THE RISE OF DOMESTIC OUTSOURCING AND THE EVOLUTION OF THE GERMAN
WAGE STRUCTURE

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ABSTRACT

The nature of the relationship between employers and employees has been changing over the last 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 of the boundary of lead employers to contracting firms. For this end 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 why 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 10 percent of the increase in German wage inequality since the 1980s.

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1 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) -

The last decades have seen a thorough transformation of the nature of the labor market, with large firms increasingly relying on non-traditional 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 which 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, strong worker representation, and union coverage. Factors such as collective bargaining agreements (Card et al., 2004; DiNardo and Lee, 2004) or efficiency wage considerations linked to fairness perceptions (Akerlof and Yellen, 1990; Rees, 1993; Card et al., 2012) may lead to wage compression within firms and rent sharing of firm profits, which in turn pushes up wages for workers who would otherwise have lower paying outside job opportunities. 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. Furthermore, workers in these firms likely benefit less from collective bargaining agreements and protection from unions since they would typically not be covered by the same sectoral union of the outsourcing company. Even though anecdotal and qualitative evidence for these changes in the labor market abound, research in the economics literature on this topic is quite limited.[1] One problem with analyzing outsourcing is that it is very difficult to measure and can usually only be approximated using industry and occupation codes. Furthermore, even with such an approximation, the existing research

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[1]Weil (2014) provides a detailed, largely qualitative analysis of the practice of domestic outsourcing in the US 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 sub-contracting of labor services. The topic has received somewhat more attention in the sociology literature, e.g. see Kalleberg (2000) for an overview.

has relied largely on cross-sectional datasets on the worker level with almost no information on the outsourcing firms and limited information on the actual jobs people do. However, outsourcing inherently occurs on the job level, where certain tasks or inputs are moved out of the firm and provided externally. Since jobs are typically not directly observed, it is difficult to identify the true causal impact of outsourcing on wages.

In this paper we analyze the phenomenon of domestic labor service outsourcing in Germany using detailed administrative data on the universe of workers and firms.[2] We document for the first time in detail the rise of outsourcing of labor services over the last three decades in Germany, focusing in particular on logistics (i.e. truck drivers, warehouse workers), cleaning, security and food services.[3] We develop a new method for identifying outsourcing events at the time that they occur, which 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 we find after outsourcing can be explained with the loss of firm wage premia and whether it is plausible that at least part of the reason that firms outsource is that it allows them to avoid paying these rents. Finally, we consider the relationship between the documented impacts of outsourcing and the broad changes in the wage structure experienced by Germany over the last decades.

An important methodological innovation for this project is the development of a new method of identifying a particular type of outsourcing which we refer to as on-site outsourcing. This type of outsourcing refers to situations where a large employer spins out a group of workers providing a particular service, such as cafeteria workers, to a legally separate business unit, for example 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. We show that such outsourcing events can be identified in administrative datasets using worker flows between establishments. The basic intuition is that if a group of workers is contracted out at the same time, this can be

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[2]We use the term 'domestic outsourcing' in order 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.

[3]The reason for focusing on these services is that we believe these are tasks that remained fairly consistent over time, they correspond to clear occupation codes and the respective business service firms can be identified over time. Furthermore the share of these occupations remained approximately constant over the past 3 decades. We believe 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 in them over time (falling for accountants and phone operators, increasing for advertising and IT) and the characteristics of these jobs may have changed substantially with the advent of new technologies.

observed by following the establishment identifiers as well as occupation and industry codes. 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.

On-site outsourcing events provide a particularly powerful testing ground to analyze the wage effects of outsourcing, since they allow us to follow jobs over time where both the worker and the work location remain the same, so that effects on wages can be attributed directly to the change in the employment relationship without selection or omitted variable bias. However, these instances of on-site outsourcing likely only constitute a small share of all outsourcing, for example missing outsourcing events where all workers providing a particular task are simply laid off and the task is sub-contracted to an external provider. We therefore complement this analysis with a broader measure of outsourcing, where a worker in a food, cleaning, security, or logistics occupation is defined as outsourced if he is employed by a business services firm. Using both measures we find a dramatic increase in outsourcing in Germany that accelerated in the late 1990s and continues into recent years.[4]

Our main contribution is to provide cleanly identified effects of outsourcing on the wages paid for outsourced jobs using two alternative 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 as for workers in the same occupations and industries who are not outsourced. This allows us to interpret the wage effects of outsourcing as the effect on the job level, free of selection. 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 services firms with those employed directly by other employers, controlling for individual fixed effects.[5] The two approaches in principle have different advantages and disadvantages, but yield very similar results: After on-site outsourcing, wages for outsourced workers fall by around 10 percent within 5-10 years compared to the control group, essentially the same

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[4]This trend to vertical disintegration appears to be more widespread than just for the area of labor services. E.g. 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.

[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, e.g. 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.

wage differential we estimate using our other method.

Firms may choose to engage in these types of alternative employment arrangements 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. In order to test the hypothesis that the wage losses of outsourced workers stem from being excluded from firm rents, we first 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 et al. (2013) - henceforth CHK - and in the spirit of Abowd et al. (1999). 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 also show that on-site outsourcing is associated with sharp drops in other firm characteristics typically associated with rents, such as firm size and average pay of coworkers. Furthermore, we show that wage losses are highly correlated with measures of wage premia at the outsourcing establishment. 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 last few decades there has been a substantial increase in wage inequality, with significant wage declines at the bottom of the wage distribution (Dustmann et al., 2009, CHK). These changes in the wage structure are in part explained by de-unionization, the erosion of the sectoral level collective bargaining system, and the increased decentralization of the wage setting mechanism.[6] However, 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 which is not easily explained by de-unionization. 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.[7]

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

[7]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 sub-contractors and suppliers.

We provide several pieces of evidence that outsourcing did indeed contribute to these changes in the German employment and wage structure. In particular, based on the establishment - worker fixed effects decomposition, we show that outsourcing of cleaning, security and logistics workers alone can account for about 10 percent 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 de-unionization for the change in the German wage structure and the increases in competitiveness, we also believe that these two channels are likely closely intertwined, since on the one hand weaker unions facilitated outsourcing decisions and, on the other hand, outsourcing weakened the bargaining positions of unions and work councils. In fact, the increase in domestic outsourcing may have put direct wage pressure on in-house employees in similar jobs, since these employees are increasingly in competition with outside business service firms.[8]

The next section presents the data and institutional background, as well as a description of our measures of domestic outsourcing. Section 3 presents our empirical results on the effects of outsourcing on workers' employment trajectories and wages of outsourced jobs. In section 4 we provide evidence that firms decide to outsource in order to avoid paying establishment specific wage premia. Finally section 5 relates outsourcing to the broader changes observed in the German wage structure and section 6 concludes.

2 The Rise of Domestic Outsourcing

2.1 Institutional Background

Germany features a somewhat unique collective bargaining system, the so-called "dual system", where wages are negotiated between employer associations and unions on the industry or firm level, often in close coordination with elected firm or establishment level work councils (see Fitzenberger et al., 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 at the same time avoiding costly strikes and conflicts between unions and employers. However, the system was always based on contractual relations and mutual agreements, and firms were free to leave the collective agreements and instead set wages either in firm level

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[8]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, that 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".

negotiations or without any agreement. Firms that do not leave the union contracts can achieve additional wage flexibility through "opening clauses", which allow for wages below the collectively agreed upon level.

Starting in the early 1990s, Germany experienced a sharp decline in collective bargaining coverage rates and union membership as more and more firms opted out of the industry level agreements and either did not have any agreements or any firm level agreements.[9] Many existing firms left the employer associations while new firms opted not to join them in the first place (see CHK). Dustmann et al. (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 the 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 real threat of moving production to Eastern Germany or the newly 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.

While 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, as noted by Doellgast and Greer (2007), outsourcing itself 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.[10]

Another factor that has facilitated outsourcing in Germany over the last two decades 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

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[9]For example Dustmann et al. (2014) report that from 1995 to 2008, industry wide agreements fell from 75 to 56 percent, while firm level agreements stayed close to 10 percent.

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

other firms, thus making it easier to outsource.[11]

2.2 Data

We use the Integrated Employment Biographies data (IEB) which represents the universe of social security records in Germany over the time period 1975 to 2009.[12] 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 employees who are employed during a year. Since this report is key for determining health insurance coverage, pension accrual and unemployment benefits eligibility it is generally of very high accuracy. 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 is generally very accurate but top coded. The data covers all employment subject to social security contributions, but excludes 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 contains establishment, not firm, identifiers.[13]

For our approach of measuring outsourcing it is important that the data contains industry and occupation for every worker. Both pieces of information are an integral part of the employment notification and cannot be easily left blank, and as a result 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 judgement 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.

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[11]It is interesting that other countries with very different institutional backgrounds also experienced a dramatic rise in outsourcing. For example Autor (2003) argues that in the US the development of the "unjust dismissal" doctrine that restricted the employment at will notion contributed to the growth in outsourcing to temporary help service firms. Since Germany always had fairly strong employment protection laws, there was no legal change in this regard driving the increase in temp services, although the existence of these laws might have spurred outsourcing once this was easier for other reasons.

[12]See Oberschachtsiek et al. (2009)

[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.

2.3 On-site Outsourcing

The IEB, like most data sets, does not contain any specific information on outsourcing. 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 sub-contractor but where 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.[14]

We identify these on-site outsourcing events using worker flows between establishment identifiers, implementing a strategy similar to Hethey-Maier and Schmieder (2013), which dealt with classifying establishment entries and exits, and Muendler et al. (2012), which 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.[15]

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[14]This description of the events is based on personal conversations with Daimler employees. There are many other case studies describing similar events, e.g. Doellgast and Greer (2007) describe outsourcing in the automobile and telecommunications sector in Germany, Dietz et al. (2013) describe outsourcing of airport workers in the U.S., and Smith Institute (2014) provides several examples from the UK.

[15]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. While the exact cutoffs we use here are of course debatable, we found that in practice changing these thresholds - even by a substantial amount - barely affects our main wage results reported below. As will be seen below, the average outsourcing establishments that 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.

Finally, we restrict the 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.[16] For all outsourcing events, we call the predecessor establishment the mother, and the successor establishment the daughter.[17]

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 themselves often outsource large shares of their workforce to temp agencies. We therefore focus our analysis of the wage effects of outsourcing on workers in FCSL (food, cleaning, security or logistics) tasks, but we do 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-90s saw a large increase in the number of outsourcing events to about 60-80 per year, as can be seen in Figure 1 (a). This increase occurred across all five types of outsourcing events, which follow similar time paths (Figure 1 (b)).[18]

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[16]Business service industries for logistics include transportation, warehouse and storage. For food occupations 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.

[17]While the outsourcing definition that we use does not explicitly exclude situations where a mother establishment re-hires the types of workers who left the firm, we find that this is not typically the case. In Appendix Figure A-1 (a) we graph the number of workers employed in the outsourced occupation at the mother establishment (i.e. for establishments outsourcing cleaning tasks, this would be the number of workers who are in occupations labeled "cleaner") in the years surrounding outsourcing (which occurs between year -1 and 0). We find that this number drops sharply at the time of outsourcing and does not increase, indicating that these workers are not replaced. If our method were instead just capturing layoffs or quits of groups of workers while the corresponding tasks still stayed in-house, then the mother establishment would have to replace these workers with others in the same occupation. Appendix Figure A-1 (b) shows establishment size before and after outsourcing, and while establishment size decreases slightly in the years before outsourcing, there is only a small drop at the time of outsourcing and afterwards employment continues to be relatively flat, assuring us that we are not capturing mass layoffs or other types of restructuring or downsizing.

[18]The spikes in 1983 and 1988 in outsourcing of food services are all due to department stores outsourcing restaurants in those two years. We cannot link up our data to the company level across different counties, but it seems likely that in each of these years a large department store chain decided to outsource all of their restaurants simultaneously. We base this interpretation largely on the fact that the spikes are driven by outsourcing events with exactly the same industry codes of mothers and daughters, as well as similar establishment sizes in those years, while in other years there is a wide mix of industry codes among the

2.4 Measuring Outsourcing using Industry and Occupation Codes

While our method for identifying on-site outsourcing has the advantage that we can observe the event of outsourcing right when it happens, the disadvantage is that we are likely missing many instances where outsourced workers are not moved together to a separate business unit. For example, we would not be capturing slower movements of tasks to outside contractors that are not at the extensive margin (getting rid of workers of a specific task or spinning off entire units of workers) and changes due to reallocation of employment shares among existing firms or between exiting and new firms (who may, for example, rely more on outsourcing).

