

# THE RISE OF DOMESTIC OUTSOURCING AND THE EVOLUTION OF THE GERMAN WAGE STRUCTURE\*

DEBORAH GOLDSCHMIDT AND JOHANNES F. SCHMIEDER

The nature of the relationship between employers and employees has been changing over the past three decades, with firms increasingly relying on contractors, temp agencies, and franchises rather than hiring employees directly. We investigate the impact of this transformation on the wage structure by following jobs that are moved outside the boundary of lead employers to contracting firms. We develop a new method for identifying outsourcing of food, cleaning, security, and logistics services in administrative data using the universe of social security records in Germany. We document a dramatic growth of domestic outsourcing in Germany since the early 1990s. Event-study analyses show that wages in outsourced jobs fall by approximately 10–15% relative to similar jobs that are not outsourced. We find evidence that the wage losses associated with outsourcing stem from a loss of firm-specific rents, suggesting that labor cost savings are an important reason firms choose to contract out these services. Finally, we tie the increase in outsourcing activity to broader changes in the German wage structure, in particular showing that outsourcing of cleaning, security, and logistics services alone accounts for around 9% of the increase in German wage inequality since the 1980s. *JEL Codes:* J31, J53, L24.

## I. INTRODUCTION

Wage discrimination is rarely seen in large firms despite the benefits it could confer. As long as workers are under one roof, the problems presented by horizontal and vertical equity remain. But what if the large employer could wage discriminate by changing the boundary of the firm? —Weil (2014)

\*We thank Katharine Abraham, David Autor, Josh Angrist, Stefan Bender, Giuseppe Berlingieri, Richard Blundell, David Card, Michael Clauss, Arindrajit Dube, Christian Dustmann, Robert Gibbons, Susan Houseman, Hillary Hoynes, Erik Hurst, Larry Kahn, Larry Katz, Pat Kline, Kevin Lang, Mark McCabe, W. Bentley McLeod, Claudia Olivetti, Anne Polivka, Jim Rebitzer, Uta Schoenberg, Till von Wachter, David Weil, Birger Wernerfelt, Heidi Williams, and seminar participants at Boston University, UC Berkeley, University of Bonn, CESifo, Chicago Fed, Cleveland Fed, University of Chicago, UCL, IZA, MIT Economics Department, MIT Sloan, and Queens University. Johannes Schmieder gratefully acknowledges funding from the W.E. Upjohn Institute Early Career Research Grant No. 14-147-08. All errors are our own.

© The Author(s) 2017. Published by Oxford University Press, on behalf of the President and Fellows of Harvard College. All rights reserved. For Permissions, please email: [journals.permissions@oup.com](mailto:journals.permissions@oup.com)

*The Quarterly Journal of Economics* (2017), 1165–1217. doi:10.1093/qje/qjx008.  
Advance Access publication on April 21, 2017.

Large firms are increasingly relying on nontraditional employment arrangements such as outsourcing, temporary or contingent work, offshoring, and subcontracting. Across a wide range of industries, firms have been focusing on their “core competencies” and hiring outside companies to provide services that were once performed by their own employees, such as cleaning, security, logistics, human resources, or IT. Outsourcing to business service providers potentially allows for reductions in wages for the contracted-out jobs.

The outsourcing firms are often traditional lead companies in sectors such as manufacturing or finance, and typically offer the most attractive jobs, with higher wages, increased job security, and union coverage. A long literature in economics (e.g., Dunlop 1957; Krueger and Summers 1988; Groshen 1991; Gibbons and Katz 1992) has documented large wage differences the same worker can earn across sectors and firms that appear not to be explained by differences in worker productivity. Instead factors such as collective bargaining agreements (Card, Lemieux, and Riddell 2004; DiNardo and Lee 2004) or efficiency wage considerations linked to fairness perceptions (Akerlof and Yellen 1990; Rees 1993; Card, Lemieux, and Riddell 2004; DiNardo and Lee 2004; Card et al. 2012) may lead to wage compression within firms and rent sharing of firm profits, which in turn pushes up wages for low-wage workers. Large employers may thus find it beneficial to reduce the number of direct employees who benefit from such wage premia by outsourcing jobs to subcontractors. These business service firms compete fiercely with each other for service contracts from large companies on price, and since labor costs are a large share of business service firms’ total costs, this creates intense pressure to lower wages and reduce benefits.

Even though anecdotal evidence for these changes in the labor market abound, the economic literature on this topic is more limited, since it is hard to measure in most data sets.<sup>1</sup> To overcome these data limitations, Katz and Krueger (2016) conduct their own

1. Weil (2014) provides a detailed, largely qualitative analysis of the practice of domestic outsourcing in the United States and an overview of the quantitative research in economics. He only lists two papers that estimate wage differentials between contracted-out and in-house workers based on CPS data (discussed below) and only a handful of studies based on firm surveys that measure the increase in the incidence of subcontracting of labor services. See Bernhardt et al. (2016) for a discussion of these data challenges. The topic has received somewhat more attention in the sociology literature, see Kalleberg (2000) for an overview.

survey based on the earlier Contingent Worker Survey and show that the share of workers in alternative work arrangements increased from 10.7% to 15.8% from 2005 to 2015, and that almost half of that increase is due to temporary help work and workers provided by contracting firms. However, studying the effects of outsourcing and delving deeper into the underlying mechanisms is difficult without larger data sets, where outsourcing can usually only be approximated using industry and occupation codes. Furthermore, even with such an approximation, the existing research has relied largely on cross-sectional data sets on the worker level with little information on the outsourcing firms and the actual jobs people do.

In this article, we analyze the phenomenon of domestic outsourcing in Germany using administrative data on the universe of workers and firms.<sup>2</sup> We first document the rise of outsourcing of labor services over the past three decades in Germany, focusing in particular on logistics (i.e., truck drivers, warehouse workers), cleaning, security, and food services. Focusing on these four services has several advantages: they are tasks that have remained fairly comparable over time, they correspond to clear occupation codes, and the respective business service firms can be identified over time in our data. Furthermore, the share of these occupations remained approximately constant over the past three decades, suggesting that these have been less subject to large technology-induced job destruction or creation than other services, making it easier to interpret long time series.<sup>3</sup> We develop a new method for identifying outsourcing events, which

2. We use the term “domestic outsourcing” to differentiate it from offshoring, which is a form of outsourcing that has been studied much more widely in the economics literature even though it is not clear that it is quantitatively more important. Furthermore we focus on workers who are contracted out through business service firms and temporary help agencies. The rise in independent contractors is clearly also important, at least in the United States (e.g., [Katz and Krueger 2016](#)), but cannot be measured in our data.

3. Outsourcing also occurred for many other tasks and we see, for example, the share of accountants, advertising jobs, IT occupations, and phone operators who are working for business service firms rise substantially over time; however all of these occupations also exhibit strong trends in the number of workers over time (falling for accountants and phone operators, increasing for advertising and IT) and the characteristics of these jobs likely changed substantially with the advent of new technologies. Our estimates are thus specific to outsourcing in relatively low-skill and low-wage jobs and it should be kept in mind that the effects might be quite different for other tasks.

allows us to observe wages for a particular job before and after the job is outsourced. Based on this we provide credible estimates of the causal effect of outsourcing on wages, documenting that moving jobs outside the boundary of the firm leads to large wage reductions. Next, we investigate whether the wage reductions associated with outsourcing can be explained with the loss of establishment wage premia. Finally, we analyze the contribution of outsourcing to the broad changes in the employment and wage structure experienced by Germany over the past decades.

To document the rise in domestic outsourcing, we begin with a very general measure of outsourcing: the share of workers in food, cleaning, security, or logistics occupations who are working for business service firms. Since the mid-1990s, there has been a dramatic increase in this measure of outsourcing, accompanied by a decline of those occupations in other sectors such as manufacturing or finance, suggesting that firms in such sectors are relying increasingly less on in-house provision of these services and instead on external contractors.<sup>4</sup>

An important innovation for this project is the development of a method for identifying what we refer to as on-site outsourcing. This type of outsourcing refers to situations where a large employer spins off a group of workers providing a particular service, such as cafeteria workers, to a legally separate business unit, such as a subsidiary or an existing business service provider. In these situations the outsourced workers still work together and do essentially the same job at the same physical location, but under a different employer. Such outsourcing events can be identified in administrative data sets using worker flows between establishments. For example, if we observe a group of workers splitting off from a large bank in year  $t - 1$  and forming a new establishment identifier in year  $t$  with an industry code of “cafeteria,” this likely reflects that the bank is outsourcing its cafeteria. This is further supported if the workers who are leaving worked in food related jobs in year  $t - 1$  at the bank, and the bank does not replace these occupations in the following year.

4. This trend to vertical disintegration appears to be more widespread than just for the area of labor services. For example, [Dustmann et al. \(2014\)](#) document that final goods producers in the German manufacturing sector have been relying increasingly on buying intermediate inputs from outside the firm and from abroad (offshoring) and are responsible for an increasingly smaller share of the value added of final goods.

We can identify around 1,000 on-site outsourcing events in the German administrative data, and we show that such events have increased at a similar rate as the rise in business service employment. Although these instances of on-site outsourcing only constitute a small share of all outsourcing, they provide a powerful testing ground to analyze the wage effects of outsourcing, since they allow us to follow jobs over time where both the worker and most likely the work location remain the same, and wage changes are plausibly due to the change in the employment relationship.

In many instances firms face a choice of whether to have a job done by in-house employees or to contract it out to a business service provider. Due to various institutional reasons and frictions in the labor market, this choice may affect the wage paid to the worker. This difference between the wage paid for a worker providing the same service, either in-house or through a contractor, is what we call the wage effect of outsourcing or the wage penalty of outsourcing (anticipating the sign of our estimates). Our main contribution is to estimate the wage effect of outsourcing using two approaches. We first show that workers who are outsourced in on-site outsourcing events typically stay with the business service firm they are outsourced to for the following years, and their employment is similarly stable compared with workers in the same occupations and industries who are not outsourced. Comparing the evolution of wages of outsourced workers before and after outsourcing to similar nonoutsourced workers, we find that wages fall by around 10% over 10 years. As a second method of estimating the wage losses from outsourcing, we compare wages of workers in logistics, cleaning, food, and security occupations who are employed in business service firms with those employed directly by other employers, controlling for individual fixed effects.<sup>5</sup> This yields almost identical estimates of the wage penalty of outsourcing. Even though the two approaches have different advantages and disadvantages, they paint a very consistent picture.

5. This is the same method used by [Abraham \(1990\)](#) and [Dube and Kaplan \(2010\)](#), who use CPS data to estimate the effect of outsourcing on wages. It is also similar to the earlier literature that estimated industry wage differentials using individual fixed effects, for example, [Krueger and Summers \(1988\)](#). The criticism of this approach in [Gibbons and Katz \(1992\)](#) applies in the outsourcing case as well, which is why identifying on-site outsourcing as an exogenous (from the individual's perspective) shock is crucial.

Firms may choose to engage in outsourcing for various reasons. Subcontractors can provide increased flexibility for firms whose needs vary throughout the year or provide specialized skills or technology that would be costly for a firm to invest in. Outsourcing can also provide cost savings through lower labor costs, if outsourced workers are excluded from wage premia or rents at the outsourcing firm. To test the hypothesis that the wage losses of outsourced workers stem from being excluded from firm rents, we obtain estimates of the establishment wage premium by implementing a full decomposition of wages in Germany into establishment and worker fixed effects as in [Card, Heining, and Kline \(2013\)](#) (henceforth [CHK](#)) and in the spirit of [Abowd, Kramarz, and Margolis \(1999\)](#).<sup>6</sup> We first show that establishments pay comparable rents (in log terms) to workers in the relatively low-skilled food, cleaning, security, and logistics (FCSL) occupations as they do for their overall workforce. For example, an establishment that pays 10% higher wages to their non-FCSL workers pays around 8% higher wages to their FCSL workers. This suggests that high rent employers face a strong incentive to outsource workers who do not belong to their core workforce. Second, we show that the establishment fixed effect of workers moving to business service firms falls by around 10 log points, fully explaining the wage losses at outsourcing. We show that workers who are outsourced at employers that pay higher rents tend to experience higher wage losses. Finally, we document that establishments that pay above market wages or are covered by collective bargaining agreements are more likely to outsource parts of their labor force. These findings suggest that exclusion from establishment wage premia is a driving factor for the wage losses and likely part of the motivation for why firms outsource.

Germany provides a particularly interesting setting to study outsourcing. Over the past few decades there has been a substantial increase in wage inequality, with significant wage declines at the bottom of the wage distribution ([Dustmann, Ludsteck, and Schönberg 2009](#); [CHK](#)). These changes in the wage structure are in part explained by deunionization, the erosion of the sectoral-level collective bargaining system, and the increased decentralization of the wage-setting mechanism.<sup>7</sup> However,

6. See [Card et al. \(2016\)](#) for a recent review of this literature.

7. See for example [Dustmann et al. \(2014\)](#) for a discussion of how the German reunification in combination with the Eastern EU expansion led to the reduction in collective bargaining coverage rates.

as [CHK](#) show, a significant portion of the rise in wage inequality comes from increased assortative matching of workers employed together with others in the same or similar jobs, and low-skilled workers being matched with low-paying firms, something that is not easily explained by deunionization. On the other hand, increased reliance on outsourcing, particularly of lower-skilled labor services and other inputs, provides a natural explanation for this change, as lead firms move parts of their labor inputs out of the core workforce and into highly specialized, lower-paying business service firms.<sup>8</sup>

We provide evidence that outsourcing did indeed contribute to these changes in the German employment and wage structure. In particular, we combine the establishment-worker fixed effects decomposition with the reweighting methodology in [DiNardo, Fortin, and Lemieux \(1996\)](#) to obtain a counterfactual distribution of wages and establishment fixed effects if outsourcing had not increased. Based on this, we show that outsourcing of cleaning, security and logistics workers alone can account for about 9% of the increased wage dispersion in Germany, with equal parts due to increased dispersion of the establishment component and increased assortative matching of low-paid workers to low-paying employers. While we view outsourcing as a complementary explanation to deunionization for the change in the German wage structure and the increases in competitiveness, these two channels are likely intertwined, since weaker unions facilitated outsourcing decisions, and outsourcing weakened the bargaining positions of unions and work councils. In fact, the increase in domestic outsourcing may have put wage pressure on in-house employees in similar jobs because these employees are increasingly in competition with outside business service firms.<sup>9</sup>

8. Outsourcing may also explain why unit labor costs in the German manufacturing sector declined even though manufacturing wages remained relatively stable (see [Dustmann et al. 2014](#)): while large employers continue to pay relatively high wages, they benefit from the drop in wages at their subcontractors and suppliers.

9. For example, this is illustrated by the final report of the [Harvard Committee on Employment and Contracting Policies \(2001\)](#), also known as the Katz committee, which investigated the situation of low-wage workers at Harvard University. The report noted in particular that “in-house employees . . . have typically been employed by Harvard service units that operate on a fee-for-service business model and compete with outside contractors” and “outsourcing competition put pressure on Harvard’s unions to bring wages down to the rates paid by outside contractors.”



