Birds, Birds, Birds:

Co-worker Similarity, Workplace Diversity,

and Voluntary Turnover

WORKING PAPER

by

Boris Hirsch, Elke J. Jahn, and Thomas Zwick

Birds, Birds, Birds:
Co-worker Similarity, Workplace Diversity,
and Voluntary Turnover

Boris Hirsch[*], Elke J. Jahn[†], and Thomas Zwick[‡]

Abstract: We investigate how the demographic composition of the workforce along the sex, nationality, education, age, and tenure dimension affects voluntary turnover. Fitting duration models for workers' job-to-job moves that control for workplace fixed effects in a representative sample of large manufacturing plants in Germany during 1975–2016, we find that larger co-worker similarity in all five dimensions substantially depresses voluntary turnover whereas workplace diversity is of limited importance. In line with conventional wisdom, which has that birds of one feather flock together, our results suggest that workers prefer having co-workers of their kind and place less value on diverse workplaces.

Keywords: workforce demography, co-worker similarity, workplace diversity, voluntary turnover

JEL classification: J63, J62, J21, J19

[*]   Boris Hirsch, Leuphana University of Lüneburg, Halle Institute for Economic Research (IWH), and IZA Institute of Labor Economics, Universitätsallee 1, 21335 Lüneburg, Germany, email: hirsch@leuphana.de

[†]   Elke J. Jahn, Institute for Employment Research (IAB), University of Bayreuth, and IZA Institute of Labor Economics, Regensburger Str. 104, 90478 Nürnberg, Germany, email: elke.jahn@iab.de

[‡]   Thomas Zwick, University of Würzburg, Centre for European Economic Research (ZEW), and Research Centre for Education and the Labour Market (ROA), Sanderring 2, 97070 Würzburg, Germany, email: thomas.zwick@uni-wuerzburg.de

1 Introduction

Empirical analyses of job mobility are at the heart of labour economics. Studies are legion that investigate which worker and which employer characteristics, such as workers' sex, age, and education as well as firm size and industry (e.g. Anderson and Meyer, 1994; Royalty, 1998; Griffeth *et al.*, 2000; Frederiksen, 2008), drive voluntary as well as involuntary turnover. Yet, up to now, little is known on how the demographic composition of the workforce along key dimensions, such as sex, nationality, education, age, and tenure, affects individual workers' quit behaviour. In other words, we lack evidence on workers' revealed preferences about workforce demography, specifically on whether workers value demographically diverse work environments and/or prefer having co-workers of their kind.

To be sure, there exists a broad management literature on the turnover effect of what has been termed "organisational demography" (Pfeffer, 1985) that documents lower turnover in demographically more homogenous work environments (see the surveys by Williams and O'Reilly, 1998, and Joshi *et al.*, 2011). Moreover, turnover and especially worker-initiated voluntary turnover have been shown to harm firm performance (Park and Shaw, 2013), so that "wrong" workforce demography poses a possible threat to a firm's competitiveness. Usually, though, evidence on the influence of workforce demography on turnover comes from the laboratory or from small-scale field studies. These contributions often consider how the demographic composition of teams affects team members' turnover, and thus refer to very specific settings that render external validity questionable. On the other hand, existing observational studies that aim at more general conclusions lack a credible research design in that data constraints prevent them from moving beyond mere correlations between workforce demography and turnover to causal effects. The only exception, we are aware of, is the study by Leonard and Levine (2006) whose panel data permits the authors to control workplace fixed effects (we will discuss their study in some detail in the following section).

Apart from these limitations in terms of internal and external validity, existing studies only examine single aspects of workforce demography. When it comes to measuring workforce demography, most studies thus ignore that it encompasses two related, yet distinct components: overall workplace diversity and co-worker similarity at the workplace level from an individual worker's perspective. At the aggregate level of the workplace, the workforce may be more or less diverse, e.g. along the age dimension with either a lot or just a little variation in workers' age. Yet at the same time, from an individual worker's perspective, he or she may have more or less same-age co-workers for any given level of age diversity at the workplace. Hence, whereas workplace diversity reflects the variation of a demographic characteristic in the entire workforce, co-worker similarity mirrors the abundance of demographically similar co-workers there from an individual worker's perspective. Consequently, co-worker similarity is a distinct determinant of voluntary turnover on top of workplace diversity if workers prefer having co-workers of their kind, which is suggested by many analyses.

In this paper, we move beyond the extant literature by investigating the impact of both workplace diversity and co-worker similarity on voluntary turnover along many different demographic dimensions for a large representative set of plants, i.e. single production sites or workplaces, in the West German manufacturing industry. Our unique data contain information on more than 3,000,000 full-time jobs in almost 1,800 large workplaces over an observation window spanning the years 1975–2016 and thus more than four decades. The data allow us to examine in detail how workplace diversity and co-worker similarity along the sex, nationality, education, age, and tenure dimension affect voluntary turnover based on duration models for workers' job-to-job turnover rate that control for permanent workplace unobservables and an unusually broad set of further determinants of voluntary employee turnover.

Our main finding will be that co-worker similarity along all five dimensions significantly reduces voluntary turnover, whereas workplace diversity plays a less important and a less unanimous role. In line with conventional wisdom, which has that birds of one feather flock

together, our findings suggest that workers prefer having co-workers of their kind, but place less value on working in diverse workplaces.

The remainder of this paper is structured as follows. Section 2 builds our hypotheses and reviews some of the relevant literature on the turnover effect of workforce demography. Section 3 introduces our data and empirical strategy and discusses possible threats to identification. Section 4 presents and discusses our empirical results, and Section 5 concludes.

2   Theoretical considerations and empirical challenges

Empirical research on job mobility is abundant with numerous studies examining the drivers of worker turnover at the worker and the employer level. Yet, convincing empirical evidence on how workforce demography affects worker turnover is still scant. In particular, little is known about its impact on worker-initiated voluntary turnover, which in turn would allow inferring workers' preferences about workforce demography. Although there exists a well-established management literature on the turnover effect of workplace demography (see the surveys by Williams and O'Reilly, 1998, and Joshi *et al.*, 2011), existing observational studies almost unanimously lack a credible research design, so that they hardly move beyond mere correlations, and typically present only a narrow picture in analysing only few aspects of workforce demography.

In terms of dimensions, most studies consider only a single dimension of workforce demography, such as workers' sex or race, or, at best, few such dimensions at the same time. In terms of aggregation, studies either analyse measures of workplace diversity that capture the variation of a demographic characteristic across the entire workforce, such as an entropy index of workers' race, or similarity measures between an individual worker and his or her co-workers, such as the share of same-race co-workers at a workplace. However, workplace diversity and co-worker similarity capture distinct components of workforce demography, such as group

dissimilarity and relational demography (Leonard and Levine, 2006; Ilmakunnas and Ilmakunnas, 2011; Garnero et al., 2014). They are thus neither orthogonal nor likely to affect workers' quit behaviour in the same way.

Taking the stance of an individual worker, we expect co-worker similarity to reduce voluntary turnover. Because of homophily (McPherson *et al.*, 2001), demographically similar workers are likely to share attitudes, values, and beliefs and for this reason are likely to feel attracted to each other. Hence, if demographically similar co-workers are more abundant, *ceteris paribus*, we expect an individual worker to be less inclined to quit. This expectation is also borne out of discrimination theory, where in-group bias gives rise to a taste for discrimination (Becker, 1971). This taste for discrimination causes workers to suffer a disutility from being surrounded by dissimilar (out-group) workers, and we expect this disutility, in turn, to increase workers' quit rate.

Turning to the workplace level, theoretical predictions on the effect of workplace diversity on workers' quit rate are less clear-cut. On the one hand, having a more diverse workforce is expected to hamper communication and conflict resolution (Lang, 1986) and is thus likely to translate into less cooperation, more conflict, and a higher quit rate. On the other hand, it has been argued that workers value diversity because they show a love for variety in social interactions (Breit and Horowitz, 1995), which would depress workers' quit rate.

Furthermore, from the employer's perspective, dealing with a diverse workforce that is more prone to conflict is likely to involve higher transaction costs and to harm firm productivity (Breit and Horowitz, 1995). However, a more diverse workforce may also raise productivity by enhancing decision making and problem solving (Kochan *et al.*, 2003), by improving the firm's adaptability to diverse product market environments (Osborne, 2000), through better knowledge transfer (Lazear, 1999), or through increased knowledge creation (Berliant and Fujita, 2008). And arguably better firm performance, in turn, facilitates worker retention. Resonating these conflicting predictions, studies have reached mixed conclusions on the productivity

effect of workforce diversity (e.g. Barrington and Troske, 2001; Ozgen and De Graff, 2013; Parrotta *et al.*, 2014; and Trax *et al.*, 2015). Therefore, it remains unclear how diversity affects workers' quit behaviour.

In terms of internal and external validity, "[c]onvincing studies are rare in part because it is challenging to measure the effects of workplace diversity" (Leonard and Levine, 2006: 548). Problems arise not only because one needs to have detailed information on the entire workforce to construct measures of co-worker similarity and workplace diversity along different demographic dimensions, but also because of workplace unobservables that influence worker turnover, such as local labour market conditions, management practices, job content, training opportunities, *etc*. Absent truly random variation in workplace demography, omitting these workplace unobservables would yield bias, and to mitigate concerns one would thus like to control for workplace fixed effects in longitudinal data, which are rarely available to researchers.