In order to obtain a broad picture of the evolution of domestic outsourcing, Figure 2 (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 onwards allow us to distinguish between business service firms and regular restaurants. The figure documents a dramatic rise in outsourcing of labor services over the past 3 decades: the share of outsourced workers in CSL business service firms and temp agencies has increased from 2 percent to almost 8 percent 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 percent 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 Appendix Figure A-4).

In Figure 2 (b) we show the share of outsourced workers in FCSL occupations, where outsourced is defined as 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 percent of cleaners were working for cleaning firms, this share has risen to almost 40 percent by 2008. Cleaning tasks may lend themselves particularly well to being broken out of the normal firm hierarchy and, as they are often very low-paying, may provide particularly good opportunities for cost savings through outsourcing. There was also a substantial rise in the share of workers in security and logistics occupations who are working for business service firms, by about 20 percentage points towards the end of the sample period. Over the shorter time period there has been

different mother establishments.

an increase in the share of food workers employed in business service firms, from about 16 percent to 26 percent.[19]

Another way to evaluate the extent of outsourcing of FCSL services is by analyzing industries which, although not in FCSL fields, typically employ some of these types of workers to provide services for their establishment or workforce. Here we focus on retail, manufacturing, finance and hospital industries. Figure 3 graphs the share of large establishments (over 100 workers) in each of these industries employing at least one FCSL worker in each year. Starting with the top left graph, for the retail industry, we see that over time fewer retail establishments employed workers in these occupations. For example, in 1975, about 82% of retail establishments had at least one cleaning worker on staff, while in 2009, only about 20% did. Presumably these retail establishments are being cleaned somehow, and 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 as in the other industries and mainly during the 1990s and 2000s.

Both our measure of on-site outsourcing events as well as 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, with almost 8 percent of the entire German labor force now working for FCSL business service firms and temp agencies. These findings are largely in line with the limited evidence from the US and other countries, which covers much shorter time periods and more restrictive occupation groups.[20] This increase in outsourcing on the worker level also corresponds to the rise of large business service firms. While we are not aware of systematic quantitative evidence, it is clear that for example, food services firms that

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[19]Food workers employed by restaurants and hotels are omitted from these calculations, as they would be considered neither "outsourced" nor "in-house", but rather 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.

[20]For example, Abraham and Taylor (1996) used a survey question in the 1979-1987 Industry Wage Surveys and found an increase in the fraction of work contracted out for janitorial, machine maintenance, engineering and drafting, accounting and computer tasks, while Wooden (1999) examined the AWIRS establishment survey and found evidence of a small increase in the use of contract workers in Australia from 1990 to 1995. Using the industry and occupation codes in the CPS from 1983 to 2000, Dube and Kaplan (2010) found an increase in the share of janitors and guards working for firms that provide labor services to other firms. Dey et al. (2010) investigated industry and occupation codes in the Occupational Employment Statistics program and found that the share of workers in security, janitor, computer, and truck driver occupations employed in industries that provide services to other firms increased from 1989-2000. Segal and Sullivan (1997) and Autor (2003) document a sharp increase in employment in temporary help services between 1980 and 2000. Finally Berlingieri (2013) argues that the rise in professional and business services outsourcing is responsible for around 14 percent of the increase in service employment in the US.

provide catering and cafeterias to other companies are now a major multi-national industry, consisting of large providers such as Compass Group (500,000 employees worldwide), Sodexo (about 415,000 employees), Eurest, and Aramark as well as smaller independent providers.

3 The Effects of Outsourcing on Wages

3.1 Framework

It is not immediately obvious why business service firms would pay different wages than outsourcing firms. In particular, if the labor market were perfectly competitive, then wages should simply 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 and thus labor costs savings by reducing the non-competitive wage component.

In order to clarify this, consider the following simple wage setting equation :

$$ln(w_{jt}) = \delta \, Outsourced_{jt} + z'_{jt}\gamma + x'_{i(j,t);t}\beta + \epsilon_{jt} \tag{1}$$

where $ln(w_{jt})$ is the (log) wage of job j at time t. $Outsourced_{jt}$ is an indicator function taking a value of one if the employer is a business service firm and zero otherwise. Furthermore wages are determined by characteristics of the job or workplace z_{jt}, and individual characteristics $x_{i(j,t);t}$. Note that i is a function of j and t, since the same job might be held by different people over time. A job is a set of tasks at a particular physical location, e.g. a cook in a cafeteria within a bank. The employer may either be the parent company operating the workplace, such as the bank, or a subcontractor that is hired by the parent company. Workplace or job characteristics that affect wages could include working conditions or characteristics such as the amount of variety or stress involved in the required tasks. The identity of the employer may affect the wage paid for a job, separately from the characteristics of the workplace, for various reasons, such as if wages are set in a collective or individual wage bargaining setting or because of efficiency wage considerations. 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 job is outsourced, then some or all of the rent component of the wage may be lost, either because the profits of the subcontractor may be lower (due to the more competitive environment) or because the workers may be in a weaker bargaining position because they are not covered by the same labor union or they might find it harder to go on strike (since the subcontractor can simply be replaced).

The effect of outsourcing could be measured by estimating equation (1) using OLS. How-

ever, in practice outsourced status is likely correlated with workplace and individual worker characteristics. While panel data may help to control for individual characteristics through individual fixed effects, it is rare to have information on job characteristics to satisfactorily deal with the omitted variable bias problem. We provide two alternative estimates, of the effects of outsourcing: First, we estimate equation (1) using an event-study design around on-site outsourcing events. Second, we implement the method used by Dube and Kaplan (2010) to estimate wage differences between outsourced and non-outsourced FCSL workers using individual fixed effects regressions. The approaches have various advantages and disadvantages, explained in detail below, and we view them as complementary evidence.[21]

3.2 The Effects of On-site Outsourcing on Wages

Method

In order to measure the effect of on-site outsourcing, we require a comparison group of workers at jobs which are not outsourced. In general workers employed at outsourced and non-outsourced jobs may differ in many dimensions. In order to obtain a comparable control group, we implement a matching algorithm. For each outsourced worker, we take the set of non-outsourced workers who worked in the same industry and occupation in the year prior to outsourcing to be our potential control group.[22] We then estimate a probit regression of whether a worker is outsourced or not, controlling for tenure and establishment size in the year prior to outsourcing as well as wages two and three years prior to outsourcing. In addition, we restrict our sample to workers with at least 2 years of tenure at their establishment in the year prior to outsourcing. For each outsourced worker we then choose the non-outsourced worker with the closest propensity score to the comparison worker.[23] Columns 1 and 2 of Table 1 show worker characteristics for our analysis sample. The characteristics of the matched outsourced and non-outsourced workers are quite similar, even for characteristics that were not part of the matching algorithm, such as fulltime status and

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[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 services firm. This type of focus on 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. Nevertheless in the appendix we discuss this type of worker level analysis, which we call Occupational Layoff outsourcing, and provide some estimates.

[22]For this we use 3 digit occupation and 3 digit industry codes (5 digit after 1999).

[23]We tested other matching specifications and found essentially the same results. For example, we matched on other variables such as current wage, full-time status, and education. We also implemented a two-step matching procedure, where we first found a control establishment for each outsourcing establishment, matching on establishment size and mean wage; in the second step, we matched each outsourced worker to a worker in the non-outsourcing matched establishment, matching on wage and education. This latter procedure makes it harder to find very similar individual matches in the second step, but the estimation results are very similar.

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:

$$y_{jt} = \sum_{k=-5}^{10} \delta_k I(t = t^* + k) \, Outsourced_{jt} + \theta_i + \xi_j + \alpha_t + x'_{it}\beta + \varepsilon_{jt} \tag{2}$$

where y_{jt} is an outcome variable and $Outsourced_{jt}$ is an indicator for whether job j was outsourced in year t^*. α_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 ε_{jt} is an error term. We cluster standard errors on the level of the outsourcing establishment.[24] While we do not directly observe the job or workplace, by restricting the sample to individuals who remain at the same employer as in the year right before and after outsourcing we can indirectly control for job fixed effects ξ_j. Each coefficient δ_k measures the change in the outcome variable y_{jt} for outsourced jobs relative to the non-outsourced control group in the k-th year before or after outsourcing occurred.[25]

Results

We start by comparing the trajectories of individual-level variables for outsourced and non-outsourced workers in the years before and after outsourcing. Figure 4 (a) shows yearly earnings before and after outsourcing for the two groups. It is reassuring for our design that the two groups show very similar trends in earnings prior to the outsourcing year. The change in the slope between t=-3 and t=-2 is due to the tenure restriction of 2 years prior to the outsourcing year. This also leads to mean reversion in earnings in the control group from year t=1 onwards.[26] However, at the time of outsourcing the two groups diverge, and

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

[25]An alternative to matching is to use all workers in the potential control group for comparison, and adjust the estimates using standard regression methods controlling for observables. One issue when doing so is that it seems appropriate to allow for each cohort of outsourced workers (a cohort being workers who are outsourced in a single year) and their comparison workers to have different year effects from each other. When we implemented regression estimates using workers from a small number of outsourcing cohorts and allowing for such flexible year fixed effects, we got virtually identical results to the propensity score matching estimates (where the control observation is implicitly controlling for different year effects by cohort). However in our main specifications we have around 30 cohorts with 15 year effects each, which brings the total number of year dummies up to 450 and makes this computationally difficult when we also try to control flexibly for other observables (state effects, industry fixed effects, individual fixed effects, ...). Our matching estimates are more robust and can be implemented without computational problems. The second advantage of creating a comparison group via propensity score matching is that comparing the raw means between the two groups over time is already quite informative, even absent any regression adjustments.

[26]We conducted extensive robustness checks with different tenure restrictions. For example with a tenure restriction of 5 years, the 'kink' occurs between year t=-6 and t=-5, which cuts our sample size but leaves

within 3 years after the outsourcing event the outsourced workers are earning approximately 1700 euros less than the non-outsourced group, a difference of about 10% of earnings. These differences are persistent, lasting for at least 10 years after outsourcing occurs.

Yearly earnings can be decomposed into the average daily wage over the year times the number of days worked per year. In order to see what drives our earnings losses, Figure 4 (b) shows the average daily wage over time for the two groups. Again the two groups are quite similar in the years prior to outsourcing. After outsourcing, wages of the non-outsourced group continue to increase steadily. Meanwhile, wages of the outsourced group drop slightly; they start to climb again after 3 years, but never catch up to the non-outsourced group. In the years following outsourcing, the wages of the outsourced group remain about 6-8 log points lower than that of the non-outsourced workers.

In Figure 4 (c), we turn to the other component of earnings, days worked per year, but find essentially no difference between the two groups. We also explored differences in fulltime 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 wages and earnings of the outsourced workers, there are basically no employment effects.

We further investigate employment stability in Figure 4 (d) by graphing the probability of being employed at the outsourced job. In each year prior to outsourcing, the dependent variable in this figure takes a value of one if the worker is employed at the outsourcing establishment - the establishment at which he was employed in time t=-1 - and zero otherwise. For each year after outsourcing, it takes a value of one if the worker is employed at the same establishment as in time t=0 (for outsourced workers this is the daughter establishment, for non-outsourced worker it is the same establishment as in time t=-1). Figure 4 (d) shows that outsourced workers are leaving their jobs at a slightly higher rate after outsourcing than non-outsourced workers - 3 years after outsourcing, 77% of outsourced workers and 85% of non-outsourced workers remain at the same job.[27] When we investigated the job stability patterns by outsourcing type, we found that the gap in mobility between outsourced and non-outsourced workers is largest for cleaning outsourcing events, which - as we document below - is also the group for whom wage losses are highest. As this suggests that the workers

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the point estimates for the wage and earnings losses very similar. We also experimented with different restrictions for when to include workers after t=0, such as whether to include workers with zero earnings in a given year as zeros or to drop them (as is often done in the displacement literature). While these different specifications affect the levels of earnings and the shape over time, it has virtually no effect on the differences between the treatment and control groups.

[27]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.

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.