The next section presents the data and institutional background, as well as a description of our measures of domestic outsourcing. [Section III](#) presents our empirical results on the effects of outsourcing on workers' employment trajectories and wages of outsourced jobs. In [Section IV](#) we provide suggestive evidence that firms outsource to avoid paying establishment-specific wage premia and that the wage losses are due to the loss of firm specific rents. Finally [Section V](#) relates outsourcing to the broader changes observed in the German wage structure, and [Section VI](#) concludes.

## II. THE RISE OF DOMESTIC OUTSOURCING

### *II.A. Institutional Background*

In the German collective bargaining system, wages are negotiated between employer associations and unions on the industry or firm level, often in close coordination with elected establishment-level work councils (see [Fitzenberger, Kohn, and Lembcke 2013](#); [Dustmann et al. 2014](#)). The close level of cooperation between the different parties appeared to lead to relatively high wages and good working conditions while avoiding costly strikes and conflicts between unions and employers. This system was based on contractual relations and mutual agreements, and firms were free to leave the collective agreements and instead set wages either in firm-level negotiations or without any agreement.

Starting in the early 1990s, Germany experienced a sharp decline in collective bargaining coverage rates and union membership.<sup>10</sup> Many existing firms left the employer associations and collective agreements, and new firms opted not to join them in the first place. [Dustmann, Ludsteck, and Schönberg \(2009\)](#) and [CHK](#) argue that this decline was kick-started by the decision of labor unions to demand West German wage levels in East German establishments almost immediately after reunification. The large productivity gap essentially forced East German employers to leave the collective agreements, which in turn led to firms in West Germany imitating them and leaving the agreements as well. Increased pressure from globalization, the threat of moving production to Eastern Germany or the newly

10. For example [Dustmann et al. \(2014\)](#) report that from 1995 to 2008, industry-wide agreements fell from 75% to 56%, and firm-level agreements stayed close to 10%.



accessible Eastern European countries, and high levels of unemployment in Germany all provided West German firms with the necessary leverage to force work councils and unions to agree to these changes.

Although work councils have to be consulted for a wide variety of firm-level decisions that affect workers, this does not apply to outsourcing decisions, and German firms are legally free to do so at their discretion. In practice work councils and unions may try to fight outsourcing, but their success will depend on the willingness of the core workforce to stand up for the workers affected by outsourcing. It seems likely that the same factors that led to decreased union coverage likely also facilitated outsourcing of parts of the workforce. On the other hand, outsourcing offers a way for firms to sidestep the unions, since even if a firm is following a collective bargaining agreement, outsourced workers employed by a different sector typically would not be covered by the same agreement. Furthermore, workers in business service firms are often not well organized and in many cases do not form a work council.<sup>11</sup>

Another factor that has facilitated outsourcing in Germany has been a steady deregulation of the temp agency sector (Vitols 2004). The number of employees in this sector subsequently increased dramatically since the early 1990s and the sector became more established, with many large temp agencies offering their services to other firms, thus making it easier to outsource.

## II.B. Data

We use the Integrated Employment Biographies data (IEB), which represents the universe of social security records in Germany over the time period 1975–2009.<sup>12</sup> The IEB has been made available through the Research Data Center of the German Federal Employment Agency at the Institute for Employment Research (IAB). Employers are required to file a report for all

11. Based on our calculations with the IAB establishment panel, around 6% of business service firms have a work council and around 30% are covered by collective bargaining agreements. The relatively large collective agreement coverage is largely due to temp agencies that are mostly covered by a collective bargaining agreement specific to the temp sector, which sets a pretty low wage floor (e.g., €7.50 an hour in 2010).

12. See Oberschachtsiek et al. (2009)

employees who are employed during a year. This report contains information on the duration of employment, the total pay over that period, the employment type (full-time, part-time, apprentice), and a number of demographic variables (such as education, nationality, gender, and age). The pay information, used for social insurance calculations, is very accurate but top coded. Using the exact start and end date of each employment spell, we calculate real daily wages in year 2000 euros as our main dependent variable. The data cover all employment subject to social security contributions but exclude certain types of government employees and the self-employed. Furthermore, since employers and individuals are uniquely identified through establishment and person IDs, it is possible to construct complete employment histories for individual workers and to follow establishments over time. One limitation is that the data only contain establishment, not firm, identifiers.<sup>13</sup>

For our approach of measuring outsourcing, it is important that the data contain industry and occupation for every worker. Both pieces of information are an integral part of the employment notification and cannot be easily left blank. Occupation, for example, is only missing in around 0.05% of employment records. The industry classification system changed several times during our observation period with breaks in 1999, 2003, and 2009. We used crosswalks together with our best judgment to consistently classify business service firms and outsourcing over time. Moreover, we do not have industry codes for the last year (2009), and therefore all results relying on long time series for identifying outsourcing only span 1975 to 2008.

### *II.C. Measuring Outsourcing Using Industry and Occupation Codes*

As a first way to show the changes in employment patterns due to outsourcing, [Figure I](#) graphs the share of large establishments (over 100 workers) which employ at least one FCSL worker in each year separately for several large industries. Starting with the top left graph, we see that over time fewer retail establishments employed workers in these occupations. For

13. Multi-establishment firms typically have a separate identifier for each establishment they own, or they may combine several establishments within the same county (such as branches) under a single establishment identifier, but establishment identifiers do not span across multiple counties. See [Hethey-Maier and Schmieder \(2013\)](#) for more details.

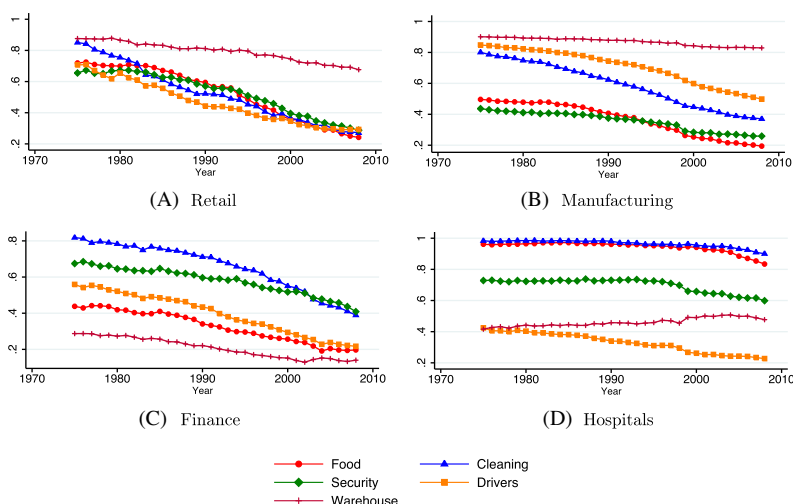


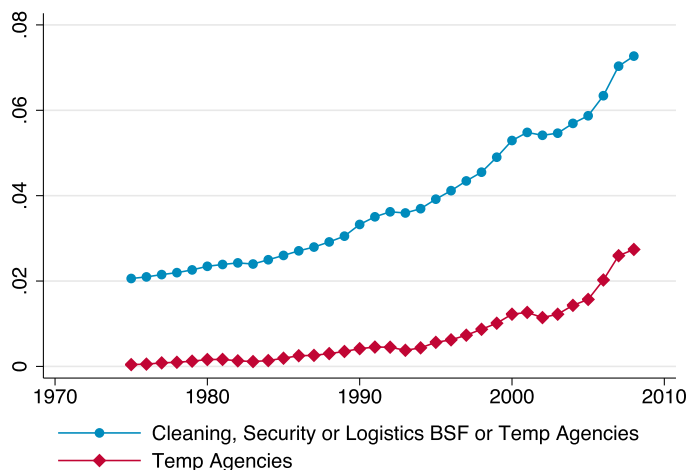
FIGURE I

Share of Firms with any Food/Cleaning/Security/Logistics workers, by Industry

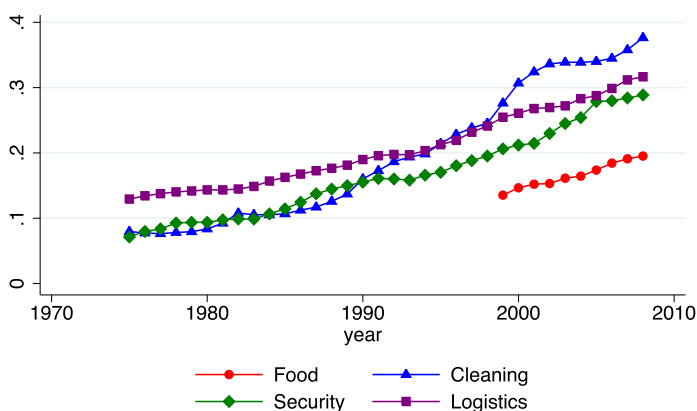
The figure shows the fraction of West German establishments with at least 100 workers in four major industries (retail, manufacturing, finance and hospitals), who are employing at least one worker in the respective occupations (food, cleaning, security, driver, or warehouse worker). The data covers 1975 to 2008 and in each year is based on the employee composition on June 30. For color versions of all figures, please see the online version of this article.

example, in 1975, about 82% of retail establishments had at least one cleaning worker on staff, whereas in 2009, only about 20% did. Presumably these retail establishments are still being cleaned, so it is likely that these tasks have been contracted out to another provider, rather than being done by workers employed directly by the retail firms. We see the same patterns among manufacturing and finance firms. For hospitals, the share employing FCSL workers has also decreased over time, although not quite as dramatically and mainly during the 1990s and 2000s.

To obtain a broad picture of the evolution of domestic outsourcing, Figure II, Panel A shows the share of workers among all West German workers who are employed in establishments that—based on their industry codes—provide cleaning, security, or logistics (CSL) services to other firms or who are temp agencies. We do not include food workers here, since only the industry codes from 1999 onward allow us to distinguish between business service firms and regular restaurants. The figure documents a



(A) Worker in all Occupations



(B) Workers in Food / Cleaning / Security / Logistics Occupations

FIGURE II

Share of Workers employed by Business Service Firms and Temp Agencies over Time

Panel A shows the share of all full-time workers in West Germany from 1975 to 2008 who are working in either a cleaning, security, or logistics business service firm or for a temp agency. Panel B shows the share of workers in food, cleaning, security, or logistics occupations who are employed in business service firms or temp agencies. For food occupations the time series in the bottom figure starts in 1999, since earlier industry codes did not differentiate between restaurants and food business services industries, such as canteens and catering. We also exclude food workers employed in the restaurant, hotel, and air travel industries.

dramatic rise in outsourcing of labor services over the past three decades: the share of outsourced workers in CSL business service firms and temp agencies has increased from 2% to almost 8% of the West German workforce in 2008. The figure also breaks out temp agency workers as a separate group, showing a stark increase to around 2.5% of all workers in Germany in 2008. Importantly, these changes occurred even though the share (and absolute numbers) of workers in CSL occupations remained approximately constant over this time period (see [Online Appendix Figure A-1](#)).

Figure II, Panel B shows the share of workers in FCSL occupations working for a FCSL business service firm or a temp agency. For example, a food services worker such as a waiter or cook is considered to be an outsourced worker if she is employed in the “catering” or “canteen” industry or in a temp agency. The share of outsourced workers in these occupations has increased substantially in all four groups over time. The most dramatic increase is the rise of cleaners working for firms providing cleaning services: while in 1975 only about 10% of cleaners were working for cleaning firms, this share has risen to almost 40% by 2008. Cleaning tasks may lend themselves particularly well to being broken out of the normal firm hierarchy and, because they are often very low-paying, may provide particularly good opportunities for cost savings through outsourcing. There was also a 20 percentage point rise in the share of security and logistics workers working for business service firms and, over the shorter time period, an increase in the share of food workers employed in business service firms, from about 16% to 26%.<sup>14</sup>

## II.D. Identifying On-Site Outsourcing

The IEB, like most data sets, does not contain any direct information on whether firms are outsourcing services and what workers they are employing through contractors. Instead, we develop a method to identify a particular type of outsourcing using worker flows between establishments. We call this on-site outsourcing, and it refers to cases where companies contract out part of their workforce to a legally independent subcontractor but where

14. Food workers employed by restaurants and hotels are omitted from these calculations, as they would be considered neither “outsourced” nor “in-house” but providing the main service of the establishment. We also exclude workers in the “waiter, steward” occupation who are employed in the air travel industry, as they are likely to be flight attendants and not relevant to this study.

the same employees continue their work at the same physical location. For example, in 2005 the Daimler corporation implemented a large cost-saving program called “CORE” to focus on its core business competencies. As part of this program it outsourced several of its in-house cafeterias into a legally independent subsidiary company, which was at first fully owned by Daimler and later sold in parts to various business service firms. The employees largely remained the same and still worked at the same locations, but were now employed by a different employer.<sup>15</sup>

We identify these on-site outsourcing events using worker flows between establishment identifiers, implementing a strategy similar to [Hethy-Maier and Schmieder \(2013\)](#), who dealt with classifying establishment entries and exits, and [Muendler, Rauch, and Tocoian \(2012\)](#), who used worker flows to identify employee spin-offs. Starting with the universe of covered workers as of June 30 in each year from 1975 to 2009, we track workers as they move between establishments from year to year. We define a clustered flow of workers to be a group of workers who were all employed in establishment A, the predecessor, in one year and then in the following year were all employed in establishment B, the successor.

A clustered flow at time  $t$  is considered an on-site outsourcing event if the following conditions hold: first, the flow must consist of 10 employees or more to eliminate small flows that may be a part of regular year-to-year worker movements. The predecessor establishment must have at least 50 employees in the year prior to the flow, continue to exist in the following year, and not shrink by more than 50%, to ensure that the flow we observe is not due to an establishment closing, severely downsizing, or breaking apart. The flow must also represent less than 30% of employment in the predecessor in the previous year, so that we are certain that the outsourced employees represent only a small part of the predecessor’s business.<sup>16</sup> Finally, we restrict the

15. This description of the events is based on personal conversations with Daimler employees. There are many other case studies describing similar events, for example, [Doellgast and Greer \(2007\)](#) describe outsourcing in the automobile and telecommunications sector in Germany, [Hall, and Jacobs \(2013\)](#) describe outsourcing of airport workers in the United States, and [Smith Institute \(2014\)](#) provides several examples from the United Kingdom.

16. If the successor is a new establishment (i.e., the establishment ID appears in the data for the first time in year  $t$ ), then we further require that the clustered flow makes up 65% or more of the successor’s employment. Although the exact cutoffs we use here are of course debatable, we found that in practice changing

successor establishment to have an industry code corresponding to a business service firm in either logistics, food services, cleaning, or security, and ensure that the predecessor establishment is not a business service firm, giving us further confidence that these flows are likely to be outsourcing occurrences and not spin-offs or other types of establishment changes.<sup>17</sup> For all outsourcing events, we call the predecessor establishment the mother, and the successor establishment the daughter.<sup>18</sup>

We also use this method to identify events where the daughter is a temp agency. Since temp agencies can in principle provide many different labor services and are not associated with clear occupation codes we find these on-site outsourcing events to temp agencies somewhat less clean from an identification perspective. On the other hand, temp agencies clearly played an important role in the rise of outsourcing in Germany. For example, there are many news stories that business service firms often outsource large shares of their workforces to temp agencies. We focus our analysis of the wage effects of outsourcing on workers in FCSL tasks, but we also provide estimates for temp agencies separately and include workers in temp agencies in our descriptive analysis on the rise of outsourcing.