To the best of our knowledge, Leonard and Levine (2006) is the only study in the literature that investigates how co-worker similarity and workplace diversity along the sex, race, and age dimension affect workers' overall turnover rate based on a credible research design. They analyse longitudinal data for over 800 workplaces of one large multi-establishment service-sector employer in the U.S. during an observation period of 30 months in 1996–1998. In contrast to existing observational studies, their data comprise many demographically varied workplaces and contain variation in workforce composition within workplaces, so that they can control for permanent unobserved workplace characteristics. Fitting linear probability models that account for workplace fixed effects, they find no consistent evidence that workplace diversity affects turnover, whereas co-worker similarity tends to lower the turnover rate.[1]

That said, Leonard and Levine's (2006) evidence, albeit superior to existing research in

---

[1] In a companion paper using the same data and the same research design, Giuliano *et al.* (2011) further find that workers have lower turnover and higher promotion rates when staff and managers are of the same race pointing at the racial composition of superiors as another relevant dimension of workforce demography.

terms of internal validity, is still borne out of data for a single large employer from the service industry within a short observational window and thus refers to a very specific setting. In particular, the jobs under consideration are part-time jobs with very high turnover that only require basic skills and where workers receive only little training. It thus remains unclear whether their findings generalise to other settings, such as long-lasting jobs involving high (specific) human capital or jobs in different industries and occupations. What is more, they just examine overall turnover, but not voluntary turnover initiated by workers. Yet, only investigating workforce demography's effect on voluntary turnover allows drawing conclusions on workers' preferences about workforce diversity and co-worker similarity. In contrast, our analysis considers all full-time jobs held at a representative sample of large workplaces in the West German manufacturing industry over an observation window spanning more than four decades and examines workers' job-to-job turnover as a proxy of voluntary turnover.

3 Data and empirical strategy

3.1 Administrative linked employer–employee data

In our empirical analysis of the impact of workplace demography on voluntary turnover, we will fit duration models for workers' job-to-job transition rate on administrative linked employer–employee data for West Germany that encompass the years 1975–2016. Our data stem from the Integrated Employment Biographies (IEB) provided by the Institute for Employment Research (IAB) that are based on the notification procedure of the German health, pension, and unemployment insurances (for details on the IEB, see Jacobebbinghaus and Seth, 2007). This notification procedure requires employers to report all the information on their workers that is necessary to calculate social security contributions and thus renders these highly reliable data especially suited for analysing job durations and wages. Overall, the IEB covers about 80 per-

cent of all people employed in Germany and contains information on those workers' job durations (at daily frequency), daily gross wages (deflated by the consumer price index), occupation, and individual characteristics (sex, age, education, and nationality). Absent from the data are civil servants and the self-employed, who do not contribute to the social security system.

The IEB data further include identifiers that allow us to assign workers and their jobs to plants, i.e. single production sites or workplaces, so that we can assume that there is interaction between workers at their workplaces (see also Cornelissen *et al.*, 2017). To arrive at our sample, we select out of the universe of the IEB all workers holding jobs in a stratified 15 percent random sample of large workplaces in the manufacturing sector in West Germany, where restricting to large workplaces allows workforce demography to vary smoothly along several of its dimensions.[2] We define five strata over plant size comprising the intervals 200–299, 300–399, 400–499, 500–999, and at least 1000 workers and assign a workplace to one of the size intervals whenever its minimum workforce during our period of observation lies within this interval. Furthermore, we exclude all workplaces that change their sector classification and that we observe for less than ten years, which leads to a sample of workplaces where stable, long-lasting jobs are possible.

In the workplaces in our sample, we consider an inflow sample of all non-managerial jobs (based on occupational codes) that started after 1st January 1975, which is the first day observed in the IEB, and follow these jobs until they either end with the worker leaving the current employer (i.e. until a job separation) or until 31st December 2016, in which case the job duration is right-censored at this point. We further ignore job separations if the same employer recalls the worker within three months. In contrast to many studies on workers' job mobility – as well as to other papers using other data sets generated from the IAB data, such as Boockmann and Steffes (2010), Hirsch *et al.* (2010), and Schaffner (2011) –, the high frequency and the

---

[2]   We exclude East German workplaces because information on the jobs held in these is only available from 1992 onward.

long time span of our data set allows us to fit duration models on an inflow sample of possibly long-lasting jobs thereby accounting for left-truncation and right-censoring of job durations.

Whereas the information on job durations and daily gross wages included in our data is highly reliable, the data do not contain detailed information on hours worked. In addition, wages are top-coded at the social security contribution ceiling. Since we include workers' entry wage and wage growth as covariates in our duration models, we decided to deal with these drawbacks by considering jobs of full-time workers only, for whom wages are comparable, and by imputing wages above the contribution ceiling using a heteroscedastic single imputation approach developed by Büttner and Rässler (2008) for the IAB data. Furthermore, information on workers' education is provided by employers on a voluntary basis and is therefore inconsistent or missing for some workers. To mitigate this problem, we impute the missing information on education by employing a procedure proposed by Fitzenberger *et al.* (2008) that allows inconsistent education information to be corrected.

3.2 Measuring voluntary turnover and workforce demography

Clearly, considering overall job separations mixes up both employer-initiated involuntary dismissals and worker-initiated voluntary quits, where only quits following changing workplace demography are informative on workers' preferences. In our data, we cannot directly distinguish employer-initiated and worker-initiated separations, but we do observe whether jobs end with a separation to employment, which refers to a new job with another plant, or with a separation to non-employment, which refers to a subsequent period of registered unemployment or no observation in the IEB data at all.[3] In line with evidence from other German data sources

---

[3] The latter implies either that the worker has changed to non-employment without receiving unemployment benefits or that he or she has become, for instance, self-employed and is not recorded in the IEB data. Although our data do not permit us to disaggregate this category of unknown destination, information from other German data sets suggests that the vast majority of workers in this category have indeed moved into non-employment and misclassification is only a minor issue (see, e.g., Hirsch *et al.*, 2018, for a comparison of the administrative data we use to the German Socio-Economic Panel that entails for example self-employment).

(see, e.g., Hirsch, 2016, for a comparison to the Socio-Economic Panel that allows distinguishing voluntary and involuntary turnover), we argue that separations to employment primarily mirror worker-initiated turnover whereas separations to non-employment predominantly mirror employer-initiated turnover and, therefore, proxy voluntary turnover by considering workers' job-to-job separation rate. In a later check of robustness, we will scrutinise whether our findings are sensitive to restricting to job-to-job moves or carry over when considering overall turnover.

In our data, we observe all workers in a workplace and, thus, we can use the information on individual workers to arrive at workplace-level and individual-level information on workforce demography. In our analysis, we will consider workforce demography along the sex, nationality, education, age, and tenure dimension both from the individual worker's perspective in terms of co-worker similarity and from the overall workplace perspective in terms of workforce diversity.

Specifically, for the three dimensions of workforce demography measured at nominal scale we distinguish female and male workers, German and non-German workers, as well as low-skilled (i.e. no vocational training), medium-skilled (i.e. with vocational training), and high-skilled (i.e. with academic education) workers. To capture co-worker similarity along these three dimensions, we consider the shares of same-sex, same-nationality, and same-education workers in the workforce of the workplace.

To measure workplace diversity, we use the Shannon diversity index

$$H = -\sum_{j=1}^{J} p_j \ln p_j,$$

where p_j denotes the share of workers belonging to group j at workplace level, e.g. the share of low-skilled workers, and J denotes the overall number of groups, e.g. the number of education groups. To facilitate interpretation, we normalize all Shannon diversity indices by dividing them by their maximum value, i.e. by $\ln J$.

For the two metric dimensions of workforce demography, age and tenure, we capture co-worker similarity by considering the share of co-workers with the same age, i.e. co-workers neither older nor younger than two and a half years compared to the worker, and the share of co-workers with the same tenure, i.e. neither longer nor shorter tenure than six months compared to the worker. As measures of workplace diversity, we use the standard deviation in workers' age and tenure at workplace level.

3.3 Econometric approach

To investigate how workforce demography affects workers' job-to-job turnover rate, we fit hazard rate models for the duration of non-managerial jobs including our measures of co-worker similarity and workplace diversity. As a baseline specification, we model the instantaneous job-to-job separation rate of non-managerial job i at workplace $j(i)$ held by worker $m(i)$ as a Cox model

$$s_i\big[t\big|\mathbf{x}_{m(i)}(t), \mathbf{z}_{j(i)}(t)\big] = s_0(t)\exp\big[\mathbf{x}_{m(i)}(t)'\boldsymbol{\beta} + \mathbf{z}_{j(i)}(t)'\boldsymbol{\gamma}\big],$$

where $s_0(t)$ denotes the baseline hazard depending on job duration t, $\mathbf{x}_{m(i)}(t)$ is a vector of worker covariates including our measures of co-worker similarity, $\mathbf{z}_{j(i)}(t)$ is a vector of workplace covariates including our measures of workforce diversity, and $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are vectors of coefficients. Our main point of interest are the coefficients of our measures of workforce demography that inform us on how larger co-worker similarity and workplace diversity along the sex, nationality, education, age, and tenure dimension affects the job-to-job turnover rate proxying voluntary turnover.

