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 being 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 analysis joint with propensity score matching 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, particularly showing that outsourcing contributed substantially to the increase in wage dispersion and the strength of assortative matching between workers and firms.

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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, where large firms rely increasingly 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 and IT. Such 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 perception (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 then find it beneficial to reduce the number of direct employees who benefit from such wage premia by outsourcing jobs to subcontractors. These business services firms compete fiercely with each other for service contracts from large companies on price, and since labor costs are a large share of business services 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 eco-
nomics 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 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. Outsourcing however 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. 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 in detail 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 such rents. Finally, we consider the relationship between the documented increases and impacts of outsourcing and the broad changes in the wage distribution experienced by Germany over the last decades.

[1] Weil (2014) provides a detailed, largely qualitative, analysis of the practice of domestic outsourcing 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.

[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.
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 large employers spin 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 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 is likely reflecting 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.

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 with different employees. However, on-site outsourcing events provide a particularly powerful testing ground to analyze the wage effects of outsourcing, since we are essentially following 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. We complement this analysis with a broader measure of outsourcing, where a worker in a logistics, food, cleaning or security 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 has accelerated in the late 1990s and continues into recent
years.

Our main contribution is to provide cleanly identified effects of outsourcing on the wages paid for outsourced jobs using three 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. The approaches in principle have various advantages and disadvantages, but yield very similar results: After on-site outsourcing wages for outsourced workers fall by around 12 percent within 5-10 years compared to the control group, essentially the same 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 estimate a measurement of the establishment wage premium by implementing a full decomposition of wages in Germany into establishment and worker fixed

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3This 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 a increasingly smaller share of the value added of final goods.

4This 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.
We find that the establishment fixed effect of workers moving to business service firms falls by around 10 log points, fully explaining the wage losses at outsourcing. We 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 and are much larger when workers are outsourced from large employers or establishments with high establishment effects. 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. 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.

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5 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.

6 Outsourcing it 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.\footnote{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.”}

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 firm 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

Throughout the 1970s and 1980s, while union coverage declined in many other countries, Germany maintained high union density and relatively stable collective bargaining agreements, covering around 75 - 80 percent (see Doellgast and Greer, 2007; Fitzenberger et al., 2013; Dustmann et al., 2014). 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 level or on the firm level, often in close coordination with elected firm or establishment level work councils. 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 negotiations or without any agreement. Firms which do not leave the union contracts can achieve additional wage flexibility through “opening clauses”, which allowed for wages below the collectively agreed upon level. While workers can attempt to resist an employer who tries to leave the collective agreements through strikes or the work councils, the success of this will depend on the ability of the employer to threaten job cuts or even plant closings to move production elsewhere.

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. 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 impose West German wage levels in East German

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Footnote:

8 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.
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. The increased pressure from globalization, the real threat of offshoring production to Eastern Germany or the newly accessible Eastern European countries, and the 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 the 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 even form a work council.

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 other firms, thus making it easier to outsource.8

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8It 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.
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\textsuperscript{10}. 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. 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 (since it determines the social security contributions) but top coded. The IEB also contains information on benefits receipt from the unemployment insurance system. The data covers all employment subject to social security contributions, but excludes certain types of government employees and the self-employed. For our approach of measuring outsourcing it is important that the data contains industry and occupation for every worker. 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\textsuperscript{11}.

2.3 On-site Outsourcing

Although the IEB, like most data sets, does not contain any specific information on outsourcing, we developed 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,

\textsuperscript{10}See Oberschachtsiek et al. (2009).

\textsuperscript{11}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.
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. As we argue below, since in the case of on-site outsourcing the worker and workplace remain the same with the main difference being the change in the employment contract, this allows for particularly clean estimates of the effects of outsourcing on jobs.

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 cluster of workers to be a group of workers who were all employed in establishment A in one year and then, in the following year, were all employed in establishment B; a cluster represents an outflow from establishment A, the predecessor, and an inflow into establishment B, the successor. We create a data set of all such clusters between every pair of establishments in each year.

On-site outsourcing events are defined using these clustered flows between predecessor and successor establishments. A clustered flow at time t is considered an 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

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12This 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.
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. 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. 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.\footnote{The Online Appendix lists the precise industry codes we use to define outsourcing and business service firms.}

For all outsourcing events, we call the predecessor establishment the mother, and the successor establishment the daughter.\footnote{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.}

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 (for example it seems more likely that these temp agencies would also provide services to other businesses). On the other hand temp agencies clearly played an important role in the rise of outsourcing in Germany. We therefore focus in 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.

Table 1 provides summary statistics for establishments in the year 2000. For the first column, we include any establishment that outsourced part of its workforce in an on-site outsourcing event between 2000 and 2007. Column 2 includes all establishments who did not outsource during these years. Outsourcing establishments tend to be larger and older. They are also more likely to be in the retail, services or health industry sector. In fact, among outsourcing establishments the most common industries are department stores and hospitals, but there are also a sizable number of manufacturing plants, financial sector companies and transportation companies. Interestingly, in terms of labor force characteristics they are very similar, for example the share of college, female workers or average years of education is almost identical across the two groups. One difference is that the outsourcing establishments pay slightly higher wages. Column (3) by comparison shows characteristics for business service firms. Average wages are much lower, the firms are younger, and workers are much more likely to be in FCSL occupations.