While this type of outsourcing was relatively uncommon in the late 1970s and 1980s, the mid-1990s saw a large increase in the number of outsourcing events to about 60–80 a year, as can

---

these thresholds—even by a substantial amount—barely affects our main wage results reported later. As will be seen, the average outsourcing establishment we identify is far away from these cutoffs: much larger prior to the flow, barely shrinks, and the flow is a very small part of total employment. Table A-14 in the [Online Appendix](#) also shows that our main results are very robust to the exact definition.

17. Business service industries for logistics include transportation, warehouse, and storage. For food occupations, industries include canteens and catering. For cleaning, industries include industrial cleaning, cleaning of buildings, rooms and equipment, street cleaning, chimney-sweeping, and scaffolding and facade cleaning. For security occupations, the industries used were labeled security activities and security and storage activities. For a complete listing of industry and occupation codes used, see [Online Appendix Tables A-3 and A-4](#).

18. Although the outsourcing definition that we use does not explicitly exclude situations where a mother establishment rehires the types of workers who left the firm, we find that this is not typically the case (See [Online Appendix Figure A-2](#)). Furthermore, outsourcing establishments evolve very similarly relative to a matched group of nonoutsourcing establishments ([Online Appendix Figure A-4](#)), and outsourcing does not seem to be correlated with other shocks or changes at an establishment.



be seen in Figure III, Panel A. This increase occurred across all five types of outsourcing events, which follow similar time paths (Figure III, Panel B), roughly coinciding with the rise in employment in business service firms shown in Figure II.<sup>19</sup>

Our measure of on-site outsourcing events and our analysis based on industry and occupation codes showed a substantial increase in outsourcing over the past three decades. Especially since the late 1980s/early 1990s the growth has accelerated and reached quite dramatic levels. These findings are in line with the limited evidence from the United States and other countries, which covers much shorter time periods and more restrictive occupation groups.<sup>20</sup>

### III. THE EFFECTS OF OUTSOURCING ON WAGES

#### III.A. Framework

It is not obvious that business service firms would pay different wages than outsourcing firms. In particular, in a competitive labor market wages should be determined by the productivity of the worker and possibly a compensating wage differential component. However, if labor markets are not perfectly competitive, then outsourcing may allow for lower wages by reducing the noncompetitive wage component.

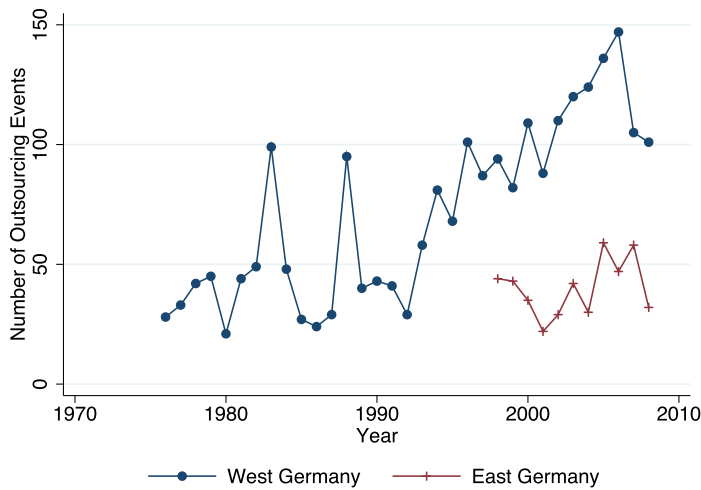
To clarify this, consider the following simple wage-setting equation:

$$(1) \quad \ln(w_{ijt}) = \delta Outsourced_{it} + z'_{jt}\gamma + x'_{it}\beta + \epsilon_{it},$$

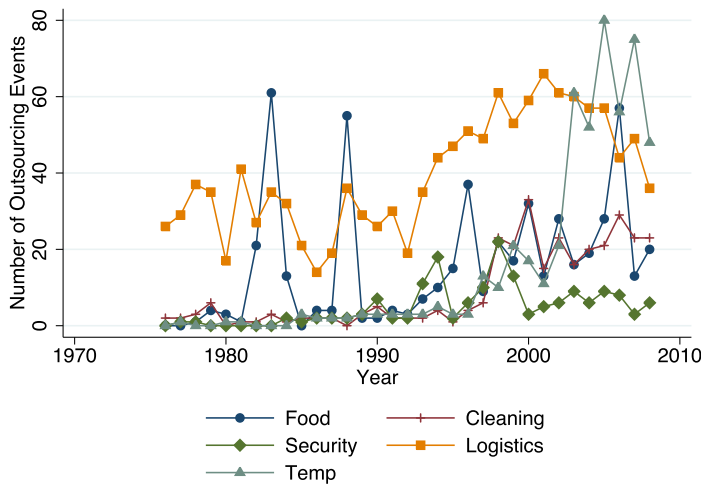
where  $\ln(w_{ijt})$  is the (log) daily wage of worker  $i$  at time  $t$  working at job  $j$ .  $Outsourced_{it}$  is an indicator function taking a value of 1 if the worker is outsourced, that is the worker is employed through a business service firm, and taking a value of 0 if the worker is employed in-house. Furthermore, wages are determined by characteristics of the job  $z_{jt}$ , and individual characteristics  $x_{it}$ . A job is a set of tasks at a particular physical location, for example, a

19. The spikes in 1983 and 1988 in outsourcing of food services are likely driven by a large department store chain outsourcing all of their restaurants simultaneously.

20. See for example, Abraham and Taylor (1996), Autor (2003), Dube and Kaplan (2010), Dey, Houseman, and Polivka (2010), Berlingieri (2013), and Katz and Krueger (2016) for evidence of increased domestic outsourcing in the United States.



(A) Number of Outsourcing Establishments in East and West Germany



(B) Number of Outsourcing Establishments by Type of Outsourcing

FIGURE III

Frequency of On-site Outsourcing Events by Year

The figure shows the number of on-site outsourcing events in Germany by year, where on-site outsourcing events are defined as groups of workers leaving large establishments and moving to business service firms. Panel A breaks this up by East and West Germany, and Panel B breaks it up by outsourcing type. Only the bottom figure includes outsourcing to temp agencies.

cook in a cafeteria within a bank. Workplace or job characteristics that affect wages include working conditions or characteristics such as the amount of variety or stress involved in the tasks. Whether a worker is outsourced or employed in-house may affect the wage for various reasons. For example, if wages are set in a collective bargaining process, then the profits of the employer might affect individual wages through rent sharing. If the worker is outsourced, then the rent component may be lost, either because profits of the subcontractor are lower or because workers may be in a weaker bargaining position because they are not covered by the same labor union.

Equation (1) could be estimated using OLS, but outsourced status is likely correlated with workplace and individual worker characteristics. Although panel data may help control for individual characteristics via individual fixed effects, it is rare to have information on job characteristics. We provide two alternative estimates of the effects of outsourcing: First, in Section III.B, we estimate equation (1) using an event-study design around on-site outsourcing events. Second, in Section III.C, we implement the method used by Dube and Kaplan (2010) to estimate wage differences between outsourced and nonoutsourced FCSL workers using individual fixed effects regressions. The two approaches have advantages and disadvantages, explained below, and we view them as complementary evidence.<sup>21</sup>

### III.B. *The Effects of On-Site Outsourcing on Wages*

1. *Method.* On-site outsourcing events correspond to situations where the same workers are doing the same job in-house (before the event) and outsourced (after the event). To be clear, our data do not allow us to observe the job directly, and we can only follow workers over time and observe their employer and occupation. However, we believe it is a plausible assumption that after an on-site outsourcing event, workers who remain employed at the daughter business service firms are very likely to be working essentially the same job, especially since the vast majority remain

21. Both the on-site outsourcing and industry-occupation estimates may fail to capture the cost of outsourcing to workers who are simply laid off and replaced by a business service firm. Estimating the effect of outsourcing on the worker level would be closer to the displaced worker literature, while here we are interested in the effects of outsourcing on the job level. In the Online Appendix we discuss this type of worker-level analysis.

in the same occupation.<sup>22</sup> If such events are correctly identified and workers are indeed working the same job before and after, one can use a suitable control group—to capture time and life cycle effects—to obtain a difference-in-difference type estimator of the effect of outsourcing on the wage paid for the outsourced job.

We construct a comparison group of workers at jobs that are not outsourced using a matching algorithm. For each outsourced worker, we take the set of nonoutsourced workers who worked in the same industry and occupation in the year prior to outsourcing to be our potential control group. We then estimate a probit regression of whether a worker is outsourced, controlling for tenure and establishment size in the year prior to outsourcing as well as wages two and three years prior. We restrict our sample to workers with at least two years of tenure in the year prior to outsourcing. For each outsourced worker we then choose the nonoutsourced worker with the closest propensity score to the comparison worker.<sup>23</sup> Columns (1) and (2) of Table I show worker characteristics for our analysis sample. The characteristics of the matched outsourced and nonoutsourced workers are quite similar, even for characteristics that were not part of the matching algorithm, such as full-time status and education.

We use an event-study framework, using the full employment histories of our treatment and control groups by estimating regression models of the form:

$$(2) \quad y_{ijt} = \sum_{k=-5}^{10} \delta_k I(t = t^* + k) Outsourced_i + \alpha_i + \xi_j + \theta_t + x'_{it} \beta + \varepsilon_{it},$$

where  $y_{ijt}$  is an outcome variable for individual  $i$  in year  $t$  on job  $j$ , such as the log daily wage, and  $Outsourced_i$  is an indicator for whether the individual was outsourced in year  $t^*$ .  $\alpha_i$  are individual fixed effects,  $\theta_t$  are year fixed effects to control for year-level shocks that could affect all workers and jobs,  $x_{it}$  are individual-level time varying worker controls, and  $\varepsilon_{it}$  is an error term. We

22. About 11% of on-site outsourced workers change occupation codes, but in most cases between very similar occupations. As a robustness check we also ran our main results conditional on not changing occupations and found virtually identical results.

23. We tested many other matching specifications and found essentially the same results. See the Online Appendix for a variety of robustness checks.

TABLE I  
CHARACTERISTICS OF OUTSOURCED AND NONOUTSOURCED WORKERS

	Outsourced at $t = -1$	Matched non-OS at $t = -1$	FCSL at BSF/temp	FCSL not at BSF/temp
Avg establishment daily wage in euro	78.83 (20.16)	77.42 (20.32)	53.65 (19.59)	74.49 (17.94)
Establishment effect*	0.03 (0.14)	0.03 (0.15)	-0.14 (0.18)	0.02 (0.15)
Establishment size	1,120.63 (2,416.86)	1,107.55 (3,207.42)	265.41 (385.18)	1,683.45 (5,204.99)
Real daily wage in euro	69.93 (29.47)	69.96 (30.73)	51.07 (24.80)	63.71 (25.36)
Age in years	42.29 (7.98)	43.63 (9.75)	40.25 (8.49)	41.87 (8.43)
Female	0.45	0.46	0.40	0.40
Years of education	10.16 (1.17)	10.23 (1.34)	9.93 (1.06)	10.06 (0.89)
College degree	0.02	0.03	0.01	0.01
Living in West Germany	0.86	0.88	0.85	0.94
Working full-time	0.78	0.76	0.70	0.78
Tenure in years	8.58 (5.80)	8.51 (6.32)	3.91 (3.83)	6.16 (5.29)
Food occupation	0.21	0.21	0.05	0.14
Cleaning occupation	0.11	0.11	0.41	0.24
Security occupation	0.03	0.03	0.11	0.08
Logistics occupation	0.34	0.34	0.42	0.53
Observations	21,195	21,195	6,412,854	35,201,181

*Notes.* Mean of each variable with standard deviation in parentheses. Columns (1) and (2) include on-site outsourced and matched nonoutsourced workers age 25–55 with at least 2 years of tenure in year before outsourcing. Statistics calculated in year before outsourcing. Columns (3) and (4) include workers in food, cleaning, security, and logistics occupations who are age 25–55 and employed at an establishment with 50 or more workers. Column (3) includes these workers who are employed at business service firms (BSF) or temp firms, and column (4) includes these workers who are not employed at BSF or temp firms. All columns exclude East Germany prior to 1997.

\*The establishment effects are the predicted fixed effects from the AKM model described in Section IV.A. The establishment effects are normalized to be equal to 0 in the sample of all workers from 1979 to 2009 (the period we use for the AKM model).

cluster standard errors on the level of the outsourcing establishment.<sup>24</sup> Although we do not directly observe the job or workplace, we can indirectly control for job characteristics under the above assumption that workers who remain at the daughter establishment after on-site outsourcing continue to be working the same job. In that case, restricting the sample to individuals in the treatment group who remain at the daughter establishment after being

24. This seems to be the most conservative in this case. If we cluster on the individual level, standard errors are about one third as large.

outsourced (and the mother establishment before outsourcing) is a way to indirectly control for job fixed effects  $\xi_j$ , since in this sample the individual fixed effects  $\alpha_i$  are collinear to the job fixed effects  $\xi_j$  and thus implicitly control for them. Each coefficient  $\delta_k$  measures the change in the outcome variable  $y_{it}$  for outsourced jobs relative to the nonoutsourced control group in the  $k$ th year before or after outsourcing occurred.

2. *Results.* We start by comparing the wage and employment trajectories of outsourced and nonoutsourced workers in the years before and after outsourcing, without restricting the sample to workers who remain at the same employer before and after outsourcing. Figure IV, Panel A shows the log daily wage before and after outsourcing for the two groups. Year 0 is the first year when outsourced workers are working at the business service firm. The two groups show very similar trends in wages prior to the outsourcing year. We do not restrict this figure to be a balanced panel, but to be in the analysis sample every individual has an observation for years  $t = -3$  to  $t = 0$ , due to the tenure restriction of two years and the requirement that we see workers in  $t = 0$  to determine whether they are outsourced. This explains the change in the slope at  $t = -3$  and  $t = 0$ , since we have a selected sample of who is observed before and after these points. Although these selection issues make it harder to compare the level of the evolution of wages in the two groups, the difference between the two groups is meaningful and clearly reveals that at the time of outsourcing the two groups diverge, and within three years after the outsourcing event outsourced workers have about 10% lower wages than the nonoutsourced group. These differences are persistent, lasting for at least 10 years after outsourcing occurs.