As worker controls, we include groups of dummies for age (in five year intervals), education, and occupation, a sex dummy, and a dummy for non-German citizenship, the worker's log entry wage as well as the log wage growth, i.e. the log difference between the current and the entry wage. On top of standard demographic drivers of workers' turnover rate identified in

the previous literature (briefly surveyed in the introduction), inclusion of entry wages and wage growth is important because previous research, in particular the seniority wage literature initiated by Lazear (1979), has shown that high-wage (growth) employers experience lower voluntary turnover (Bronars and Famulari, 1997; Zwick, 2012).

Workplace controls include groups of share variables that capture the composition of the workforce along the sex, nationality, education, age, and tenure dimension (the latter two in five-year intervals), dummies for two-digit industry and plant size, a full set of year dummies, and two dummy variables indicating an expanding or a shrinking workforce (by more than 10 percent), respectively.[4] The latter two variables are meant to control for employers' hiring and firing behaviour. Previous studies, such as Varejão and Portugal (2007), have established marked non-convexities in employment adjustment costs meaning that labour adjustment is expected to be lumpy and that phases of active hiring and firing are visible from large changes in the workforce. Such phases of active employment adjustment, in turn, may not only trigger changes in workforce demography but also changes in (unobserved) worker quality with, as a case in point, "surviving" workers during a phase of active firing being high-quality workers likely to have better outside options and thus a higher quit rate. To avoid bias stemming from such active hiring and firing, we control for large changes in the workforce.

One obvious concern with our Cox regression is omitted variables bias stemming from unobserved workplace characteristics that are correlated with voluntary turnover. To address

---

[4] Hence, the Cox regression includes a dummy variable indicating whether a job belongs to an individual worker who, say, is female, the share of female workers in the workforce, and the share of same-sex workers in the workforce at individual level. Intuitively, this means that in essence the impact of co-worker sex similarity is identified from the differential effect of the share of female workers for male and female workers or, in other words, from an interaction effect of the female dummy and the female share. Yet, we decided against including this interaction in the Cox regressions and stuck to the share of same-sex workers because estimating the interaction effect renders interpretation very cumbersome. As a side remark, since identification of the effect of co-worker sex similarity in essence rests on an interaction effect of the female dummy and the female share, it is not possible to check for heterogeneous effects for female and male workers in separate Cox regressions, and analogously for other dimensions of workforce demography.

these omitted factors, in a second specification we model the instantaneous job-to-job separation rate of non-managerial jobs as a stratified Cox model

$$s_i\big[t\big|\mathbf{x}_{m(i)}(t),\mathbf{z}_{j(i)}(t)\big] = s_{0j(i)}(t)\exp\big[\mathbf{x}_{m(i)}(t)'\boldsymbol{\beta} + \mathbf{z}_{j(i)}(t)'\boldsymbol{\gamma}\big],$$

where $s_{0j(i)}(t)$ now denotes a baseline hazard that is specific to workplace $j(i)$ and thus encompasses unobserved permanent workplace characteristics.[5] To estimate the stratified Cox model, we adopt the stratified partial likelihood estimator. This estimator allows us to sweep out the workplace-specific baseline hazard without the need to identify it and, thus, allows us to estimate the covariates' coefficients $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ while controlling for permanent workplace unobservables in a similarly convenient way as with the within estimator in linear fixed-effects models (Ridder and Tunalı, 1999). Stratified partial likelihood estimation does so by resting identification on within variation at the workplace level and therefore requires multiple jobs per workplace. It is feasible with our data because we observe an inflow sample of all non-managerial full-time jobs at large workplaces in the manufacturing industry and thus sufficient within-workplace variation to obtain precise estimates.

When interpreting the estimated coefficients, however, we have to bear in mind the source of identification. The coefficients of the workforce demography variables are now identified from variation in the demographic composition of the workforce within workplaces and, thus, inform us on how workers' job-to-job turnover rate responds to workplace-level changes in co-worker similarity and workplace diversity controlling for many observable worker and workplace characteristics as well as permanent workplace unobservables.

---

[5] Note that by allowing for a workplace-specific baseline hazard, the proportionality assumption inherent to the stratified Cox model needs to hold only for jobs at the same workplace but may very well be violated across jobs at different workplaces without invalidating identification (e.g., Kalbfleisch and Prentice, 2002: 118/119). As a consequence, our estimates relying on stratified Cox models do not suffer from the widely raised criticism against proportional hazard models.

3.4 Threats to identification

Yet, one may still wonder whether it is legitimate to consider the responses in workers' job-to-job turnover to varying workforce demography as causal effects. In other words, one may doubt the exogeneity of the co-worker similarity and workforce diversity variables in the stratified Cox regression because we lack credible quasi-experimental variation in these.

Clearly, within-workplace changes in workforce demography could be regarded as exogenous if employers hired workers without giving thought on how these workers' demographic characteristics feedback into workplace demography and voluntary turnover and if workers entered jobs without caring for workforce demography, either. Turning to employers, they may simply neglect such side effects of recruiting because in adjusting their employment they mainly react to the current labour market situation or the (expected) demand for their goods (as argued by Pfeffer, 1985). Furthermore, the identifying transient fluctuations of workforce demography (around the permanent levels controlled for by the fixed workplace effects) may stem from sources outside the employer's control, such as labour market imperfections originating in information asymmetries and mobility costs or worker voice institutions like works councils.

Crucially, though, even if they wanted to, employers could not simply change single components of workforce demography in isolation. As a case in point, increasing co-worker similarity for one type of worker, e.g. for high-skilled workers, inevitably decreases co-worker similarity for other types of workers, viz. for low-skilled and medium-skilled workers. Similarly, changing workplace diversity necessarily involves raising co-worker similarity for some types of workers and lowering co-worker similarity for other types. Hence, any employment adjustment will imminently induce temporary fluctuations in workforce demography that affect workers' voluntary turnover. And we suspect employers not to care much – nor to be able to do so – about such transient fluctuations in workforce demography since these yield (unintended)

temporary costs that are likely to be small (permanent differences are taken care of by the workplace fixed effects).

That said, the last decades have seen increased interest in the "business case for diversity" from managers and scientists alike (see Kochan *et al.*, 2003, for a detailed discussion) and more engagement in diversity-management practices. Employers' attempts to manage diversity may thus render workplace diversity in part endogenous, although controlling for time and workplace fixed effects takes care of general economy-wide trends towards more workforce diversity as well as permanent differences in diversity across workplaces. Yet, we cannot rule out that our estimated effects of workplace diversity still suffer from some bias (though, somewhat reassuringly, we observe little trending in average workplace diversity over time, see below). At a minimum, we argue that workplace diversity measures serve as suitable control variables when turning to the effects of co-worker similarity from the individual worker's perspective that cannot be managed by employers but is closely intertwined with workplace-level changes in diversity.

Turning to workers, one may wonder whether workers who, as we hypothesised, prefer demographically similar co-workers may select into jobs based on workforce demography. This self-selection of workers, however, hinges on workforce demography being observable to workers *before* starting the job, and workforce demography is arguably hard to assess from the outside. What is more, workers applying for a job are unlikely to select themselves into jobs based on transient fluctuations in workforce demography, with permanent differences across workplaces controlled for in the stratified Cox regression.

In summary, we feel confident that given the non-experimental nature of our data the stratified Cox regression comes as close as possible to credibly identify the causal effect of co-worker similarity and, perhaps to a somewhat lesser degree, the causal effect of workplace diversity on workers' job-to-job turnover rate. Hence, we think that our estimates permit us to shed light on workers' preferences about workforce demography, in particular about co-worker

similarity.

4 Results

4.1 Descriptive analysis

Before turning to the Cox regressions, we present some descriptive evidence based on the inflow sample of all the 3,356,018 non-managerial jobs held by 2,634,091 workers during the period 1975–2016 in our representative sample of 1,780 large manufacturing workplaces in West Germany. As is seen from Table 1, about 40 percent of jobs end with a separation to employment, our proxy for workers' voluntary turnover rate, roughly 50 percent involve a separation to non-employment, and 10 percent are right-censored in that they did not end before 31st December 2016 (for further descriptive statistics, see Table 2).

Remarkably and in contrast to recent contributions claiming that workplace diversity shows a secular upward trend (e.g. Kochan *et al.*, 2003; Parrotta *et al.*, 2014), we do not observe such a secular rise in our workplace-level data. Based on yearly medians of our workplace diversity measures along the sex, nationality, education, age, and tenure dimension reported in Table 3, we see little trending at all. For the typical worker, workplace diversity did not change much over our four decades of data. The sole exception is the tenure dimension, but the apparent upward trend here simply reflects a data artefact borne out of the fact that workers' tenure is left-censored at 1st January 1975 (i.e. the starting date of the IEB data records). Our inflow sample results in overstated tenure similarity and understated tenure diversity in early years and thus contaminates descriptive analyses. In our Cox regressions, this problem is taken care of by the year fixed effects, and we also checked whether confining our analysis to the later part of our observational window, where the censoring loses bite, altered our findings, which it did not. Notably, the absence of clear trending in our diversity measures is at odds with the notion that employers' diversity-management practices led to a rise in workplace diversity and alleviates

concerns to some extent that active diversity management poses a major threat to identification, as discussed in the previous section.

