Fairness and Wage Setting

Theory and evidence from Domestic Outsourcing in Germany*

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Abstract

In this paper, I estimate the effect of domestic outsourcing events on wages of workers that remain in outsourcing establishments. To do so, I use employer-employee linked data from Germany that include detailed administrative information on earnings, industry and occupation of employment. I exploit outsourcing event as my main source of identification and find substantial effects on the wages of workers that stay: high skilled workers typically receive immediate wage increases of about five log points, while low skilled workers typically face wage cuts of about one to two log points. Additionally, I find that, on average, the wage increases enjoyed by high skilled workers are positively correlated with changes in the skill ratio within the establishment. I propose a new theoretical model of wage setting in which fairness considerations generate spillover effects that are consistent with these two empirical findings. Taken together, these results indicate a role for fairness considerations in wage setting.

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1 Introduction

The increased use of domestic outsourcing services in recent decades has changed the employment relationship in the labor market in important ways, as employers increasingly rely on outside contractors rather than employed workers in the production process. Domestic outsourcing is generally defined as the decision of firms to buy local services (such as cleaning or security) on the market from other firms, instead of producing them in-house. The GDP share of these services almost doubled from 7 to 12 percent between 1982 and 2009 (Yuskavage et al., 2008), and about half of the workers used in the production of manufacturing products are currently employed outside of the manufacturing sector (Houseman, 2014).

Outsourcing firms typically pay higher wages than smaller firms that workers are being outsourced to (Abraham, 1990; Dube and Kaplan, 2010; Goldschmidt and Schmieder, 2015). In particular, recent evidence shows that the outsourced workers on average face substantial wage losses of about 10 to 20 percent (Dube and Kaplan, 2010; Goldschmidt and Schmieder, 2015). This is consistent with the finding that high (low) wage workers are increasingly sorted into high (low) wage firms (Card et al., 2013). In fact, the domestic outsourcing of cleaning, catering, security and logistics services alone explains about 10 percent of the rise in wage inequality in Germany (Goldschmidt and Schmieder, 2015). However, it is unclear whether outsourcing events impact the wages of "stayers", that is, of workers at the outsourcing firms, and other establishment-level outcomes. Nevertheless, this would provide valuable information on the possible wage setting mechanisms in outsourcing establishments.

In this paper, I fill this gap by estimating the effect of domestic outsourcing on the wages of workers that remain in outsourcing establishments. To do so, I use employer-employee linked data from Germany that include detailed administrative information on earnings, industry and occupation on the entire workforce for a panel of up to 15,000 establishments in Germany over a period of 18 years (1993–2010). I exploit outsourcing events, that are plausibly exogenous for workers employed and staying at the establishment, as my main source of identification. I find substantial effects on the wages of workers that stay: high skilled workers typically receive immediate wage increases of about five log points, and low skilled workers typically face wage cuts of about one to two log points. These findings are both statistically and economically significant. Additionally, I

find that wage increases for high skilled workers are correlated to changes of the skill ratio within establishments.

These empirical findings are consistent with a new theoretical model that describes the outsourcing decision for an employer that faces fairness considerations in the wage setting process. More specifically, workers have some internal notion of a "fair wage" and workers' morale is affected when they are paid below this wage, resulting is decreased effort (Akerlof and Yellen, 1988). Rees (1993) and Card et al. (2012) provide empirical evidence that fairness perceptions depend on the wages of coworkers, and being paid less than coworkers tends to affect workers' morale negatively, while being paid more has no detectable effects.[1] Following these studies, I model fairness perceptions for low skilled workers that are typically less well paid as affecting their productivity negatively if the spread between their own wage and the wage of high skilled colleagues increases. I account for the posibility that wages not only depend on these fairness considerations, but also on changes in technology at the establishment level, following a strand of literature that has linked wages to technology complementarities (Bound and Johnson, 1992; Autor et al., 1998).

The model predicts that fairness considerations generate wage increases for high skill workers in the wake of an outsourcing decision if the ratio of high to low skill workers increases, while wages for low skill workers go down. Furthermore, if fairness considerations are at play, the wage increase earned by high skill workers will be correlated to the change in the ratio of high to low skill labor within the establishment. While technology investments that are complements for high skill workers and substitutes for low skill workers are consistent with the first empirical finding, there is no evident reason to expect the wage increases for high skill workers to be correlated to the change in skill ratio at the establishment.

The empirical findings therefore support the theoretical predictions of a wage setting model where wages of workers do depend on the wages of their coworkers. While the second prediction may not rule out that new technological investments at the establishment are complements for high skill workers and substitutes, it does suggest there is a role for fairness considerations in the labor market. Furthermore, domestic outsourcing does not only lead to sorting by moving low-skill workers into low-wage occupations Goldschmidt and Schmieder (2015), it also does so by becoming

[1] It is worth pointing out there are other ideas of fairness in the workplayce, and therefore different ways in which fairness considerations could be modeled. This model simply takes a stand on a specific type that can be regarded of as a first-order concern in outsourcing decisions, and does not discard these other forms of fairness.

increasing high-skilled after the outsourcing decision. Finally, domestic outsourcing and fairness considerations also provide an economic incentive for establishments to rely on outside contractors and become more concentrated in terms of skills and occupations, two important trends in the labor market that are not readily explained by other labor market models.

This paper makes three contributions. First, this is the first study to focus on the effect of domestic outsourcing events on workers that stay in the outsourcing establishments. Second, I leverage these results to learn something about wage setting in establishments. In contrast to most standard models of wage setting, I find that wages of coworkers seem to be important and that fairness considerations in particular may be important. In contrast to most studies that rely on experimental lab evidence, this is some of the first evidence linking fairness considerations to wage setting. Finally, this model is also consistent with several recent trends in the labor market, such as the increasing use of domestic outsourcing and contracting out, or the trend of establishments to be increasing concentrated in terms of skill and occupations.

The remainder of this paper is organized as follows. Section 2 presents a theoretical model of wage setting where establishments act as wage setters and face fairness constraints. Section 3 presents the data and institutional setting of this study, while section 4 presents a measure for establishment-level domestic outsourcing. Section 5 presents the empirical strategy and results. Finally, section 6 concludes.

2 Theoretical framework

In this section, I build a simple model of domestic outsourcing decisions that allows for both mechanisms to affect the outcomes of interest. In particular, I allow for fairness considerations to impact the effort of workers (and hence their marginal productivity) and the search behavior of workers. These two mechanisms are grounded in both theoretical work and empirical work. The model has an establishment choosing between two types of labor (high skill and low skill) that each have their labor supply. I follow a recent literature that models establishments as diversified product that can act as wage setters because of differences in productivity across establishments (Card et al., 2016).

In a first step, I model establishments as cost-minimizers that can offer different wages as

a results of underlying differences in productvitiy. The establishment employs high and low skill workers both directly (in-house) and through the market (outsourcing). For in-house labor, they face a static labor supply as a result of these differences in wages. Workers observe the wages establishments set for their skill group, but only discover the wages of other skill groups in this establishment once employed. This, in turn, has an effect on their productivity in the establishment through fairness considerations.

Labor supply

There are two types of worker on the labor market: high skilled workers (type 1) and low skilled workers (type 2). A type s worker gets an indirect utility from working at an establishment j that offers wage w_{js} that is given by

$$\nu_{ijs} = \sigma w_{js} + \varepsilon_{ijs} \tag{1}$$

where ε_{ijs} is some idiosyncratic error term that follows a type I extreme value distribution. It is important to note here the worker does not necessarily observe the wages for the other types of workers. Each firm has some degree of market power as workers have some unobserved taste shock. Conditional on wages, these taste shocks as assumed to be independent.[2] If the number of establishments J is sufficiently large, Card et al. (2016) show these logit choice probabilities simplify to

$$P(\nu_{ijs} \geq \nu_{iks} \quad \forall\ k \neq j) \approx \lambda_s \exp(\sigma w_{js}) \tag{2}$$

where λ_s is some constant that is different across skill groups.[3] Finally, the labor supply function an establishment faces can then be written as

$$\ln(L_{js}(w_{js})) = \ln(I_s \lambda_s) + \sigma \ln(w_{js}) \tag{3}$$

The assumption that the number of establishments is sufficiently large implies a partial equilibrium framework where there are no strategic interactions between establishments. Given that the fraction

[2]Compared to other labor markets, such as the United States, the majority of benefits in Germany is captured through wages. While company cars and other amenities do exist, important benefits such as 401(k)'s are not used in Germany.

[3]It is possible to distinguish for different labor supply elasticities σ_s for different skill groups. Since I am not aware of any studies that highlight these elasticties are dramatically different across skill groups, I choose to simplify in this specific model.

of firms deciding to outsourcing is low in any given year, this seems like a reasonable assumption.

Additionally, market conditions allow establishment j to hire some high and low skill labor on the market — $\bar{L}_{j1}$ and $\bar{L}_{j2}$ respectively. The extent to which the establishment uses such services will depend on transaction costs, the availability of different services in local market, and other environmental factors. For these reasons, the firm largely is assumed to take these numbers as given and fixed.