While the raw means are quite informative in our matched sample, 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 non-outsourced group, low wage workers are more likely to leave the labor force, thus creating a mechanical increase in wages in the non-outsourced group relative to the outsourced group. The event study design allows us to easily control for this type of selection by estimating equation (2) controlling for individual fixed effects as well as year-level shocks. Figure 5 (a) graphs the δ_k coefficients from estimating equation (2) using log daily wage as the dependent variable. The regression framework confirms the results: outsourced workers suffer an immediate drop in wages at the time of outsourcing and wages continue to decline relative to non-outsourced workers, ending up about 10% lower after 10 years.[28]

While we can follow workers over extended time periods, the further away from the outsourcing event we compare outsourced to non-outsourced workers, the less likely it is that the workers are still at the same jobs, as we documented in Figure 4 (d) above. The main goal of this paper however is to estimate how wages change for jobs that are outsourced. We can follow jobs - rather than workers - over time by excluding those workers who change establishments, and hence leave their job, from our sample. Figure 5 (b) shows estimates of the δ_k coefficients in equation (2) restricting our sample to workers who remained at the same job after outsourcing, thus effectively 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. This is consistent with workers moving to other establishments after outsourcing in order to avoid the wage losses, so that the estimates without mobility restrictions are attenuated towards zero.

Table 2 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 simply uses three indicator variables for the time periods: pre-outsourcing (includes the 6 years prior to outsourcing), short-run post-outsourcing (includes the year outsourcing occurs and the following 3 years), and long-run post-outsourcing (years 4-10 after outsourcing). In panel A we include all matched outsourced and non-outsourced workers and verify that, for each type of daughter establishment, outsourced workers suffer a decrease in log wages both

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[28]Appendix figures A-5 and A-6 show these results for other outcome variables, indicating that there is a very small short term effect on employment variables such as days worked and days working fulltime per year.

in the short- and long-term of about 5.6% and 8.5%, respectively, implying a large cost of outsourcing to the outsourced workers' lifetime expected income. Workers outsourced to cleaning establishments face the largest decrease in both the short and long term, while logistics and food workers are impacted slightly less. We also report the effects of on-site outsourcing events where the 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 percent drops in the long run. In panel B we follow jobs rather than workers by restricting the sample to only those workers who remain at their outsourced (or non-outsourced) job. The results show that outsourced jobs suffer an even larger wage loss in the long term, of about 10%, relative to non-outsourced jobs. 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.

The last columns in Table 2 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 run wage losses of about 10 percent 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 vs. purely regression adjusted estimates). We also explored whether on-site outsourcing had an effect on the wages of workers who stayed behind. Appendix Figure A-3 shows that workers who stayed at an outsourcing firm had very smooth wage trajectories around the outsourcing event with no evidence of a jump or trend break in the outsourcing year. Furthermore the wage (and employment) evolution for them is parallel to the wage evolution of workers in non-outsourcing firms.

3.3 The Effect of Working for a Business Services 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 since 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 who 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,

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making it possible that we are underestimating the true effect of outsourcing on wages.

In order to obtain a broader estimate of the effect of outsourcing on wages, we estimate the wage differentials for outsourced workers in FCSL occupations, where outsourcing is defined based on workers' occupation and industry codes.[29] Food, cleaning, security and logistics services workers are identified by their 3-digit occupation codes. "Outsourced" workers are those who are employed at service contractors, i.e. establishments whose main business is providing services to other firms, identified by their industry codes, while non-outsourced workers are those who are employed in-house to provide services to a firm. We take the universe of workers in FCSL occupations and estimate an equation of the form:

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

where w_{it} is the daily wage of worker i in year t, $Outsourced_{it}$ is an indicator variable that takes a value of one if the worker is employed at a business services firm in time t and zero otherwise, θ_t account for year-level shocks that affect all workers, and individual fixed effects α_i control for fixed and x_{it} for time varying individual characteristics.[30] Using this method, we identify the impact of outsourcing on wages using the movement of food, cleaning, security and logistics workers between outsourced and non-outsourced 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 instead provide separate results of the effect of working for a temp agency.

Results are shown in the bottom panel of Table 2. We find that workers in FCSL occupations employed in business services firms have wages that are about 9% lower than non-outsourced workers in the same occupations. Cleaning workers face the largest losses from being outsourced, a deficit of 17%, while security workers face a 12% loss. Food and logistics workers at business services 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

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[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). While 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. Controling 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 cafes 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 were run using all years of data from 1975 to 2008, food regressions started in 1999 because before then, industry codes did not differentiate between canteens, catering and restaurants.

occupation in a temp agency as well as in other industries.[31] We find that working for a temp agency is associated with a 26% wage penalty, the largest of any type of business service firm.

While on-site outsourcing provides a high degree of internal validity, the estimates may over- or under-state the effect for the general population. On the other hand, the higher degree of external validity in the Dube-Kaplan approach comes at a cost: 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.[32] 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 reassuring that our estimates based on on-site outsourcing are quite similar as the results from this section despite the difference in methodology and sample.

4 Do Firms Outsource to Exclude Workers from Rents?

There are four primary reasons why a firm may choose to outsource.[33] The first is increased flexibility - if a firm's labor input needs vary throughout the year, they may prefer to sub-contract for these workers rather than either hiring and firing workers throughout the year or hiring the number of workers needed for the busy season, who then remain idle when the workload decreases. The second is comparative advantage - the firm may require a service that involves specialized skills or technology, which could be expensive for an individual firm to investment in. In this case they may prefer to work with a contractor, who can take advantage of economies of scale and invest in the needed technologies which could be used for a large number of clients. The third reason is that managers have finite resources to coordinate complex production chains and outsourcing may allow them to focus on the more important areas of the firm.[34] Finally, outsourcing could provide cost savings, in particular on labor inputs. Firms may be constrained in their wage-setting for various reasons. For example, they may be required to pay higher wages to all employees because of collective bargaining

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[31]Instead of individual fixed effects, here 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 a repeated cross-section and not a panel, he cannot control for selection into outsourcing; in addition, the sample contains less than 100 outsourced workers.

[33]For a discussion of these also see Abraham and Taylor (1996), Houseman (2001) and Berlingieri (2015).

[34]See Berlingieri (2015).

agreements, which are typically set at the industry level in Germany. Alternatively, firms may pay efficiency wages to some workers for various reasons. At larger firms workers may be hard to monitor, and so 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 associated with a loss of firm rents, and provide pieces of evidence suggesting that firms do in fact outsource in order to avoid paying establishment level wage premia.

4.1 Estimating the Loss in Firm Rents Using AKM Decomposition

We follow Abowd et al. (1999) and CHK and estimate a full worker - establishment fixed effect decomposition using the universe of social security data in Germany:

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

where $\psi_{J(i,t)}$ represents a vector of establishment fixed effects, α_i a vector of individual fixed effects and θ_t and $X_{it}\beta$ are year effects and time varying observables. We closely follow CHK in the estimation of this model.[35] First, we impute wages above the social security maximum in Germany using their algorithm. Like CHK, we estimate the model on all fulltime 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.[36] The establishment and worker fixed effects are only separately identified within a connected set of establishments

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[35]Estimating the model is computationally challenging even on modern computers. To make this more manageable we only run the estimation on the subset of individuals who switch employers, which provides unbiased estimates with a negligible loss in efficiency (see CHK). This allows us to calculate the establishment fixed effects which can then be used to calculate person and establishment effects for the whole sample. Even then, we estimate that around 200GB or RAM would be necessary to estimate this using a conjugent gradient algorithm like a2reg, which is not available to us at the research data center of the IAB. Instead we used the Stata tool gpreg (written by us), based on Guimaraes and Portugal (2010), which is a slow but much more memory efficient algorithm.

[36]Breaking the sample up into separate pieces has obvious computational advantages, but also allows establishments to have different fixed effects in different years. 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. For the same reason we estimate the AKM model including the earlier years from 1979 onwards. As Dustmann et al. (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.

which are linked through workers moving between them.[37] We therefore restrict our analysis to this largest connected group, which in our data covers around 90 percent of observations. 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 do indeed seem to be 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. Figure 6 shows a binned scatter plot of the two estimated AKM effects for all establishments with at least 100 employees and who have at least one FCSL and one non-FCSL worker. Both sets of AKM effects are normalized to have a mean of zero in the overall establishment distribution. Quite remarkably, even though the two measures of wage premia are estimated using mutually exclusive samples of workers, the relationship between the two is essentially linear with an estimated slope of 0.95. Measurement error in the right hand side variable will lead to a downward bias in the slope coefficient. When we correct for this using split sample IV we obtain a slope coefficient of 1.05 (SE around 0.0004).[38] Thus, establishments that pay their non-FCSL workers a premium pay almost the same premium, in log terms, to FCSL workers.[39] This suggests that firms do indeed 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, which will increase the precision of

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[37]In the on-site outsourcing sample all observations are in the connected group, which is not surprising since at baseline all workers are employed at relatively large establishments.

[38]In order to correct for the downward bias from measurement error, we took all workers who are not in FCSL occupation and divided them in two equal sized random samples (on the worker level not the employment spell level, so that worker histories stay together). We then estimate the AKM model separately for each sample and keep the predicted establishment FE, call these EFE1 and EFE2. If measurement error of the establishment FE in the AKM model is only due to small sample imprecision or due to measurement error of individual wages where the error is IID across individuals, then the measurement error of EFE1 and EFE2 is uncorrelated. We then regress the predicted AKM effect estimated using FCSL worker only on EFE1, but instrument EFE1 with EFE2. Since the measurement error of EFE1 and EFE2 is uncorrelated given the above assumptions this gives an unbiased estimate for the slope coefficient. We calculate standard errors clustering on the establishment level. We also repeated this for establishments with at least 500 employees (and where measurement error should thus also be smaller). For this sample the coefficient is 0.99 using OLS and 1.01 using split sample IV.

[39]Technically the level of the premium is not identified (we cannot separately identify the average of the individual fixed effects and the average of the establishment effects), so this statement is about the premium relative to other establishments, that is if an establishment pays around 1 percent higher wages to Non-FCSL workers than other establishments it also pays around 1 percent higher wages to FCSL workers than other establishments.

the estimates (relative to using only FCSL workers).

The effect of outsourcing on wages is reflected in this decomposition as the average difference in establishment fixed effects between an outsourced and a non-outsourced worker: $E\left[\psi_{J(i,t)}|outsourced_i, \alpha_i, \theta_t, X_{it}\right] - E\left[\psi_{J(i,t)}|nonoutsourced_i, \alpha_i, \theta_t, X_{it}\right]$. To compute the difference we take all workers in FCSL occupations and regress the estimated establishment fixed effects $\hat{\psi}_{J(i,t)}$ on a dummy for working at a business service firm or temp agency, as well as year dummies and time varying observables.[40] Results are shown in panel A of Table 3. We find that overall, FCSL workers who are outsourced tend to be employed at firms with with lower wage premia - their AKM effect is about 12 log points lower than FCSL workers who are not at business service firms. This is fairly consistent across occupation types - we see the largest difference for security workers (26 log points) and the smallest for logistics (6.6 log points), but all are negative and significant. As in the last column of panel C in Table 2, we separately estimate the effect of working for a temp agency on the AKM effect, for workers who have been in the same occupation in a temp agency and in other industries. Again we find a large, negative effect, of 33 log points.

In panel B we include individual fixed effects. These estimates can be interpreted as the difference in AKM effects between establishments where workers are actually moving between outsourced and non-outsourced jobs. Here the loss in AKM effect for workers at BSFs is slightly smaller, but still negative and significant. Overall for FCSL workers, after controlling for individual fixed effects, being employed by a business service or temp firm is associated with a 7 log point loss in AKM effect, implying a 7 percentage points lower wage premium, with losses ranging from 20 log points for security workers to 4 log points for logistics workers.