Turning to co-worker similarity (see Table 4), we do not see much trending either, with the exception of the education (and, again, by construction the tenure) dimension. The median share of same-education co-workers rises from about 55 percent to 65 percent in the first one and a half decades of our observational window and then oscillates between 65 percent and 70 percent. The initial rise is likely to mirror the impact of education expansion in Germany during the 1960s and 1970s on the inflow of workers starting new jobs in our sample of workplaces.

To get a first impression whether co-worker similarity and workplace diversity are related to workers' voluntary turnover, Figures 1 and 2 show separate Kaplan–Meier curves for jobs with above-median and below-median co-worker similarity or workforce diversity in the sex, nationality, education, or age dimension, respectively. (We do not present descriptive evidence for tenure similarity and tenure diversity for the reasons discussed in the penultimate paragraph.) Figure 1 documents substantially larger survival rates for workers with high co-worker similarity along the sex, nationality, and education dimensions. Along the age dimension, we see only little differences with survival curves diverging in the first ten years or so of job duration and then converging again.

Turning to workplace diversity, the descriptive evidence shown in Figure 2 is quite mixed. Along the sex and education dimensions, high workplace diversity comes along with lower survival rates, though Kaplan–Meier curves converge again at high job durations of more than 20 years or so. For the nationality and the age dimensions, there is no clear pattern with intersecting survival curves. Our descriptive findings are thus in line with our theoretical predictions that high co-worker similarity lowers voluntary turnover and workplace diversity has less clear-cut effects.

4.2 Multivariate evidence from the Cox regression

We now turn to the results of our econometric analysis of how workforce demography affects workers' job-to-job turnover rate. As a baseline specification, we run a Cox regression for the job-to-job turnover rate including the worker and workplace covariates detailed in Section 3.3. In particular, we include our measures for co-worker similarity and workforce diversity along the sex, nationality, education, age, and tenure dimension.

Our core results are shown in Table 5 that presents estimates for the covariates capturing workforce demography. Remarkably, all dimensions of co-worker similarity are negatively related to voluntary turnover and statistically significantly so at the 1 percent level. A 10 percentage points larger share of same-sex co-workers is associated with a fall in the job-to-job turnover rate by 1.5 percent.[6] Furthermore, a 10 percentage points larger share of same-nationality (same-education) co-workers comes along with a fall in the job-to-job turnover rate by 1.2 (1.9) percent, and a 10 percentage points larger share of same-age (same-tenure) co-workers is associated with a larger drop of the rate by 8.0 (6.5) percent. Note, however, that there is considerably less variation in co-worker similarity in age and tenure (see Table 2), meaning that standardised effect sizes do not differ that much across our five dimensions of co-worker similarity. Specifically, a one standard deviation increase in any of our five measures of co-worker similarity is associated with a decrease of the job-to-job turnover rate by 3.1–11.5 percent. Standardised effect sizes of co-worker similarity are pretty comparable along the sex (3.6 percent), nationality (4.8 percent), education (3.1 percent), and age (4.3 percent) dimension, whereas the standardised effect of tenure similarity is somewhat larger (11.5 percent).

Turning to workplace diversity, four out of five dimensions of diversity show no statistically significant association with voluntary turnover. The sole exception is age diversity, where an increase in the standard deviation of workers' age by one, which coincides with the

---

6   We obtain the percentage change in the job-to-job turnover rate by exponentiating a tenth of the respective coefficient and subtracting one.

standard deviation of age diversity in our sample (see Table 2), is associated with a 9.8 percent lower job-to-job transition rate, which is statistically significant at the 1 percent level.

In line with theory and our descriptive findings, estimates from the Cox regression point at a clear negative association between co-worker similarity and voluntary turnover. Moreover, voluntary turnover shows little association with workplace diversity, which is consistent with our inconclusive descriptive evidence and the mixed theory predictions.

Note that the omitted estimates for the other worker and workplace covariates show no surprises (with detailed results available upon request). In line with previous studies, we find, for example, higher job-to-job turnover rates for males, more skilled and younger workers and those employed in large plants. Further, voluntary turnover is lower for non-German workers and those with higher entry wages and more pronounced wage growth.

4.3 Multivariate evidence from the stratified Cox regression

Yet, our estimates from the simple Cox regression may suffer from bias rooted in permanent workplace unobservables. In the next step, we therefore redo our analysis running a stratified Cox regression that controls for workplace fixed effects and that rests identification on within-workplace variation in workforce demography across jobs. As argued in detail in Section 3.4, these estimates are likely to be informative on the causal effect of co-worker similarity and workforce demography because they rely on transient fluctuations in workforce demography that are unlikely to affect employers' hiring decisions and workers' self-selection into jobs.

As Table 6 makes clear, all measures of co-worker similarity still significantly negatively affect workers' voluntary turnover, both from a statistical and an economic point of view. Notably, (standardised) effect sizes of all similarity measures change only little compared to the simple Cox regression. A rise in the shares of same-sex, same-nationality, or same-education workers by 10 percentage points lowers the job-to-job turnover rate by 1.7–2.2 percent, and a 10 percentage points rise in the share of same-age (same-tenure) workers leads to a fall

in the rate by 7.6 (8.6) percent.

Turning to workplace diversity, we see some changes in the estimated effects *vis-à-vis* the simple Cox regression, although the overall picture remains similar. Three out of five diversity measures – related to sex, nationality, and tenure diversity – show no statistically significant effect on workers' voluntary turnover. Other than in the simple Cox model, an increase in the education diversity index by 0.15, that is one standard deviation in our sample, leads to a statistically significant (at the 5 percent level) drop in the job-to-job turnover rate by 5.8 percent. Similar to the simple Cox model, we find that a one-standard-deviation increase in the standard deviation of workers' age (by about one) lowers the job-to-job turnover rate by 16.0 percent, which is again statistically significant at the 1 percent level.

In summary, we see that higher co-worker similarity along all five dimensions significantly reduces voluntary turnover. This finding is consistent with both theory and our descriptive results, and it is also in line with conventional wisdom, which has that birds of one feather flock together. In contrast, our results for workforce diversity are mixed, which is again in line with theory that points at opposing effects and the mixed descriptive evidence. Together, our results imply that workers prefer having co-workers of their kind and place less value on working in diverse workplaces.

4.4 Checks of robustness

One of the advantages of our data is that we observe whether a job separation involves a job-to-job move and is thus likely to reflect voluntary turnover initiated by the worker, or instead a transition to non-employment, likely to be initiated by the employer. We argued that changes in voluntary turnover are more informative on workers' preferences about workplace demography. In order to investigate our results' robustness, we now re-estimate our preferred stratified Cox specification for workers' overall turnover rate.

As Table 7 makes clear, our conclusions for job-to-job turnover carry over to overall

turnover. Still, all five dimensions of co-worker similarity affect turnover in a statistically significant way, with very similar effect sizes. Only the effect of education similarity becomes markedly smaller. This result is borne out of the fact that (except for education similarity) co-worker similarity also affects turnover into non-employment negatively (results available on request). Our finding does make sense against the background of our theoretical considerations in Section 2, where we argued that co-worker similarity improves communication and conflict resolution. More cooperation and less conflict are likely to reduce workers' intention to quit, but they are also likely to reduce employer-initiated layoffs and thus should also depress the separation rate to non-employment. What is more, our results for the effects of workforce diversity do not change much in that most dimensions remain unrelated to turnover.

To scrutinise our results further and to tie them closer to theory, we examine in a further check of robustness whether co-worker similarity matters more for workers in a strong minority position where they have just very few co-workers of their kind. If in-group bias and/or homophily are important, we might hypothesise that an increase in co-worker similarity increases workers' inclination to stay in a more pronounced way when they are "isolated" with only few similar co-workers around than in a situation where at least some modest level of co-worker similarity is achieved (Leonard and Levine, 2006). To capture this latter possibility, we re-estimate our stratified Cox specification including our co-worker similarity measures and interactions of these with dummy variables that indicate jobs in the first decile of the respective co-worker similarity distribution across all jobs in the respective year.

In line with expectations, all but one of the interaction effects are negative, and two of them are also statistically significant at the 1 percent level. For "isolated" workers in the nationality dimension, an increase in the share of same-nationality co-workers by 10 percentage points leads to a fall in the job-to-job turnover rate by 6.2 percent whereas the fall accounts to just 2.6 percent for "non-isolated" workers. Further, for "isolated" workers in the tenure dimension, an increase in the share of same-tenure co-workers by 10 percent leads to a marked drop

in the job-to-job turnover rate by 20.5 percent whereas the fall in the rate for "non-isolated" workers is 8.0 percent.