Firm problem

Firms are cost-minimizers that produce a final good using high and low skill labor and need to set wages in order to meet the demand for their product. It is reasonable to allow for low and high skill workers to be imperfect substitutes. Therefore, I model this production function $f_j = f(L_{j1}(w_{j1}), L_{j2}(w_{j2}))$ as a CES production function with two inputs. Following Card et al. (2016), I allow for a productivity shifter T_j that differs across establishments and captures differential technological innovations. A_1 and A_2 capture differential productivity shifters across high and low skill workers.[4]

Following Akerlof and Yellen (1988) and Rees (1993), I assume high wage differentials within the establishment can negatively affect the effort (and hence marginal product) of workers. Most research (see, e.g., Card et al. (2012) or Rees (1993)) has found that fairness considerations mainly affect workers earning below the mean or the median within the establishment.[5] As low skill workers typically earn less than high skill workers, I assume the productivity of both these workers is affected by large wage differentials, following the empirical literature (Card et al., 2012). In particular, the productivity wedge can be written as $\tau(w_{j1}, w_{j2})$ where $\tau_1(.,.) < 0$ and $\tau_2(.,.) > 0$.[6] The cost minimization problem when producing the business service in-house can be written as

$$V_j(w_{j1}, w_{j2}) = \min_{w_{j1}, w_{j2}} w_{j1} L_{j1}(w_{j1}) + w_{j2} L_{j2}(w_{j2}) + C(\bar{L}_{j1}, \bar{L}_{j2}) \tag{4}$$

$$s.\ t. \qquad T_j \left\{ A_1 \left[L_1(w_{j1}) + \bar{L}_{j1} \right]^{\rho} + A_2 \left[\tau(w_{j1}, w_{j2}) L_2(w_{j2}) + \bar{L}_{j2} \right]^{\rho} \right\}^{\frac{1}{\rho}} \geq Y_{j1}$$

[4] These three productivity shifters are not separately identified, but this notation may clarify how different technological shocks may impact wages. Therefore, I opt to use this notation.

[5] In Card et al. (2012), the median is calculated at the department level, which could be thought of as an establishment. What workers exactly see as their reference group is not something that is clearly laid out in the fairness literature. Therefore, I assume the reference group of interest is the establishment.

[6] Here, $\tau_1(w_1, w_2)$ is shorthand for $\frac{\partial \tau(w_1, w_s)}{\partial w_1}$ and $\tau_2(w_1, w_s)$ is shorthand for $\frac{\partial \tau(w_1, w_s)}{\partial w_s}$.

It is worth noting here that in this context, differential skills are important for two reasons. On the one hand, there are different productivity levels associated to workers of different skill. On the other hand, they offer one way in which workers differ in wage levels, generating fairness considerations. Other reference groups are possible, but using difference in skill levels has the benefit it is a relatively clean and objective measure.

Firms or establishments will decide to outsource when new opportunities make it viable, i.e. when there is a shock to or change in $C(\bar{L}_{j1}, \bar{L}_{j2})$. When the outsourcing environment for an establishment changes in such a way that outsourcing becomes cheaper and outside labor can be contracted, an establishment can alter its employment by increasing the level of outside workers $\bar{L}_{j1}$ and $\bar{L}_{j2}$.

Wage setting

In any one time period, the firm minimizes the objective function, leading to the following first order conditions. I suppress the firm subscripts for brevity.

$$(1+\sigma)\mathcal{L}_1^{1-\rho} = \underbrace{\mu T f^{1-\rho}\left\{A_1 \frac{\sigma}{w_1}\right\}}_{\text{Without fairness}} + \underbrace{\mu T f^{1-\rho}\left\{A_2\tau_1(w_1,w_2)\left[\frac{\mathcal{L}_2}{\mathcal{L}_1}\right]^{\rho-1}\frac{L_2(w_2)}{L_1(w_1)}\right\}}_{\text{Fairness effect}} \tag{5}$$

$$(1+\sigma)\mathcal{L}_2^{1-\rho} = \underbrace{\mu T f^{1-\rho}\left\{A_2\tau(w_1,w_2)\frac{\sigma}{w_2}\right\}}_{\text{Without fairness}} + \underbrace{\mu_1 T f^{1-\rho}\left\{A_2\tau_2(w_1,w_2)\right\}}_{\text{Fairness effect}} \tag{6}$$

where μ is the Lagrange multipliers on the production constraint in equation **??**. For simplicity, $\mathcal{L}_1 = L_1(w_1) + \bar{L}_1$ and $\mathcal{L}_2 = \tau(w_1, w_2)L_2(w_2) + \bar{L}_2$ represent the effective labor units in terms of high and low skill labor. This can be though of as the amount of work that needs to is performed. There is perfect substitution between the actual work being done, which is arguably a reasonable assumption for several outsourcing services, such as catering workers, security guards, and cleaning workers.

In the absence of fairness considerations, $\tau(.,.) = 1$, $\tau_1(.,.) = 0$ and $\tau_2(.,.) = 0$. Therefore, all fairness effects simply drop out, and we are left with the leading terms in all equations. If $\tau_1(.,.) < 0$ and $\tau_2(.,.) > 0$ as assumed, the left hand side of equation 5 is driven downwards compared to the scenario when there are no fairness considerations, while the right hand side of equations 6 and

?? are driven up. Therefore, the effect of fairness considerations predicts wage compression, a prediction that is often hypothesized as an effect of fairness considerations (Bernhardt et al., 2016).

Furthermore, fairness considerations work operate as a tax that is carried by high skill workers. This follows from the assumption that workers are paid more (i.e. high skill workers) are typically not affected by fairness considerations (Card et al., 2012). Establishments internalize this knowledge therefore levy the tax on these high skill workers. However, this model can easily be extended to a scenario where the morale of high skill workers is affected and this decreases overall productivity at the establishment. This could be modeled by an overall productivity wedge for the establishment. However, as long as low skill workers and their morale are affected more by fairness considerations, the main intuitions of the model go through.

Additionally, the labor composition of the establishment also determines the extent to which fairness considerations affect the establishment. If the ratio of low to high skill workers is high, fairness considerations are expected to depress the wage of high skill workers more, as high skill workers need to carry a larger burden.

Assumptions on fairness and demand.

I follow Card et al. (2016) and assume firms face an inverse demand function of $P_j = P_j^0 (Y_{j1})^{-\frac{1}{\epsilon}}$. Here, ϵ is a market wide-parameter, while the P_j^0 parameter can be thought of as the potential of different firms to charge differential prices for the final good.

In order to get more traction on the effect of fairness considerations, I assume some structure on $\tau(w_1, w_s) = \left(\frac{w_s}{w_1}\right)^a$ where $a > 0$. If $a = 0$, there are no fairness effects.[7] This parameterization need not be a deep structural relationship, but can be thought of as a local approximation of the effect of fairness considerations on the marginal productivity of low skill.

Comparative statics.

When establishments decide to outsource, the wages that the establishment sets will change. Denote the wages before outsourcing are $\{w_1, w_2\}$, whereas the wages after outsourcing are $\{w_1', w_2'\}$. Taking logs and substracting wages pre-outsourcing from post-outsourcing wages gives the following

[7] If $a < 0$ low skill workers become more productive as their wages is further away from high skill workers. This is not supported by any empirical work, therefore assuming $a \geq 0$ seems relatively innocuous.

relationships[8]

$$\ln\left(\frac{w_1'}{w_1}\right) = (\rho-1)\ln\left(\frac{\mathcal{L}_1'}{\mathcal{L}_1}\right) + \ln\left(A_1\sigma - A_2 a\left(\frac{\mathcal{L}_2'}{\mathcal{L}_1'}\right)\left(\frac{L_2(w_2')}{L_1(w_1')}\right)^{1+\frac{a}{\sigma}}\xi^a\right) - \ln\left(A_1\sigma - A_2 a\left(\frac{\mathcal{L}_2}{\mathcal{L}_1}\right)\left(\frac{L_2(w_2)}{L_1(w_1)}\right)^{1+\frac{a}{\sigma}}\xi^a\right) \tag{7}$$

$$\ln\left(\frac{w_2'}{w_2}\right) = \frac{(\rho-1)}{1-a}\ln\left(\frac{\mathcal{L}_2'}{\mathcal{L}_2}\right) - \frac{a}{1-a}\ln\left(\frac{w_1'}{w_1}\right) \tag{8}$$

Under the assumption that "effective" labor units (i.e. $\mathcal{L}_1$ and $\mathcal{L}_2$) are constant, three key predictions arise.

1. The wage for high skill workers increases if the establishment becomes more "skill intensive", where skill intensity means $\frac{L_2(w_2')}{L_1(w_1')} < \frac{L_2(w_2)}{L_1(w_1)}$. In other words, if the share of high skilled workers increases, the wages of high skill workers are expected to go up.

2. Wages for low skill workers move in the opposite direction of the wages of low skill workers.

3. The wage increase high skill workers receive after an outsourcing event are larger if the establishment becomes more skill intensive.

The details for these predictions are provided in the appendix. The assumption that effective labor units are constant is a reasonable assumption where services provided are relatively homogenous, easy to provide, and not part of the core business of the establishment. Cleaning, for instance, is a task that is relatively well defined where it is reasonable to assume that the amount of cleaning does not change after outsourcing. For high skill outsourcing, this assumption may be less clearcut. If important, one may expect the change in effective labor units to be relatively strong (and increasing) for high skill workers. Under this assumption, we are likely to understate fairness considerations, as part of the wage increase for high skill workers does not only reflect this effect, but also the change in effective labor units after outsourcing.