Since the unbalanced panel in Figure IV, Panel A complicates the interpretation, Panel B shows log daily wages for a restricted panel of workers who are continuously observed from 5 years prior to 10 years after outsourcing. While we have fewer observations in this sample, the figure shows clearly that outsourced and nonoutsourced workers have steady wage growth until outsourcing occurs. However, as soon as workers are outsourced, wages fall slightly and remain essentially flat over the following years, so that a gap of about 10 log points opens up relative to the control group.

In Figure IV, Panel C, we turn to days worked a year, but find essentially no difference between the two groups. We also

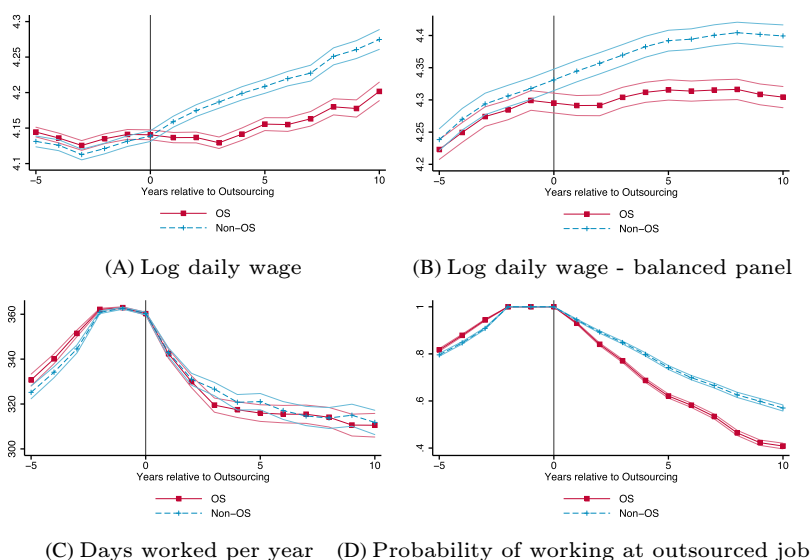


FIGURE IV

#### Employment Outcomes of Outsourced and Nonoutsourced Workers before and after On-site Outsourcing

The figures follow two group of workers: the first is a group of workers who are outsourced between year  $t = -1$  and  $t = 0$  (the first year at the new establishment), while the second group is a control group of nonoutsourced workers. The control group was chosen by finding workers employed in the same industry and occupation with similar tenure and establishment size in the year prior to outsourcing, who have similar wages two and three years prior to outsourcing as the outsourced workers. The figures show average characteristics of the workers in the two groups before and after the outsourcing event. Panels A, C, and D show data from the unbalanced panels of workers in the outsourced and control group. Panel B restricts the data to a balanced panel of individuals observed in each year from 5 years before to 10 years after the outsourcing event.

explored differences in full-time status before and after outsourcing and found no difference between the two groups. It thus seems that while outsourcing has a strong negative effect on the daily wages of the outsourced workers, there are basically no employment effects. Furthermore, although we do not observe hourly wages, the fact that neither days worked nor full-time status is affected by outsourcing makes it likely that hours are not the driving factor behind the loss in daily wages. In the [Online Appendix \(Table A-6\)](#), we show that the results are very robust, for example to controlling for full-time status or alternative control groups.



We further investigate employment stability in [Figure IV](#), Panel D. In the years  $-5$  to  $-1$ , the dependent variable in this figure takes a value of 1 if the worker is employed at the establishment at which he was employed in time  $t = -1$  and 0 otherwise. In the years 0 to 10, it takes a value of 1 if the worker is employed at the same establishment as in time  $t = 0$  (for outsourced workers this is the daughter establishment, for nonoutsourced worker it is the same establishment as in time  $t = -1$ ). [Figure IV](#), Panel D shows that outsourced workers are leaving their jobs at a slightly higher rate after outsourcing than nonoutsourced workers. For example, three years after outsourcing, 77% of outsourced workers and 85% of nonoutsourced workers remain at the same job.<sup>25</sup> When we investigated the job stability patterns by outsourcing type, we found that the gap in mobility between outsourced and nonoutsourced workers is largest for cleaning outsourcing events, which—as we document later—is also the group for whom wage losses are highest. Because this suggests that the workers who experience the largest wage losses are most likely to leave their jobs after outsourcing, our method may slightly underestimate the wage losses associated with outsourcing.

The raw means are informative in our matched sample, but there is the possibility that selection and time-varying variables on the individual level (in particular age) affect the changes over time. For example, it is possible that in the nonoutsourced group, low wage workers are more likely to leave the labor force, thus creating a mechanical increase in wages in the nonoutsourced group relative to the outsourced group. The event study design allows us to control for this type of selection by estimating [equation \(2\)](#) controlling for individual fixed effects as well as year-level shocks. [Figure V](#), Panel A graphs the  $\delta_k$  coefficients from estimating [equation \(2\)](#) using log daily wage as the dependent variable. The regression framework confirms that outsourced workers suffer an immediate drop in wages at the time of outsourcing and wages continue to decline relative to nonoutsourced workers, ending up about 10% lower after 10 years. It seems plausible that the gap continues to grow over time due to wage rigidity that makes

25. The increased mobility among outsourced workers could also in part be due to ownership changes of the outsourced establishments. Anecdotally it appears somewhat common that workers are outsourced into subsidiaries that are later sold to other companies, which may be accompanied by a change in the establishment ID.

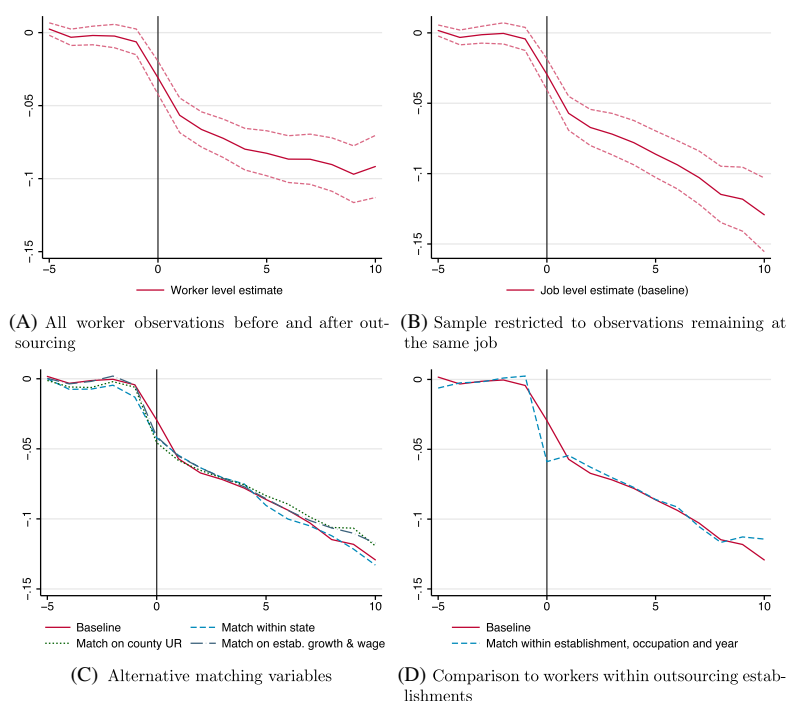


FIGURE V

## Regression Estimates of the Effect of On-site Outsourcing on Log Daily Wages

The figures show regression estimates of the effects of being outsourced between  $t = -1$  and  $t = 0$  (the first year at the new establishment) on log wages before and after the outsourcing event (see equation (2)). The omitted category is year  $-1$ . The bands are 95% confidence intervals (standard errors clustered on the level of the outsourcing establishment). The regressions control for individual fixed effects and year dummies. The figures follow two group of workers: the first is a group of workers who are outsourced between year  $t = -1$  and  $t = 0$  while the second group is a control group of nonoutsourced workers. Panel A shows results irrespective of whether they move to other establishments in later years. Panel B restricts the sample to workers who are at the outsourced job, that is, at the same establishment as in time  $t = -1$  in all years before outsourcing, and in the same establishment as in time  $t = 1$  in all years after outsourcing. Panel C shows results for the same restriction as B but uses alternative establishment level control variables in the matching algorithm, and Panel D uses a control group of workers at the outsourcing establishment who are not outsourced.

nominal wage cuts difficult but allows for real wage cuts in the outsourced group by excluding them from any raises.

While we can follow workers over extended time periods, the further away from the outsourcing event we compare outsourced

to nonoutsourced workers, the less likely it is that the workers are still at the same jobs, as we documented in [Figure IV](#), Panel D. The main goal of this article is to estimate how wages change for jobs that are outsourced. These estimates may partly be driven by workers who change establishments, and hence leave their job, from our sample. [Figure V](#), Panel B shows estimates of the  $\delta_k$  coefficients in [equation \(2\)](#) restricting our sample to workers who remained at the same job after outsourcing, thus indirectly controlling for job fixed effects. The results for this restricted sample show a similar pattern but indicate somewhat larger wage losses of about 15% 10 years after outsourcing. The impact on jobs is likely larger than the long-term wage impact on workers since in the long term outsourced workers can move out of the outsourced job and to a higher-paying position.<sup>26</sup>

[Table II](#) presents wage regression results for workers and jobs, for the full sample as well as by daughter establishment type. This table uses a specification similar to [equation \(2\)](#), but instead of using individual dummy variables for each year relative to outsourcing, it uses three indicator variables for the time periods: preoutsourcing (includes the 6 years prior to outsourcing), short-run postoutsourcing (includes the year outsourcing occurs and the following 3 years), and long-run postoutsourcing (years 4–10 after outsourcing). In Panel A we include all matched outsourced and nonoutsourced workers and verify that outsourced workers suffer a decrease in log wages both in the short and long term of about 5.6% and 8.5%, respectively. Workers outsourced to cleaning establishments face the largest decrease in both the short and long term, while logistics and food workers are affected slightly less. We also report the effects of on-site outsourcing events where the

26. Selecting individuals based on an endogenous outcome after the treatment (whether or not to move to a different employer), raises the possibility of selection bias, if there are heterogeneous trends or shocks in terms of wages across individuals. If mobility is correlated with negative wage shocks at the outsourced job, then our job level estimates are lower bounds of the wage penalty from outsourcing (i.e., the true effect would be even larger). If mobility is positively correlated with wage shocks (that is workers who moved would have experienced wage increases had they stayed at the outsourced jobs), then our job-level estimates may be biased towards larger wage losses. In this case, worker level estimates still provide a lower bound of the wage penalty, since workers who moved probably did not move to jobs that paid less than if they had stayed behind. Given that mobility was highest among workers who experienced the largest wage losses (cleaners), we find the interpretation that the job-level estimates are lower bounds more plausible.

TABLE II  
THE EFFECTS OF OUTSOURCING ON LOG DAILY WAGES

	All FCSL OS events & workers	Food	Cleaning	Security	Logistics	Temp	OS to new estab.	OS to existing estab.
Panel A: Effect of on-site outsourcing on workers								
Post-OS short-run	-0.056*** (0.0048)	-0.048*** (0.0056)	-0.11*** (0.013)	-0.069*** (0.016)	-0.039*** (0.0058)	-0.15*** (0.019)	-0.043*** (0.0053)	-0.074*** (0.0083)
Post-OS long-run	-0.085*** (0.0077)	-0.087*** (0.010)	-0.12*** (0.021)	-0.10*** (0.021)	-0.066*** (0.010)	-0.16*** (0.019)	-0.080*** (0.0095)	-0.092*** (0.013)
Observations	517,662	158,971	73,064	83,574	202,053	97,538	305,315	212,347
Avg outcome var at $t = -1$	4.14	4.02	3.95	4	4.37	4.37	4.11	4.19
Panel B: Effect of on-site outsourcing on jobs								
Post-OS short-run	-0.054*** (0.0050)	-0.045*** (0.0049)	-0.10*** (0.013)	-0.072*** (0.019)	-0.035*** (0.0057)	-0.15*** (0.016)	-0.041*** (0.0056)	-0.073*** (0.0087)
Post-OS long-run	-0.097*** (0.0079)	-0.11*** (0.0093)	-0.12*** (0.018)	-0.14*** (0.024)	-0.059*** (0.011)	-0.16*** (0.023)	-0.090*** (0.0099)	-0.11*** (0.013)
Observations	429,949	134,005	61,276	69,976	164,692	72,854	259,434	170,515
Avg outcome var at $t = -1$	4.14	4.02	3.95	4	4.37	4.37	4.11	4.19
Panel C: Effects of working for business service firm (Dube and Kaplan 2010 measure)								
Working for business service firm	-0.090*** (0.0064)	-0.036*** (0.0030)	-0.17*** (0.0015)	-0.12*** (0.0027)	-0.028*** (0.00064)	-0.26*** (0.00075)		
Observations	36,234,249	1,455,432	10,703,132	3,373,983	20,701,702	13,084,766		
OS workers	1,529,268	45,950	723,294	204,031	576,039	629,278		
Mean outcome for OS workers	3.83	3.79	3.43	3.95	4.21	3.93		

Notes. Standard errors in Panel A and B are clustered at the level of the outsourcing establishment, in Panel C at the worker level. Panels A and B use matched sample of OS and non-OS workers. Panel B includes only workers who are at the same establishment as in time  $t = -1$  in all years prior to outsourcing, and in the same establishment as in time  $t = 0$  in all years after outsourcing. Time periods are five years pre-OS; four years short-run; six years long-run. First column, for all outsourcing types, does not include workers outsourced to temp firms. All regressions include individual fixed effects and year dummies, and exclude East Germany before 1997. Panel C, first column includes only workers in food, cleaning, security, or logistics occupations; columns (2)–(5) include only workers in the occupation indicated by the column heading. For food workers, the independent variable has a value of 1 if the worker is employed by a firm that provides food services to other companies (defined analogously for other occupations). The sixth column is restricted to individuals in any occupation who have worked in the same occupation at both a temp agency and in another industry; the independent variable has a value of 1 if the worker is employed by a temp agency. All regressions in Panel C control for individual fixed effects, year indicator variables, age, age squared, and age cubed interacted with education dummies; samples are restricted to workers age 25–55, working at establishments with at least 50 workers, and excluding East Germany before 1997. Food workers employed at restaurants and hotels are omitted. \* $p < .1$ , \*\* $p < .05$ , \*\*\* $p < .01$ .

daughter is a temp agency, though these cases are not included in the pooled specifications. It is striking that for outsourcing to temp agencies wage losses are the largest with around 16% drops in the long run. This could be because hours for temp workers may be more volatile and our measure for full-time status may be less informative. In Panel B we restrict the sample to only those workers who remain at the establishment that they are outsourced to as a way to likely restrict it to workers remaining on the same job. The results show that outsourced jobs suffer an even larger wage loss in the long term, of about 10%, relative to nonoutsourced jobs.

The last columns in [Table II](#) show the wage losses depending on whether the business service firm that workers are outsourced to is a new establishment or an existing establishment. The wage losses are similar, with just slightly larger losses for existing establishments, which could be due to outsourcing events into existing establishments being different along other dimensions.