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)). 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 different mother establishments.
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, or when outsourcing happens more gradually. For example we would not be capturing slower movements of tasks to outside contractor 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). This is, on the one hand, because the on-site measure of outsourcing relies on worker flows that are somewhat extreme and therefore easily interpretable but also exclude many gray cases. On the other hand, this is because on-site outsourcing represents a flow measure (new outsourcing events) as opposed to a stock measure of the total amount of outsourcing in the labor market.

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 who - based on their industry codes - provide cleaning, security or logistics services to other firms or who are temp agencies.\footnote{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.} 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 number 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.

In Figure 2(b) we show the share of outsourced workers in food, cleaning, security and
logistics occupations who are outsourced, where outsourced is again defined as working for a
FCSL business service firm or a temp agency.\textsuperscript{16} 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 occupations who are
working for business service firms, from less than 10 to almost 30 percent towards the end of
the sample period. Over the shorter time period there has been an increase in the share of
food workers employed in business service firms, from about 16 percent to 26 percent.\textsuperscript{17} This
may still undercount the number of jobs outsourced in relation to establishment cafeterias, as
establishment cafeterias are likely to also employ a large number of workers (such as cashiers)
who are not in food occupations and who these figures thus do not count as outsourced.

Another way to evaluate the extent of outsourcing of FCSL services is by analyzing in-
dustries 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, manu-
facturing, 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

\textsuperscript{16}To our knowledge this approach of using industry and occupation codes to identify outsourcing was first

\textsuperscript{17}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.
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.\footnote{\textsuperscript{18} For example, Abraham and Taylor\cite{Abraham1996} 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\cite{Wooden1999} 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\cite{Dube2010} found an increase in the share of janitors and guards working for firms that provide labor services to other firms. Dey et al.\cite{Dey2010} 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\cite{Segal1997} and Autor\cite{Autor2003} document a sharp increase in employment in temporary help services between 1980 and 2000.} 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 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

The fact that firms outsource jobs that fall outside of their core business function suggests that they are able to realize cost savings by doing so. Many of these are service tasks for which labor costs are a large share of inputs; therefore, one way to achieve cost savings would be through lower wages. It is, however, not immediately obvious why business service firms would pay lower wages than the outsourcing firm. 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. Whether a particular job falls directly under a parent-business or is instead part of a subcontractor should not affect the wage in such an environment, and thus would not allow for wage savings by contracting out this task. 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:

\[ \ln(w_{jt}) = \delta \text{Outsourced}_{jt} + z_{jt}' \gamma + x_{i(j,t);t}' \beta + \epsilon_{jt} \]  

where \( \ln(w_{jt}) \) is the (log) wage of job \( j \) at time \( t \). \( \text{Outsourced}_{jt} \) 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 char-
acteristics 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, for example 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 estimated by estimating equation (1) using OLS. However, in practice employer status (in-house vs contractor) 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 very rare to have information on job characteristics to satisfactorily deal with the omitted variable bias problem.

We provide two alternative estimates, explained in detail below, 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 Dubé 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 and we view them as complementary evidence. On-site outsourcing provides a setting which mitigates the omitted variable bias problem described above, allowing for a clean identification strategy for $\delta$. On-site outsourcing identifies events where outsourced workers are likely to remain in the same workplace doing the same job but under a different contractual arrangement. By following these workers over time before and after the outsourcing event, we are implicitly controlling for job fixed effects. However, such events are relatively rare and may not be representa-
tive of the bulk of outsourcing, since for example 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 for $\delta$ for the general population. On the other hand, wages after on-site outsourcing events may still be constrained by wage setting mechanisms at the outsourcing firms. The other approach, based on individuals switching for unspecified reasons between establishments, should cover many more types of outsourcing events. This higher degree of external validity comes at a cost, that there is more potential for selection into who becomes an outsourced worker. While individual fixed effects control for permanent differences between workers, it may be that workers work for business service firms after some kind of shock, such as a protracted unemployment spell associated with human capital depreciation and loss in earnings potential. This could lead to downward biases in the wage estimates. In addition, in this type of estimation, we have no information about job or workplace characteristics. To the extent that job characteristics, such as non-wage compensation, in general are worse at business service firms, this could lead to an underestimate of the true loss in compensation or utility in the latter two approaches. We thus view the two methods as separate important and complementary pieces. \[19\] Next we will focus on how we estimate the effect of on-site outsourcing, followed by the alternative estimates.

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

\[19\] 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. Such a 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.
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. 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.\footnote{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.}

Columns 1 and 2 of Table 2 show worker characteristics for our analysis sample.\footnote{The random non-OS workers were restricted to be age 25-55 and not in either the outsourced or the matched non-outsourced groups.} 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 education.