Finally, the final prediction is specific to fairness considerations. It may well be that outsourcing events are associated changes in effective labor units or the adoption of investment that

[8] For simplicity, I assume that f does not change over time. It is, however, necessary to control for this in eventual regressions. Additionally, ξ in this context is a constant equal to $\xi = \left(\frac{\lambda_1 I_1}{\lambda_2 I_2}\right)^{1/\sigma}$

are complementary with high skill labor, while they are substitutes for low skill labor. There is not reason, however, to correlations such as the final one in the data. Therefore, this correlation might provide suggestive evidence that, at a minimum, fairness considerations are at play.

3 Data and Institutional Setting

Data

The data used in this paper combines two data sources from Germany, both made available by the Institute for Employment Research or IAB.[9] The first data source is the Betriebspanel or Establishment Survey, a representative and yearly survey of establishments in Germany, stratified according to establishment size, industry and federal state. The survey provides each establishment with a unique identifier that is matched to the establishment identification number (EID) that links this survey data to administrative employment data. The sample spans years 1993 through 2010 and consists of about 5,000 establishments at the start of the sample and about 15,000 establishments at the end of the sample.[10] The topics of the survey include, but are not limited to, employment development, production outcomes, investment decisions, unionization information and personnel structure.

The second data source is the Linked IAB or LIAB, a linked employer-employee dataset that augments the Betriebspanel with detailed administrative information from the German Social Security system for every employee in those establishments that are part of the survey. This data is matched using the unique EID identifier. The Social Security system combines data for all establishments and individuals into the Integrated Employment Biographies (IEB), that is built on the integrated notification procedure for health insurance, unemployment insurance, and the statutory pension scheme. Employers have to notify the social security agencies for all employees in a calendar year, using their administrative EID. They provide information on the employment spell (the exact starting and end date of their job), the total earnings, and education, occupation,

[9]For completeness, IAB stands for Institüt for Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit. The data used in this study are also described in further detail in Alda et al. (2005) or Heining et al. (2013).

[10]More specifically, the survey samples about 5,000 establishments from West Germany from 1993 until 1999 and about 10,000 establishments from West Germany from 2000 until 2010. The survey also samples about 5,000 establishments from East Germany from 1996 until 2010. Data past 2010 are not available yet, as the data reporting system underwent some changes. The IAB is working to make the post-2010 data consistent, and information until 2014 should be available soon.

trainee status, employment type (i.e. part-time of full-time), and several demographics for each unique employee identifier.[11] If the employment spell lasts longer than one year, an annual report is set up and communicated with social security agencies. In contrast to the IEB, the LIAB therefore does not cover the universe of the German workforce, only those workers that are employed by establishments sampled for the establishment surveys.

There are two models of the LIAB available, a cross-sectional model and a longitudinal model. The cross-sectional model follows establishments and provides detailed information of employment within all these establishments and only follows workers when they leave one establishment for another that is surveyed. In contrast, the longitudinal model tracks fewer establishments, but follows workers even when they leave. For the purposes of this paper, the cross-sectional model is used, as it maximizes the number of establishments in the sample and provides detailed information to answer the research questions of interest.

The EIDs are assigned by social security agencies on the basis of ownership, industry and municipality. Hethey et al. (2010) discuss some important issues that arise when using these EIDs. For instance, two manufacturing plants or restaurants owned by the same firm, operating in the same authority district (Kreis) will receive one EID. A manufacturing plant and a sales outlet that are run by one firm in the same Kreis, will receive two EIDs. Additionally, new EIDs can be issued when establishments change ownership. One way in which this could be important for my results is when an establishment breaks up in two separate establishments, one "general industry" establishment and one "business service" establishment, which would possibly lead to missing outsourcing events in the data. Mergers, with subsequent outsourcing, could similarly bias my results. Another limitation of the data is that there is top coding of the earnings information.

Appendix A provides details on the data processing used in this paper. I restrict the sample to observations that have non-missing establishment and person identifiers and focus on workers that are between 20 and 60 years old. In order to adjust for top coding, I use imputation techniques that follow other papers that made use of this data (Dustmann et al., 2009; Card et al., 2013; Goldschmidt and Schmieder, 2015). The precise details are discussed in appendix A.2. After imputing, I drop observations with daily earnings below 10 Deutsche Mark or euros.

[11] This unique employee identifier is not only unique at the establishment level, but unique for Germany, as it is based on social security numbers.

For the skill variable, the schooling variable is split up in high and low skill workers. Low skill workers include those workers that have finished middle or high school, with or without a vocational degree. High skill workers have finished either technical university or college. The effects within these skill groups are relatively similar when estimating the models at more granular levels of skill, so this grouping makes does not mask heterogeneous effects across the different skill levels within groups (e.g. those low skill workers with or without a vocational degree).

Institutional Setting

As labor relations and wage setting in Germany differ substantially from the US setting.[12] Collective bargaining agreements are typically set at the industry level and negotiated between the industry and labor unions. Establishments can either agree – covering *all* workers automatically – or they deviate from these agreements and set up an agreement at the firm or establishment level that union representatives have to agree and sign off on. Even in the absence of such agreement, establishments can opt out of agreements. When doing so, they are required to pay their existing employees according to previous wage agreements, but need not follow these agreements for new hires.[13]

Unionization is different from the collective bargaining agreement, as workers decide individually to join the union. Workers that are covered by the industry or establishment collective bargaining agreement are therefore not necessarily part of a union and vice versa. Addtionally, when it comes to firing workers, Germany does not adhere to employment-at-will which is common in the United States. There are specific laws protecting workers from mass layoffs. There is an upper bound on the number of employees any one establishment can fire within a 30-day period. Any layoffs above these thresholds need the authorization of the employment office, also called the Agentur für Arbeit. The last revision to this law was passed in 2008, with, for example, an upper bound of 5 employees for establishments employing 21 to 59 employees (see Kündigungsschutzgesetz, Section 17).

[12] For more complete discussions, Dustmann et al. (2014) and Fitzenberger et al. (2013) provide a good overview

[13] Despite the apparent benefits of changing to firm-level agreements, Dustmann et al. (2014) show that the union decline in Germany is primarily driven by firms going from industry level agreements to non-unionized workplaces.

4 Domestic Outsourcing

Measuring Domestic Outsourcing

Several methods to measure domestic outsourcing or contracting out have been used in the literature, and all methods require detailed industry and occupational information to do so. Abraham (1990) compares both high and low wage occupation workers across "general" industries and "business service" industries. Another strand of literature has focused on low skilled occupations such as janitorial or security services. The reason to focus on these occupations is twofold (Goldschmidt and Schmieder, 2015). First, these occupations are easily measured in the data and represent tasks that are fairly consistent over time. Second, the employment share of these occupations in the labor market has remained relatively constant. The employment of other occupations, such as typists or accountants, exhibits strong trends and changing job contents. Dube and Kaplan (2010) use a fixed effects strategy for people moving from a general to a business service industry, acknowledging that different types of workers may sort into different industries. Both of these studies can be performed using CPS or similar data. Both Abraham (1990) and Dube and Kaplan (2010) find that, using this definition, workers take a pay cut of about 10 to 20% when they are outsourced.

Linked employer-employee data provide other ways of measuring domestic outsourcing. Similar to Dube and Kaplan (2010), Goldschmidt and Schmieder (2015) study catering, cleaning, security and logistics occupations, but highlight the concern that the outsourcing decision in the previous definition is not necessarily exogenous from an individual's perspective, even when including worker fixed effects.[14] Using the complete IEB covering all German workers since 1975, they exploit the linked nature of their data, and identify events where at least ten people leave one "general industry" establishment to then all show up at a new "business service" establishment in the following year, something they coin *on-site outsourcing*.[15] They contrast this definition to the one used by Dube and Kaplan (2010) and find similar results: workers take a pay cut of about 10 to 15% when they are outsourced.

Similar to Goldschmidt and Schmieder (2015), I exploit the linked character of my data and

[14] See Gibbons and Katz (1992) for a more complete discussion.

[15] The precise restrictions they impose are the following. At least 10 workers leave a "general industry" establishment and show up at a new "business service" establishment in the following year; the "general industry" establishment does not close down in the following year; this worker flow represents at most 30% of the initial workforce at the originating establishment; and this establishment initially has at least 50 full-time employees.

focus on CCSL occupations, but define outsourcing events differently.[16] I build on a set of five descriptive facts, discussed in appendix B, to define outsourcing events at the establishment level rather than at the individual level. The first three panels of table B.3 describe the stability of CCSL employment within establishments. First, simple establishment fixed effects explain the majority of the variation in the employment level of these occupations. Second, adding a AR(1) structure on the error component highlights that employment within establishments is highly persistent, as the autocorrelation is close to one. Third, running these regressions with employment shares rather than employment levels decreases the autocorrelation coefficient considerably, indicating that the employment of these occupations does not increase one-to-one with the size of the establishment. Fourth, the final panel of the table highlights that, once the employment in these occupations drops to zero, it is highly unlikely these occupations are insourced again. Finally, figure B.1 highlights that turnover rates are highly stable for these occupations.

Building on this set of facts, I define an outsourcing event at the establishment level as follows. First, the employment in the relevant occupation drops to zero, after it was positive in the year immediately before. Second, the establishment does not switch to a business service or temp industry identifier after the outsourcing event.[17] Third, the flow of workers that are outsourced, constitute no more than 30% of employment at the moment of outsourcing. Fourth, and finally, the outsourcing establishment employs at least 20 people. Figure 1 shows the outsourcing rates (i.e. the fraction of establishments making the decision to outsource) are relatively stable across the sample period and the fraction of establishments that are outsourcing under this definition.[18]

Summary Statistics

Table 1 provides some key summary statistics for establishments. The upper panel focuses on establishments the year before outsourcing, while the lower panel focuses on establishments that have never outsourced. Overall, employers that are about to outsource are large and pay slightly higher wages than establishments that do not outsource, consistent with the findings of Goldschmidt

[16] I follow on the codes used in Goldschmidt and Schmieder (2015). The precise occupational and industry codes are presented in appendix B.1, tables **??** and **??**.