Overall, we find very consistent medium- to long-run wage losses of about 10% for jobs that are outsourced during on-site outsourcing events. These results are very robust to different choices with respect to sample, outsourcing definition, or estimation method (such as matching algorithms versus purely regression adjusted estimates). One concern is whether wages for outsourced workers decline relative to nonoutsourced workers because the outsourcing establishments are negatively selected. [Figure V](#), Panel C provides alternative estimates where we create the control group by also matching with establishments in the same state (in addition to matching within industry and occupation), matching on the county unemployment rate in the year prior to outsourcing, and matching on establishment mean wages and employment growth rates. The estimates are virtually unchanged, suggesting that we are not selecting particularly badly performing establishments.

To address further the concern that wage losses of outsourced workers are simply capturing general wage declines at the outsourcing establishment, we also estimated the effects using a control group of workers in the outsourcing establishment who are not being outsourced. To construct this control group we use exact matching within establishment and occupation, as well as using propensity score matching to match on tenure and preoutsourcing wages. Although this leads to a smaller sample (about half the size), since we often cannot find any remaining

workers in the outsourced occupations, [Figure V](#), Panel D shows that the point estimates are virtually unchanged.<sup>27</sup> In the [Online Appendix](#) we provide a variety of additional robustness checks.

The effect of outsourcing on wages that we measure is best understood as the partial equilibrium effect to an individual worker (or job) relative to the counterfactual that his particular employer would not have been able to (or simply did not decide to) outsource at the time. It does not answer how the increasing prevalence of outsourcing affected wages of FCSL workers in general. For example, the mere threat of outsourcing may have led to wage reductions for FCSL workers in nonoutsourcing firms. On the other hand if outsourcing had not been a possibility at all, the firms that did decide to outsource might have found other ways to reduce wages to FCSL workers. In [Section V](#), we return to the question of how outsourcing may have affected the overall wage distribution.

### *III.C. The Effect of Working for a Business Service Firm*

While the wage estimates using our measure of on-site outsourcing have a high degree of internal validity, they may be limited in their generalizability because these events are relatively rare and may not be representative of the bulk of outsourcing. On-site outsourcing may be more common among larger, more successful companies that might be paying higher wages, which can lead to larger wage losses after outsourcing and thus to an overestimate of the wage loss for the general population. On the other hand, jobs that are outsourced in the circumstances identified by on-site outsourcing may be subject to agreements between work councils/unions and the outsourcing employer regarding the wages of the outsourced workers, making it possible that we are underestimating the true effect of outsourcing on wages.<sup>28</sup>

27. Note that this also suggests that outsourcing did not have positive effects for the workers who stayed behind, as one could imagine if outsourcing makes the firm more profitable, potentially increasing the potential for rent sharing. Since the on-site outsourcing events in our analysis are very small relative to total employment (on average around 3%), we likely do not have enough power to detect such positive effects for the stayers.

28. In some cases, outsourcing events are subject to a law (§613aBGB) that restricts wage cuts after selling parts of a company. We found many legal cases regarding the applicability of this law and several guides by business associations that provide advice on how to avoid the law when outsourcing parts of the workforce.

To obtain a broader estimate of the effect of outsourcing on wages, we use the same approach as in [Dube and Kaplan \(2010\)](#) and estimate the wage differentials for outsourced workers defining outsourcing based on workers' occupation and industry codes.<sup>29</sup> FCSL services workers are identified by their three-digit occupation codes. Outsourced workers are those who are employed at service contractors, that is, establishments whose main business is providing services to other firms, identified by their industry codes, while nonoutsourced workers are those who are employed in-house at non-business service firms. We take the universe of workers in FCSL occupations and estimate an equation of the form:

$$(3) \quad \ln(w_{it}) = \gamma Outsourced_{it} + \alpha_i + \theta_t + x'_{it}\beta + \varepsilon_{it},$$

where  $w_{it}$  is the daily wage of worker  $i$  in year  $t$ ,  $Outsourced_{it}$  is an indicator variable that takes a value of 1 if the worker is employed at a business service firm in time  $t$  and 0 otherwise,  $\theta_t$  account for year-level shocks that affect all workers, and individual fixed effects  $\alpha_i$  control for fixed and  $x_{it}$  for time-varying individual characteristics.<sup>30</sup> Using this method, we identify the impact of outsourcing on wages using the movement of FCSL workers between outsourced and nonoutsourced status, rather than through the timing of outsourcing as in the on-site outsourcing analyses. For the main specifications we do not include FCSL workers working for temp agencies, but provide separate results of the effect of working for a temp agency.

29. [Dube and Kaplan \(2010\)](#) restricted their analysis to janitors and security guards; we additionally analyze the effect of outsourcing on workers in food and logistics occupations. The approach in Dube and Kaplan is in turn based on [Abraham \(1990\)](#). Although both use CPS data, Abraham did not control for selection, while Dube and Kaplan use the short panel structure of the CPS to estimate specifications with individual fixed effects and thus control, in part, for selection into outsourcing.

30. We control for age, age squared, and age cubed, all interacted with education dummy variables. Controlling for full-time status or dropping part-time workers makes little difference in the results. In the food regressions, we omit workers employed by restaurants and cafés because they would not be considered outsourced nor to be providing services to a firm, since food services is the firm's main business. In addition, while the logistics, cleaning, and security regressions use all years of data from 1975 to 2008, food regressions start in 1999 since before then industry codes did not differentiate between canteens, catering, and restaurants.



Results are shown in the bottom panel of [Table II](#). We find that workers in FCSL occupations employed in business service firms have wages that are about 9% lower than nonoutsourced workers in the same occupations, a very similar point estimate as our estimate for the long-run wage loss after on-site outsourcing (Panel B). Cleaning workers face the largest losses from being outsourced, a difference of 17%, and security workers face a 12% loss. Food and logistics workers at business service firms have wages that are about 3% lower than those employed in-house. In the last column, we estimate the wage effect of working for a temp agency. For this regression, we include only individuals who have worked in the same occupation in a temp agency as well as in other industries.<sup>31</sup> Working for a temp agency is associated with a 26% wage penalty, the largest of any type of business service firm, but these larger losses may be due to the more volatile nature of hours at temp agencies.

Although the Dube-Kaplan approach likely covers the effect of outsourcing more generally and offers higher external validity than the on-site outsourcing estimates, the downside is that there is more potential for selection into who becomes an outsourced worker. While individual fixed effects control for permanent differences between workers, it may be that workers work for business service firms after some kind of shock, such as a protracted unemployment spell associated with human capital depreciation and loss in earnings potential. This could lead to downward biases in the wage estimates. In addition, in this type of estimation we have no information about job or workplace characteristics.<sup>32</sup> To the extent that job characteristics are worse at business service firms, this could lead to an underestimate of the true loss in compensation or utility. It is therefore reassuring that despite the differences in methodology and sample, the two approaches yield very similar results.

31. Instead of individual fixed effects, we control for individual occupation fixed effects.

32. [Berlinski \(2008\)](#) uses the Contingent Workers and Alternative Employment Arrangements supplement to the CPS, which contains information on industry of assignment for workers employed by contract firms, and thus can estimate the effect of outsourcing on wages controlling in part for job conditions. However, because his data is not a panel, he cannot control for selection into outsourcing and the sample contains fewer than 100 outsourced workers.

## IV. OUTSOURCING AND FIRM RENTS

The wage losses associated with outsourcing that we found in the previous section are hard to reconcile with labor markets being fully competitive. Instead, these wage losses suggest that firms are constrained in their wage-setting process, making it difficult to cut wages to workers in these occupations while they are employed in-house. For example, firms may be required to pay higher wages to all employees because of collective bargaining agreements, which are typically set at the industry level in Germany. Alternatively, firms may pay efficiency wages to some workers for various reasons. For example, at larger firms workers may be hard to monitor, and higher wages may discourage shirking. At firms that employ a large number of high-skilled, high-wage workers, lower-skilled workers may receive a wage premium in the interest of fairness or equity. Outsourcing provides a way for firms to get around these constraints: by moving these jobs outside the boundary of the firm, they can be excluded from receiving these wage premia or rents. In this section we show that outsourcing is indeed associated with a loss of firm rents, and provide pieces of evidence suggesting that firms may outsource to avoid paying establishment-level wage premia.

#### IV.A. *Estimating the Loss in Firm Rents Using AKM Decomposition*

We follow [Abowd, Kramarz, and Margolis \(1999\)](#) (henceforth [AKM](#)) and [CHK](#) and estimate a full worker-establishment fixed effect decomposition using the universe of social security data in Germany:

$$(4) \quad \ln(w_{it}) = \psi_{J(i,t)} + \alpha_i + \theta_t + x'_{it}\beta + \varepsilon_{it},$$

where  $\psi_{J(i,t)}$  represents a vector of establishment fixed effects,  $\alpha_i$  a vector of individual fixed effects, and  $\theta_t$  and  $x'_{it}\beta$  are year effects and time-varying observables. We closely follow [CHK](#) in the estimation of this model. First, we impute wages above the social security maximum in Germany using their algorithm. Like [CHK](#), we estimate the model on all full-time male workers, but rather than breaking the data up into different periods, we pool the entire time period 1979 to 2009, which covers around 480 million

observations.<sup>33</sup> The establishment and worker fixed effects are only separately identified within a connected set of establishments that are linked through workers moving between them. We therefore restrict our analysis to this largest connected group, which in our data covers around 90% of observations (and all workers in our on-site outsourcing sample). Identification of the [AKM](#) model requires that workers do not move across establishments in a way that is systematically related to individual productivity shocks or trends. The underlying assumptions are discussed in detail in [CHK](#), who provide various tests suggesting that these assumptions are justified.

The estimated establishment fixed effect—which we refer to as the “[AKM](#) effect”—provides a measure of the wage premium paid by each establishment. As a first test whether the [AKM](#) decomposition provides a useful measure of wage premia for the group of workers we are interested in, we estimated the [AKM](#) model separately, once excluding FCSL workers and once only using FCSL workers. After correcting for measurement error, we found that the [AKM](#) effect estimated for FCSL workers is very highly correlated with the [AKM](#) effect estimated for all other workers. On average, if an establishment pays around 1% higher wages to non-FCSL workers than other establishments, it also pays around 0.8% higher wages to FCSL workers than other establishments (see [Online Appendix Figure A-8](#)).

The fact that even FCSL workers, who are on average much lower-wage workers than non-FCSL workers, are paid a large wage premium of similar level as non-FCSL workers is quite striking. In particular when we estimate the [AKM](#) model on all workers, FCSL workers have on average individual effects that are 19 log points lower than non-FCSL workers.<sup>34</sup> This suggests

33. Since for some of our analysis in the next sections we are interested in following workers over time after outsourcing, we want to have [AKM](#) effects that are comparable across all periods, otherwise there would be large jumps at the transitions from one period to the next. In practice this does not make a significant difference to our results. As [Dustmann, Ludsteck, and Schönberg \(2009\)](#) and others note, there was a change in the way bonuses were recorded in the IEB in 1984. We found that this did not affect our estimates of the [AKM](#) decomposition (where we control for year dummies in any case). When we did the same analysis excluding the years prior to 1985 the results were virtually identical.

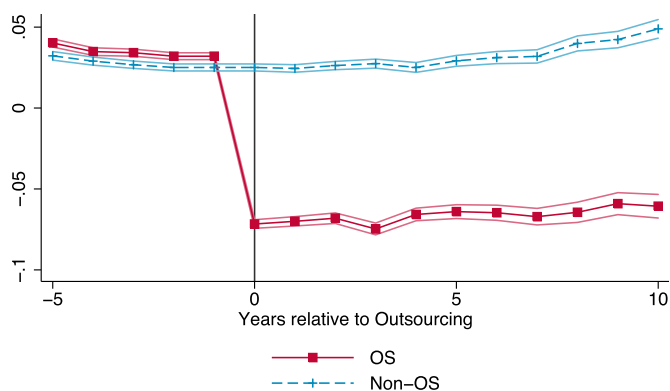
34. This is similar to the analysis in [Card, Cardoso, and Kline \(2016\)](#) contrasting [AKM](#) effects estimated separately for men and women using Portuguese data.

that firms do pay wage premia across the board and may find it difficult to exclude low-skill workers from these premia if they are employed directly by the firm. In the following analysis we will use [AKM](#) effects estimated by pooling FCSL and non-FCSL workers, which will increase the precision of the estimates (relative to using only FCSL workers). Given the high correspondence between [AKM](#) effects for FCSL workers and non-FCSL workers, these joint [AKM](#) effects provide a good and relatively precisely measured proxy for the rents workers receive at individual establishments.

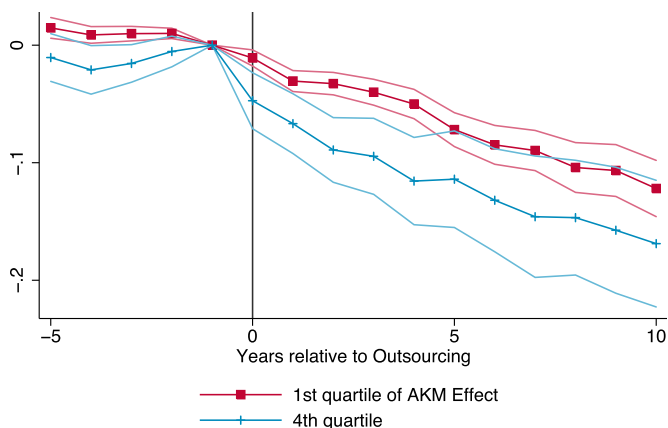
#### *IV.B. Firm Rents of Workers at Business Service Firms*

Having obtained a measure of firm rents from the [AKM](#) model in the form of the estimated establishment effects, we can now investigate how these rents differ for in-house workers and outsourced workers at business service firms. We first explored whether the estimates from the [AKM](#) model are consistent with our estimates of wage losses associated with on-site outsourcing events by investigating how the average [AKM](#) effect for workers changes after outsourcing. [Figure VI](#), Panel A shows that while prior to the outsourcing event both the outsourced and the control group are employed at establishments with very similar [AKM](#) effects, the average [AKM](#) effect falls by almost exactly 10 log points for the outsourced group after they are outsourced. Since the [AKM](#) effect does not vary within establishment ID, the [AKM](#) effect cannot gradually adjust and we would expect it to pick up the long-term wage differential. It is therefore striking that the drop corresponds almost precisely to the long-run wage losses for outsourced workers from the previous section.