4.2 Establishment Characteristics after On-site Outsourcing

If exclusion from firm rents is the primary driver of wage losses for outsourced jobs, then we would expect outsourced workers to move from higher-rent firms to lower-rent firms. To test this, we analyze the characteristics of the establishments employing outsourced and matched non-outsourced workers in the years before and after an on-site outsourcing event. In particular, we look at the characteristics typically associated with rents - firm size, average wage, and our measure of the establishment wage premium, the AKM effect

Figure 7 shows employer characteristics before and after on-site outsourcing. Panel (a) shows that outsourced and non-outsourced workers work in relatively similarly sized establishments, although the outsourced workers experienced a slightly declining trend in employer

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[40]We include age, age squared, and age cubed, and interact these variables with dummy variables for different levels of education.

size in the years up to the outsourcing event. The outsourced jobs experience a dramatic drop in employment size of their employer in year 0 to about 100 workers. In the years following outsourcing we see that establishment size rises slowly for both groups. This is because workers who leave their establishment - and therefore their job - are removed from our sample. Workers may be more likely to stay at larger firms and therefore as the workers at smaller establishments leave over time, the average establishment size in our sample goes up.

Figure 7 (b) graphs results for the average (log daily) wage at the establishments where the workers in the two groups are employed. While the pre-outsourcing levels match well, after the outsourced workers leave, the average wage at the establishment in which they are employed drops substantially, by about 20%.

Mean establishment wages are determined by a number of factors, such as the average skill, education level, and experience in the establishment. An establishment could pay high average wages but these might be entirely explained by the high skill level of its workers and relative to this skill level the wages may actually be below average. To get a better measure of the pay policy of an establishment, in graph (c), we show the average of the AKM effect for the establishment at which each outsourced and matched non-outsourced worker is employed in each year. Before outsourcing, both groups of workers were employed at firms with similar AKM effects, but the outsourced workers move to firms with much lower AKM effects at the time of outsourcing, and remain at lower-AKM effect firms in the years that follow. In fact, the AKM effect drops by about 10 log points at the time of outsourcing, similar in size to the long-term wage decrease that we see for outsourced workers.

4.3 Wage Losses by Establishment Characteristics

If the loss of firm rents is indeed the primary driver of wage losses for outsourced jobs, then it is likely that workers with the most to lose - those coming from establishments with the highest wage premia - would suffer the biggest drop in wages. To test whether this is indeed the case, we divide our sample into groups based on the characteristics of the outsourcing establishment (the establishment at time -1) most associated with firm rents.

Figure 8 (a) shows the effects of outsourcing separately for establishments in the top and bottom quartile of the establishment size distribution (within the matched establishments). Jobs outsourced by the smaller establishments (in the bottom quartile) experience significantly smaller wage losses in every year. For example, 5 years after outsourcing, jobs outsourced from the smallest establishments experienced wages about 8% lower relative to year -1 and compared to the comparison group, while those that came from the largest establishments had losses of about 14%.

Similarly, Figure 8 (b) shows the effects by the mean wage of the outsourcing establishment, again comparing the first with the fourth quartile. Jobs outsourced by establishments located at the bottom of the (establishment level) wage distribution show less dramatic wage losses relative to those that came from establishments in the top quartile. Figure 8 (c) shows the wage losses separately for jobs outsourced from establishments with the top and bottom establishment AKM effect. Jobs outsourced from high-AKM effect establishments saw a much more dramatic loss in the short term, although the long-term effects are similar.[41]

4.4 Propensity to Outsource

Finally, we turn to the question of which type of firms are most likely to outsource their service workers. We start by creating a definition of outsourcing that is more general than our on-site outsourcing definition. In particular, it will capture situations where an establishment lays off all of its workers providing a particular service - either logistics, cleaning, security or food services - either in one large layoff event or over a few years. We say that, for example, generalized outsourcing of cleaning services has occurred when an establishment loses the last of its cleaning workers, conditional on having at least 5 workers in cleaning occupations in the last 5 years and on not downsizing by more than 50 percent.[42] We also only keep the earliest instance of cleaning outsourcing for any establishment. Generalized outsourcing of food, logistics and security services is defined analogously.[43]

Using this definition, we can analyze whether establishment characteristics typically associated with higher firm rents are associated with outsourcing. Results of our analysis are presented in Table 4. 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 zero otherwise. The sample is restricted to those establishments who are "eligible" to outsource (i.e.

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[41]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, while those from the lowest only around 2. Similarly for cleaning workers, the highest quartile losses are around 3.5 times the size of the lowest quartile losses. See Online Appendix Figure A-7 for more details.

[42]More specifically, an establishment is said to have outsourced in time t if: it does not employ and workers in cleaning occupations in time t; it employed at least 1 cleaning worker in time $t-1$, and at some point in the last 5 years it employed at least 5 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.

[43]This definition may be best suited for cleaning, logistics and security outsourcing, which are services that an establishment is likely to need whether they hire the workers directly or contract these services from another provider. Food services are less clear - when a firm lays off its cooks and waiters, it may be that these services are being provided by an outside vendor, or that the firm has decided to close down the cafeteria altogether. Here we include food outsourcing events, but excluding them does not affect the results.

they have at least 50 employees) and excludes East Germany prior to 1997. All regressions include state fixed effects to account for regional variations in outsourcing, year fixed effects to control for shocks that may affect all firms in a year, and controls for broad industry categories to account for differences across types of industries in the propensity to outsource. We augment our data with information from the IAB Establishment Panel Survey, an annual survey of approximately 16,000 employers which has taken place since 1993.

Columns (1) through (4) include all establishments in the sample, while columns (5) through (6) include only those establishments that are included in the Establishment Panel Survey. The independent variables all provide different correlates or measures of establishment wages or rents. Larger establishments and those with a higher estimated AKM effect are more likely to outsource, while 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 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. The Establishment Panel Survey asked respondents whether they were bound by a collective agreement; those who replied yes are also more likely to outsource FCSL workers, conditional on year, industry and state. In addition, establishments that responded that they paid wages above the collectively agreed scale were also more likely to outsource. While one should be cautious to interpret this evidence as causal, we view Table 4 as providing supporting evidence for our hypothesis regarding firm rents and outsourcing by documenting the correlation between characteristics associated with higher firm rents - in particular the firm AKM effect and participation in a collective agreement - and increased likelihood of outsourcing.

While the previous evidence suggests that firms are more likely to outsource when they pay high wage premia and there is potential for wage savings, this does not explain why outsourcing has increased over time. A possible reason is that over time new business service firms have been entering the market competing for contracts. As the environment became more competitive between business service firms, this increased the pressure to lower prices and may in turn have lead to more firms considering outsourcing as an option. Indeed Figure 9 (a) shows that the AKM effects of new business service firms have been falling substantially over time, with the newest entrants paying much lower wage premia compared to both the earlier cohorts of BSF and non-BSF establishments. Figure 9 (b) on the other hand illustrates how the market for BSF has become increasingly competitive over time, by plotting the average county-level market concentration herfindahl index for business service

firms by year. For cleaning and security BSF competition on the local level has increased markedly, which in turn may have driven down prices and wages. For food services we have a much shorter time series, but over this short time series competition has increased as well. For logistics BSFs, market concentration has always been relatively low, likely because this is a more heterogeneous sector that always had a larger number of firms.

5 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 US labor market (see Autor et al., 2008; Dustmann et al., 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 dispersion of establishment wage premia - as measured by the AKM effect - as well as stronger assortative matching between workers and firms.[44] While CHK and Dustmann et al. (2014) mention outsourcing as a possible channel, their empirical evidence focuses on de-unionization as the driving force behind these changes. Our results support the importance of the former channel, and in this section we explore the extent to which outsourcing may have been a contributor to these broad changes in the wage structure.

5.1 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 percent between 2000 and 2008.[45] This pattern is also apparent among the labor service occupations we study in this paper: Figure 10 (a) shows the evolution of real wages in cleaning, security and logistics (CSL) occupations from 1975 to 2009.[46] The figure shows that 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 markedly from around 1990 onwards, when wage growth for CSL occupations decoupled from the general wage evolution: While wage growth began to slow considerably across all occupations since 1990 and essentially

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[44]Barth et al. (2014) show that rising wage dispersion between establishments also plays an important role in explaining the rise in wage dispersion in the U.S..

[45]This decline has been even more pronounced in non-tradable sectors and tradable services, where real wages at the 15th percentile already started to fall in the mid 1990s and then decreased by 10 to 15 percent.

[46]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.

stagnated over the past 10 years, real wages in CSL occupations declined by a remarkable 20 log points over the past 20 years. It is noteworthy that this decoupling occurred at the same time as the general rise in outsourcing shown in Figure 2.

Figure 10 (b) provides further suggestive evidence that outsourcing is part of the explanation for this decoupling. The figure shows wages for outsourced (working for business service firms / temp agencies) and non-outsourced workers in CSL occupations as well as for other occupations. Both outsourced and non-outsourced wages move in parallel with the general wage evolution until 1990. From 1990 onwards 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 by a substantial amount. The fact that wages for non-outsourced CSL workers also fell may be in part a selection effect, where the establishments with the highest wage premia were most likely to outsource, and may also be because the threat of outsourcing allowed employers to cut wages to non-outsourced workers.

The role of establishment wage premia for CSL wages is illustrated in Figure 10 (c), which shows the estimated AKM effects for CSL and other occupations. Decoupling is very apparent in these graphs as well: 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 rapidly fall 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, while in the 1970s and 1980s logistics workers were employed in firms that paid the average wage premium in the economy, by the late 2000s they were employed in firms paying around 15 percent lower wages.

Figure 10 (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 onwards outsourced workers are working at increasingly worse firms, with wage premia declining by almost 15 log points. Non-outsourced 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 4, the firms that are not outsourcing are those that are already paying very low wage premia and therefore face weaker incentives to outsource.

5.2 Occupational Sorting of Workers

CHK documented that workers are increasingly concentrated in establishments with homogenous workforces.[47] Outsourcing provides a natural explanation for this: since business service firms are much more homogenous (for example, in the typical cleaning BSF about 60% of the employees are cleaners), moving workers from heterogeneous lead employers to BSFs that employ largely the same occupations as the outsourced worker will increase the overall occupational assortativeness. Figure 11 illustrates this mechanism for cleaning, security, and logistics occupations by graphing the average Herfindahl index of occupational sorting over time for establishments that employ cleaning, security or logistics workers.[48] While panel a) shows that CSL workers are employed by increasingly homogenous establishments, with an increase of the Herfindahl index of occupational sorting from 0.22 to 0.43, panel b) shows that there there has been much less increase conditional on being outsourced and only a mild increase conditional on not being outsourced. There is, however, a huge level difference in occupational sorting between outsourced and non-outsourced workers, with the former having a Herfindahl index of around 0.61 and the latter of around 0.3 towards the end of the sample period. Thus much of the increase in occupational sorting among CSL workers stems directly from movement from the non-outsourced group to the outsourced group. Note that this may even understate the influence of outsourcing, since the increase in the Herfindahl index for CSL workers at non-BSF firms might in part be due to increases in occupational homogeneity because *other* occupations may have been outsourced.

5.3 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 the bottom, this will lead to a mechanical increase in the dispersion of the *employment weighted* AKM effects

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[47]This is only briefly discussed in the published paper. More details are provided in the NBER working paper version.

[48]The Herfindahl index was originally used as a measure of market concentration; we use it here as a measure of occupational concentration within firms. For each establishment, we calculate the Herfindahl index as the sum of squared occupation shares within the establishment. Establishments with workers in a large number of different occupations will have a low Herfindahl index, while establishments made up of workers in only a few occupations will have a large index.

distribution. Furthermore since workers in the affected occupations tend to be low wage workers, this will also lead to concentration of low person fixed effects workers in firms at the bottom of the AKM distribution, thus increasing assortative matching.

On the other hand, while this can occur even if the unweighted distribution of AKM affects remains constant, there are good 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 a smaller number of workers and AKM effects may well rise for the non-outsourced 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 remaining high skill 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. And finally, outsourcing may shift bargaining power away from workers towards firms, thus potentially reducing the role of wage premia in firms where this is a threat.

In order to illustrate the extent to which outsourcing contributes to the changes in the AKM dispersion and assortative matching, we follow the decomposition of the variance of log wages proposed in CHK:[49]

$$Var(w_{it}) = Var(\theta_i) + Var(\psi_{J(i,t)}) + 2\,Cov(\theta_i, \psi_{J(i,t)}) + Var(\varepsilon_{it})$$

Table 5 Panel A shows that the variance of log 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.[50]

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. E.g. if in 1985, x percent of CSL workers were in the 90th percentile of the AKM distribution, we reweight CSL worker in 2008 so that x percent are in the 90th percentile at that time as well. To construct these counterfactual weights, we use the reweighting method of DiNardo et al. (1996), where the conditioning variables are indicators for the deciles of the AKM distribution interacted with a dummy for being in a

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[49]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.