[17] I follow the industry codes used by Goldschmidt and Schmieder (2015), with the slight difference that I don't have access to 5 digit industry codes.

[18] This graph possibly underestimates the extent to which establishments are outsourcing. Establishments that decided to outsource prior to 1993 show up as non-outsourcing.

and Schmieder (2015). Additionally, they are more likely to be covered by a collective bargaining agreement and tend to have somewhat higher levels of education and productivity, but lower shares of part-time workers.

Table 2 provides some summary statistics for workers that remain in outsourcing establishments in the upper panel, and summary statistics for workers that work in establishments that never outsource in the lower panel. Overall, the workers are relatively similar in terms of wages, education levels and demographics, such as age, gender, nationality and part-time status. However, workers that stay in outsourcing establishments tend to have higher tenure.

5 Empirical Strategy and results

I examine the impact of outsourcing events on establishment and worker outcomes using an event study research design. Consider the following econometric model of outsourcing:

$$y_{ij(i)t} = \sum_{\Delta=-3}^{4} \delta_{\Delta} \mathbb{I}\{t - t^*_{j(i)} = \Delta\} + \gamma X_{ij(i)t} + \xi_i + \theta_t + \varepsilon_{ij(i)t} \tag{9}$$

Here, $y_{ij(i)t}$ are the log wages worker i earns working at establishment j at time t, while t^*_j is the year the outsourcing decision is made at establishment j, with employment for the occupation of interest dropping to zero in $t^*_j + 1$. θ_t represents a year fixed effect, while ξ_i represents either a worker fixed effect. $X_{ij(i)t}$ is a vector of controls.

The sample includes all establishments.[19] For establishments that engage in multiple outsourcing events, I focus on the first one only.[20] The identifying assumption that the timing of outsourcing events is randomly assigned from the point of view of the worker is credible for workers that have been at the establishment for a while. I restrict the sample of workers to those who have been at the establishment at least three years before the outsourcing event and not fired until the post-period, to alleviate concerns of workers strategically moving (or being hired) into the establishments just before or at the time of outsourcing.[21] The timing is likely not exogenous

[19] Running the regressions on a restricted sample of firms that only decide to outsource provide similar results in terms of magnitude and statistical and economic significance.

[20] It seems reasonable to assume this first one may have the strongest impact. Whether or not it is truly the first outsourcing event the establishment has gone through, however, can't be uncovered using the data I have to my disposal.

[21] Alternatively, it is possible to restrict the sample of workers to those who have been at the establishment at

from the point of view of the establishment. Rather than invalidating the results, this affects the type of establishments (and possibly workers) that affected by outsourcing events. The worker-level regressions are therefore likely to represent a Local Average Treatment Effect (LATE) that does not coincide the with the population Average Treatment Effect (ATE).

Intuitively, the coefficients δ_Δ represent the time path of log wages relative to the timing of the outsourcing decision and conditional on the set of controls. One way to test the identifying assumption is to verify that $\delta_\Delta = 0$ for $\Delta < 1$. The estimation of equations 9 can be undertaken using standard panel data techniques, provided one of the indicators $\mathbb{I}\{t - t_j^* = \Delta\}$ is normalized for some Δ, as the full set of indicators is perfectly collinear with either the establishment or worker fixed effect. As is standard in this literature, I normalize the indicator where $\Delta = 0$ to zero, as this is when the outsourcing decision is taken, so post-decision coefficients can be interpreted as treatment effects.

An augmented version of equation 9 can be used to test for heterogeneity in the wage setting process for the different skill groups. In particular, I test this hypothesis using the following specification, where $Education_{i(e)t}$ is an indicator variable that takes on value one when individual j has education level e, and 0 if not. I collapse the results to three education levels: middle or high school (with or without vocational degree), technical college and college.[22]

$$y_{ij(i)t} = \sum_{\Delta=-3}^{4} \delta_\Delta \mathbb{I}\{t - t_{j(i)}^* = \Delta\} + \sum_{e=1}^{2} \alpha_e \times Education_{i(e)t} \times \mathbb{I}\{t > t_{j(i)}^*\} + \gamma X_{ij(i)t} + \xi_i + \theta_t + \varepsilon_{jt} \quad (10)$$

The skill interactions in this regression are identified off of changes in the wages of workers that have a certain skill level, and move from the non-outsourcing into the outsourcing period within this establishment, controlling for fixed worker unobservable characteristics. Therefore, these are not changes at the establishment across skill groups that are possibly driven by composition, but rather represent wage increases and wage cuts at the individual level. The relative pay increase or decrease for other skill groups is then captured by the α_e coefficients. Finally, the α_e are not identified for both education groups simultaneously, so the low skill workers are chosen as the

least three years before the event, without imposing the second restriction. Yet, given the typical long job spells in Germany, this restriction does not seem excessive.

[22]Similar regressions that distinguish between all six levels of education find relatively similar effects for middle school (with or without vocational) and high school (with or without vocational). Also technical college and college exhibit similar patternsmotivating the decision to collapse the education variable to these levels.

omitted category. This means that the event study coefficients δ_Δ show the time path of wages for low skill workers, and the α_1 coefficient capture the level shift for high skill workers in the aftermath of an outsourcing event. I cluster standard errors at the establishment level.

Additionally, I provide some descriptive evidence on establishment-level outcomes through an event-study type framework. The identifying assumption for these events – that the timing of these events is randomly assigned from the point of view of the establishment – is unlikely to hold and outcomes should therefore be interpreted as correlations rather than causal effects of outsourcing. Nevertheless, they provide some valuable information and insight to interpret the effects of domestic outsourcing on the wages of workers that stay. In particular, the estimating equations for the establishment-level regressions are shown below.

$$y_{jt} = \sum_{\Delta=-3}^{4} \delta_\Delta \mathbb{I}\{t - t_j^* = \Delta\} + \xi_j + \theta_t + \varepsilon_{ij(i)t} \tag{11}$$

Here, y_{jt} is the outcome of interest for establishment j at time t. ξ_j is an establishment fixed effect, while θ_t is a year fixed effect. As before, t_j^* represents year the outsourcing decision is made.

Worker-level results

This section presents the results from the event study regressions. Figure 2a graphically presents the effect of domestic outsourcing on the wages of workers that remain in outsourcing establishment and shows the δ_Δ coefficients with 95% cluster-robust confidence intervals for estimating equation 9. Overall, there is little to no evidence of spillover effects of domestic outsourcing events on the average wages of workers that remain in the establishment. Nevertheless, these results mask substantial heterogeneity. Figure 2b graphically presents the effects for different education groups, again showing the δ_Δ coefficients with 95% cluster-robust confidence intervals, but now for estimating equation 9. Where low skill workers face wage losses of about one to two log point, high skill workers receive immediate wage increases of about four log points.

Both these effects are not only statistically significant, but also economically significant. Dustmann et al. (2009) provide a useful starting point to interpret the magnitude of these effects. Using IAB data that also draw from the IEB files, they find that wages at the 15th (85th) percentile of the wage distribution decreased (increased) by about six (ten) percentage points from 1993 to

2010. The immediate effects of domestic outsourcing on the wages of workers staying in establishments represent about a third to a half of this increase. Domestic outsourcing events therefore leads to the same workers being paid substantially different wages just before and after the outsourcing event.[23]

Interacting the level increase for high skill workers with the change in the ratio of low to high skill workers can provide supporting evidence for the existence of fairness considerations. While this is essentially an equilibrium relationship, these results should not be interpreted as a causal relationship. However, there is no reason to find a correlation like this in the data if the underlying mechanism is not related to fairness considerations. Table 3 presents the results from this empirical appraoch. The first column are the estimation results from running specification 10, whereas the second column presents the relationship between the change in skill intensity at the establishment and the changes in wages for low and high skill workers. The third column presents the relationship between the change in skill intensity and the increase in wages for high skill workers only. The results hint at a marginally significant relationship between the change in skill intensity and both high and low skill wages. As wages for high and low skill workers are expected to move in opposite directions, the different sign on the coefficients is in line with the theoretical model. Finally, when just focusing on the high skill workers, the results remain relatively similar. Overall, these results are in line with a model where fairness considerations matter.

Establishment-level Outcomes and Structure

Figures 3a and 3b highlight the impact of outsourcing events on the stucture of outsourcing establishments. Both establishment size and occupations employed are relatively constant before and after the outsourcing event, but exhibit and clear and sudden drop in the wake of an outsourcing event. The drop in size and occupations at the establishment highlights that the domestic outsourcing event based on CCSL occupations seems to coincide with a larger restructuring of the production process. However, much of this restructuring is occupation-specific. Understanding which occupations are being outsourced and what that might mean for the results in this paper and labor market dynamics in general is a promising avenue for future research.

[23]The domestic outsourcing events, however, do not affect the full working population. Therefore, these findings should not be interpreted as domestic outsourcing representing about a third of this wage dispersion. They do, however, highlight these wage gains and losses are relatively substantial.