The exception to this pattern is co-worker age similarity where the interaction effect is statistically significantly positive at the 1 percent level and such large in magnitude that it even reverses the effect of co-worker age similarity for "isolated" workers. Specifically, for "non-isolated" workers, a rise in the share of same-age co-workers by 10 percentage points leads to a fall in the job-to-job turnover rate by 6.2 percent. In contrast, for "isolated" workers an even smaller share of same-age co-workers is followed by a fall rather than a rise in job-to-job turnover. Although these results seems puzzling at first sight, one explanation, which we unfortunately cannot substantiate in our data, may be rooted in the observation that for given tenure (controlled for by the baseline hazard) being part of a very small age cohort disproportionately raises the probability of being promoted in internal labour markets (as put forward by Keyfitz, 1973, and Stewman and Konda, 1983). Despite in-group bias, age isolation may thus be beneficial to workers in terms of career progress and this side effect may decrease their intention to quit.

5 Conclusions

This paper has investigated how workforce demography along the sex, nationality, education, age, and tenure dimension affects voluntary turnover. To that end, we fitted duration models for workers' job-to-job turnover rate on a unique rich administrative data set for the years 1975–2016 that comprises all the full-time jobs in a stratified 15 percent random sample of large single production sites or workplaces in the West German manufacturing industry. In the duration models, we included the shares of similar co-workers in the five demography dimensions to capture co-worker similarity from the individual worker's perspective as well as Shannon diversity indices (for nominal variables) or standard deviations (for metric variables) as

measures for overall workplace diversity.

In a stratified Cox regression that controls for permanent workplace unobservables, we documented that all five dimensions of co-worker similarity significantly depress workers' job-to-job turnover rate, and tend to exert a larger effect for "isolated" workers in a strong minority position with only very few similar co-workers around. In contrast to co-worker similarity, results for workplace diversity are mixed with only two dimensions affecting job-to-job turnover in a significant way. In a check of robustness, we further saw that effects are very similar for the overall turnover rate, which lumps together worker-initiated and employer-initiated turnover.

Although we lack credible quasi-experimental variation in workforce demography, we argue that our estimates are likely to be informative on the causal effect of co-worker similarity and workplace diversity on voluntary turnover because they rely on transient fluctuations in workforce demography that are unlikely to affect employers' hiring decisions and workers' self-selection into jobs. Our findings suggest that workers prefer having co-workers of their kind, yet place less value on working in diverse workplaces. They are in line with conventional wisdom, which has that birds of one feather flock together, and underscore the relevance of in-group bias (Becker, 1971) and homophily (McPherson *et al.*, 2001) in employment relationships.

References

Anderson, P. M., and Meyer, B. D. (1994), "The extent and consequences of job turnover", *Brooking Papers on Economic Activity: Microeconomics*, 1994: 177–248.

Barrington, L., and Troske, K. (2001), Workforce Diversity and Productivity: An Analysis of Employer-Employee Matched Data, Economics Program Working Papers 01-02, New York: The Conference Board.

Becker, G. (1971), *The Economics of Discrimination*, 2nd ed., Chicago, IL: University of Chicago Press.

Berliant, M., and Fujita, M. (2008). "Knowledge creation as a square dance on the Hilbert cube", *International Economic Review*, 49(4): 1251–1295.

Boockmann, B., and Steffes, S. (2010), "Workers, firms, or institutions: What determines job duration for male employees in Germany?", *Industrial and Labor Relations Review*, 64(1): 109–127.

Breit, W., and Horowitz, J. B. (1995), "Discrimination and diversity: Market and non-market settings", *Public Choice*, 84(1): 63–75.

Bronars, S. G., and Famulari, M. (1997), "Wage, tenure, and wage growth variation within and across establishments", *Journal of Labor Economics*, 15(2): 285–317.

Büttner, T., and Rässler, S. (2008), Multiple imputation of right-censored wages in the German IAB Employment Sample considering heteroscedasticity, IAB Discussion Paper No. 44/2008, Nuremberg: Institute for Employment Research.

Cornelissen, T., Dustmann, C., and Schönberg, U. (2017), "Peer effects in the workplace", *American Economic Review*, 107(2): 425–456.

Fitzenberger, B., Osikominu, A., and Völter, R. (2008), "Imputation rules to improve the education variable in the IAB employment subsample", *Schmollers Jahrbuch*, 126(3): 405–436.

Frederiksen, A. (2008), "Gender differences in job separation rates and employment stability: New evidence from employer-employee data", *Labour Economics*, 15(5): 915–937.

Garnero, A., Kampelmann, S., and Rycx, F. (2014), "The heterogeneous effects of workforce diversity on productivity, wages, and profits", *Industrial Relations*, 53(3): 430–477.

Giuliano, L., Levine, D. I., and Leonard, J. S. (2011), "Racial bias in the manager-employee relationship: An analysis of quits, dismissals, and promotions at a large retails firm", *Journal of Human Resources*, 46(1): 26–52.

Griffeth, R. W., Hom, P. W., and Gaertner, S. (2000), "A meta-analysis of antecedents and correlates of employee turnover: Update, moderator tests, and research implications for the next millennium", *Journal of Management*, 26(3): 463–488.

Hirsch, B. (2016), "Dual labor markets at work: The impact of employers' use of temporary agency work on regular workers' job stability", *Industrial and Labor Relations Review*, 69(5): 1191–1215.

Hirsch, B., Jahn, E. J., and Schnabel, C. (2018), "Do employers have more monopsony power in slack labor markets?", *Industrial and Labor Relations Review*, 71(3): 676–704.

Hirsch, B., Schank, T., and Schnabel, C. (2010), "Works councils and separations: Voice, monopoly, and insurance effects", *Industrial Relations*, 49(4): 566–592.

Ilmakunnas, P., and Ilmakunnas, S.(2011), "Diversity at the workplace: Whom does it benefit?", *De Economist* 159(2): 223–255.

Jacobebbinghaus, P., and Seth, S. (2007), "The German Integrated Employment Biographies Sample IEBS", *Schmollers Jahrbuch*, 127(2): 335–342.

Joshi, A., Liao, H., and Roh, H. (2011), "Bridging domains in workplace demography research: A review and reconceptualization", *Journal of Management*, 37(2): 521–552.

Kalbfleisch, J. D., and Prentice, R. L. (2002), *The Statistical Analysis of Failure Time Data*, 2nd ed., Hoboken, NJ: John Wiley & Sons.

Keyfitz, N. (1973), "Individual mobility in a stationary population", *Population Studies*, 27(2): 335–352.

Kochan, T., Bezrukova, K., Ely, R., Jackson, S., Joshi, A., Jehn, K., Leonard, J., Levine, D., and Thomas, D. (2003), "The effects of diversity on business performance: Report of the Diversity Research Network", *Human Resource Management*, 42(1): 3–21.

Lang, K. (1986), "A language theory of discrimination", *Quarterly Journal of Economics*, 101(2): 362–382.

Lazear, E. P. (1979), "Why is there mandatory retirement?", *Journal of Political Economy*, 87(6): 1261–1284.

Lazear, E. P. (1999), "Globalisation and the market for team-mates", *Economic Journal*, 109(454): C15–C40.

Leonard, J. S., and Levine, D. I. (2006), "The effect of diversity on turnover: A large case study", *Industrial and Labor Relations Review*, 59(4): 547–572.

McPherson, M., Smith-Lovin, L., and Cook, J. M. (2001), "Birds of a feather: Homophily in social networks", *Annual Review of Sociology*, 27: 415–444.

Osborne, E. (2000), "The deceptively simple economics of workplace diversity", *Journal of Labor Research*, 21(3): 463–475.

Ozgen, C., and De Graff, T. (2013), Sorting out the impact of cultural diversity on innovative firms: An empirical analysis of Dutch micro-data, Norface Migration Discussion Paper No. 2013-12: London: Norface.

Park, T.-Y., and Shaw, J. D. (2013), "Turnover rates and organizational performance: A meta-analysis", *Journal of Applied Psychology*, 98(2): 268–309.

Parrotta, P., Pozzoli D. and Pytlikova, M. (2014), "Labor diversity and firm productivity", *European Economic Review*, 66: 144–179.

Pfeffer, J. (1985), "Organizational demography: Implications for management", *California Management Review*, 28(1): 67–81.

Ridder, G., and Tunalı, İ (1999), "Stratified partial likelihood estimation", *Journal of Econometrics*, 92(2): 193–232.

Royalty, A. B. (1998), "Job-to-job and job-to-nonemployment turnover by gender and education level", *Journal of Labor Economics*, 16(2): 392–443.

Schaffner, S. (2011), "Heterogeneity in the cyclical sensitivity of job-to-job flows", *Journal for Labour Market Research*, 43(4): 263–275.

Stewman, S., and Konda, S. L. (1983), "Careers and organizational labor markets: Demographic models of organizational behavior", *American Journal of Sociology*, 88(4): 637–685.

Trax, M., Brunow, S., and Südekum, J. (2015), "Cultural diversity and plant-level productivity", *Regional Science and Urban Economics*, 53: 85–96.

Varejão, J., and Portugal, P. (2007), "Employment dynamics and the structure of labor adjustment costs", *Journal of Labor Economics*, 25(1): 137–165.

Williams, K. Y., and O'Reilly, C. A. (1998), "Demography and diversity in organizations: A review of 40 years of research", *Research in Organizational Behavior*, 40: 77–144.