[50]Since the IEB started to include bonues in the wage variable from 1985 onwards (see Dustmann et al., 2009), the time series on wage dispersion are hard to compare before and after and exhibit jumps in 1985. This is less of an issue for our specific occupations, but affects the variance and percentiles of the overall wage distribution. For this reason we follow the literature and use 1985 as the starting year for this analysis.

CSL occupation.[51] The results of this reweighting exercise are shown in Figure 12. The solid line in panel (a) shows the variance of log wages by year for male fulltime 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 percent. As (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 5 Panel B confirms this visual impression, showing that the DFL reweighting exercise can account for 9 percent of the rise in the variance of log wages, and similarly for the AKM effect and covariance term.

An alternative 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 workers who are outsourced on top of the outsourcing level in 1975. As Table 5 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 non-outsourced workers has changed dramatically: even the non-outsourced CSL workers are now working at much worse establishments, likely because the high-paying establishments were the first to outsource.

While 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 (un-weighted) distribution of AKM effects constant. As described above, there are good reasons to assume that outsourcing may have affected the AKM effects of establishments directly. While we believe these equilibrium adjustments of wage premia to be important, modeling them would require a more structural approach beyond the scope of this paper. Second, our analysis here only uses CSL occupations, a relatively small fraction of the German workforce. Outsourcing occurred for other low skill labor services as well that we do not capture here. And third, while we focus on outsourcing of relatively low skilled jobs, it is conceivable that outsourcing of high skill tasks lead to the creation of new high AKM establishments, leading to increases in the dispersion of AKM effects and assortative matching at the upper end of

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[51]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 non-outsourced 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.

the distribution as well.

Finally, we also investigate whether the effects of outsourcing on wage dispersion were concentrated, as one might expect, in the lower half of the wage distribution. Figure 12 (d) shows the 85th, 50th, and 15th percentiles of the log wage distribution (normalized to 0 in 1985). The figure shows that while 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 5 shows similarly that outsourcing - based on the reweighting exercise - can account for about 6.7 percent of the increase in the 85-15 gap, with a larger effect on the 50-15 gap. We also did the same analysis for women (shown in the online appendix). For women outsourcing explains around 7 percent of the increase in inequality which is consistent with CSL workers only making up around 6 percent of employment among women.

6 Conclusion

The labor market has seen a fundamental restructuring in recent decades, with lead employers increasingly contracting out parts of their non-core labor force. Using high quality administrative data, we document the trend towards increasing reliance on outsourcing for Germany, with a marked acceleration in the late 1990s. While we focus on a subgroup of labor services where domestic outsourcing can be measured comparatively well (logistics, cleaning, food and security 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.

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 products and which compete fiercely with similar firms for contracts with lead companies. This creates pressure to reduce costs and lower wages, which likely make up a large share of input costs among these types of 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 paper, we provide careful estimates of how this translates into lower wages for outsourced workers and we find that across a wide range of measures, outsourcing reduces wages by around 10 percent. Our method implies that this is not due to selection of different types of workers in outsourced employment relationships, or due to differences in the types of jobs that outsourced workers do. Instead it appears that outsourced workers receive lower pay since they are excluded

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from firm rents that are being paid to workers at the lead companies. This suggests that the boundary of the firm is a crucial component for the wage setting and bargaining process.

It is difficult to know why firms decide to outsource part of their workforce. Our evidence that firms that seem to pay wage premia to their workers are more likely to outsource is suggestive that saving labor costs is part of the motivation, but there are many other reasons that are likely of similar or possibly higher importance, such as the comparative advantage of business service firms in their specialty, cost savings through economies of scale, or gains in efficiency through market pressures in the competitive environment of bidding for service contracts. It is even more difficult to know what is driving the long-term increase in outsourcing. Changes in management philosophy (e.g. a move towards emphasis on shareholder value in the 1980s and 1990s) may be of similar importance as the development of new technologies that facilitate breaking out service provision.[52] 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. Our findings suggest that the increasing reliance on contracting-out reduced the participation of these workers in firm rents and contributed to the sharp rise in wage inequality in Germany. However, outsourcing also made the provision of these kinds of labor services more efficient, and while rents to workers may have diminished, it 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.

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[52] As an indication that outsourcing was simply not on the radar of managers and consulting firms, Appendix Figure A-12 shows the frequency of the term "outsourcing" in the Google books database. The term outsourcing only appears in the 1990s, coinciding with the rise of outsourcing in Germany.

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Table 1: Characteristics of Outsourced and Non-outsourced Workers

	Outsourced at t=-1	Matched Non-OS at t=-1	FCSL at BSF/Temp	FCSL not at BSF/Temp
Avg Establishment Wage	78.83 (20.16)	77.70 (20.35)	53.65 (19.59)	74.49 (17.94)
AKM 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)	1,110.63 (3,246.35)	265.41 (385.18)	1,683.45 (5,204.99)
Real Daily Wage in Euro	69.93 (29.47)	70.18 (30.83)	51.07 (24.80)	63.71 (25.36)
Age in Years	42.29 (7.98)	43.67 (9.72)	40.25 (8.49)	41.87 (8.43)
Female	0.45	0.47	0.40	0.40
Years of Education	10.16 (1.17)	10.22 (1.33)	9.93 (1.06)	10.06 (0.89)
College Degree	0.02	0.03	0.01	0.01
Living in West Germany	0.86	0.91	0.85	0.94
Working Fulltime	0.78	0.76	0.70	0.78
Tenure in Years	8.58 (5.80)	8.58 (6.35)	3.91 (3.83)	6.16 (5.29)
Food Occupation	0.21	0.21	0.05	0.14
Cleaning Occupation	0.11	0.12	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	21195	20621	6412854	35201181

Notes: Mean of each variable with standard deviation in parentheses. Columns 1-2 include On-Site Outsourced and matched Non-Outsourced workers age 25-55 with at least 2 years of tenure in year before outsourcing. Statistics calculated in year before outsourcing. Columns 3-4 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 services or temp firms, while column 4 includes these workers who are not employed at business service or temp firms. All columns exclude East Germany prior to 1997.

* The AKM effect is the predicted establishment fixed effect from the AKM model described in section 4.1. The AKM effects are normalized to be equal to 0 in the sample of all workers from 1979-2009 (the period we use for the AKM model).

Table 2: The Effects of Outsourcing on Log 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***	-0.048***	-0.11***	-0.069***	-0.039***	-0.15***	-0.043***	-0.074***
	(0.0048)	(0.0056)	(0.013)	(0.016)	(0.0058)	(0.019)	(0.0053)	(0.0083)
Post-OS long-run	-0.085***	-0.087***	-0.12***	-0.10***	-0.066***	-0.16***	-0.080***	-0.092***
	(0.0077)	(0.010)	(0.019)	(0.021)	(0.010)	(0.019)	(0.0095)	(0.013)
Observations	517662	158971	73064	83574	202053	97538	305315	212347
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***	-0.045***	-0.10***	-0.072***	-0.035***	-0.15***	-0.041***	-0.073***
	(0.0050)	(0.0049)	(0.013)	(0.019)	(0.0057)	(0.016)	(0.0056)	(0.0087)
Post-OS long-run	-0.097***	-0.11***	-0.12***	-0.14***	-0.059***	-0.16***	-0.090***	-0.11***
	(0.0079)	(0.0093)	(0.018)	(0.024)	(0.011)	(0.023)	(0.0099)	(0.013)
Observations	429949	134005	61276	69976	164692	72854	259434	170515
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 & Kaplan 2010 Measure)								
Working for Business Service Firm	-0.090***	-0.036***	-0.17***	-0.12***	-0.028***	-0.26***		
	(0.00064)	(0.0030)	(0.0015)	(0.0027)	(0.00064)	(0.00075)		
Observations	36234249	1455432	10703132	3373983	20701702	13084766		
OS Workers	1529268	45950	723294	204031	576039	629278		
Mean Outcome for OS workers	3.83	3.79	3.43	3.95	4.21	3.93		

Notes: (*p<.1, **p<.05, ***p<.01) 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 5 yrs pre-OS; 4 yrs short-run; 6 yrs 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, column 1 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). Column 6 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 workers 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.

Table 3: The Effects of Outsourcing on Establishment Wage Premia

	All OS	Food	Cleaning	Security	Logistics	Temp
Panel A: OLS						
Working for Business	-0.12***	-0.13***	-0.10***	-0.26***	-0.066***	-0.33***
Service Firm	(0.00021)	(0.00090)	(0.00028)	(0.00058)	(0.00026)	(0.00039)
Observations	33744965	1205601	10057326	3014162	19467876	11628470
OS Workers	1316240	33321	616064	171077	513344	529642
Mean Outcome for OS workers	-.12	-.15	-.16	-.26	-.03	-.34
Panel B: Individual Fixed Effects						
Working for Business	-0.069***	-0.051***	-0.067***	-0.20***	-0.041***	-0.33***
Service Firm	(0.00038)	(0.0023)	(0.00075)	(0.0022)	(0.00044)	(0.00063)
Observations	33744965	1205601	10057326	3014162	19467876	11628470
OS Workers	1316240	33321	616064	171077	513344	529642
Mean Outcome for OS workers	-.12	-.15	-.16	-.26	-.03	-.34

Notes: (*p<.1, **p<.05, ***p<.01) Standard errors, in parentheses, are clustered at the worker level. Dependent variable is the AKM effect of the establishment at which each worker is employed. Column 1 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). Column 6 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 workers is employed by a temp agency. All regressions control for year indicator variables, age, age squared and age cubed interacted with education dummies; Panel B also controls for individual fixed effects. 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.

Table 4: Determinants of Outsourcing

	All Establishments				Establishment Panel Sample	
	(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	2086507	2086505	1892408	1769077	68577	68595
Mean of Dep Var	.012	.012	.011	.014	.02	.02
Mean of Indep Var	4.788	4.285	.003	1.162	.81	.34

Notes: (*p<.1, **p<.05, ***p<.01) Standard errors, in parentheses, are clustered at the establishment level. All regressions exclude East Germany before 1997 and establishments with less than 50 workers. Columns 5-6 includes only establishments included in the IAB Establishment Panel Survey. All regressions control for state dummies, year dummies, and industry dummies. 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 or temp agencies in the same county and year.

Table 5: 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 - 2008	Percent of Change explained by Counterfactual
Panel A: Observed				
Total Variance of Log Wages	0.132	0.205	0.073	
Variance of Estab Effects	0.0289	0.0547	0.0258	
$2 \times$ Cov(person, estab effect)	-0.0050	0.0426	0.0475	
85-15 log wage percentile gap	0.655	0.934	0.279	
85-50 log wage percentile gap	0.385	0.512	0.127	
50-15 log wage percentile gap	0.270	0.422	0.152	
Panel B: Counterfactual I: DFL Reweighting of CSL Workers				
Total Variance of Log Wages	0.132	0.198	0.067	8.9%
Variance of Estab Effects	0.0289	0.0525	0.0236	8.4%
$2 \times$ Cov(person, estab effect)	-0.0050	0.0381	0.0431	9.4%
85-15 log wage percentile gap	0.655	0.916	0.260	6.7%
85-50 log wage percentile gap	0.385	0.503	0.118	7.1%
50-15 log wage percentile gap	0.270	0.412	0.142	6.4%
Panel C: Counterfactual II: Adjusting Wage and AKM Effect of Additional Outsourced Workers				
Total Variance of Log Wages	0.132	0.200	0.068	7.1%
Variance of Estab Effects	0.0289	0.0518	0.0229	11.2%
$2 \times$ Cov(person, estab effect)	-0.0050	0.0408	0.0457	3.8%
85-15 log wage percentile gap	0.655	0.925	0.270	3.3%
85-50 log wage percentile gap	0.385	0.510	0.125	1.6%
50-15 log wage percentile 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 fulltime 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. Panel B shows the counterfactual where workers in cleaning, security and logistics (CSL) occupations in 2008 are reweighted in order to keep them at the same percentiles of the AKM distribution as in 1985 using DFL reweigthing (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.