Additionally, figure 4 shows the effects of domestic outsourcing events on the separation and hiring rate at establishment. Figure 4a shows no real impact on the separation rate, apart from a drop that is associated with the outsourcing event, while figure 4b highlights the fraction of workers entering only picks up after several years. Figures 5 breaks up separation rates by educational group for separation and hiring rates respectively. Overall, these effects do not differ by skill groups.

6 Robustness Checks

The empirical specification so far imposed a parametric assumption that might be quite strong. In order to relax this assumption and test its validity, I test a more flexible and nonparameteric model that does not impose a level shift across skill groups that takes the form

$$y_{ij(i)t} = \sum_{\Delta=-3}^{4} \delta_{\Delta} \mathbb{I}\{t - t^*_{j(i)} = \Delta\} \times \sum_{e=1}^{2} \alpha_e \times Education_{i(e)t} + \gamma X_{ij(i)t} + \xi_i + \theta_t + \varepsilon_{jt} \tag{12}$$

Figure 6 highlights that, despite this very flexible approach, the assumption of a level shift is reasonable, as wages for low skill workers seem to decrease more or less immediately, while wages for high skill workers seem to increase more or less immediately. The standard errors increase compared to the more parametric version, but the overall effects of outsourcing on wages are clear. Furthermore, there are no pre-trends for either skill group, strenghtening the identification assumption.

Furthermore, additional specification checks confirm the results are not driven by workers with imputed wages, or part-time workers. Additional robustness checks are in the process of being obtained and being released.

7 Conclusion

This paper investigates the effects of domestic outsourcing events on workers that stay in the outsourcing establishment. Most research so far has focused on what happens to wages of those workers that get outsourced at the industry or establishment level. While these studies find substantial wage losses for workers that are being outsourced (Dube and Kaplan, 2010; Goldschmidt and Schmieder, 2015), this paper finds that outsourcing events also have substantial effects on

the wages of workers that stay in the establishment. These findings indicate that employers set wages for workers that likely depend on the wages of their coworkers. This finding is underpinned by additional findings, that show the wage increase high skill workers receive in the aftermath of outsourcing events depends on the extent to which the establishment becomes more skill intensive.

Building on these empirical facts, I consider a model that incorporates fairness considerations into wage setting, allowing for wages of workers to depend on the wages of their colleages. In particular, I model fairness considerations to affect effort, as proposed by Akerlof and Yellen (1988). The reference wage builds on empirical work (see, e.g. Card et al. (2012)) that fairness considerations primarily affect workers that are paid less than their coworkers. I use skill to distinguish between high and low wage workers in the establishment and postulate that effort of low skill workers depends on the wage dispersion between low and high skill workers within the establishment.

The model predicts that wages for high skill workers will increase if more low than high skill jobs are outsourced. Additionally, the wages of low skill workers will move in the opposite direction: when the wages of high skill workers go up, those for low skill workers go down and vice versa. Finally, the wage increase that high skill workers obtain is correlated with the change in skill intensity at the establishment. If the ratio of high to low skill workers increases after the outsourcing event, the wage increase for high skill is expected to be higher.

There are several interesting areas for future research. First, better understanding which occupations – both for high and low skill workers – are being outsourced is a feasible and interesting avenue for future research. Additionally, this study cannot investigate the cost shocks that allow these occupations to be outsourced, since there is not information on the outsourcing costs. This would allow a more specific modelling of this decision and a better understanding of this phenomenon. Furthermore, there are several interesting other aspects to fairness that might make for interesting future research. For instance, what is the effect of fairness on labor market flows and actual search behavior in the labor market. Finally, it is important to note that understanding the precise mechanism is crucial to understand labor market dynamics and policymaking. Whereas technological change that favors educated workers requires a push toward a more skilled workforce, it is not clear ex ante which policies are necessary to deal with labor market outcomes that are the result of fairness considerations.

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Table 1: Summary Statistics for Establishments

	Outsourcing Category			
	Catering	**Cleaning**	**Security**	**Logistics**
Year Before Outsourcing				
Median log Daily Wage (€)	4.314	4.275	4.316	4.256
	(0.329)	(0.332)	(0.335)	(0.358)
Middle/High School	0.158	0.137	0.160	0.127
Middle/High School + Vocational	0.675	0.675	0.670	0.683
Technical College / College	0.095	0.074	0.104	0.096
Missing	0.072	0.104	0.087	0.093
Total Employment	508.9	270.1	344.9	212.0
	(1,158.0)	(717.0)	(532.4)	(573.3)
CBA	0.793	0.665	0.750	0.675
Missing	0.035	0.023	0.034	0.026
Part-Time	0.192	0.177	0.206	0.172
log per capita Profit	6.032	6.875	6.470	6.592
	(8.866)	(8.031)	(8.465)	(8.231)
Missing	0.388	0.234	0.378	0.277
Observations	1,537	3,407	2,117	2,322
Not Outsourcing				
Median log Wage	4.207	4.193	4.193	4.200
	(0.429)	(0.443)	(0.439)	(0.441)
Middle/High School	0.129	0.130	0.131	0.132
Middle/High School + Vocational	0.665	0.663	0.662	0.661
Technical College / College	0.077	0.094	0.092	0.094
Missing	0.113	0.112	0.116	0.113
Total Employment	179.8	182.7	184.0	196.3
	(827.6)	(857.2)	(877.6)	(866.5)
CBA	0.566	0.560	0.560	0.570
Missing	0.019	0.019	0.019	0.020
Part-Time	0.210	0.215	0.212	0.217
log per capita Profit	6.217	6.118	6.161	6.191
	(8.354)	(8.408)	(8.372)	(8.363)
Missing	0.211	0.214	0.204	0.216
Observations	183,221	171,929	181,924	181,924

Notes: Mean of each variable with standard deviation in parentheses. Statistics are calculated in year before outsourcing for outsourcing establishments and across all observations for establishments that do not outsourced in the sample period. All columns exclude East Germany prior to 1996.

Table 2: Summary Statistics for Workers Remaining in the Establishment

	Outsourcing Category			
	Catering	**Cleaning**	**Security**	**Logistics**
At Outsourcing				
Mean log Daily Wage (€)	3.844	3.830	3.786	3.888
	(0.480)	(0.472)	(0.500)	(0.535)
Age	41.750	41.729	41.478	42.158
	(10.019)	(10.100)	(10.156)	(10.077)
Female	0.362	0.363	0.411	0.449
Nongerman	0.068	0.067	0.079	0.048
Part-Time	0.135	0.117	0.138	0.172
Education				
Middle/High School	0.165	0.175	0.181	0.133
Middle/High School + Vocational	0.723	0.712	0.705	0.715
Technical College / College	0.112	0.113	0.114	0.152
Missing	0.029	0.036	0.056	0.050
Job Tenure	10.525	10.513	9.527	9.151
	(7.395)	(7.547)	(7.039)	(7.331)
Establishment Tenure	11.379	11.395	10.241	9.975
	(7.493)	(7.618)	(7.123)	(7.588)
Observations	253,448	311,844	259,916	135,484
Never Outsourced				
Mean log Daily Wage (€)	3.897	3.915	3.900	3.897
	(0.569)	(0.560)	(0.569)	(0.573)
Age	41.658	41.578	41.639	41.587
	(10.113)	(10.105)	(10.106)	(10.141)
Female	0.369	0.361	0.372	0.387
Nongerman	0.071	0.069	0.071	0.071
Part-Time	0.141	0.132	0.142	0.146
Education				
Middle/High School	0.162	0.154	0.164	0.159
Middle/High School + Vocational	0.706	0.714	0.705	0.706
Technical College / College	0.132	0.132	0.131	0.135
Missing	0.045	0.041	0.044	0.043
Job Tenure	9.819	9.852	9.929	9.877
	(7.432)	(7.441)	(7.478)	(7.454)
Establishment Tenure	10.585	10.622	10.712	10.674
	(7.556)	(7.565)	(7.600)	(7.579)
Observations	28,842,142	27,943,626	29,200,157	28,719,570

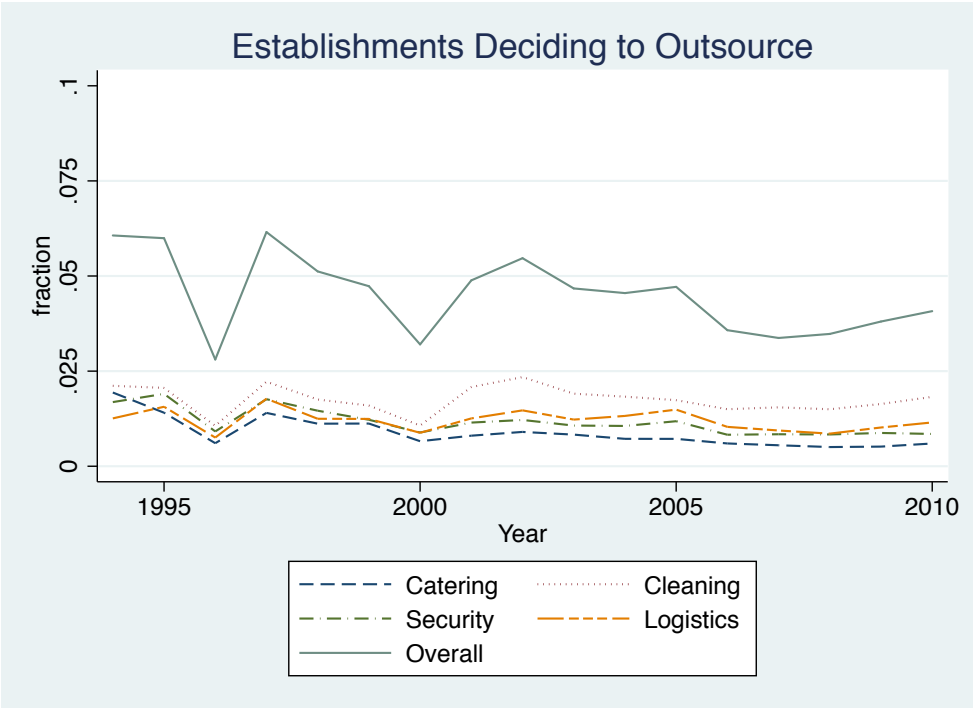
Notes: Mean of each variable with standard deviation in parentheses. The top panel reports statistics that are calculated for each type of outsourcing separately, and covers workers that work in an establishment that outsources catering, cleaning, security or logistics (CCSL) services, but are not employed in the outsourced category. These statistics are reported the year before outsourcing. The second panel reports statistics that are calculated for each type of outsourcing separately, and covers workers that are not employed in the occupation of interest or in the related business service industry. The sample covers workers that are between 20 and 60 years old, and whose log earnings are between 2 and 6.5 for both the top and the bottom panel. All columns exclude East Germany prior to 1996.