Of course the flow of outsourced workers is part of the variation that identifies the [AKM](#) effect in the first place, but the [AKM](#) effect relies on a lot more information because it incorporates all worker transitions during the existence of an establishment, including many workers in occupations that are never outsourced. In some ways the fact that the loss in [AKM](#) effects is so similar to the wage losses we find can be viewed as confirmation of the [AKM](#) model, because arguably the variation underlying the wage losses after outsourcing is better understood and more exogenous. Either way, the fact that the loss in [AKM](#) effects are so similar suggests that the [AKM](#) model provides a useful framework for estimating the rents that are likely lost during outsourcing, a fact



(A) Evolution of AKM Effects Before and After Outsourcing



(B) Wage Losses by AKM Effect of Outsourcing Establishment (1st / bottom vs. 4th / top Quartile)

## FIGURE VI

## On-site Outsourcing and Establishment (AKM) Effects

Panel A shows the average estimated establishment (AKM) effect of the establishments where the workers in the outsourced and control groups are working before ( $t = -1$ ) and after ( $t = 0$ ) the outsourcing event. The AKM effect is estimated from a wage regression including a full set of worker and establishment fixed effects using the universe of wage records for full-time male workers in Germany. Panel B shows regression estimates of the effects of being outsourced on log wages before and after the outsourcing event separately for workers who are outsourced from high and low AKM effect establishments. The bands are 95% confidence intervals (standard errors clustered on the level of the outsourcing establishment). The sample is restricted to workers who are at the same establishment as in time  $t = -1$  in all years before outsourcing, and in the same establishment as in time  $t = 1$  in all years after outsourcing.

that will be very helpful when we explore the relationship between outsourcing and the general wage structure.

If the loss of firm rents is indeed the primary driver of wage losses for outsourced jobs, one would expect that outsourcing events at high rent firms would lead to larger drops in wages. [Figure VI](#), Panel B shows the effects of outsourcing separately for establishments in the bottom (1st) and top (4th) quartiles of the [AKM](#) effects distribution (within the matched establishments). Jobs outsourced by establishments in the bottom quartile experience smaller wage losses in every year. For example, five years after outsourcing, jobs outsourced from the low [AKM](#) effect establishments experienced wages about 8% lower relative to year  $-1$  and compared to the comparison group, while those from the highest [AKM](#) effect establishments had losses of about 11%.<sup>35</sup>

We can also use the [AKM](#) effects to estimate the difference in rents when workers move from in-house to outsourced jobs and vice versa. To do so we estimated [equation \(3\)](#) with the estimated establishment fixed effects  $\hat{\psi}_{J(i,t)}$  as the dependent variable (See [Online Appendix Table A-10](#)). If we do so without worker fixed effects (but with basic age and education controls), this yields the average difference in rents between outsourced and in-house workers conditional on basic demographics. Overall, outsourced FCSL workers have [AKM](#) effects that are about 12 log points lower than FCSL workers who are in-house. When we include individual fixed effects we obtain the difference in [AKM](#) effects between establishments where workers are actually moving between outsourced and nonoutsourced jobs. Here the loss in [AKM](#) effect for workers at business service firms is slightly smaller with about a 7 log point difference, with losses ranging from 20 log points for security workers to 4 log points for logistics workers.

#### IV.C. Firm Rents and the Decision to Outsource

If the wage losses associated with outsourcing are in fact due to workers being excluded from rents, then this could be a reason for firms to outsource. While fully analyzing what drives the firm decision to outsource is beyond the scope of the article, we can

35. We also found that workers who get outsourced from high [AKM](#) firms experience significantly larger drops in the [AKM](#) effect of their employer after outsourcing. For example logistics workers outsourced from establishments in the highest quartile of [AKM](#) distribution lose around 14 log points, whereas those from the lowest only around 2 (see [Online Appendix Figure A-11](#)).

test whether firms that would have more to gain in terms of wage savings due to outsourcing are more likely to outsource.<sup>36</sup> Since on-site outsourcing is a very rare event and since we believe most outsourcing is done by laying-off workers and directly bringing in a business service firm, we create a more general definition of outsourcing to increase power. We define a “general” cleaning outsourcing event as the occurrence of an establishment losing the last of its cleaning workers, conditional on having at least five workers in cleaning occupations in the past five years and on not downsizing by more than 50%.<sup>37</sup> General outsourcing events are defined analogously for food, logistics, and security services. This captures situations where an establishment lays off all of its workers providing a particular service, either in one large layoff event or over a few years.

Using this definition, we estimate linear probability models of whether establishment characteristics typically associated with higher firm rents are associated with outsourcing. In these regressions, observations are at the establishment-year level, and the dependent variable takes a value of 1 if the establishment experienced either an on-site outsourcing event or a generalized outsourcing in the following year and 0 otherwise. The sample is restricted to establishments with at least 50 employees and excludes East Germany prior to 1997. We control for state, year and industry fixed effects.

Table III, columns (1) through (4) show the results using four different right-hand-side variables as proxies for firm rents. Larger establishments and those with a higher estimated AKM effect are more likely to outsource, whereas the coefficient on log average establishment wage is positive but insignificant. The wage premium paid to FCSL workers—calculated as the average wage paid to workers in FCSL occupations at the establishment divided by the average wage paid to FCSL workers employed at business service or temp firms in the same county and year—is also

36. For a general discussion of why firms choose to outsource see for example Abraham and Taylor (1996), Houseman (2001), or Berlingieri (2015).

37. More specifically, an establishment is said to have outsourced in time  $t$  if: it does not employ any workers in cleaning occupations in time  $t$ ; it employed at least one cleaning worker in time  $t - 1$ , and at some point in the past five years it employed at least five such workers; the establishment had at least 50 employees in time  $t - 1$ , and its size did not shrink by 50% or more between time  $t - 1$  and  $t$ ; and the establishment is not in an industry associated with cleaning. We also only keep the earliest instance of cleaning outsourcing for any establishment.



TABLE III  
THE EFFECT OF PROXIES FOR WAGE PREMIA ON THE PROBABILITY OF OUTSOURCING

	All establishments				Estab. Panel	
	(1)	(2)	(3)	(4)	(5)	(6)
Log estab size	0.0084*** (0.00016)					
Log avg estab wage		0.00044 (0.00032)				
AKM effect			0.0046*** (0.00057)			
Wage premium to FSCL workers over BSF firms				0.0015*** (0.00026)		
Collective agreement					0.0091*** (0.0013)	
Pay wages above standard						0.0029** (0.0014)
Observations	2,086,507	2,086,505	1,892,408	1,769,077	68,577	68,595
Mean of dep var	0.012	0.012	0.011	0.014	0.02	0.02
Mean of indep var	4.788	4.285	0.003	1.162	0.81	0.34

Notes. Standard errors, in parentheses, are clustered at the establishment level. All regressions exclude East Germany before 1997 and establishments with fewer than 50 workers. Columns (5)–(6) include only establishments included in the IAB Establishment Panel Survey. All regressions control for state dummies, year dummies, and three-digit industry fixed effects. Dependent variable = 1 if the establishment was involved in either a general outsourcing event or an on-site outsourcing event in the following year, and 0 otherwise. “Collective agreement” = 1 if the establishment responded that they were bound by a collective agreement. “Pay wages above standard” = 1 if the establishment responded that they pay salaries and wages above the collectively agreed scale. “Wage premium to FSCL workers over BSF firms” is the ratio of the average wage paid to food, security, cleaning, and logistics workers at the establishment to the average wage paid to food, security, cleaning, and logistics workers employed by business services firms (BSF) or temp agencies in the same county and year. \* $p < .1$ , \*\* $p < .05$ , \*\*\* $p < .01$ .

positive and significant, indicating that those establishments that may save more money in wages by outsourcing their FCSL to a business service firm are likely to do so.

To obtain additional proxies for firm rents, we augment our data with information from the IAB Establishment Panel Survey, an annual survey of approximately 16,000 employers that has taken place since 1993. Column (5) shows that establishments covered by collective bargaining agreements are also more likely to outsource FCSL workers, conditional on year, industry, and state. Finally, column (6) shows that establishments that responded that they paid wages above the levels set by collective

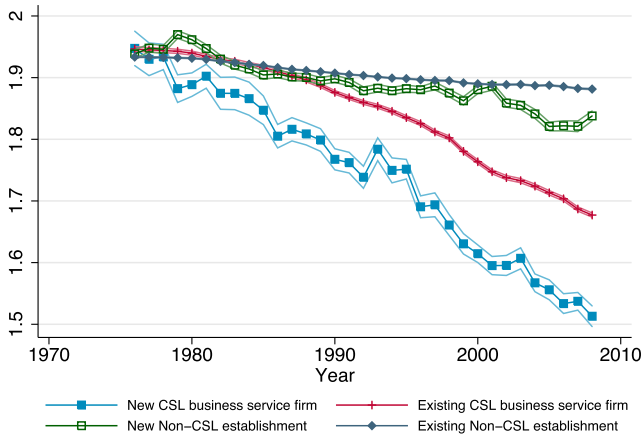
bargaining agreements were also more likely to outsource. Although one should be cautious to interpret this evidence as causal, we view [Table III](#) as suggestive that excluding low-wage workers from firm rents is part of the motivation underlying outsourcing decisions.

Although it is plausible that firms outsource to avoid paying rents, this does not explain why outsourcing has increased over time. A possible reason is that new business service firms have been entering the market competing for contracts. As the environment became more competitive between business service firms, this may have increased the pressure to lower prices and made outsourcing more attractive. Indeed [Figure VII](#), Panel A shows that the [AKM](#) effects of new business service firm establishments have been falling substantially over time, with the newest entrants paying much lower wage premia compared to both the earlier cohorts of business service establishments and non business service establishments. [Figure VII](#), Panel B on the other hand illustrates how the market for business services has become increasingly competitive over time, by plotting the average county-level market concentration Herfindahl index for business service firms by year.<sup>38</sup> For cleaning and security, business service firm competition on the local level has increased markedly, which may have driven down prices and wages. For food services we have a much shorter time series, but competition has increased as well, whereas for logistics business service firms, market concentration has always been relatively low, likely because this is a more heterogeneous sector.

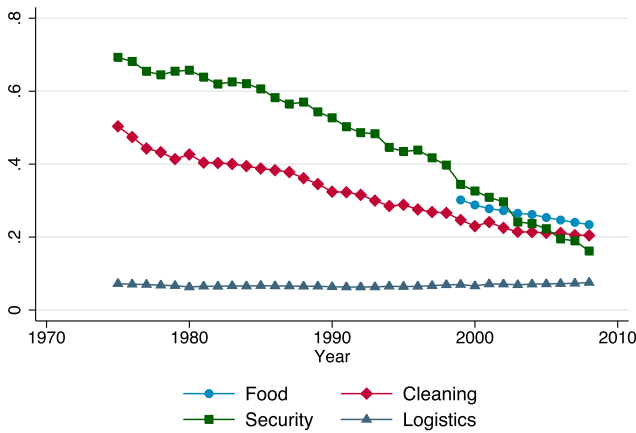
## V. THE EFFECTS OF OUTSOURCING ON THE EMPLOYMENT AND WAGE STRUCTURE

Germany experienced a substantial increase in wage inequality over the past decades, comparable in magnitude to the changes in the U.S. labor market (see [Autor, Katz, and Kearney 2008](#); [Dustmann, Ludsteck, and Schönberg 2009](#)). This has been partly due to a considerable decline in real wages at the lower end of the wage distribution ([Dustmann et al. 2014](#)). Furthermore, [CHK](#) showed that a large share of the increase was driven by increased

38. Firms should typically report all workers within the same county under a single establishment identifier, so we can compute market concentration on the county level but unfortunately not on any higher level.



(A) AKM Effects of New and Existing Establishments by Year



(B) Market Concentration of Business Service Firms by Year

FIGURE VII

Market Entry of New Establishments of Business Service Firms over Time

Panel A shows the [AKM](#) effect (estimated over the entire duration of an establishment's existence) of establishments by the year the establishment was founded (first appears in the data). The figure is restricted to establishments with at least 10 employees in West Germany 1976–2008. Panel B shows the average county-level index of employment weighted market concentration among business service firms. The index can be interpreted as the probability that two randomly picked workers at business service firms in a particular year and county are working for the same firm. The data are restricted to West Germany 1975–2008.

dispersion of establishment wage premia—as measured by the [AKM](#) effect—as well as stronger assortative matching between workers and firms.<sup>39</sup> In this section we explore the extent to which outsourcing may have been a contributor to these broad changes in the wage structure.

#### *V.A. Decoupling of Wages in Labor Services*

[Dustmann et al. \(2014\)](#) document a dramatic decline of real wages at the lower end of the wage distribution since the early 2000s. After a decade of stagnation between 1990 to 2000, real wages at the 15th percentile fell by around 10% between 2000 and 2008. This pattern is also apparent among the occupations we study in this article: [Figure VIII](#), Panel A shows the evolution of real wages in CSL occupations from 1975 to 2009.<sup>40</sup> Real wages in CSL occupations moved in tandem with wages in other occupations until around 1990. Even for cleaners, where mean wages were 50 log points lower during the early period, wages grew at approximately the same rate as for the other occupations. This pattern changed from around 1990 onward, when wage growth for CSL occupations decoupled from the general wage evolution: while wage growth began to slow across all occupations since 1990 and stagnated over the past 10 years, real wages in CSL occupations declined by 20 log points over the past 20 years. Note that this decoupling occurred at the same time as the general rise in outsourcing shown in [Figure II](#).

To provide further evidence that outsourcing is part of the explanation for this decoupling, [Figure VIII](#), Panel B shows wages for outsourced and nonoutsourced workers in CSL occupations as well as for other occupations. Both outsourced and nonoutsourced wages move in parallel with the general wage evolution until 1990. From 1990 onward CSL wages diverge, but more so for outsourced jobs. This is consistent with the explanation that outsourcing allowed firms to indirectly cut wages for labor services

39. [Barth et al. \(2016\)](#) show that rising wage dispersion between establishments also plays an important role in explaining the rise in wage dispersion in the United States. Using a similar approach to the one pursued here and in [Card, Heining, and Kline \(2013\)](#), [Song et al. \(2016\)](#) show that while the distribution of firm effects appears to have remained fairly stable over the past decades, assortative matching of high-wage workers to high-wage firms has increased substantially.

40. Since we can only identify food business service firms in the industry codes since 1999, we do not separate out food workers for this part of the analysis.