Figure 1:   Frequency of On-site Outsourcing Events by Year
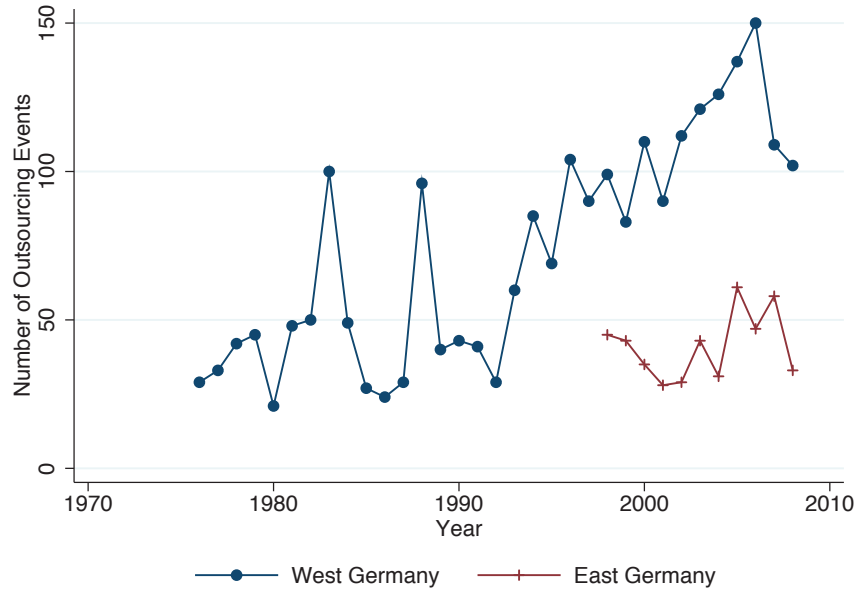
(a) Number of Outsourcing Establishments in East and West Germany
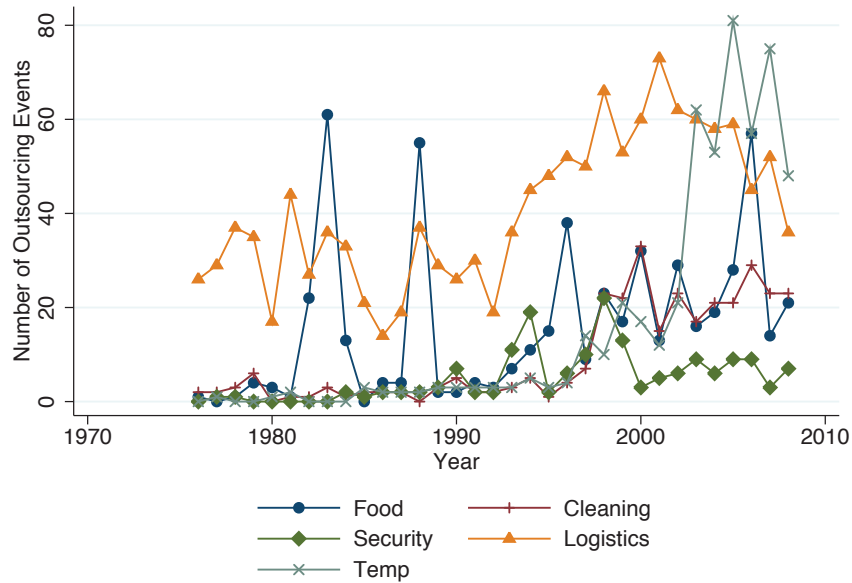
(b) Number of Outsourcing Establishments by Type of Outsourcing

Notes: 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. The top figure breaks this up by East and West Germany, while the bottom breaks it up by outsourcing type. Only the bottom figure includes outsourcing to temp agencies.

Figure 2: Share of Workers employed by Business Service Firms and Temp Agencies over time
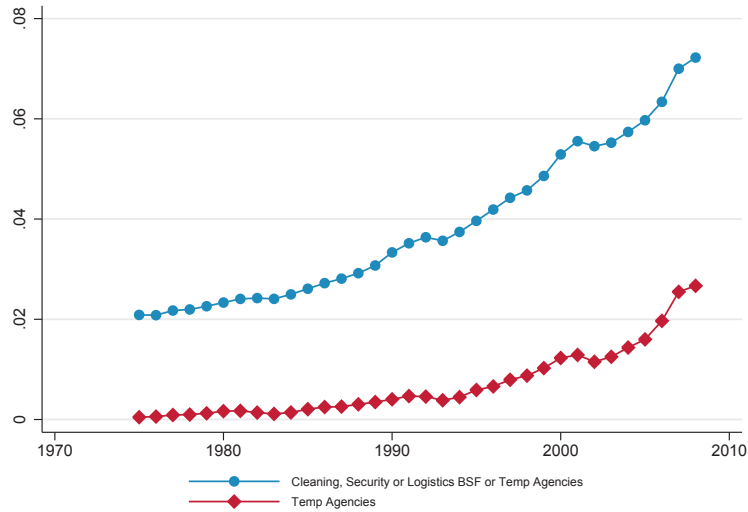
(a) Worker in all Occupations
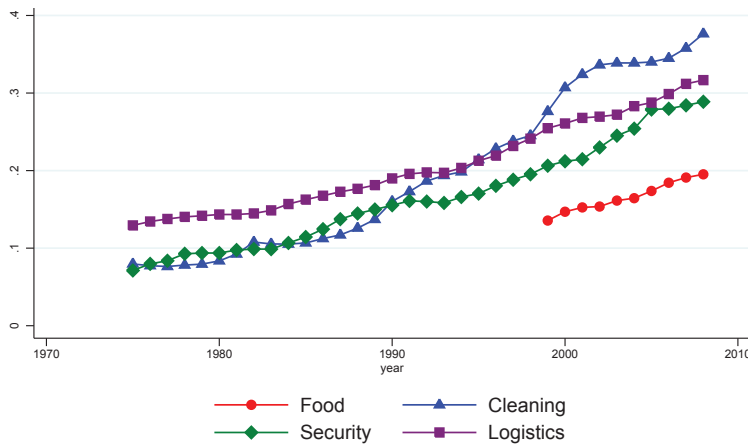
(b) Workers in Food / Cleaning / Security / Logistics Occupations

Notes: The top figure shows the share of all fulltime 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. The top figure 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.

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Figure 3: Share of Firms with any Food/Cleaning/Security/Logistics workers, by Industry

(a) Retail

(b) Manufacturing

(c) Finance

(d) Hospitals

Food   Cleaning
Security   Logistics – Drivers
Logistics – Warehouse
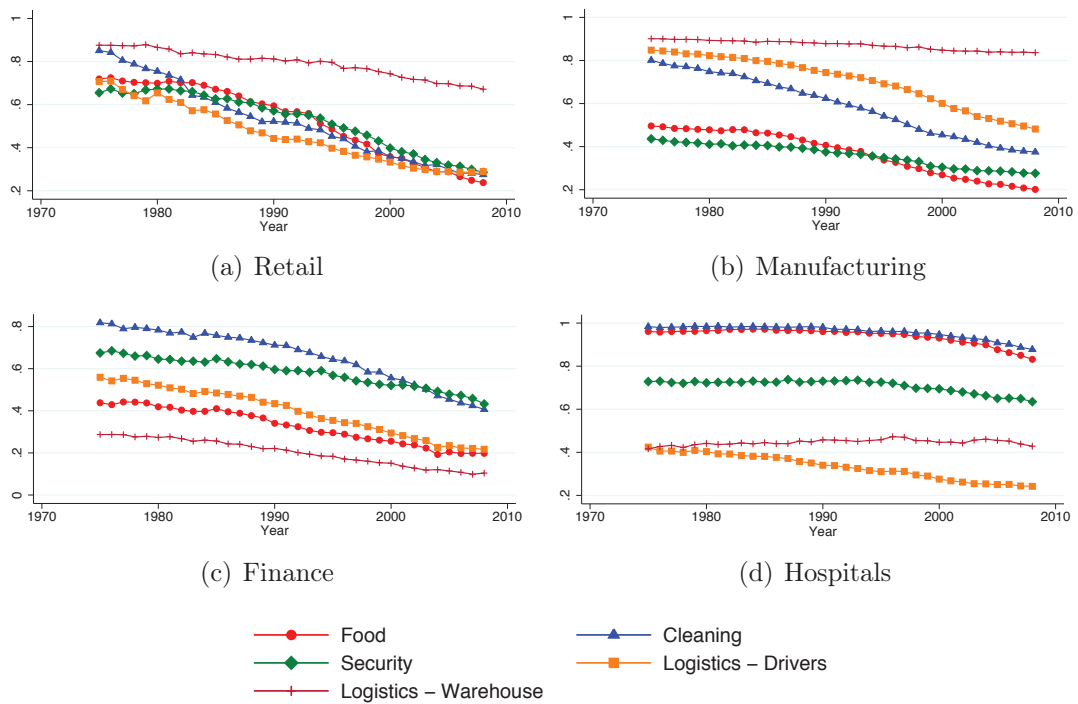
Notes: The Figure shows the fraction of West German establishments with at least 100 workers in 4 major industries (retail, manufacturing, finance and hospitals), who are employing at least 1 worker in the respective occupations (food, cleaning, security, driver or warehouse worker). The data covers 1975 to 2008 and in each year is based on the employee composition on June 30th.

Figure 4: Employment Outcomes of Outsourced and Non-Outsourced Workers Before and After On-site Outsourcing

(a) Yearly Earnings

(b) Log Daily Wage

(c) Days Worked Per Year

(d) Probability of working at outsourced job
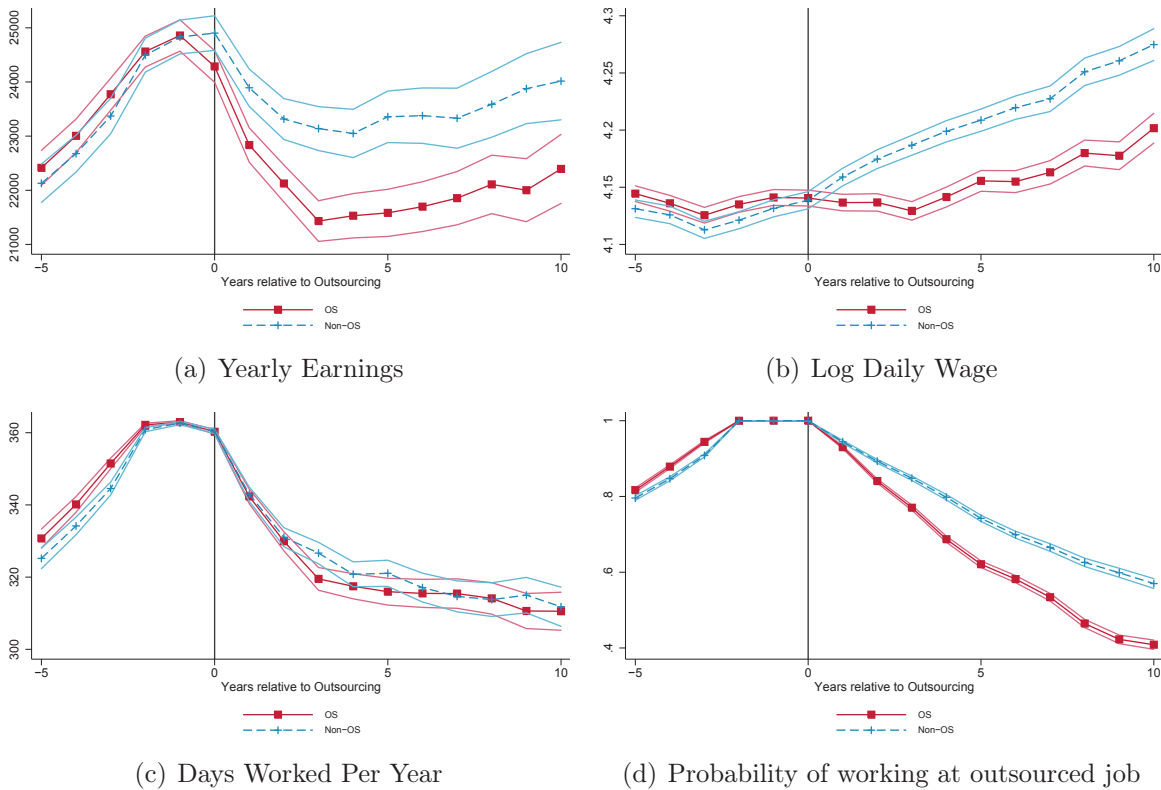
Notes: The figures follow two group of workers: the first is a group of workers who are outsourced between year t=-1 and t=0, while the second group is a control group of non-outsourced workers. The control group was chosen by finding workers employed in the same industry and occupation with similar tenure and establishment size in the year prior to outsourcing, and have similar wages 2 an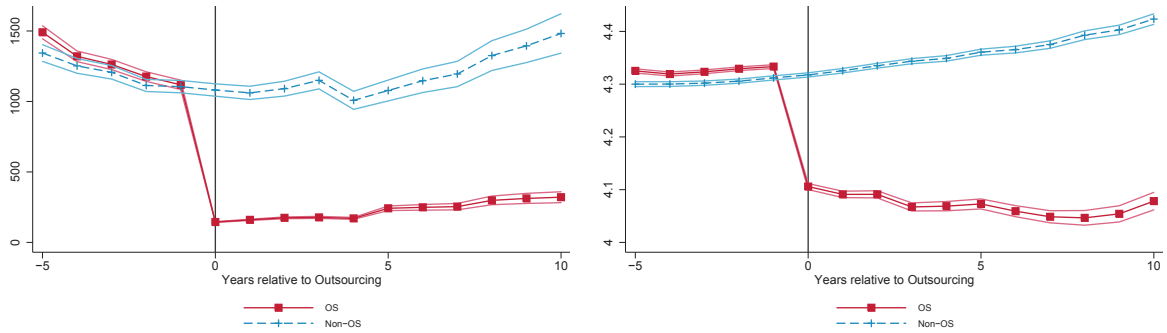d 3 years prior to outsourcing as the outsourced workers. The figures show average characteristics of the workers in the two groups before and after the outsourcing event. The wage graph uses the full universe of workers, while the earnings and days worked graphs use a 25pct sample (to be updated using the full universe of workers soon).