Table 3: Event Study coefficients Interacted with Change in Share Low over High Skill

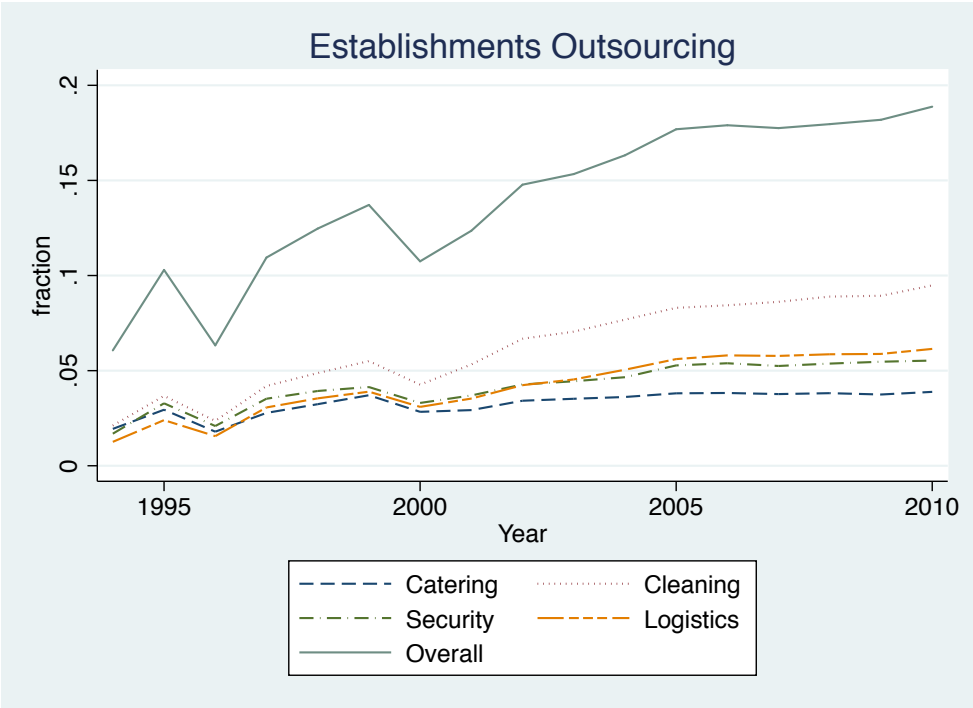
	Dependent Variable: $\ln(w_{ij(i)t})$		
	(1)	**(2)**	**(3)**
$High\ Skill \times Outsourcing$	0.0641***		
	(.0084)		
$High\ Skill \times Outsourcing$		0.0167*	0.0189*
$\times \Delta SkillRatio$		(0.0100)	(0.0106)
$Low\ Skill \times Outsourcing$		-0.0058*	
$\times \Delta SkillRatio$		(0.0032)	
$\mathbb{I}\{t - t^* < -5\}$	-0.0044	0.0084	0.0085
	(0.0142)	(0.0155)	(0.0155)
$\mathbb{I}\{t - t^* = -5\}$	-0.0033	0.0065	0.0065
	(0.0105)	(0.0112)	(0.0112)
$\mathbb{I}\{t - t^* = -4\}$	-0.0050	0.0037	0.0037
	(0.0077)	(0.0081)	(0.0081)
$\mathbb{I}\{t - t^* = -3\}$	-0.0129	-0.0051	-0.0050
	(0.0089)	(0.0101)	(0.0101)
$\mathbb{I}\{t - t^* = -2\}$	-0.0085	-0.0034	-0.0033
	(0.0089)	(0.0094)	(0.0094)
$\mathbb{I}\{t - t^* = -1\}$	-0.0113	-0.0094	-0.0094
	(0.0101)	(0.0107)	(0.0107)
$\mathbb{I}\{t - t^* = 1\}$	-0.0125	-0.0054	-0.0107
	(0.0068)	(0.0088)	(0.0074)
$\mathbb{I}\{t - t^* = 2\}$	-0.0198**	-0.0142	-0.0196**
	(0.0083)	(0.0097)	(0.0084)
$\mathbb{I}\{t - t^* = 3\}$	-0.0247**	-0.0208*	-0.0262**
	(0.0099)	(0.0114)	(0.0103)
$\mathbb{I}\{t - t^* = 4\}$	-0.0228**	-0.0210**	-0.0263***
	(0.0091)	(0.0103)	(0.0092)
$\mathbb{I}\{t - t^* = 5\}$	-0.0232**	-0.0222*	-0.0276**
	(0.0113)	(0.0125)	(0.0115)
$\mathbb{I}\{t - t^* > 6\}$	-0.0312**	-0.0336**	-0.0388**
	(0.0147)	(0.0165)	(0.0158)

Notes: These coefficients provide event study coefficients for the different models where the outcome of interest is the log of worker wages. The event study regression controls for sales, an indicator for whether sales is missing, a second-order polynomial in (establishmet) tenure, and worker and year fixed effects.

Figure 1: Incidence of Outsourcing



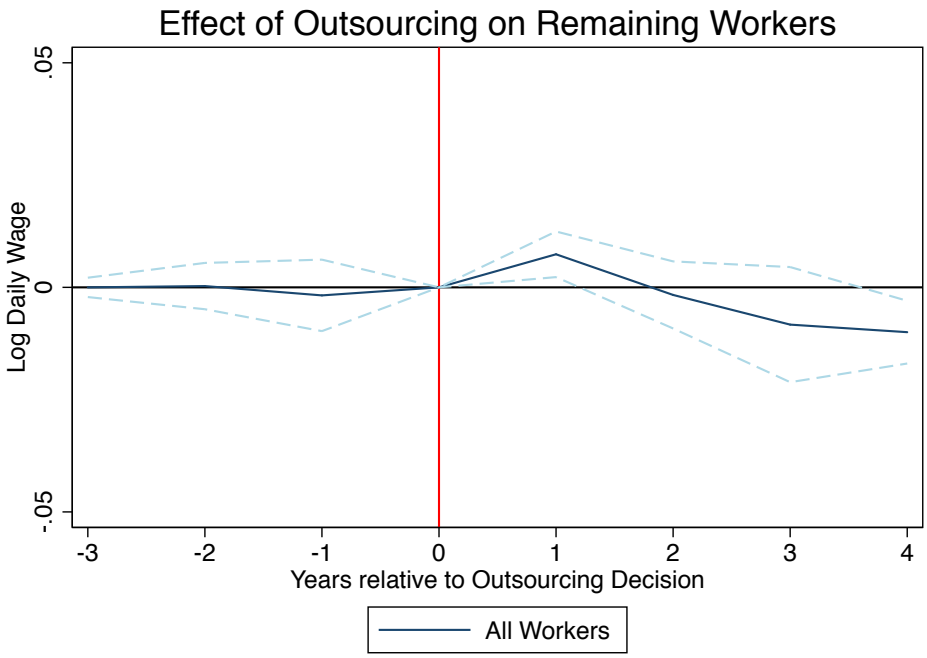
(a) Fraction of Establishments making Outsourcing Decision



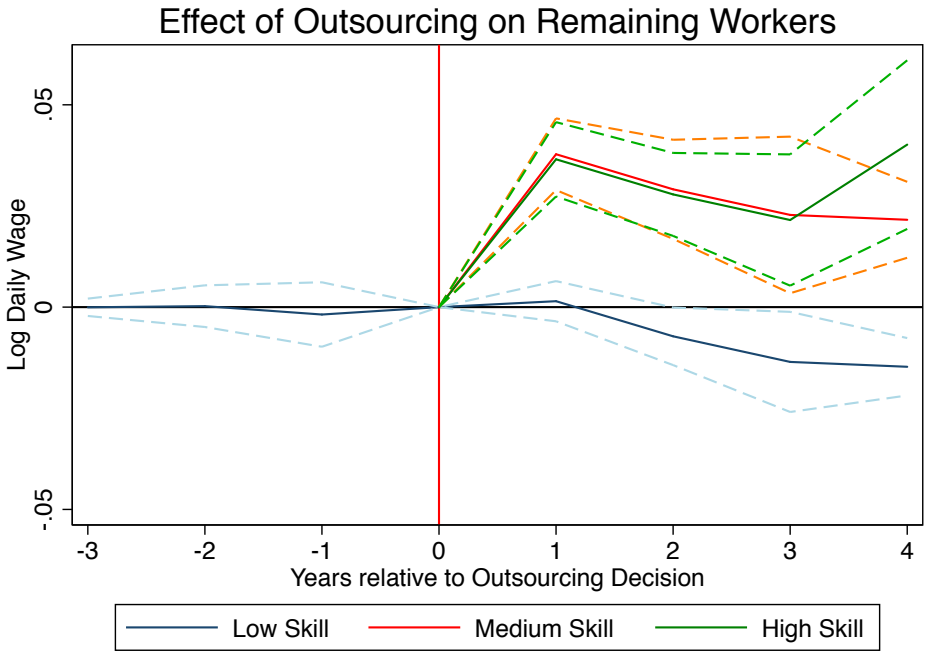
(b) Fraction of Establishments Outsourcing

Notes: The top panel shows the fraction of establishment that decide to engage in outsourcing, broken up by relevant occupational category. The bottom panel shows the fraction of establishments that are currently engaging in outsourcing. Source: author's calculations.