Zwick, T. (2012), "Consequences of seniority wages on the employment structure", *Industrial and Labor Relations Review*, 65(6): 108–125.

Figures
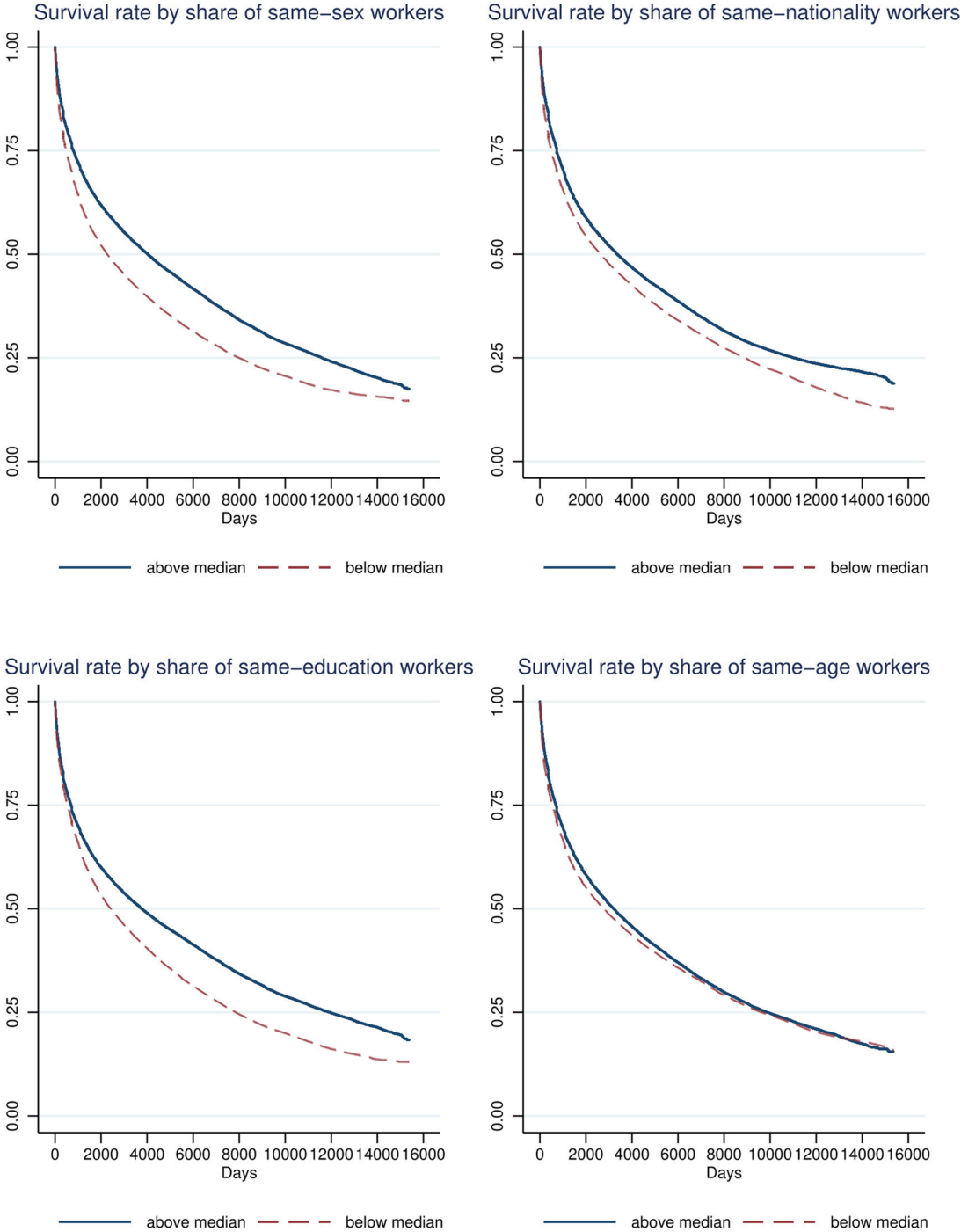
Figure 1:   Kaplan–Meier curves by co-worker similarity
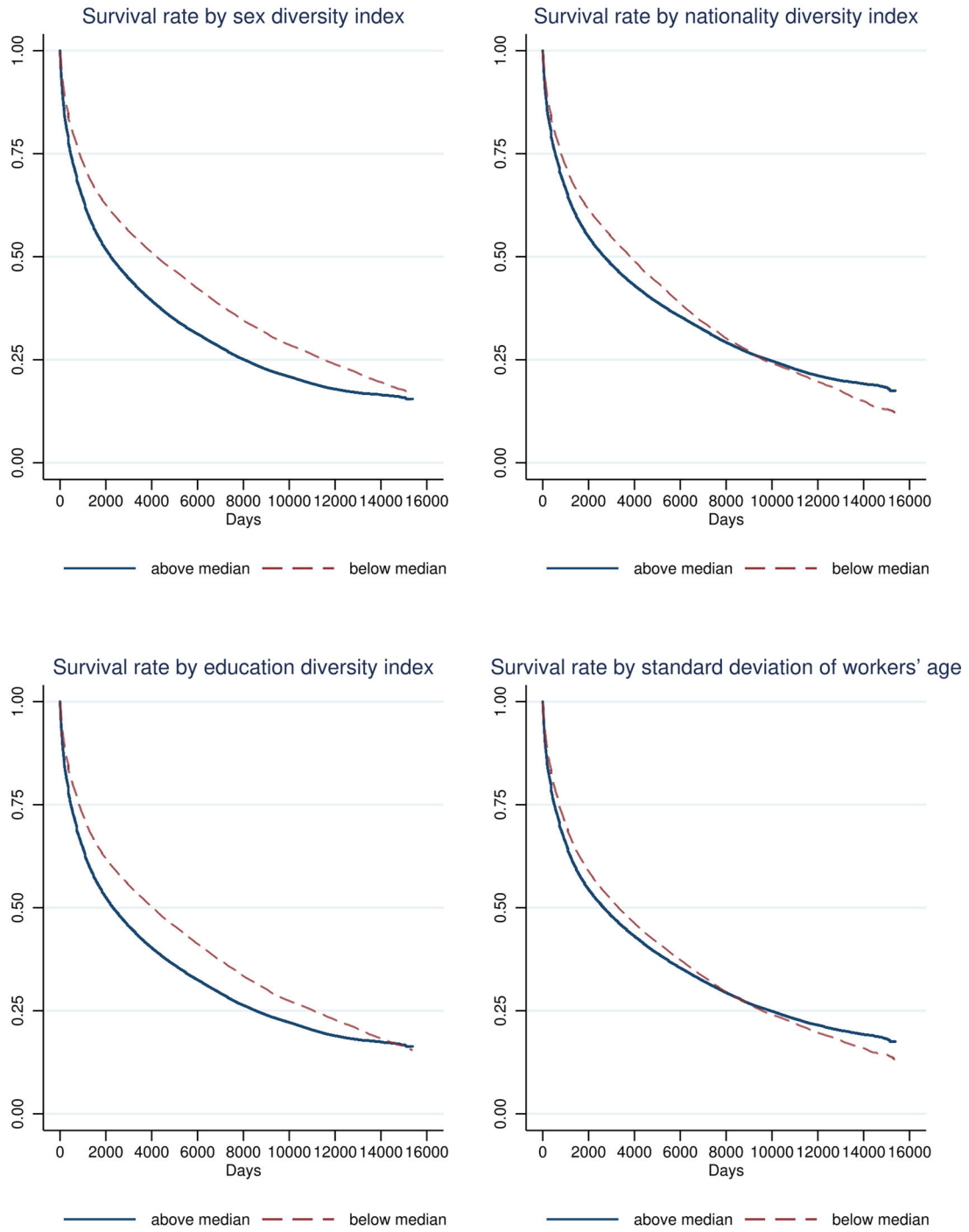
Figure 2: Kaplan–Meier curves by workplace diversity

Tables

Table 1: Jobs and turnover (percentages in parentheses)

Jobs	3,356,018	
Job separations (turnover)	3,034,172	(90.4)
… to employment	1,323,338	(39.4)
… to non-employment	970,810	(51.0)
Right-censored job durations	275,630	(9.6)
Observations	19,399,797	
Workers	2,634,091	
Workplaces	1,780	