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

\[
y_{jt} = \sum_{k=-5}^{10} \delta_k I(t = t^* + k) \text{Outsourced}_{jt} + \theta_t + \xi_j + \alpha_t + x_{it}' \beta + \varepsilon_{jt} \tag{2}
\]

where \(y_{jt}\) is an outcome variable and \(\text{Outsourced}_{jt}\) is an indicator for whether job \(j\) was outsourced in year \(t^*\). \(\alpha_t\) are year fixed effects to control for year-level shocks that could affect all workers and jobs, \(x_{it}\) are individual-level time varying worker controls, and \(\varepsilon_{jt}\) is an error term. We do not directly observe the job or workplace, however 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 \(\xi_j\). Each coefficient \(\delta_k\) 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.

**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. However, at the time of outsourcing the two groups diverge, and 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

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22 Alternatively to matching one can also 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 of any regression adjustments.

23 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 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 treatment and control group.
similar in the years prior to outsourcing. After outsourcing, the wages of the non-outsourced group continue to increase steadily. Meanwhile, the 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 essentially no differences between the two groups. It thus seems that while outsourcing has a strong negative effect on wages and earnings of the outsourced workers, there are basically no employment effects.

While we can follow workers over extended time periods, the further away from the outsourcing event we compare outsourced and non-outsourced workers, the less likely it is that the workers are still at the same jobs. This leads to the potential for omitted variable bias, since our data lacks specific details on job characteristics. In order to more carefully control for job characteristics in our analysis, we can follow jobs - rather than workers - over time, by excluding those workers who change establishments, and hence leave their job, from our sample. However, we may be concerned that workers at business services firms, who may have lower wages, are more likely to leave in order to find a higher-paying job. In Figure 4 (d) we graph 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. 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 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.

In Figure 5 (a) we examine mean wages for outsourced and matched non-outsourced workers restricting our sample to workers who remained at the same job after outsourcing, effectively controlling for job fixed effects. There is a small drop in mean log daily wages for outsourced workers right after outsourcing of about 1-2 percent, and wages remain essentially flat thereafter. This is in sharp contrast to wages at non-outsourced jobs, which continue to grow at around 2-3 percent per year in real terms. Thus over time outsourced jobs pay significantly lower wages, with a 20 log-point difference between the wages of the two groups after 10 years.

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 could in principle be 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 such selection by estimating equation (2) controlling for individual fixed effects as well as year-level shocks, and by restricting the sample to workers at the same establishment as in time zero, thus implicitly controlling for job fixed effects.

Figure 5 (b) graphs the $\delta_k$ coefficients from estimating equation (2) using log daily wage

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24 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.
as the dependent variable. The regression framework confirms the results from comparing the means: outsourced jobs suffer an immediate drop in wages at the time of outsourcing and continue to decline relative to non-outsourced jobs, ending up about 15% lower after 10 years.\footnote{Results are similar if we include workers who change jobs, although the magnitudes are a bit smaller and there is a small short-term effect on employment variables such as days worked and days working fulltime per year. Please see appendix figures A-4 and A-5 for more details.}

Table 3 summarizes the results for wages for workers and jobs for the full sample and 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 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. 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 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 3 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 new establishments, which could be due to outsourcing events into new establishments being different along other
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 this is not the typical outsourcing experience for most workers. In addition, jobs that are outsourced in the circumstances identified by on-site outsourcing may be subject to agreements between work councils/unions and the outsourcing employer regarding the wages of the outsourced workers making it possible that we are underestimating the true effect of outsourcing on wages.

In order to obtain a broader estimate of the effect of outsourcing on wages, in this section we follow the method by [Dube and Kaplan (2010)], where outsourcing is defined based on workers’ occupation and industry codes. 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 FCSSL occupations and estimate an equation of the form:

\[
\ln(w_{it}) = \gamma_{\text{Outsourced}_{it}} + \theta_i + \alpha_t + x_{it}' \beta + \epsilon_{it} \tag{3}
\]

where \(w_{it}\) is the daily wage of worker \(i\) in year \(t\), \(\gamma_{\text{Outsourced}_{it}}\) 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, \(\alpha_t\) account for year-level shocks that affect all workers, and individual fixed effects \(\theta_i\) control for fixed and \(x_{it}\) for time varying individual characteristics.\(^{27}\) We also control for

\(^{26}\)Dube and Kaplan 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.

\(^{27}\)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.
a dummy whether a worker is employed fulltime or parttime, but this makes little difference and our results are virtually identical when we drop parttime workers. 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.

The drawback of this type of estimation is that we cannot control - either directly or indirectly - for workplace characteristics or job conditions, which may differ for outsourced and in-house jobs.\footnote{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.} Thus a negative effect of outsourcing on wages could, in part, be the result of worse working conditions for jobs with business services firms compared to in-house jobs. In addition, if workers are more likely to move to business services firms after experiencing a negative shock that would also affect their wages, then there may be issues of selection into outsourcing that are not controlled for by individual fixed effects.

Results are shown in the bottom panel of Table 3. We find that workers in FCSL occupations employed in business services firms have wages that are about 12% lower than non-outsourced workers in the same occupations. Cleaning workers face the largest losses from being outsourced, a deficit of 18%, while security workers face a 12% loss. Food and logistics workers at business services firms have wages that are about 7% lower than those employed in-house.