Figure 2: Effect of outsourcing on wage of workers that stay.



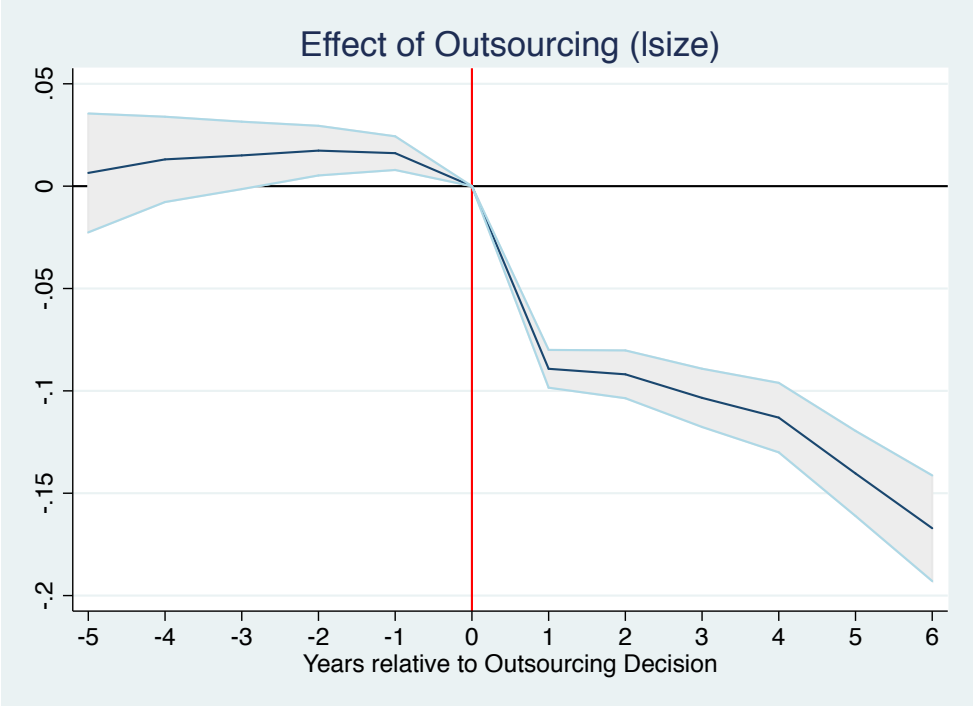
(a) Effect on wages at the establishments



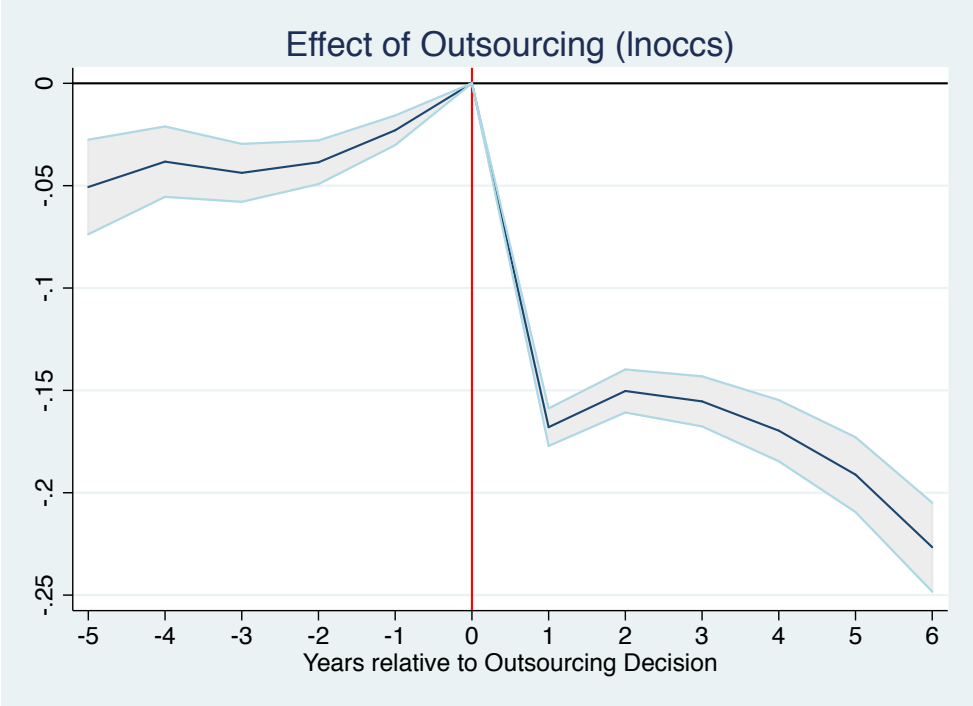
(b) Effect on wages at the establishments by skill group

Notes: These graphs plot event study coefficients where the outcome of interest is the log of worker wages. The event study regression controls for age, gender, education, and worker, region, and year fixed effects. The above graph makes no additional changes. The lower graph interacts the education outcomes with an indicator whether the establishment is outsourcing or not.

Figure 3: Effect of outsourcing on establishment structure.



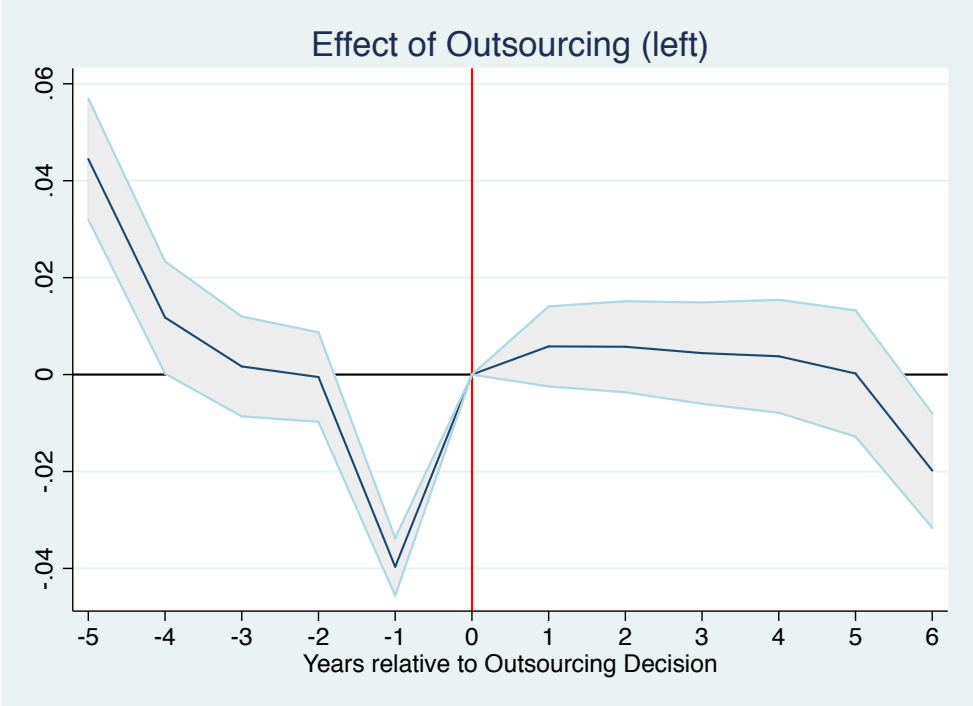
(a) Effect on log(Employment) at the establishments



