,000 establishments were selected. For large establishments the number of employees was limited to 1,000 randomly selected employees. Once an individual was selected into the sample all available information on the individual between 1990 and 2015 was provided even if the employee was working only for a limited period in the previously selected establishments. This allows us to calculate not only establishment-level but also individual fixed-effects.

The customized sample of the Integrated Employment Biographies Sample (IEBS) are episode data, i.e. each observation has a start date and an end date. The data is transformed from spell into panel data to estimate the models. For the estimations employees are nested within the selected establishments in every year of the establishment existence and for every employee there is only one job per year.

Yearly earnings associated with each job is the observed earnings concept. We do not have hourly wage, but have a precise measure of days worked and so our wage concept is daily wage. Marginal jobs were defined as those which reported less than 450 euros per month. Persons employed in such jobs (e.g. newspaper delivering) are not obligated to pay social security, which are currently at less than €450 per month, are excluded from the sample. They were automatically excluded from the sample until 1999 and are removed afterwards by excluding wages €2 above the threshold after. Full-time jobs are defined by the employer based on employment contract.

Because the German Earnings data are top-coded, an imputation strategy based on Card, Heining, and Kline (2013) was used to impute top daily earnings. The method uses a tobit model that incorporates individual and workplace-specific components in the prediction equation. Estimates are weighted to produce national estimates. However, rather than focusing on the mean individual and workplace wage prior to the censored observation as was done by Card and his coauthors we utilize information on lagged waged. We reason that the censored wage is more strongly influenced by the most recent period than by mean wages over longer periods. Using lagged information, the wage distribution is smoother than that created by a replication of Card's imputation model, which seem to have too few jobs immediately to the right of the censoring limit and also too few cases in the far tails of the distribution. Appendix 2 provides the rational and code used.

Japan. Estimates are generated from the Basic Survey on Wage Structure conducted by the Ministry of Health, Labor, and Welfare of Japan. The survey is a two-stage design in which a sample of private sector establishments with at least five employees are selected, and then a

uniform random sampling of workers among these establishments is taken. Full-time work is defined in the survey as those working "general hours." In the survey, part-time workers are defined to be workers whose daily hours worked is shorter than that of full-time workers or whose working days per week is less than those of full-time workers. Person-job matches that report monthly earnings less than half of the minimum wage are excluded. This eliminates less than .01% of all person-job matches.

South Korea. Estimates are from the Wage Structure Survey conducted annually by the Korean Ministry of Labor. The data consist of a sample of private sector establishments, first stratified by size and then by region and industry. An establishment must have had a minimum of five employees to be included in the sample before 1999, and 10 employees beginning in 1999. All industries except Agriculture are included. The dataset contains only full-time employees, defined by employers as employees with a fixed-term employment contract longer than twelve months or those with a permanent (open-ended) contract.

The Survey provides information on a worker's monthly base pay, monthly overtime pay, and annual bonus, as well as information on monthly hours of work and hours of overtime work. Based on the information, we calculated hourly wage by dividing monthly base pay by regular work hours. Additionally, monthly earnings were calculated by adding monthly base pay, monthly overtime pay, and a one-month amount of bonus (i.e., annual bonus divided by 12). Marginal jobs are defined as those that pay hourly wages smaller than one-half of the wage at the 10^{th} percentile of total workers included in the Survey each year.

Appendix 2. Imputation strategy for top coded income

In the German social security records wages are censored at the social contribution limit which differs by year and in East and West Germany. The wage information stated in the social security notification is sum of wages related to the employment episode. The daily wage is the episode wage divided by number of calendar days, i.e. it is the average wage for this period. Wages are deflated by the CPI, base year is 2010. We consider all daily wages as censored that are larger than the contribution limit minus 3 € in order to account for rounding errors.

1. Imputation methods

1.1 Simple. A simple approach to top-coding is to use individual information only to impute missing earnings for top coded cases. Tobit regressions by year, East/West Germany, gender, education and age groups. This is the most common approach in the literature that developed out of top coded survey data. Since much wage variation is associated with employment organization this is not a satisfying approach for linked employer-employee panel (LEEP) data.

1.2 Card/Heining/Kline

Card, Heining and Kline (2013) include in their imputation equations using German LEEP data the leave-one-out mean workplace and mean individual wage and workplace shares of censored observations in their imputation equations to improve top-code estimates. In our replication of their imputation model we discovered that their method produces too few jobs immediately to the right of the censoring limit and too few cases in the far tails of the distribution.

1.3 The lagged wage alternative

Rather than focusing on the mean individual and workplace wage prior to the observation year we utilize information on lagged wages in our prediction equation. When the lagged wage is missing it is imputed in an earlier stage. We reason that the censored wage is more strongly influenced by the most recent wage than by mean wages over longer periods.

1.3.1 Individual Stratification

Individual variables are used in the imputation models to stratify the sample. These include the cross-classification of gender, education, age groups and East and West German residence. Each imputation equation is estimated separately for each cell of this cross-classification.

1.3.2 Firm variables

Each imputation is based on a prediction equation that contains lagged individual daily earnings plus a series of organizational characteristics.

We include the following workplace level variables in the imputation equations: fraction of workers with university degree, mean years of schooling of firm by gender, log firm size, fulltime employees, log firm size squared, dummy for firm size>10 full-time employees, mean log real daily wage of co-workers, fraction of co-workers with censored wage, dummy firm has only 1 worker in current year.

1.4 Stata Code for Imputation Procedure

Since censored wages are likely to be censored in prior years we utilize an iterative imputation strategy.

Step 1: independent imputation models by year, age (4 categories) education (five categories), sex and east/west Germany

$$logw_{it} = \gamma * x_{it} + \varepsilon_{it} \quad t \in [1994 \dots 2010]$$

Predict $logw_{it-1}^{ind}$

Step 2: include lagged variables in order to account for correlation over time

$$logw_{it} = \propto * logw_{it-1}^{type} + \beta * (logw_{it-2}^{type} - logw_{it-1}^{type}) + \gamma x_{it} + \varepsilon_{it}$$

$$t \in [1996 \dots 2010]$$

type = {org, ind, lag, mean}

If person in sample in t-1

org = observed uncensored wage

ind = imputed wage from regression in t-1 without lag variables

lag = imputed wage from regression in t-1 with lag variables

If person is not in sample in t-1

$logw_{it-1}$ is replaced by the person mean estimated:

$$logw_{it-1}^{mean} = logw_{it}^{org,ind} - mean(logw_{it}^{org,ind} - logw_{it-1}^{org,ind})$$

i.e. current wage – average change

$$(logw_{it-2}^{type} - logw_{it-1}^{type}) = mean(logw_{it-2}^{org,ind} - logw_{it-1}^{org,ind})$$

i.e. average change →close to 0

If person is not in sample in t-2

$logw_{it-1}$ is replaced by mean

$$logw_{it-1}^{mean} = logw_{it}^{org,ind} - mean(logw_{it}^{org,ind} - logw_{it-1}^{org,ind})$$

i.e. current wage – average change

$$(logw_{it-2}^{type} - logw_{it-1}^{type}) = mean(logw_{it-2}^{org,ind} - logw_{it-1}^{org,ind})$$

i.e. average change →close to 0