4 Do Firms Outsource to Exclude Workers from Rents?

There are three primary reasons why a firm may choose to outsource.\footnote{For a discussion of these also see Abraham and Taylor (1996) and Houseman (2001).} 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 which involves specialized skills or technology, which could be expensive for an individual firm to invest 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. 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 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. We start by providing a measurement of firm wage premia, following the methodology of Abowd et al. (1999) and CHK. We show that, consistent with the rent-exclusion hypothesis, these wage premia are lower for outsourced workers. In addition, other establishment characteristics typically associated with wage premia fall sharply after on-site outsourcing. Next, we show that the wage losses are highest among establishments with characteristics typically associated with paying larger wage premia. And third, we show that establishments that pay higher wage premia or are covered by collective bargaining agreements are more likely to outsource labor services.
4.1 Estimating the Loss in Firm Rents Using AKM Decomposition

To start, 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:

\[
\ln(w_{it}) = \psi_{J(i,t)} + \theta_i + \alpha_t + x_{it}' \beta + \epsilon_{it},
\]

where \(\psi_{J(i,t)}\) represents a vector of establishment fixed effects, \(\theta_i\) a vector of individual fixed effects and \(\alpha_t\) and \(X_{it}\beta\) are year effects and time varying observables. We closely follow CHK in the estimation of this model.\(^{30}\) 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.\(^{31}\) The establishment and worker fixed effects are only separately identified within a connected set of establishments which are linked through workers moving between them.\(^{32}\) 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.

\(^{30}\)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.

\(^{31}\)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.

\(^{32}\)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.
The estimated establishment fixed effect - which we refer to as “AKM effect” - provides a measurement of the wage premium provided by each establishment. 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: 

\[ E[\psi_{J(i,t)}|\text{outsourced}_i, \theta_i, \alpha_t, X_{it}] - E[\psi_{J(i,t)}|\text{non-outsourced}_i, \theta_i, \alpha_t, X_{it}] \].

To compute the difference we take all workers working 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. Results are shown in panel A of Table 4. 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 16 log points lower than FCSL workers who are not at business service firms or temp agencies. This is fairly consistent across occupation types - we see the largest difference for security workers (27 log points) and the smallest for logistics (12 log points), but all are negative and significant.

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 and temp agencies 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 10 log point loss in AKM effect, implying an approximately 10 percentage points lower wage premium, with losses ranging from 18 log points for security workers to 7.8 log points for cleaners.

### 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

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33 We include age, age squared, and age cubed, and interact these variables with dummy variables for different levels of education.
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 6 shows employer characteristics before and after on-site outsourcing, for whatever establishment they are employed at in each year. Panel (a) shows employer size before and after outsourcing. Outsourced and non-outsourced workers work in relatively similarly sized establishments, although the outsourced workers experienced a slightly declining trend in employer 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 6 (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 those with the most to lose - those coming from establishments with the highest
wage premia - would suffer the biggest drop in wages upon outsourcing. 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 7 (a) shows the effects of outsourcing separately for establishments in the top
and bottom quartile of the establishment size distribution (within the matched establish-
ments). 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 7 (b) shows the effects by the mean wage of the outsourcing establish-
ment, 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 7 (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.

In Table 5 we show the losses in AKM effects by quartiles of the AKM distribution prior
to outsourcing.\footnote{The quartiles are employment weighted and conditional on being in our treatment and control group
prior to outsourcing. Thus even the lowest quartile reflects AKM effects relatively high compared to the
average business service firm.} The table highlights that workers in the highest quartile have larger losses
in AKM effects. For example the highest quartile of logistics workers loses around 14 log points, while 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.

4.4 Propensity to Outsource

Finally, we turn to the question of which type of firms are most likely to outsource their service workers.\textsuperscript{35} 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 at least 5 workers in cleaning occupations in the last 5 years and on not downsizing by more than 50 percent. 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 $t$

- the establishment is not in an industry associated with cleaning

We also only keep the earliest instance of cleaning outsourcing for any establishment. Generalized outsourcing of food, logistics and security services is defined analogously.\textsuperscript{36}

\textsuperscript{35} Here we are somewhat limited by our data, which doesn’t contain characteristics of individual establishments beyond those that we can infer from the worker-level data. We are working to incorporate data from an establishment-level survey. Although the sample size of this survey is much smaller, it contains potentially useful information on collective bargaining status, profit levels, and workforce concerns.

\textsuperscript{36} 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
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 6. 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. 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 (7) 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 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 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 6 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 8 (a) shows that the AKM effects of business service firms have been falling substantially over time, with the newest entrants paying much lower wage premia compare to both the earlier cohorts of BSF and non-BSF establishments. Figure 8 (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 over time. For all types of BSF competition on the local level has increased markedly, which in term may have driven down prices and wages.

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 documented 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. 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. This pattern is also apparent among the labor service occupations we study in this paper: Figure 9 (a) shows the evolution of real wages in cleaning, security and logistics (CSL) occupations from 1975 to 2009. 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 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 9 (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

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37 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.
38 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.
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 on the one hand is likely a selection effect, were the establishments with the highest wage premia are most likely to outsource and on the other hand may 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 9 (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 2009. For logistics workers the pattern is even more striking, since until 1990 the AKM effects for logistics workers where 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, in the late 2000s they are employed in firms paying around 15 percent lower wages.