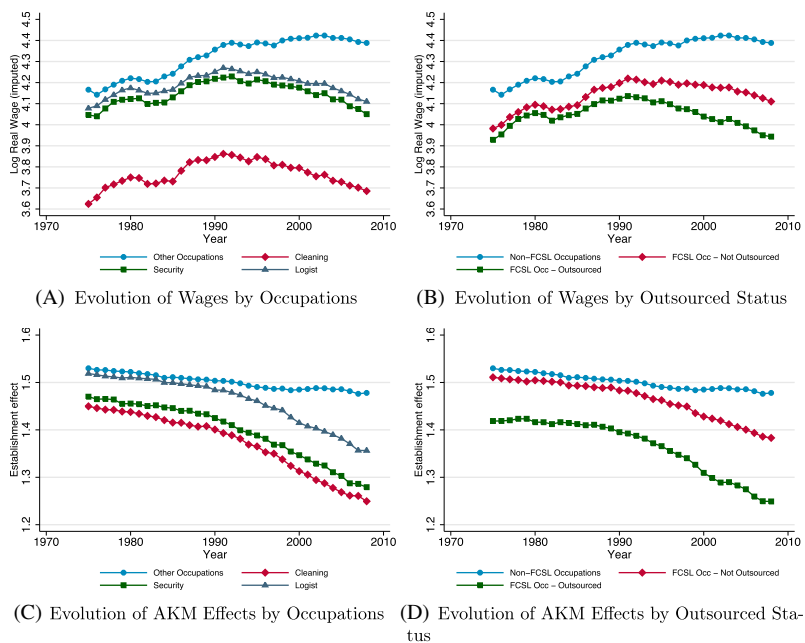


FIGURE VIII

Decoupling of Wages in Logistics, Cleaning, and Security Occupations from General Wage Growth

The figures show how wages in cleaning, security and logistics (CSL) occupations have evolved relative to wages in other occupations. Panel A shows the log wage for the different occupations. Panel B shows how wages for CSL workers have evolved depending on whether they are outsourced or not, relative to workers in other (non-CSL) occupations. Panel C shows the establishment (AKM) effect by occupation, and panel D shows the AKM effects for CSL workers by outsourcing status and the AKM effects for all other occupations.

by a substantial amount. The fact that wages for nonoutsourced CSL workers also fell may be in part a selection effect, where (as we showed in the previous section) the establishments with the highest wage premia were most likely to outsource, and in part due to the threat of outsourcing allowing employers to cut wages to nonoutsourced workers.

The role of establishment wage premia for CSL wages is illustrated in Figure VIII, Panel C, which shows the AKM effects for CSL and other occupations. AKM effects for cleaning and security workers are around 7 log points lower in 1975 compared to the other occupations, but move in parallel until 1990, when

they begin to fall rapidly until the gap is more than 20 log points in 2008. For logistics workers the pattern is even more striking, since until 1990 the AKM effects for logistics workers were essentially identical to average AKM effects in the general population but then began to diverge sharply during the 1990s and 2000s to a gap of around 15 log points. In other words, in the 1970s and 1980s logistics workers were employed in firms that paid the average wage premium in the economy, but by the late 2000s they were employed in firms paying around 15% lower wages.

Figure VIII, Panel D shows the evolution of AKM effects broken up by outsourcing status. While outsourced workers in CSL occupations always worked at establishments that paid significantly lower wage premia, the differential remained roughly constant until 1990. From 1990 onward outsourced workers are working at increasingly worse firms, with wage premia declining by almost 15 log points. Nonoutsourced workers are also losing wage premia relative to the general population, with a gap of close to 10 log points by 2008. This suggests that, consistent with the results in Section IV, the firms that are not outsourcing are those that are already paying very low wage premia and therefore face weaker incentives to outsource.

### *V.B. Changes in the Employment Structure*

CHK documented that German workers are increasingly concentrated in establishments with homogeneous workforces, and Handwerker and Spletzer (2016) report similar trends for the United States. Outsourcing provides a natural explanation for this, since business service firms are much more homogeneous (for example, in the typical cleaning business service firm about 60% of the employees are cleaners). Moving workers from heterogeneous lead employers to business service firms that employ largely the same occupations as the outsourced worker will increase the overall occupational assortativeness. To gauge the possible impact of outsourcing of CSL workers on the structure of employment, we simulate for each establishment in Germany a counterfactual number of workers in CSL occupations based on the distribution of CSL workers across industry by establishment size (net of CSL workers) cells in 1975. For example if a car manufacturing establishment with 100 non-CSL workers in 1975 had 12 workers in CSL occupations then we assign the same number of CSL workers to establishments in the same cell in future

years.<sup>41</sup> Figure IX, Panel A shows the occupational concentration across establishments over time. We use the average Herfindahl index across establishments, which measures the probability that two randomly chosen workers from the same establishment have the same (one-digit) occupation. Occupations are much more concentrated across establishments over time. Moreover the simulation suggests that almost half of that increase can be explained by outsourcing of CSL workers over the time period.

Similar to other countries like the United States (Charles, Hurst, and Notowidigdo 2016), Germany has experienced a massive decline in manufacturing employment over the past decades. However, this could partly be driven by changes in the employment structure where increasingly jobs that used to be done in-house (and thus would count as manufacturing sector jobs) are now provided by business service firms (and thus count as service sector employment). Figure IX, Panel B shows the actual and counterfactual evolution of manufacturing employment in West Germany. Manufacturing employment declined from 7.5 million to just over 5 million workers between 1975 and 2008, similar to the decline in the United States. Our simulation suggests that if the distribution of CSL workers across establishments had not changed, then an additional 250,000 workers would be employed in manufacturing, which explains about 11.2% (3.4 percentage points) of the overall decline of 30.4%.

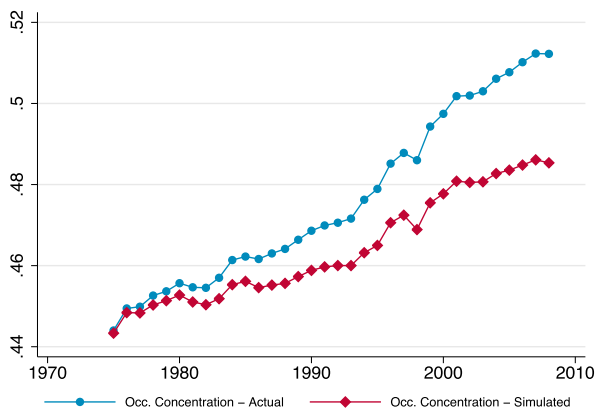
### *V.C. The Contribution of Outsourcing to the Rise in Wage Dispersion*

The main findings in CHK were that dispersion in AKM effects and assortative matching between person and AKM effect increased substantially over the past two decades, accounting for the lion's share of the increase in wage dispersion. Our results from the previous sections suggest that outsourcing may explain these developments in several ways.

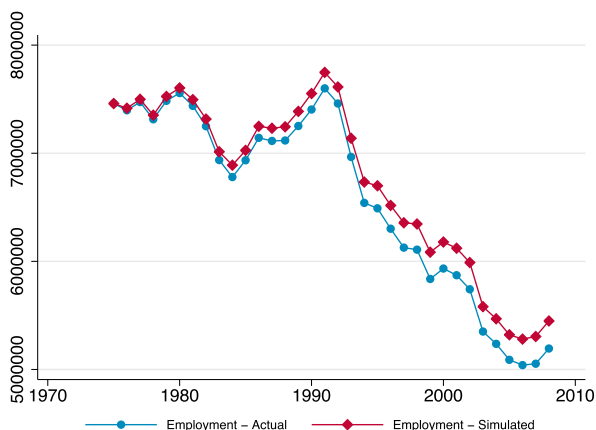
On the one hand, outsourcing changes the allocation of workers across establishments, with outsourced workers moving to establishments at the lower end of the AKM effects distribution. Since workers are moving from throughout the distribution to

41. For the simulation we calculate the Herfindahl index for all possible values of numbers of CSL workers of an establishment and then integrate up to the expected index for each establishment using the empirical distribution from 1975. Otherwise the index would be mechanically downward biased.





(A) Occ. Concentration, Actual and Simulated (without increase in outsourcing of CSL workers)



(B) Manufacturing Employment, Actual and Simulated (without increase in outsourcing of CSL workers)

### FIGURE IX

#### The Effect of Outsourcing of Cleaning, Security, and Logistics (CSL) Workers on the Employment Structure

Panel A shows the Herfindahl index of occupational concentration in establishments with at least 50 employees. The index shows the probability that two randomly selected workers from the same establishment have the same (one-digit) occupation. Panel B shows total employment in West German manufacturing establishments. The simulated time series in both figures shows the counterfactual where we compute the expected number of CSL workers for each establishment under the assumption that the distribution of CSL workers (relative to non-CSL workers) did not change within establishment size and industry cells relative to 1975.

the bottom, this will lead to an increase in the dispersion of the employment-weighted AKM effects distribution. Furthermore, because these tend to be low-wage workers, this will also lead to the concentration of low person fixed effects workers in firms at the bottom of the AKM distribution, increasing assortative matching. On the other hand, although this can occur even if the unweighted distribution of AKM effects remains constant, there are reasons to assume that outsourcing affected the wage premia of establishments directly. First, if rents arise from profit sharing, then outsourcing would lead to profits being shared among fewer workers, and AKM effects may rise for the nonoutsourced workers. Second, if within-firm wage inequality is constrained due to collective bargaining or efficiency wage/fairness considerations, then after a firm outsources these constraints may be loosened and wages may also rise for the nonoutsourced workers. Third, the creation of new business service firms who likely pay low or no wage premia corresponds to the entry of new very low AKM effect firms, thus spreading out the AKM distribution. Finally, outsourcing may shift bargaining power away from workers toward firms, reducing wage premia in firms where outsourcing is a threat.

To illustrate the extent to which outsourcing contributes to the changes in the wage structure, we follow the variance decomposition proposed in CHK based on the AKM decomposition in equation (4):

$$(5) \quad \text{Var}(\ln(w_{it})) = \text{Var}(\psi_{J(i,t)}) + \text{Var}(\alpha_i) + 2\text{Cov}(\alpha_i, \psi_{J(i,t)}) + \text{Var}(\varepsilon_{it}).$$

The variance of log daily wages can thus be decomposed into the variance of the establishment effect ( $\psi_{J(i,t)}$ ), the variance of the individual effect ( $\alpha_i$ ), and the covariance between the two.<sup>42</sup> We focus on the wage distribution for full-time male workers in West Germany here, since labor force participation in this group remained relatively stable and working part-time is less prevalent, thus reducing selection concerns. This also allows for easier comparison with the existing literature. We also use 1985 as the starting year, since that is the year in which the IEB data began to include bonuses in the wage variable, leading to a break

42. For the sake of brevity we ignore the components associated with time-varying observables  $x'_{it}\beta$ . As CHK showed these components play almost no role in explaining changes in wage dispersion over time.

TABLE IV  
THE EVOLUTION OF THE WEST GERMAN WAGE STRUCTURE FROM 1985 TO 2008  
AND THE ROLE OF OUTSOURCING

	Wage structure 1985	Wage structure 2008	Change from 1985 to 2008	Percent of change explained
Panel A: Observed				
Total variance of log daily wages	0.132	0.205	0.073	
Variance of estab effects	0.0289	0.0547	0.0258	
2 × cov(person, estab effect)	−0.0050	0.0426	0.0475	
85-15 log wage gap	0.655	0.934	0.279	
85-50 log wage gap	0.385	0.512	0.127	
50-15 log wage gap	0.270	0.422	0.152	
Panel B: Counterfactual I: DFL reweighting of CSL workers				
Total variance of log daily wages	0.132	0.198	0.067	8.9
Variance of estab effects	0.0289	0.0525	0.0236	8.4
2 × cov(person, estab effect)	−0.0050	0.0381	0.0431	9.4
85-15 log wage gap	0.655	0.916	0.260	6.7
85-50 log wage gap	0.385	0.503	0.118	7.1
50-15 log wage gap	0.270	0.412	0.142	6.4
Panel C: Counterfactual II: adjusting daily wage and AKM effect of additional outsourced workers				
Total variance of log daily wages	0.132	0.200	0.068	7.1
Variance of estab effects	0.0289	0.0518	0.0229	11.2
2 × cov(person, estab effect)	−0.0050	0.0408	0.0457	3.8
85-15 log wage gap	0.655	0.925	0.270	3.3
85-50 log wage gap	0.385	0.510	0.125	1.6
50-15 log wage gap	0.270	0.415	0.144	4.7
Percent working in CLS occupations	0.127	0.138	0.011	
Percent outsourced	0.039	0.099	0.060	

*Notes.* Sample are all full-time male workers in West Germany, excluding workers in food occupations or food industries. Panel A shows the observed wage structure in 1985 and 2008 as well as the estimated components due to the variance of establishment effects and the covariance of establishment with person effects. 85–15 log wage gap refers to the difference between the 85th and 15th percentiles of log daily wages. Panel B shows the counterfactual where workers in cleaning, security, and logistics (CLS) occupations in 2008 are reweighted to keep them at the same percentiles of the AKM distribution as in 1985 using DFL reweighting (see text). Panel C shows the counterfactual where a random fraction of workers in CSL business service firms and temp agencies are “insourced” in 2008 by adding 10 log points to their log wage and establishment effect. The fraction to be insourced is picked so that the fraction of outsourced workers remains at the 1985 level.

in the time series of wage dispersion (see [Dustmann, Ludsteck, and Schönberg 2009](#)). Results for women are provided in the [Online Appendix](#). Table IV, Panel A shows that the variance of log daily wages increased by around 0.073 from 1985 to 2008, around

one third of which was due to the increase in the variance in establishment effects and slightly less than half of it due to the increase in the covariance term.

We construct a counterfactual distribution of log wages and *AKM* effects, where we reweight workers in CSL occupations so that CSL workers are kept at constant locations of the *AKM* distribution. For example, if in 1985,  $x\%$  of CSL workers were in the 90th percentile of the *AKM* distribution, we reweight CSL workers in 2008 so that  $x\%$  are in the 90th percentile at that time as well. To construct these counterfactual weights, we use the reweighting method of DiNardo, Fortin, and Lemieux (1996) (DFL), where the conditioning variables are indicators for the deciles of the *AKM* distribution interacted with a dummy for being in a CSL occupation.<sup>43</sup> The results of this reweighting exercise are shown in Figure X. The solid line in Panel A shows the variance of log wages by year for full-time male workers excluding workers in food industries or occupations. This figure documents the dramatic increase in inequality since the 1990s. Panels B and C show the two components of this increase highlighted by *CHK*: the variance of the establishment effects and the covariance between person and establishment effect. The dashed line shows the reweighted distribution that holds the location of CSL workers in the *AKM* distribution constant at 1985 levels. Overall reweighting reduces the increase in the variance of wages by about 10%. As Panels B and C show, reweighting reduces the variance and the covariance terms, consistent with our hypothesis that outsourcing contributed significantly to the increases in wage premia and assortative matching. Table IV, Panel B confirms this visual impression, showing that the DFL reweighting exercise can account for 9% of the rise in the variance of log wages and similarly for the *AKM* effect and covariance term.

An alternate way to construct a counterfactual is to simply use the point estimate for the loss in *AKM* effects at outsourcing, around 10 log points, and add it back to the *AKM* effects of

43. There are several other ways one could construct such a counterfactual. One choice would be to simply keep the share of outsourced workers constant. However, since outsourced workers are typically displaced from high *AKM* firms, such a simple reweighting scheme would reweight the outsourced workers to the nonoutsourced workers later in the sample who are at very low *AKM* firms. Thus this completely ignores the selection effect of who is outsourced. Our method, on the other hand, simply assumes that without outsourcing, the allocation of CSL workers across the *AKM* distribution would have remained unchanged.