Figure 5: Regression Estimates of the Effect of On-site Outsourcing on Log Daily Wages
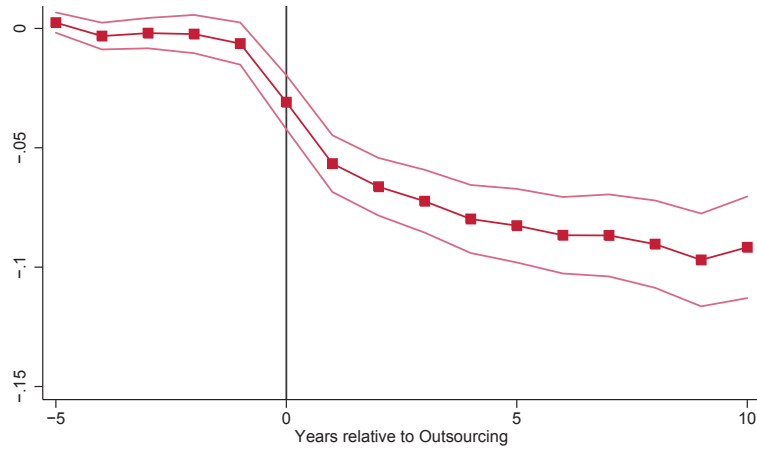
(a) All worker observations before and after outsourcing
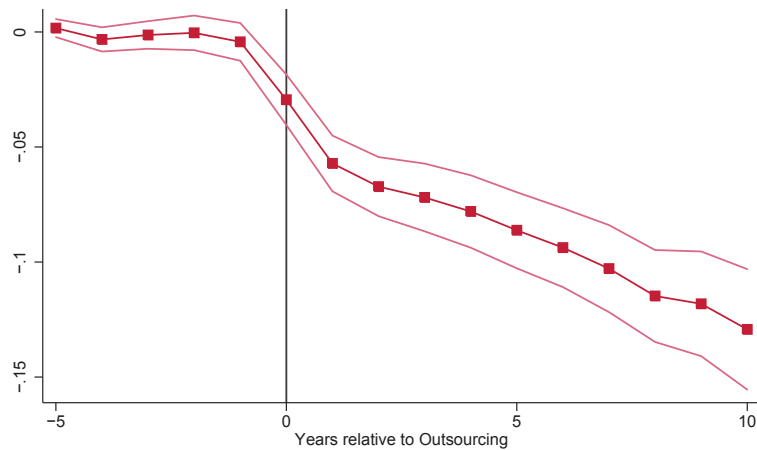
(b) Sample restricted to observations remaining at the same job

Notes: The figures show regression estimates of the effects of being outsourced on log wages before and after the outsourcing event (see equation 2). The omitted category is year -1. The bands are 95 percent confidence intervals (SE 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 non-outsourced 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, and have similar wages 2 and 3 years prior to outsourcing as the outsourced workers.

The sample consists of all workers outsourced during on-site outsourcing events from 1975 to 2008 as well as the matched control group. The top panel shows results irrespective of whether they move to other establishments in later years. The bottom panel restricts the sample to workers who are at the outsourced job, i.e. 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.

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Figure 6: Comparing Estimated Wage Premia (AKM Effects) based on FCSL and Non-FCSL workers
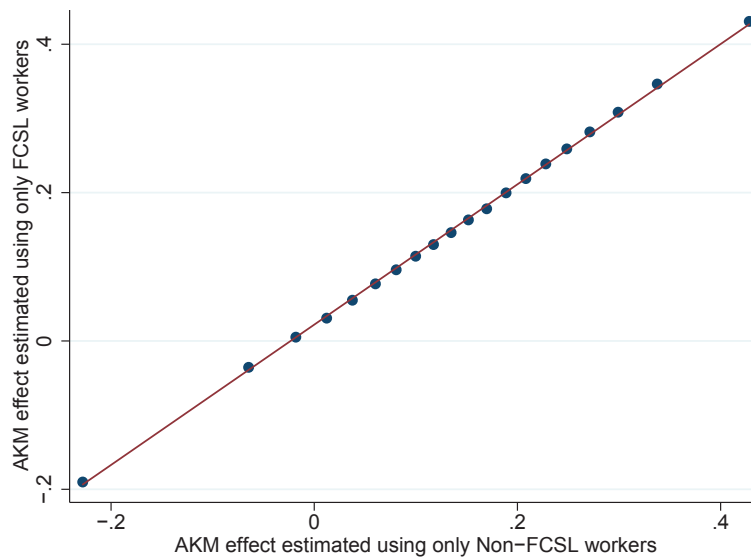
Notes: The figure shows a binned scatter plot of AKM effects estimated using food, cleaning, security and logistics (FCSL) workers and non-FCSL workers. Each dot corresponds to 1/20th of the observations. Sample is restricted to all German establishments with at least 100 employees. The regression coefficient of the simple regression is 0.946 (SE: 0.0003). The measurement bias corrected regression coefficient (using split sample IV to correct for measurement error in the RHS variable) is 1.05 (SE: 0.0004). For establishments with more than 500 employees the reg coefficient is 0.99 using OLS and 1.01 using split sample IV (SE around 0.0004 in both cases). All standard errors clustered on the establishment level.

Figure 7: Establishment Characteristics of Outsourced and Non-outsourced Jobs before and after Outsourcing

(a) Size of Employer (Establishment)

(b) Average Log Wage of Coworkers
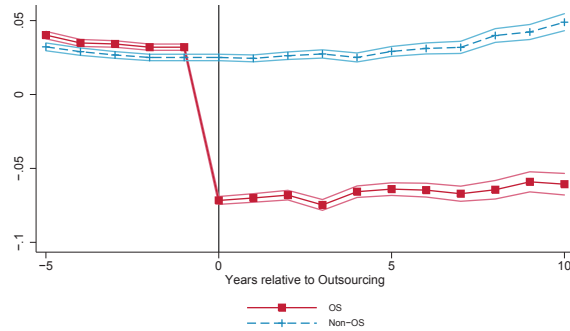
(c) AKM Effect of Employer

Notes: Sample 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. 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 non-outsourced workers. The figures show average characteristics of the establishments where the workers in the two groups are working before and after the outsourcing event. The AKM effect is the estimated establishment fixed effect from a wage regression including a full set of worker and establishment fixed effects using the universe of wage records in Germany.

Figure 8: The Effects of Outsourcing by Characteristics of Outsourcing Firm
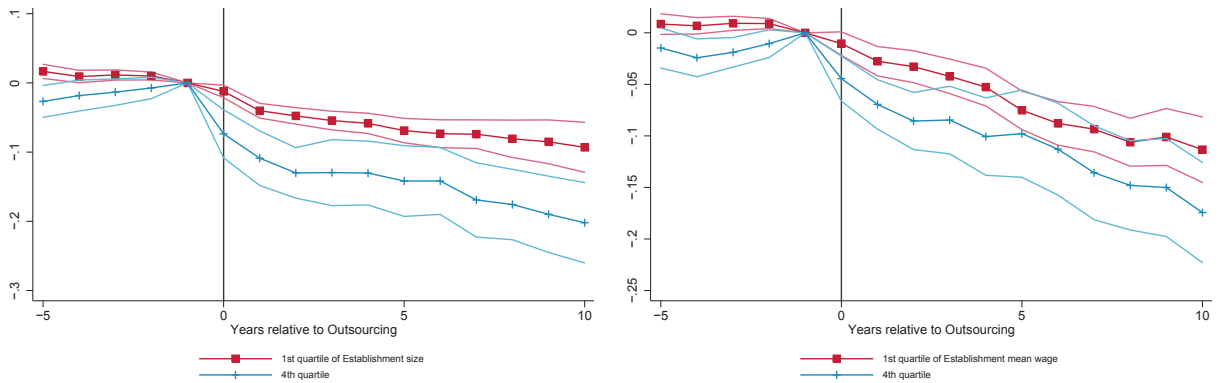
(a) Log Wage by Size of Outsourcing Establishment (1st vs. 4th Quartile)

(b) Log Wage by Mean Wage of Outsourcing Establishment (1st vs. 4th Quartile)
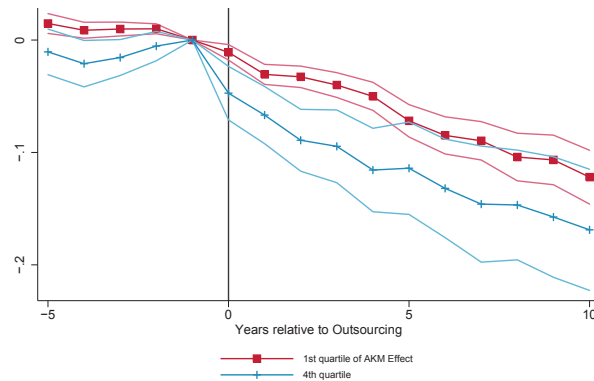
(c) Log Wage by Establishment AKM Effect of Outsourcing Establishment (1st vs. 4th Quartile)

Notes: The figures show regression estimates of the effects of being outsourced on log wages and establishment AKM effect before and after the outsourcing event. The regression is based on equation (2) in the paper where outsourcing is interacted with characteristics of the outsourcing establishment. The omitted category is year -1. The bands are 95 percent confidence intervals (SE 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. The establishment AKM effects are calculated using the method described in Card, Heining and Kline (2013) using the universe of social security data for Germany (own calculations).