Figure 9 (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 2009. 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.\footnote{This is only briefly discussed in the published paper. More details are provided in the NBER working paper version.} 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\ref{fig:herfindahl} 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.\footnote{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.}

While panel a) shows that cleaning workers are employed by increasingly homogenous establishments, with an increase of the Herfindahl index of occupational sorting from 0.27 to 0.47, panel b) shows that there has been no increase conditional on being outsourced and only a very 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 0.68 and the latter of around 0.28 towards the end of the sample period. Thus almost all of the increase in occupational sorting among cleaning 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 cleaners at non-BSF firms might in part be due to increases in occupational homogeneity because other occupations may have been outsourced. Panels c) and d) show very similar trends for security workers. For logistics workers the increase in occupational homogeneity is similar, with one difference being that logistics business service firms are less homogenous than other business service firms but become more and more con-
centrated over time. The increase in occupational sorting for logistics workers is thus due to both the shift towards business service firms and the increase in concentration within the two groups.

5.3 The Distribution of Establishment Wage Premia

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. 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 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 log wages proposed in CHK.\(^{41}\)

We construct a counterfactual distribution of 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 are in the 90th percentile of the AKM distribution, we reweight CSL worker in 2009 so that still x percent are in the 90th percentile. 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 CSL occupation.\(^{42}\) The results of this reweighting exercise are shown in Figure 11. The solid line in panel (a) shows the variance of log wages by year, documenting 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.

The reweighting procedure is in many ways a lower bound of the impact of outsourc-

\(^{41}\)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.

\(^{42}\)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 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. Another alternative would be to simply use the point estimates for the loss in AKM effects at outsourcing and add it back to the AKM effects of workers who are outsourced on top of the outsourcing level in 1975. This leads to qualitatively very similar results as the results reported here.
ing on the wage structure. First, this exercise is holding the (unweighted) distribution of AKM effects constant. As described above however, 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 these 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 the distribution as well.

6 Conclusion

The labor market in modern economies has seen a fundamental restructuring in recent decades, where lead employers are increasingly contracting out parts of their non-core labor force. This transformation appears to be widespread across many occupations and industries, yet has received limited attention from economists. Using high quality administrative data, we document that the trend towards increasing reliance on outsourcing has also taken place in Germany, with a marked acceleration in the late 1990s. While we focus on a sub-group 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. Analyzing these changes more broadly will be an important area of future research.

This reorganization of the production structure changes the employment relationship for a large share of the workforce. As workers are employed by specialized business service firm, they are working for firms providing narrow products which are competing fiercely
with each other for contracts from lead companies. This creates pressure to reduce costs and lower wages, which likely make up a large share of input costs among 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 10 years after being outsourced. 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 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. This is supported by our finding that outsourced workers generally move to employers with characteristics commonly associated with lower wage premia and that these characteristics can account for most of the wage losses.

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 do so 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 share-holder value in the 1980s and 1990s) may be of similar importance as the development of new technologies that facilitate breaking out service provision.\textsuperscript{43} Understanding this is beyond the scope of

\textsuperscript{43}As an indication that outsourcing was simply not on the radar of managers and consulting firms, Appendix Figure A-7 shows the frequency of the term “outsourcing” in the Google books database. The term outsourcing only appears in the 1990s, coinciding with the sharp rise of outsourcing in Germany.
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 diminishing rents, might have contributed to overall economic growth and possibly the improved performance of the German economy over the past decade. The general equilibrium effects may well have increased average welfare, while at the same time having hurt the affected workers.
References


Guimaraes, Paulo and Pedro Portugal, “A simple feasible procedure to fit models with high-dimensional fixed effects,” *Stata Journal, 10* (4), (2010), 628.


<table>
<thead>
<tr>
<th>Establishments Outsourcing on-site 2000-2010</th>
<th>All Non-OS Estab.</th>
<th>Business Service Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># Employees</strong></td>
<td>832.47</td>
<td>169.20</td>
</tr>
<tr>
<td></td>
<td>(2,345.74)</td>
<td>(383.46)</td>
</tr>
<tr>
<td><strong>Avg Wage in Euro</strong></td>
<td>82.06</td>
<td>78.15</td>
</tr>
<tr>
<td></td>
<td>(20.70)</td>
<td>(22.21)</td>
</tr>
<tr>
<td><strong>AKM Effect</strong></td>
<td>1.48</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td>(0.15)</td>
</tr>
<tr>
<td><strong>Avg Yrs of Education</strong></td>
<td>10.70</td>
<td>10.70</td>
</tr>
<tr>
<td></td>
<td>(1.03)</td>
<td>(1.32)</td>
</tr>
<tr>
<td><strong>Share College</strong></td>
<td>0.09</td>
<td>0.10</td>
</tr>
<tr>
<td><strong>Share Female</strong></td>
<td>0.43</td>
<td>0.42</td>
</tr>
<tr>
<td><strong>Share West Germany</strong></td>
<td>0.79</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Firm Age in Yrs</strong></td>
<td>16.42</td>
<td>16.53</td>
</tr>
<tr>
<td><strong>Share Food Workers</strong></td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Share Cleaning Workers</strong></td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Share Security Workers</strong></td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Share Logistics Workers</strong></td>
<td>0.08</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Industry Shares</strong></td>
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</tr>
<tr>
<td>Mining, Energy</td>
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<td>0.20</td>
</tr>
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<td>Consumption Goods</td>
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<td>0.09</td>
</tr>
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<td>Construction</td>
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<td>Retail</td>
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<tr>
<td>Traffic, Telecom</td>
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<td>0.05</td>
</tr>
<tr>
<td>Health</td>
<td>0.03</td>
<td>0.05</td>
</tr>
<tr>
<td>Services</td>
<td>0.31</td>
<td>0.30</td>
</tr>
<tr>
<td>Other</td>
<td>0.03</td>
<td>0.09</td>
</tr>
</tbody>
</table>