Table 2: Selective descriptive statistics

Variable	Mean	Std. dev.
Workforce demography		
Share of same-sex co-workers	0.701	0.241
Share of same-nationality co-workers	0.761	0.257
Share of same-education co-workers	0.584	0.249
Share of same-age co-workers	0.137	0.053
Share of same-tenure co-workers	0.139	0.181
Sex diversity index	0.676	0.235
Nationality diversity index	0.547	0.243
Education diversity index	0.632	0.153
Standard deviation of workers' age	10.526	1.005
Standard deviation of workers' tenure	5.566	2.740
Worker characteristics		
Female (dummy)	0.230	0.421
Non-German nationality (dummy)	0.164	0.370
Low-skilled (dummy)	0.212	0.409
Medium-skilled (dummy)	0.680	0.467
High-skilled (dummy)	0.108	0.310
Age (years)	36.655	11.055
Tenure (years)	5.580	6.526
Log entry wage (€)	4.403	0.450
Log wage growth (€)	0.167	0.312
Workplace characteristics		
Share of female workers	0.241	0.177
Share of non-German workers	0.153	0.115
Share of low-skilled workers	0.207	0.165
Share of medium-skilled workers	0.682	0.155
Share of high-skilled workers	0.111	0.125
Share of workers aged up to 20 years	0.009	0.011
Share of workers aged 21–25 years	0.078	0.048
Share of workers aged 26–30 years	0.113	0.048
Share of workers aged 31–35 years	0.130	0.044
Share of workers aged 36–40 years	0.140	0.039
Share of workers aged 41–45 years	0.145	0.037
Share of workers aged 46–50 years	0.142	0.040
Share of workers aged 51–55 years	0.128	0.045
Share of workers aged 56–60 years	0.089	0.041
Share of workers aged more than 60 years	0.026	0.025
Share of workers with tenure up to 5 years	0.445	0.237
Share of workers with tenure 6–10 years	0.237	0.184
Share of workers with tenure 11–15 years	0.154	0.151
Share of workers with tenure 16–20 years	0.088	0.111
Share of workers with tenure 21–25 years	0.044	0.072
Share of workers with tenure 26–30 years	0.021	0.043
Share of workers with tenure 31–35 years	0.009	0.025
Share of workers with tenure more than 35 years	0.003	0.013
Plant size	6,091	13,910
Employment growth by more than 10 percent (dummy)	0.136	0.342
Employment decline by more than 10 percent (dummy)	0.070	0.254
Observations	19,399,797	
Jobs	3,356,018	
Workers	2,634,091	
Workplaces	1,780	

Table 3: Median of workplace diversity measures by year

Year	Shannon diversity index			Standard deviation	
	Sex	Nationality	Education	Age	Tenure
1975	0.668	0.516	0.668	11.027	0.032
1976	0.657	0.511	0.669	10.712	0.284
1977	0.647	0.504	0.662	10.581	0.629
1978	0.650	0.496	0.665	10.672	0.991
1979	0.644	0.496	0.666	10.703	1.396
1980	0.645	0.511	0.665	10.832	1.831
1981	0.651	0.509	0.667	10.696	2.141
1982	0.647	0.502	0.667	10.813	2.480
1983	0.631	0.476	0.665	10.640	2.696
1984	0.639	0.475	0.666	10.660	3.094
1985	0.642	0.474	0.664	10.784	3.591
1986	0.640	0.463	0.664	11.130	4.131
1987	0.639	0.465	0.663	11.122	4.484
1988	0.643	0.458	0.664	10.959	4.783
1989	0.652	0.464	0.667	10.938	5.116
1990	0.652	0.503	0.662	11.057	5.508
1991	0.651	0.514	0.657	11.012	5.854
1992	0.653	0.514	0.650	10.862	6.053
1993	0.644	0.515	0.649	10.517	6.213
1994	0.639	0.499	0.645	10.277	6.334
1995	0.624	0.528	0.641	10.145	6.584
1996	0.623	0.526	0.641	10.057	6.724
1997	0.629	0.517	0.636	9.997	6.909
1998	0.657	0.512	0.630	10.075	7.094
1999	0.705	0.549	0.647	10.155	7.288
2000	0.669	0.518	0.633	10.074	7.457
2001	0.675	0.536	0.629	10.060	7.571
2002	0.667	0.519	0.630	10.004	7.613
2003	0.673	0.515	0.627	9.920	7.738
2004	0.684	0.513	0.636	9.851	7.631
2005	0.661	0.512	0.649	9.877	7.527
2006	0.680	0.499	0.633	9.881	7.477
2007	0.674	0.509	0.630	9.971	7.510
2008	0.673	0.506	0.628	10.137	7.699
2009	0.669	0.491	0.632	10.031	7.783
2010	0.677	0.485	0.634	10.073	7.805
2011	0.683	0.492	0.634	10.260	8.013
2012	0.677	0.510	0.641	10.489	8.159
2013	0.684	0.503	0.642	10.597	8.336
2014	0.694	0.507	0.658	10.844	8.515
2015	0.708	0.508	0.672	10.959	8.612
2016	0.713	0.511	0.677	11.069	8.660

Table 4: Median of worker similarity measures by year

Year	Share of workers with the same				
	Sex	Nationality	Education	Age	Tenure
1975	0.789	0.876	0.550	0.133	1.000
1976	0.798	0.878	0.548	0.135	0.906
1977	0.805	0.878	0.593	0.136	0.807
1978	0.801	0.888	0.591	0.136	0.722
1979	0.798	0.884	0.587	0.135	0.621
1980	0.799	0.881	0.589	0.134	0.518
1981	0.800	0.884	0.588	0.134	0.452
1982	0.803	0.889	0.585	0.134	0.385
1983	0.813	0.895	0.593	0.136	0.333
1984	0.811	0.898	0.600	0.135	0.242
1985	0.811	0.895	0.607	0.133	0.175
1986	0.811	0.898	0.621	0.132	0.150
1987	0.808	0.895	0.633	0.133	0.132
1988	0.806	0.894	0.639	0.134	0.117
1989	0.798	0.894	0.642	0.134	0.112
1990	0.798	0.887	0.649	0.133	0.108
1991	0.802	0.880	0.657	0.134	0.104
1992	0.803	0.872	0.665	0.135	0.097
1993	0.807	0.877	0.674	0.140	0.088
1994	0.813	0.879	0.683	0.144	0.083
1995	0.813	0.874	0.685	0.146	0.081
1996	0.814	0.876	0.688	0.147	0.078
1997	0.812	0.877	0.692	0.148	0.074
1998	0.802	0.874	0.685	0.146	0.073
1999	0.776	0.858	0.670	0.145	0.075
2000	0.791	0.869	0.691	0.145	0.080
2001	0.792	0.863	0.691	0.145	0.080
2002	0.790	0.871	0.691	0.145	0.077
2003	0.792	0.875	0.693	0.147	0.073
2004	0.787	0.875	0.690	0.148	0.071
2005	0.789	0.875	0.689	0.149	0.068
2006	0.788	0.881	0.686	0.149	0.066
2007	0.790	0.877	0.690	0.148	0.063
2008	0.790	0.876	0.696	0.145	0.062
2009	0.789	0.881	0.690	0.146	0.061
2010	0.785	0.882	0.692	0.146	0.058
2011	0.780	0.883	0.695	0.144	0.057
2012	0.779	0.882	0.689	0.140	0.057
2013	0.782	0.878	0.680	0.138	0.057
2014	0.780	0.873	0.670	0.135	0.058
2015	0.771	0.872	0.662	0.134	0.058
2016	0.780	0.868	0.653	0.133	0.059

Table 5:   Cox regression for workers' job-to-job turnover rate

Variable	Coefficient	SE
Share of same-sex co-workers	–0.152***	(0.024)
Share of same-nationality co-workers	–0.191***	(0.025)
Share of same-education co-workers	–0.125***	(0.026)
Share of same-age co-workers	–0.836***	(0.121)
Share of same-tenure co-workers	–0.673***	(0.088)
Sex diversity index	–0.031	(0.098)
Nationality diversity index	0.212	(0.133)
Education diversity index	–0.037	(0.150)
Standard deviation of workers' age	–0.103***	(0.022)
Standard deviation of workers' tenure	–0.019	(0.021)

Notes: Estimates come from a Cox regression for the job-to-job turnover rate. Worker covariates included are (groups of) dummy variables for sex, non-German citizenship, education, age, and one-digit occupation, as well as the log entry wage and the log difference between the current and the entry wage. Workplace covariates are (groups of) dummy variables for plant size, two-digit industry, employment growth and decline by more than 10 percent, the shares of female, foreign, high-skilled, and low-skilled workers, as well as groups of share variables capturing the age and tenure of the workforce. Standard errors are clustered at the workplace level. ***/**/* indicates statistical significance at the 1/5/10 percent level.

Table 6: Stratified Cox regressions for workers' job-to-job turnover rate

Variable	Coefficient	SE
Share of same-sex co-workers	–0.184***	(0.024)
Share of same-nationality co-workers	–0.217***	(0.030)
Share of same-education co-workers	–0.168***	(0.024)
Share of same-age co-workers	–0.895***	(0.088)
Share of same-tenure co-workers	–0.788***	(0.072)
Sex diversity index	0.218	(0.143)
Nationality diversity index	0.023	(0.185)
Education diversity index	–0.401**	(0.189)
Standard deviation of workers' age	–0.174***	(0.021)
Standard deviation of workers' tenure	–0.028	(0.023)

Notes: Estimates come from a stratified Cox regression for the job-to-job turnover rate at workplace level. Worker covariates included are (groups of) dummy variables for sex, non-German citizenship, education, age, and one-digit occupation, as well as the log entry wage and the log difference between the current and the entry wage. Workplace covariates are (groups of) dummy variables for plant size, employment growth and decline by more than 10 percent, the shares of female, foreign, high-skilled, and low-skilled workers, as well as groups of share variables capturing the age and tenure of the workforce. Standard errors are clustered at the workplace level. ***/**/* indicates statistical significance at the 1/5/10 percent level.