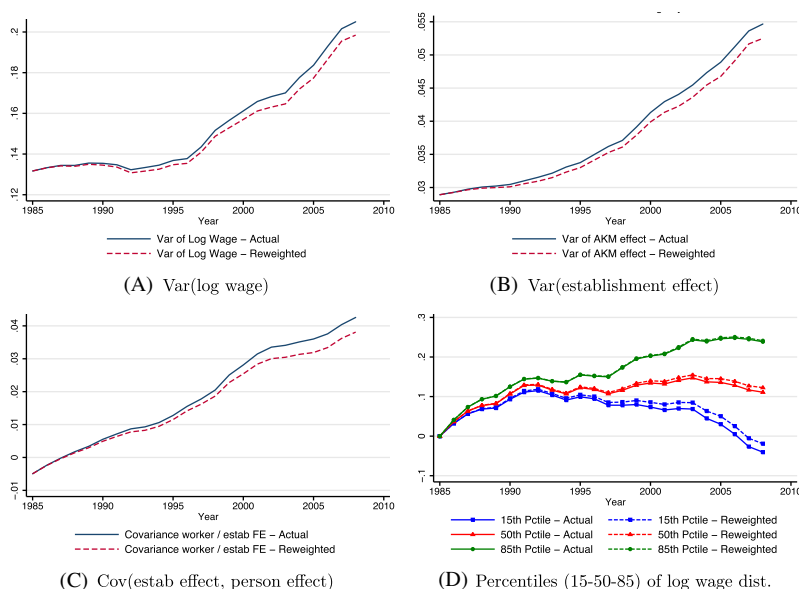


FIGURE X

### The Evolution of the West German Wage Structure for Men, Actual and DFL Reweighted

The figures show how the variance of log daily wages and its components have evolved over time for full-time male workers in West Germany. Panel A shows the variance of log wages, Panel B shows the variance of the estimated establishment effect (AKM effect) over time, and Panel C the covariance between establishment effects and the individual fixed effect. Panel D shows percentiles of the log wage distribution. The solid line is the actual evolution over time, while the dashed line shows the counterfactual evolution if outsourcing of cleaning, security and logistics workers had remained constant at the 1985 level, where the counterfactual is constructed using the reweighting method described in the text.

workers who are outsourced on top of the outsourcing level in 1985. As Table IV, Panel C shows, this leads to qualitatively similar results. The downside of this procedure is that it does not account for the fact that the composition of nonoutsourced workers has changed dramatically: even the nonoutsourced CSL workers are now working at much worse establishments, likely because the high-paying establishments were the first to outsource.

Although we prefer the reweighting procedure, even this method is likely just a lower bound of the impact of outsourcing on the wage structure. First, this exercise is holding the (unweighted) distribution of AKM effects constant. As described

already, there are good reasons to assume that outsourcing may have affected the AKM effects of establishments directly. These equilibrium adjustments of wage premia are important, but modeling them would require a more structural approach beyond the scope of this article. Second, our analysis only uses CSL occupations, and outsourcing occurred for other low-skill labor services as well that we do not capture here.

One would expect that the effects of outsourcing on wage dispersion is concentrated in the lower half of the wage distribution, especially when focusing on relatively low wage workers. Figure X, Panel D shows the 85th, 50th, and 15th percentiles of the log wage distribution (normalized to 0 in 1985). The figure shows that although outsourcing had no effect at the top of the wage distribution, it lowered both the median and the 15th percentile substantially, contributing to the erosion of wages at the bottom. Table IV shows similarly that outsourcing—based on the reweighting exercise—can account for about 6.7% of the increase in the 85-15 gap, with a larger effect on the 50-15 gap. When we do the same analysis for women (see Online Appendix Table A-11), we find that outsourcing explains around 7% of the increase in inequality, which is consistent with CSL workers only making up around 6% of employment among women.

## VI. CONCLUSION

The labor market has seen a fundamental restructuring in recent decades, with lead employers increasingly contracting out parts of their noncore labor force. We document the trend toward increasing reliance on outsourcing for Germany, with a marked acceleration in the late 1990s. Though we focus on a subgroup of low-wage labor services where domestic outsourcing can be measured comparatively well (food, cleaning, security, and logistics services), anecdotal evidence suggests that this is a widespread phenomenon affecting many types of labor services and occupations, such as human resources, IT, call centers, and legal services.<sup>44</sup>

This reorganization of the production structure changes the employment relationship for a large share of the workforce. As more workers end up employed by specialized business service firms, they find themselves working for firms that provide narrow

44. We provide some evidence for outsourcing of these other services in the Online Appendix. The estimates are less consistent and harder to interpret but also point toward negative wage effects.

products and compete fiercely with similar firms for contracts with lead companies. This creates pressure to reduce costs and lower wages, which make up a large share of input costs among such business service providers. It also drastically changes the bargaining environment, as the price competition among business service firms makes it difficult for outsourced workers to bargain for a share of the firm rents at the lead company. In this article, we provide estimates of how this translates into lower wages for outsourced workers, and we find that across a range of measures, outsourcing reduces wages by around 10%.

It is difficult to know why firms decide to outsource. Our evidence is suggestive that exclusion from rents is part of the motivation, but there are many other reasons that are likely important, such as the comparative advantage of business service firms in their specialty or cost savings through economies of scale. It is even more difficult to know what is driving the long-term increase in outsourcing. Changes in management philosophy (e.g., a move toward shareholder value in the 1980s and 1990s) may be of similar importance as the development of new technologies that facilitate contracting out.<sup>45</sup> Understanding this is beyond the scope of this project but a fruitful area for future research.

Finally, it should be noted that the welfare implications of increased outsourcing are not straightforward. Although increases in outsourcing seem to have contributed to the rise in wage inequality in Germany, outsourcing also made the provision of these kinds of labor services more efficient and might have contributed to overall economic growth and possibly the improved performance of the German economy over the past decade. The general equilibrium effects might have decreased unemployment and even increased average welfare, while at the same time having hurt the workers who were directly affected.

ANALYSIS GROUP

BOSTON UNIVERSITY NBER, IZA, CESifo, CEPR

45. As an indication that outsourcing may simply not have been on the radar of managers and consulting firms, [Online Appendix Figure A-16](#) shows the frequency of the term “outsourcing” in the Google books database. The term “outsourcing” only appears starting in the 1990s, coinciding with the rise of outsourcing in Germany.



## SUPPLEMENTARY MATERIAL

An Online Appendix for this article can be found at *The Quarterly Journal of Economics* online.

## REFERENCES

- Abowd, John M., Francis Kramarz, and David N. Margolis, "High Wage Workers and High Wage Firms," *Econometrica*, 67 (1999), 251–334.
- Abraham, Katharine G., "Restructuring the Employment Relationship: The Growth of Market-Mediated Work Arrangements," in *New Developments in the Labor Market: Toward a New Institutional Paradigm*, K. G. Abraham and R. B. McKersie eds. (Cambridge, Massachusetts: MIT Press, 1990), 85–119.
- Abraham, Katharine G., and Susan K. Taylor, "Firms' Use of Outside Contractors: Theory and Evidence," *Journal of Labor Economics*, 14, (1996), 394–424.
- Akerlof, George A., and Janet L. Yellen, "The Fair Wage-Effort Hypothesis and Unemployment," *Quarterly Journal of Economics*, 105 (1990), 255–283.
- Autor, David H., "Outsourcing at Will: The Contribution of Unjust Dismissal Doctrine to the Growth of Employment Outsourcing," *Journal of Labor Economics*, 21 (2003), 1–42.
- Autor, David H., Lawrence F. Katz, and Melissa S. Kearney, "Trends in US Wage Inequality: Revising the Revisionists," *Review of Economics and Statistics*, 90 (2008), 300–323.
- Barth, Erling, Alex Bryson, James C. Davis, and Richard Freeman, "It's Where You Work: Increases in the Dispersion of Earnings Across Establishments and Individuals in the United States," *Journal of Labor Economics*, 34 (2016), S67–S97.
- Berlingieri, Giuseppe, "Outsourcing and the Rise in Services," CEP Discussion Paper No. 1199, 2013.
- , "Managing Export Complexity: The Role of Service Outsourcing," mimeo, London School of Economics, (2015), [http://personal.lse.ac.uk/berlingi/Berlingieri\\_JMP.pdf](http://personal.lse.ac.uk/berlingi/Berlingieri_JMP.pdf), Accessed on 29 April 2017.
- Berlinski, Samuel, "Wages and Contracting Out: Does the Law of One Price Hold?," *British Journal of Industrial Relations*, 46 (2008), 59–75.
- Bernhardt, Annette, Rosemary Batt, Susan N. Houseman, and Eileen Appelbaum, "Domestic Outsourcing in the United States: A Research Agenda to Assess Trends and Effects on Job Quality," Technical Report, Upjohn Institute, 2016.
- Card, David, Jörg Heining, and Patrick Kline, "Workplace Heterogeneity and the Rise of West German Wage Inequality," *Quarterly Journal of Economics*, 128 (2013), 967–1015.
- Card, David, Thomas Lemieux, and W. Craig Riddell, "Unions and Wage Inequality," *Journal of Labor Research*, 25 (2004), 519–559.
- Card, David, Alexandre Mas, Enrico Moretti, and Emmanuel Saez, "Inequality at Work: The Effect of Peer Salaries on Job Satisfaction," *American Economic Review*, 102 (2012), 2981–3003.
- Card, David, Ana Rute Cardoso, Jörg Heining, and Patrick Kline, "Firms and Labor Market Inequality: Evidence and Some Theory," NBER Working Paper No. w22850, 2016.
- Card, David, Ana Rute Cardoso, and Patrick Kline, "Bargaining, Sorting, and the Gender Wage Gap: Quantifying the Impact of Firms on the Relative Pay of Women," *Quarterly Journal of Economics*, 131 (2016), 633–686.
- Charles, Kerwin Kofi, Erik Hurst, and Matthew J. Notowidigdo, "The Masking of the Decline in Manufacturing Employment by the Housing Bubble," *Journal of Economic Perspectives*, 30 (2016), 179–200.
- Dey, Matthew, Susan Houseman, and Anne Polivka, "What Do We Know about Contracting Out in the United States? Evidence from Household and

- Establishment Surveys," in *Labor in the New Economy* (Cambridge, MA: National Bureau of Economic Research, 2010), 267–304.
- Dietz, Miranda, Peter Hall, and Ken Jacobs, "Course Correction: Reversing Wage Erosion to Restore Good Jobs at American Airports," Working Paper, UC Berkeley Center for Labor Research and Education, 2013.
- DiNardo, John, Nicole M. Fortin, and Thomas Lemieux, "Labor Market Institutions and the Distribution of Wages, 1973–1992: A Semiparametric Approach," *Econometrica*, 64 (1996), 1001–1044.
- DiNardo, John, and David S. Lee, "Economic Impacts of New Unionization on Private Sector Employers: 1984–2001," *Quarterly Journal of Economics*, 119 (2004), 1383–1441.
- Doellgast, Virginia, and Ian Greer, "Vertical Disintegration and the Disorganization of German Industrial Relations," *British Journal of Industrial Relations*, 45 (2007), 55–76.
- Dube, Arindrajit, and Ethan Kaplan, "Does Outsourcing Reduce Wages in the Low-Wage Service Occupations? Evidence from Janitors and Guards," *Industrial and Labor Relations Review*, 63 (2010), 287–306.
- Dunlop, John, "The Task of Contemporary Wage Theory," in *New Concepts in Wage Determination*, G. Taylor and F. Pierson, eds. (New York: McGraw-Hill, 1957), 3–27.
- Dustmann, Christian, Bernd Fitzenberger, Uta Schönberg, and Alexandra Spitz-Oener, "From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy," *Journal of Economic Perspectives*, 28 (2014), 167–188.
- Dustmann, Christian, Johannes Ludsteck, and Uta Schönberg, "Revisiting the German Wage Structure," *Quarterly Journal of Economics*, 124 (2009), 843–881.
- Fitzenberger, Bernd, Karsten Kohn, and Alexander C. Lembcke, "Union Diversity and Varieties of Coverage: The Anatomy of Union Wage Effects in Germany," *Industrial & Labor Relations Review*, 66 (2013), 169.
- Gibbons, Robert, and Lawrence Katz, "Does Unmeasured Ability Explain Inter-Industry Wage Differentials?," *Review of Economic Studies*, 59 (1992), 515–535.
- Groshen, Erica L., "Sources of Intra-industry Wage Dispersion: How Much do Employers Matter?," *Quarterly Journal of Economics*, (1991), 869–884.
- Handwerker, Elizabeth Weber, and James R. Spletzer, "The Role of Establishments and the Concentration of Occupations in Wage Inequality," in *Inequality: Causes and Consequences*, Lorenzo Cappellari, Solomon W. Polachek, and Konstantinos Tatsiramos, eds. (Bingley, UK: Emerald, 2016), 167–193.
- Harvard Committee on Employment Contracting Policies, "Lower-Paid Workers at Harvard University," Committee Report, Harvard University, 2001.
- Hethey-Maier, Tanja, and Johannes Schmieder, "Does the Use of Worker Flows Improve the Analysis of Establishment Turnover? Evidence from German Administrative Data," *Journal of Applied Social Science Studies*, 133 (2013), 477–510.
- Houseman, Susan N., "Why Employers Use Flexible Staffing Arrangements: Evidence from an Establishment Survey," *Industrial & Labor Relations Review*, 55 (2001), 149–170.
- Kalleberg, Arne L., "Nonstandard Employment Relations: Part-time, Temporary and Contract Work," *Annual Review of Sociology*, (2000), 341–365.
- Katz, Lawrence F., and Alan B. Krueger, "The Rise and Nature of Alternative Work Arrangements in the United States, 1995–2015," NBER Working Paper 22667, 2016.
- Krueger, Alan B., and Lawrence H. Summers, "Efficiency Wages and the Inter-Industry Wage Structure," *Econometrica*, 56 (1988), 259–293.
- Muendler, Marc-Andreas, James E. Rauch, and Oana Tocoian, "Employee Spinoffs and Other Entrants: Stylized Facts from Brazil," *International Journal of Industrial Organization*, 30 (2012), 447–458.

- Oberschachtsiek, Dirk, Patrycja Scioch, Christian Seysen, and Jörg Heining, "Integrated Employment Biographies Sample IEBS: Handbook for the IEBS in the 2008 Version," Handbook, Institut für Arbeitsmarkt-und Berufsforschung (IAB), Nürnberg, 2009.
- Rees, Albert, "The Role of Fairness in Wage Determination," *Journal of Labor Economics*, 11 (1993), 243–252.
- Smith Institute, "Outsourcing the Cuts: Pay and Employment Effects of Contracting Out," Report, 2014, <http://www.smith-institute.org.uk/book/outsourcing-the-cuts-pay-and-employment-effects-of-contracting-out/>, Accessed on 29 April 2017.
- Song, Jae, David J. Price, Fatih Guvenen, Nicholas Bloom, and Till Von Wachter, "Firming Up Inequality," Technical Report, UCLA, 2016.
- Vitols, Katrin, "Reforming the German Labour Market: the Case of Temporary Agency Work," *Competition and Change*, 8 (2004), 375–389.
- Weil, David, *The Fissured Workplace: Why Work Became So Bad for So Many and What Can Be Done to Improve It* (Cambridge, MA: Harvard University Press, 2014).