**Observations**                           | 855              | 73002                  | 6295                   |

**Notes:** Table shows mean of each variable with standard deviation in parentheses. Data excludes East Germany prior to 1997. All characteristics as of 2000. Each outsourced worker was matched to a non-outsourced worker based on wage, establishment size, industry, occupation and tenure. Matched Non-OS establishments are where matched non-OS workers were employed. Outsourcing, Non-Outsourcing and Daughter Establishments are included if they were involved in an outsourcing events between 2000 and 2010. Excludes establishments with less than 50 employees.
Table 2: Characteristics of Outsourced and Non-outsourced Workers

<table>
<thead>
<tr>
<th></th>
<th>Outsourced at t=-1</th>
<th>Matched Non-OS at t=-1</th>
<th>FCSL at BSF/Temp</th>
<th>FCSL not at BSF/Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Daily Wage in Euro</td>
<td>69.93</td>
<td>70.18</td>
<td>51.07</td>
<td>63.71</td>
</tr>
<tr>
<td></td>
<td>(29.47)</td>
<td>(30.83)</td>
<td>(24.80)</td>
<td>(25.36)</td>
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<tr>
<td>AKM Effect</td>
<td>1.49</td>
<td>1.49</td>
<td>1.30</td>
<td>1.49</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.16)</td>
<td>(0.20)</td>
<td>(0.17)</td>
</tr>
<tr>
<td>Age in Years</td>
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<td>43.67</td>
<td>40.25</td>
<td>41.87</td>
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<td>(7.98)</td>
<td>(9.72)</td>
<td>(8.49)</td>
<td>(8.43)</td>
</tr>
<tr>
<td>Female</td>
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<td>0.47</td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>Years of Education</td>
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<td>10.22</td>
<td>9.93</td>
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<td>(1.06)</td>
<td>(0.89)</td>
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<td>0.03</td>
<td>0.01</td>
<td>0.01</td>
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<td>Working Fulltime</td>
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<td>0.76</td>
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<td>Tenure in Years</td>
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<td>8.58</td>
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<td>(5.80)</td>
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<td>Food Occupation</td>
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<td>0.21</td>
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<tr>
<td>Cleaning Occupation</td>
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<td>Security Occupation</td>
<td>0.03</td>
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<td>0.08</td>
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<tr>
<td>Logistics Occupation</td>
<td>0.34</td>
<td>0.34</td>
<td>0.42</td>
<td>0.53</td>
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</table>

| 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.
Table 3: The Effects of Outsourcing on Log Wages