Table 7: Stratified Cox regressions for workers' overall turnover rate

Variable	Coefficient	SE
Share of same-sex co-workers	–0.189***	(0.021)
Share of same-nationality co-workers	–0.204***	(0.027)
Share of same-education co-workers	–0.052**	(0.025)
Share of same-age co-workers	–1.123***	(0.077)
Share of same-tenure co-workers	–0.839***	(0.048)
Sex diversity index	0.050	(0.089)
Nationality diversity index	–0.074	(0.120)
Education diversity index	–0.147	(0.112)
Standard deviation of workers' age	–0.100***	(0.019)
Standard deviation of workers' tenure	–0.046***	(0.016)

Notes: Estimates come from a stratified Cox regression for the overall turnover rate at workplace level. Worker covariates included are (groups of) dummy variables for sex, non-German citizenship, education, age, and one-digit occupation, as well as the log entry wage and the log difference between the current and the entry wage. Workplace covariates are (groups of) dummy variables for plant size, employment growth and decline by more than 10 percent, the shares of female, foreign, high-skilled, and low-skilled workers, as well as groups of share variables capturing the age and tenure of the workforce. Standard errors are clustered at the workplace level. ***/**/* indicates statistical significance at the 1/5/10 percent level.

Table 8: Stratified Cox regression for workers' job-to-job turnover rate with heterogeneous effects for workers in strong minority position

Variable	Coefficient	SE
Share of same-sex co-workers	–0.200***	(0.035)
× First decile of same-sex co-workers	–0.078	(0.103)
Share of same-nationality co-workers	–0.263***	(0.033)
× First decile of same-nationality co-workers	–0.375***	(0.125)
Share of same-education co-workers	–0.176**	(0.032)
× First decile of same-education co-workers	–0.044	(0.151)
Share of same-age co-workers	–0.645***	(0.099)
× First decile of same-age co-workers	1.364***	(0.153)
Share of same-tenure co-workers	–0.838***	(0.076)
× First decile of same-tenure co-workers	–1.461***	(0.287)

Notes: Estimates come from a stratified Cox regression for the job-to-job turnover rate at workplace level. Worker covariates included are (groups of) dummy variables for sex, non-German citizenship, education, age, and one-digit occupation, as well as the log entry wage and the log difference between the current and the entry wage. Workplace covariates are the workplace diversity measures from previous regressions, (groups of) dummy variables for plant size, employment growth and decline by more than 10 percent, the shares of female, foreign, high-skilled, and low-skilled workers, as well as groups of share variables capturing the age and tenure of the workforce. Standard errors are clustered at the workplace level. ***/**/* indicates statistical significance at the 1/5/10 percent level.

Working Paper Series in Economics

(recent issues)

No.369:   *Joachim Wagner:* Multiple import sourcing First evidence for German enterprises from manufacturing industries, January 2017 [published in : Open Economies Review 29 (2018), 1, 165-175]

No.368:   *Joachim Wagner:* Active on many foreign markets A portrait of German multi-market exporters and importers from manufacturing industries, January 2017 [published in: Jahrbücher für Nationalökonomie und Statistik 238 (2018), 2, 157-182]

No.367:   *Institut für Volkswirtschaftslehre:* Forschungsbericht 2016, Januar 2017

No.366:   *Tim W. Dornis and Thomas Wein:* Trademarks, Comparative Advertising, and Product Imitations: An Untold Story of Law and Economics, September 2016

No.365:   *Joachim Wagner:* Intra-good trade in Germany: A first look at the evidence, August 2016 [published in: Applied Economics 49 (2017), 57, 5753-5761]

No.364:   *Markus Groth and Annette Brunsmeier:* A cross-sectoral analysis of climate change risk drivers based on companies' responses to the CDP's climate change information request, June 2016

No.363:   *Arne Neukirch and Thomas Wein:* Collusive Upward Gasoline Price Movements in Medium-Sized German Cities, June 2016

No.362:   *Katja Seidel:* Job Characteristics and their Effect on the Intention to Quit Apprenticeship., May 2016

No.361:   *Katja Seidel:* Apprenticeship: The Intention to Quit and the Role of Secondary Jobs in It., May 2016

No.360:   *Joachim Wagner:* Trade costs shocks and lumpiness of imports: Evidence from the Fukushima disaster, May 2016 [published in: Economics Bulletin 37 (2017), 1, 149-155]

No.359:   *Joachim Wagner:* The Lumpiness of German Exports and Imports of Goods, April 2016 [published in: Economics - The Open-Access, Open-Assessment E-Journal 10, 2016-21]

No.358:   *Ahmed Fayez Abdelgouad:* Exporting and Workforce Skills-Intensity in the Egyptian Manufacturing Firms: Empirical Evidence Using World Bank Firm-Level Data for Egypt, April 2016

No.357:   *Antonia Arsova and Deniz Dilan Karaman Örsal:* An intersection test for the cointegrating rank in dependent panel data, March 2016

No.356:   *Institut für Volkswirtschaftslehre:* Forschungsbericht 2015, Januar 2016

No.355:   *Christoph Kleineberg and Thomas Wein:* Relevance and Detection Problems of Margin Squeeze – The Case of German Gasoline Prices, December 2015

No.354:   *Karsten Mau:* US Policy Spillover(?) - China's Accession to the WTO and Rising Exports to the EU, December 2015

No.353:   *Andree Ehlert, Thomas Wein and Peter Zweifel:* Overcoming Resistance Against Managed Care – Insights from a Bargaining Model, December 2015

No.352:   *Arne Neukirch und Thomas Wein:* Marktbeherrschung im Tankstellenmarkt - Fehlender Binnen- und Außenwettbewerb an der Tankstelle? Deskriptive Evidenz für Marktbeherrschung, Dezember 2015

No.351:   *Jana Stoever and John P. Weche:* Environmental regulation and sustainable competitiveness: Evaluating the role of firm-level green investments in the context of the Porter hypothesis, November 2015

No.350: *John P. Weche:* Does green corporate investment really crowd out other business investment?, November 2015

No.349: *Deniz Dilan Karaman Örsal and Antonia Arsova:* Meta-analytic cointegrating rank tests for dependent panels, November 2015

No.348: *Joachim Wagner:* Trade Dynamics and Trade Costs: First Evidence from the Exporter and Importer Dynamics Database for Germany, October 2015 [published in: Applied Economics Quarterly 63 (2017), 2, 137-159]

No.347: *Markus Groth, Maria Brück and Teresa Oberascher:* Climate change related risks, opportunities and adaptation actions in European cities – Insights from responses to the CDP cities program, October 2015

No.346: *Joachim Wagner:* 25 Jahre Nutzung vertraulicher Firmenpaneldaten der amtlichen Statistik für wirtschaftswissenschaftliche Forschung: Produkte, Projekte, Probleme, Perspektiven, September 2015 [publiziert in: AStA Wirtschafts- und Sozialstatistisches Archiv 9 (2015), 2, 83-106]

No.345: *Christian Pfeifer:* Unfair Wage Perceptions and Sleep: Evidence from German Survey Data, August 2015

No.344: *Joachim Wagner:* Share of exports to low-income countries, productivity, and innovation: A replication study with firm-level data from six European countries, July 2015 [published in: Economics Bulletin 35 (2015), 4, 2409-2417]

No.343: *Joachim Wagner:* R&D activities and extensive margins of exports in manufacturing enterprises: First evidence for Germany, July 2015 [published in: The International Trade Journal 31 (2017), 3, 232-244]

No.342: *Joachim Wagner:* A survey of empirical studies using transaction level data on exports and imports, June 2015 [published in: Review of World Economics 152 (2016), 1, 215-225]

No.341: *Joachim Wagner:* All Along the Data Watch Tower - 15 Years of European Data Watch in Schmollers Jahrbuch, June 2015 [published in: Schmollers Jahrbuch / Journal of Applied Social Science Studies 135 (2015), 3, 401-410]

No.340: *Joachim Wagner:* Kombinierte Firmenpaneldaten – Datenangebot und Analyse-potenziale, Mai 2015 [publiziert in: S. Liebig et al. (Hrsg.), Handbuch Empirische Organisationsforschung, Wiesbaden: Springer Fachmedien 2017, S. 63-74]

No.339: *Anne Maria Busch:* Drug Prices, Rents, and Votes in the German Health Care Market: An Application of the Peltzman Model, May 2015

No.338: *Anne Maria Busch:* Drug Prices and Pressure Group Activities in the German Health Care Market: An Application of the Becker Model, May 2015

No.337: *Inna Petrunyk and Christian Pfeifer:* Life satisfaction in Germany after reunification: Additional insights on the pattern of convergence, May 2015

No.336: *Joachim Wagner:* Credit constraints and the extensive margins of exports: First evidence for German manufacturing, March 2015 [published in: Economics: The Open-Access, Open-Assessment E-Journal, 9(2015-18): 1-17]

No.335: *Markus Groth und Jörg Cortekar:* Die Relevanz von Klimawandelfolgen für Kritische Infrastrukturen am Beispiel des deutschen Energiesektors, Januar 2015

No.334: *Institut für Volkswirtschaftslehre:* Forschungsbericht 2014, Januar 2015

(see www.leuphana.de/institute/ivvl/publikationen/working-papers.html for a complete list)