Figure 9: Market Entry of New Business Service Firms over Time
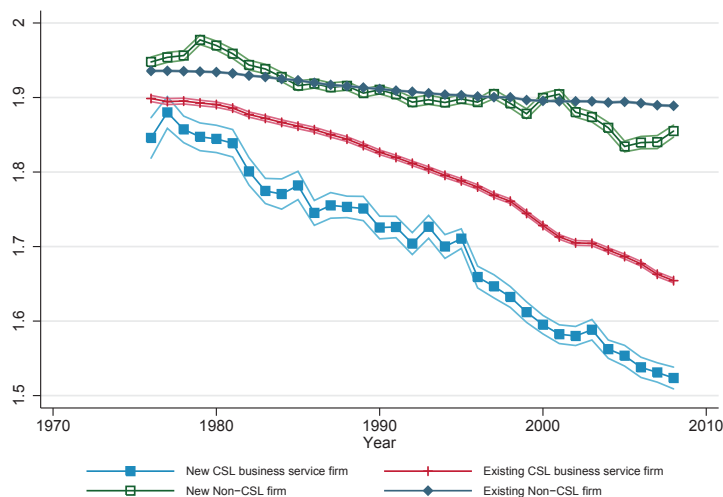
(a) AKM Effects of New and Existing Establishments by Year
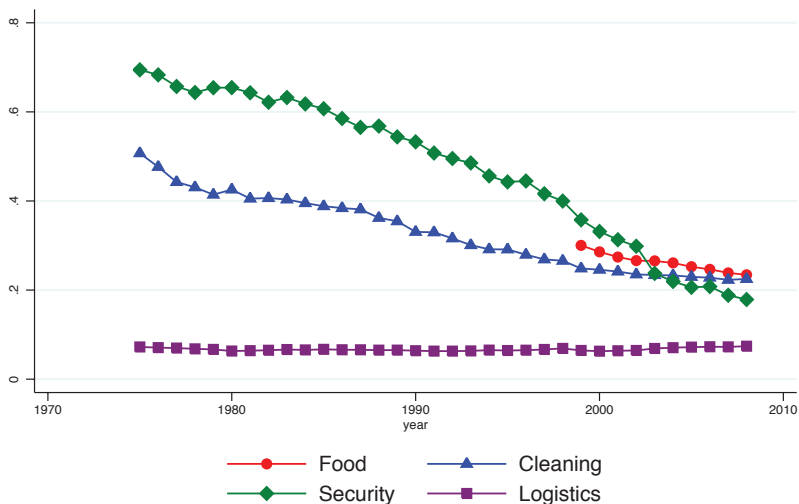
(b) Market Concentration of Business Service Firms by Year

Notes: The top figure shows the AKM effect (estimated over the entire duration of an establishments 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. The bottom figure 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 is restricted to West Germany 1975-2008.
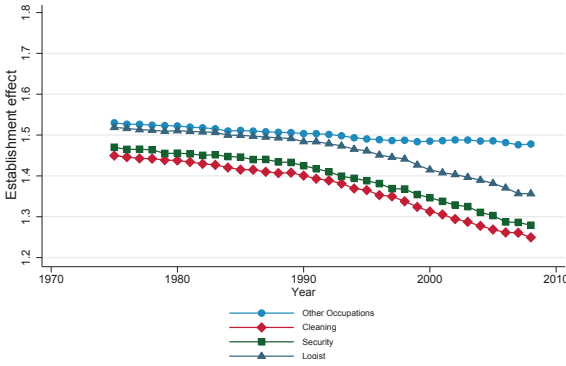
Figure 10: Decoupling of Wages in Logistics, Cleaning and Security Occupations from General Wage Growth
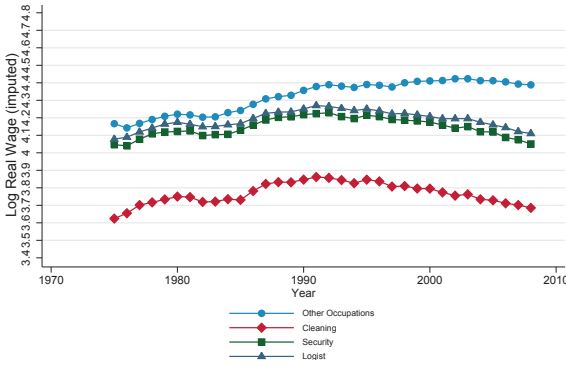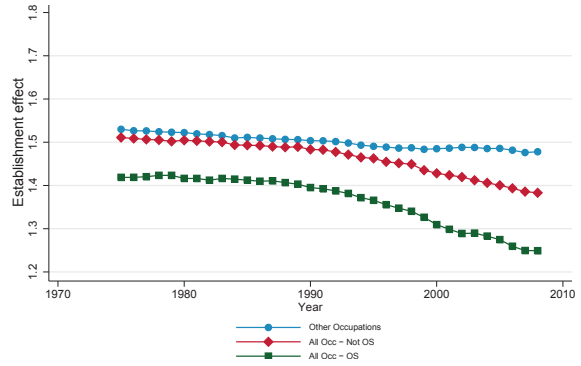

(a) Evolution of Wages by Occupations
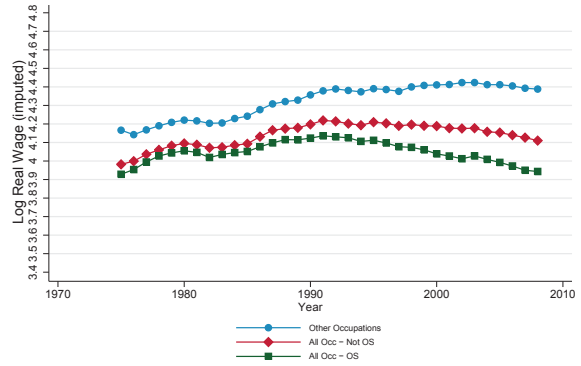
(b) Evolution of Wages by Outsourced Status

(c) Evolution of AKM effects by Occupations

(d) Evolution of AKM Effects by Outsourced Status

Notes: The figures show how wages in logistics, cleaning, and security (LCS) 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 LCS workers have evolved depending on whether they are outsourced or not, relative to workers in other (non-LCS) occupations. Panel (c) the establishment (AKM) effect by occupation, and panel (d) shows the AKM effects for LCS workers by outsourcing status and the AKM effects for all other occupations.

Figure 11: Occupational Concentration (Herfindahl index) over Time for Cleaning, Security and Logistics Workers
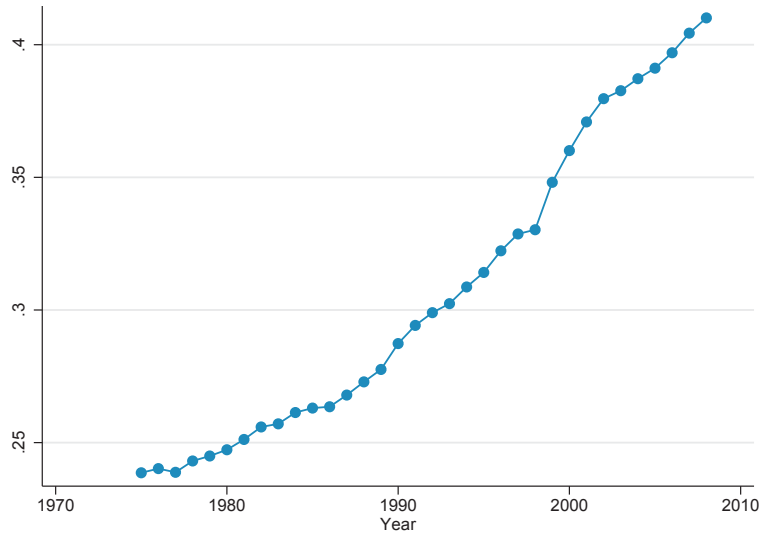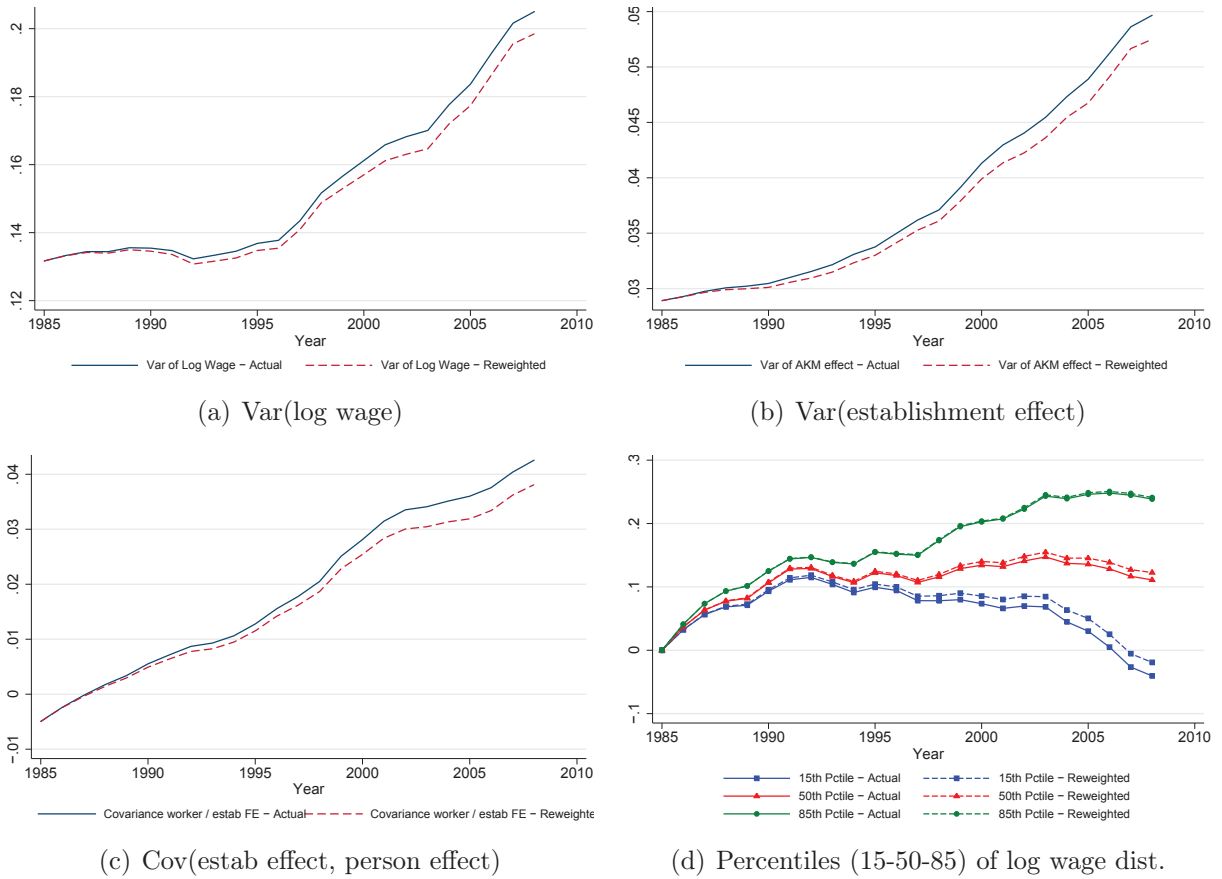

(a) Occ. Concentration CSL Workers
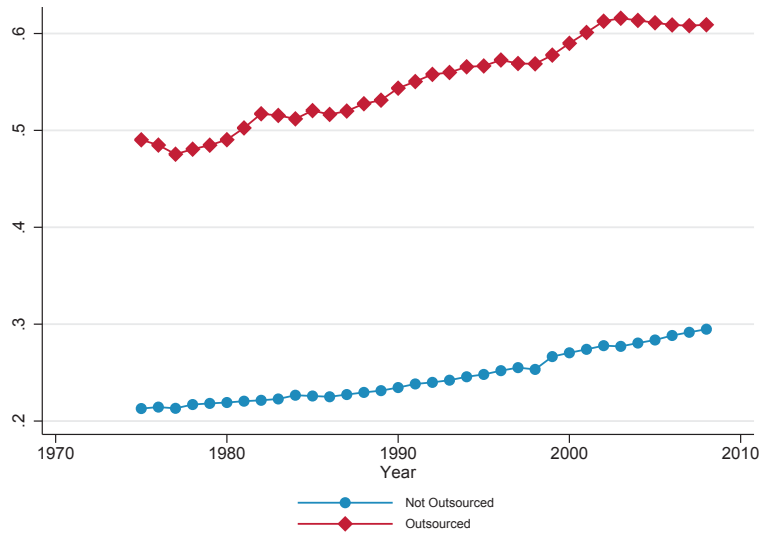
(b) Occ. Concentration by Outsourced Status

Notes: The figures show the herfindahl index of occupational concentration in the establishments where cleaning, security and logistics workers are employed. While show the average concentration index for all CSL workers, Figure b) breaks it up by whether or not the worker is working for a business service firm (outsourced).

Figure 12: The Evolution of the West German Wage Structure, Actual and DFL Reweighted

(a) Var(log wage)

(b) Var(establishment effect)

(c) Cov(estab effect, person effect)

(d) Percentiles (15-50-85) of log wage dist.

Notes: The figures shows how the variance of log wages and its components has evolved over time. 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 had remained constant at the 1985 level, where the counterfactual is constructed using DFL reweighting (see text).