<table>
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<tr>
<th></th>
<th>All FCSSL OS events &amp; workers</th>
<th>Food</th>
<th>Cleaning</th>
<th>Security</th>
<th>Logistics</th>
<th>Temp</th>
<th>OS to existing Estab.</th>
<th>OS to new Estab.</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>Post-OS short-run</td>
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<td>-0.048***</td>
<td>-0.11***</td>
<td>-0.069***</td>
<td>-0.039***</td>
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<tr>
<td></td>
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<td>(0.0028)</td>
<td>(0.0044)</td>
<td>(0.0050)</td>
<td>(0.0023)</td>
<td>(0.0040)</td>
<td>(0.0021)</td>
<td>(0.0026)</td>
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<tr>
<td>Post-OS long-run</td>
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<td>-0.087***</td>
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<td>517662</td>
<td>158971</td>
<td>73064</td>
<td>83574</td>
<td>202053</td>
<td>97538</td>
<td>305315</td>
<td>212347</td>
</tr>
<tr>
<td>Avg Outcome Var at t=-1</td>
<td>4.14</td>
<td>4.02</td>
<td>3.95</td>
<td>4</td>
<td>4.37</td>
<td>4.37</td>
<td>4.11</td>
<td>4.19</td>
</tr>
<tr>
<td><strong>Panel B: Effect of On-site Outsourcing on Jobs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-OS short-run</td>
<td>-0.054***</td>
<td>-0.045***</td>
<td>-0.10***</td>
<td>-0.072***</td>
<td>-0.035***</td>
<td>-0.15***</td>
<td>-0.041***</td>
<td>-0.073***</td>
</tr>
<tr>
<td></td>
<td>(0.0015)</td>
<td>(0.0025)</td>
<td>(0.0041)</td>
<td>(0.0044)</td>
<td>(0.0020)</td>
<td>(0.0035)</td>
<td>(0.0018)</td>
<td>(0.0024)</td>
</tr>
<tr>
<td>Post-OS long-run</td>
<td>-0.098***</td>
<td>-0.11***</td>
<td>-0.12***</td>
<td>-0.14***</td>
<td>-0.059***</td>
<td>-0.16***</td>
<td>-0.090***</td>
<td>-0.11***</td>
</tr>
<tr>
<td></td>
<td>(0.0030)</td>
<td>(0.0050)</td>
<td>(0.0083)</td>
<td>(0.0082)</td>
<td>(0.0043)</td>
<td>(0.011)</td>
<td>(0.0038)</td>
<td>(0.0048)</td>
</tr>
<tr>
<td>Observations</td>
<td>429949</td>
<td>134005</td>
<td>61276</td>
<td>69976</td>
<td>164692</td>
<td>72854</td>
<td>259434</td>
<td>170515</td>
</tr>
<tr>
<td>Avg Outcome Var at t=-1</td>
<td>4.14</td>
<td>4.02</td>
<td>3.95</td>
<td>4</td>
<td>4.37</td>
<td>4.37</td>
<td>4.11</td>
<td>4.19</td>
</tr>
<tr>
<td><strong>Panel C: Effects of working for Business Service Firm</strong> (Dube &amp; Kaplan 2010 Measure)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working for Business</td>
<td>-0.11***</td>
<td>-0.074***</td>
<td>-0.16***</td>
<td>-0.12***</td>
<td>-0.073***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Firm</td>
<td>(0.00055)</td>
<td>(0.0025)</td>
<td>(0.0013)</td>
<td>(0.0025)</td>
<td>(0.00060)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>36234249</td>
<td>1455432</td>
<td>10703132</td>
<td>3373983</td>
<td>20701702</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OS Workers</td>
<td>1701500</td>
<td>56263</td>
<td>733330</td>
<td>205880</td>
<td>739909</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-OS Workers</td>
<td>4709388</td>
<td>293825</td>
<td>1337476</td>
<td>446141</td>
<td>2774380</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Outcome Var</td>
<td>3.81</td>
<td>3.76</td>
<td>3.43</td>
<td>3.95</td>
<td>4.15</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: (*p<.1, **p<.05, ***p<.01) Standard errors are clustered 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. In Panel C, food regressions include only workers in food occupations, such as cooks, waiters and food preparers. A worker is 'outsourced' if he is employed in an industry that provides food services to other firms or a temp agency. Samples and variables are defined analogously for cleaning, security and logistics regressions. In food services regressions, workers at restaurants, cafes and hotels are excluded. Samples are restricted to workers age 25-55, working at establishments with at least 50 workers, and excluding East Germany before 1997. All regressions in this table control for individual fixed effects and year indicator variables, fulltime status, and age, age squared and age cubed interacted with education dummies.
Table 4: The Effects of Outsourcing on Establishment Wage Premia

<table>
<thead>
<tr>
<th>Panel A: OLS</th>
<th>All OS</th>
<th>Food</th>
<th>Cleaning</th>
<th>Security</th>
<th>Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working for Business</td>
<td>-0.14***</td>
<td>-0.17***</td>
<td>-0.11***</td>
<td>-0.26***</td>
<td>-0.11***</td>
</tr>
<tr>
<td>Service Firm</td>
<td>(0.00020)</td>
<td>(0.00095)</td>
<td>(0.00028)</td>
<td>(0.00059)</td>
<td>(0.00028)</td>
</tr>
<tr>
<td>Observations</td>
<td>33744965</td>
<td>1205601</td>
<td>10057326</td>
<td>3014162</td>
<td>19467876</td>
</tr>
<tr>
<td>OS Workers</td>
<td>1462892</td>
<td>41534</td>
<td>624617</td>
<td>172323</td>
<td>651270</td>
</tr>
<tr>
<td>Non-OS Workers</td>
<td>4327576</td>
<td>245946</td>
<td>1262057</td>
<td>390783</td>
<td>2563769</td>
</tr>
<tr>
<td>Mean dep var for OS workers</td>
<td>1.82</td>
<td>1.78</td>
<td>1.79</td>
<td>1.69</td>
<td>1.88</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Individual Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working for Business</td>
</tr>
<tr>
<td>Service Firm</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>OS Workers</td>
</tr>
<tr>
<td>Non-OS Workers</td>
</tr>
<tr>
<td>Mean dep var for OS workers</td>
</tr>
</tbody>
</table>

Notes: (*p < .1, **p < .05, ***p < .01) Standard errors, in parentheses, are clustered at the worker level. Food regressions include only workers in food occupations, such as cooks, waiters and food preparers. The variable “Working for Business Service Firm” takes a value of one if the worker is employed in an industry that provides food services to other firms or a temp agency. Samples and variables are defined analogously for cleaning and security regressions, respectively. In all regressions, sample is restricted to workers age 25-55 at establishment with at least 50 employees. Workers in East Germany before 1997 are excluded. In food services regressions, workers at restaurants and cafes and hotels are excluded. Controls for year dummies; fulltime status age age-squared and age-cubed interacted with education dummies. Panel B also controls for individual fixed effects.

Table 5: Change in AKM Effect by Outsourcing Type and Outsourcing Establishment AKM Effect

<table>
<thead>
<tr>
<th>Mother AKM Quartile</th>
<th>Food</th>
<th>Cleaning</th>
<th>Security</th>
<th>Logistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.10</td>
<td>-0.07</td>
<td>-0.14</td>
<td>-0.02</td>
</tr>
<tr>
<td>2</td>
<td>-0.08</td>
<td>-0.16</td>
<td>-0.10</td>
<td>-0.07</td>
</tr>
<tr>
<td>3</td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.06</td>
<td>-0.10</td>
</tr>
<tr>
<td>4</td>
<td>-0.24</td>
<td>-0.26</td>
<td>-0.16</td>
<td>-0.14</td>
</tr>
</tbody>
</table>

Notes: Change in AKM Effect of outsourced worker following on-site outsourcing. Sample divided into quartiles of akm effect of outsourcing (mother) establishment.
Table 6: Determinants of Outsourcing

<table>
<thead>
<tr>
<th></th>
<th>All Establishments</th>
<th>Establishment Panel Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Log Estab Size</td>
<td>0.0084***</td>
<td>0.00044</td>
</tr>
<tr>
<td>Log Avg Estab Wage</td>
<td>0.0046***</td>
<td>0.0046***</td>
</tr>
<tr>
<td>AKM Effect</td>
<td>0.0046***</td>
<td>0.0046***</td>
</tr>
<tr>
<td>Wage Premium to FSCL workers over BSF firms</td>
<td>0.0015***</td>
<td>0.0015***</td>
</tr>
<tr>
<td>Collective Agreement</td>
<td></td>
<td>0.0091***</td>
</tr>
<tr>
<td>High Salaries a Burden</td>
<td></td>
<td>0.00048</td>
</tr>
<tr>
<td>Pay Wages Above Standard</td>
<td></td>
<td>0.0029**</td>
</tr>
<tr>
<td>Observations</td>
<td>2086507</td>
<td>2086505</td>
</tr>
<tr>
<td>Mean of Dep Var</td>
<td>0.012</td>
<td>0.012</td>
</tr>
<tr>
<td>Mean of Indep Var</td>
<td>4.788</td>
<td>4.285</td>
</tr>
</tbody>
</table>

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 5-7 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. “High Salaries a Burden” = 1 if the establishment responded that one of its expected problems with human resources management in the next two years was the high financial burden on wage costs. “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.
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: Own Calculations
Figure 2: Share of Workers employed by Business Service Firms and Temp Agencies over time

(a) Workers in all Occupations

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

Notes: Own Calculations. Before 1999, industry codes did not differentiate between restaurants and food business services industries, such as canteens and catering. Excludes food workers employed in the restaurant, hotel and air travel industries. West Germany only.
Figure 3: Share of Firms with any Food/Cleaning/Security/Logistics workers, by Industry

Notes: Own Calculations. Excludes establishments with fewer than 100 workers. West Germany only.
Figure 4: Employment Outcomes of Outsourced and Non-Outsourced Workers Before and After On-site Outsourcing

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 and 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: Effect of On-site Outsourcing on Log Daily Wage of Jobs

Notes: Sample restricted 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. The figures follow two groups 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 top figure shows average wages of the workers in the two groups before and after the outsourcing event. The bottom figure show regression estimates of the effects of being outsourced on wages, controlling for individual fixed effect and year dummies. Bands represent 95 percent confidence intervals.
Figure 6: Establishment Characteristics of Outsourced and Non-outsourced Jobs before and after Outsourcing

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 7: 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: 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 show regression estimates of the effects of being outsourced on log wages and establishment AKM effect before and after the outsourcing event. The omitted category is year -1. Bands represent 95 percent confidence intervals. 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 8: Market Entry of New Business Service Firms over Time

(a) AKM Effects of New Establishments by Establishment Birthyear

(b) Market Concentration of Business Service Firms by Year

Notes: The top figure shows the AKM effect (estimated over the entire duration of an establishment's existence) of establishments by the year the establishment was founded (first appears in the data). The bottom figure shows the county level index of employment weighted market concentration among business service firms. The index can be interpreted as what is the probability of two randomly picked workers at business service firms in a particular year and county to work for the same business service firm.
Figure 9: Decoupling of Wages in Logistics, Cleaning and Security Occupations from General Wage Growth

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 groups and panel (b) the corresponding akm effect. Panel (c) Shows how wages for LCS workers have evolved depending on whether they are outsourced or not, relative to workers in other occupations. Panel (d) shows the AKM effects for LCS workers by outsourcing status and the AKM effects for all workers.
Figure 10: Occupational Concentration (Herfindahl index) over Time for Cleaning and Security Workers

Notes: The figures show the herfindahl index of occupational concentration in the establishments where cleaning workers (a and b), security workers (c and d) and logistics workers (e and f) are employed. While a), c) and e) show the overall concentration index, figures b),d) and f) break it up by whether or not the worker is working for a business service firm (outsourced).
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. 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).