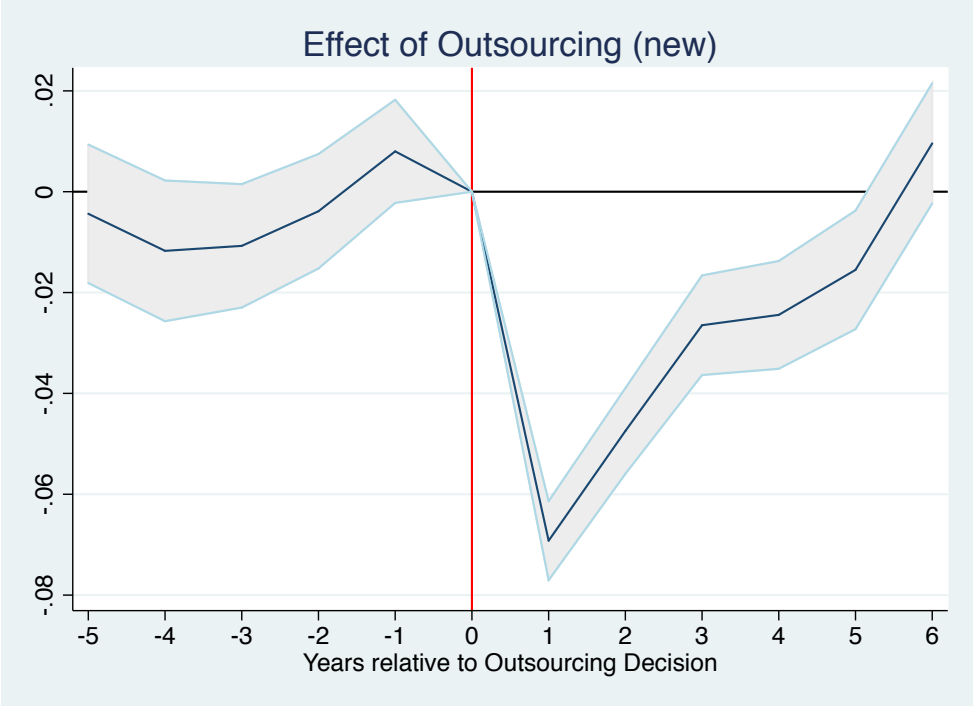
(b) Effect on log(Occupations) at the establishments

Notes: These graphs plot event study coefficients where the outcome of interest is the log of the number of employees (upper panel) and occupations (lower panel) in the establishment. The event study regression controls for region, establishment and year fixed effects.

Figure 4: Effect of outsourcing on separation and hiring rates at establishment.



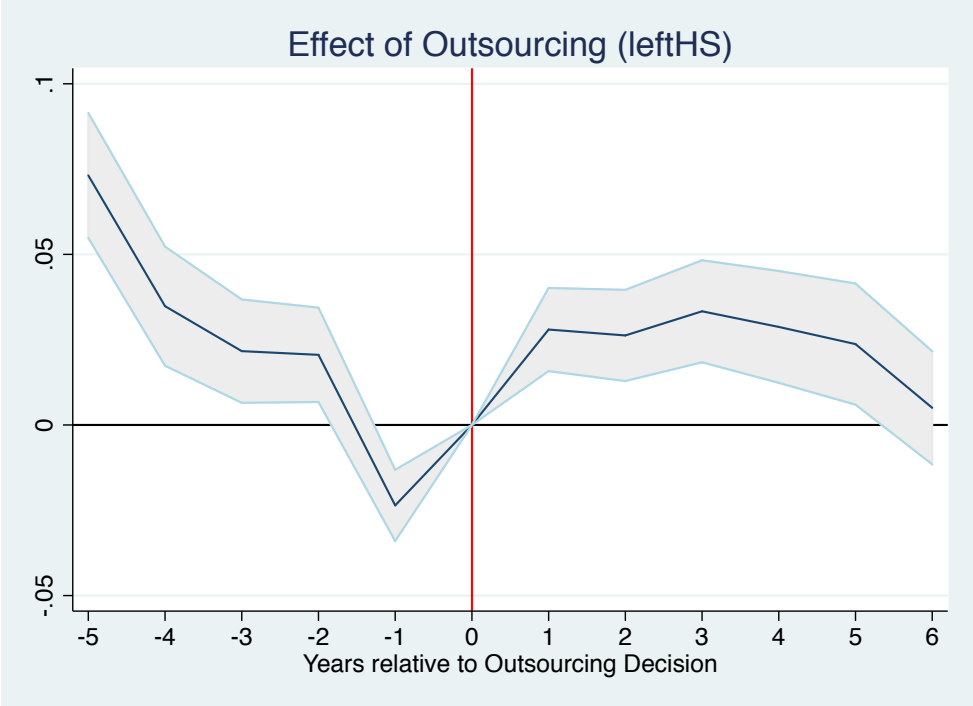
(a) Effect on separation rates at establishments



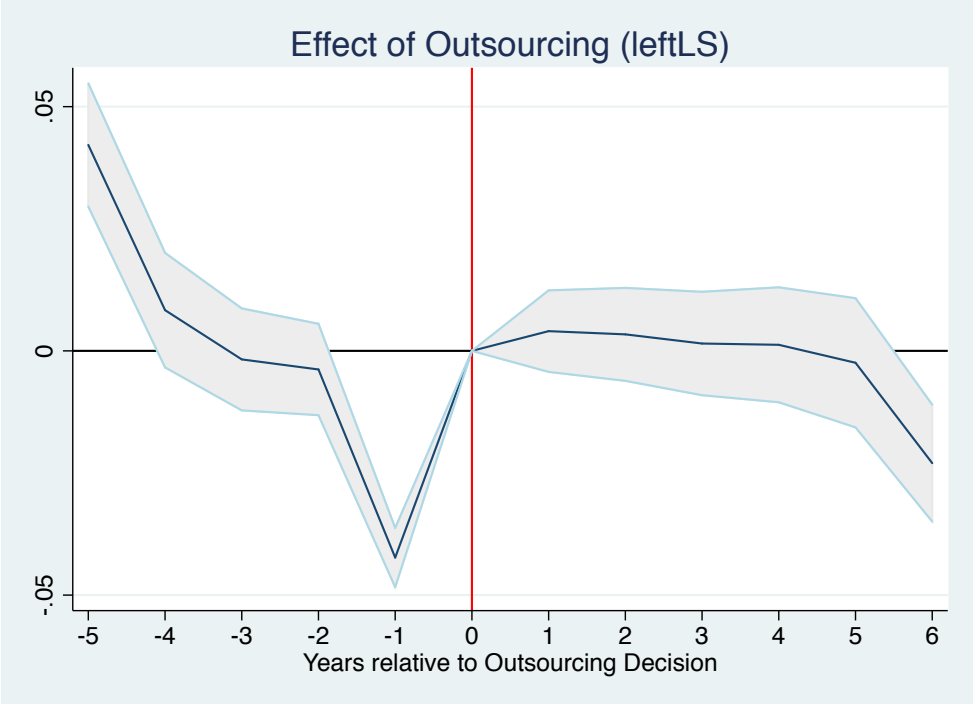
(b) Effect on hiring rates at the establishmentss

Notes: These graphs plot event study coefficients where the outcome of interest is the percentage of employees that leave the establishment in the subsequent year (upper panel) and enter the establishment (lower panel). The event study regression controls for region, establishment and year fixed effects.

Figure 5: Effect of outsourcing on separation behavior of establishment by skill group.



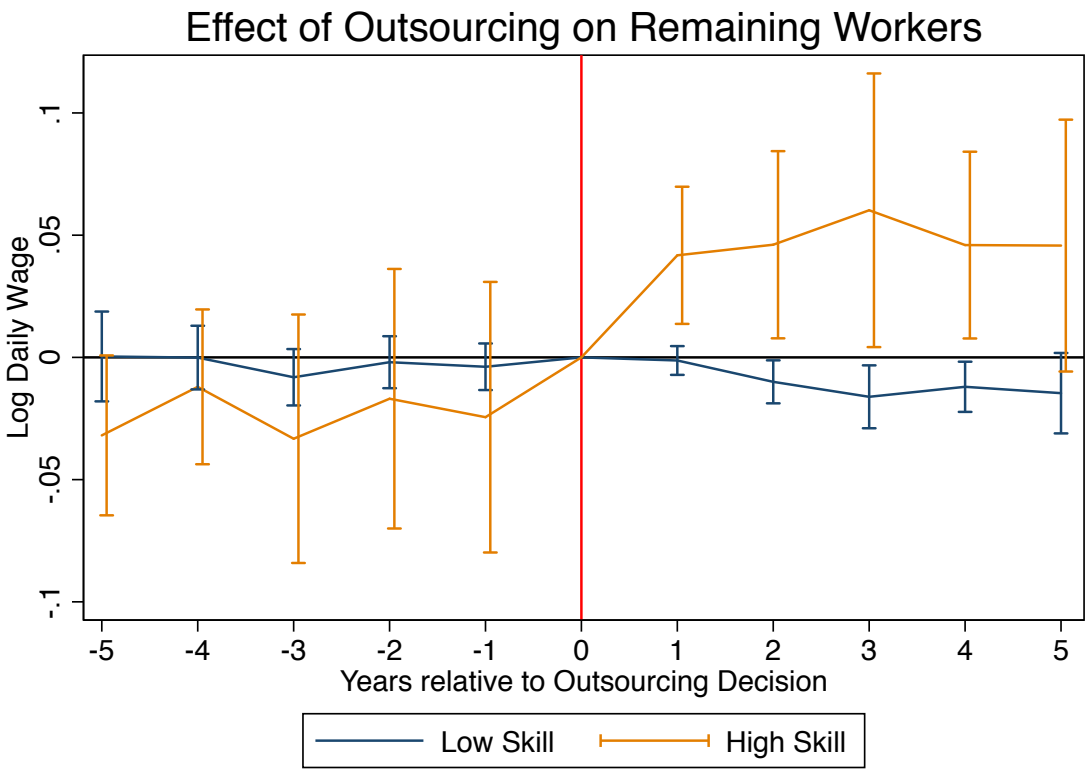
(a) High skill workers



(b) Low skill workers

Notes: These graphs plot event study coefficients where the outcome of interest is the percentage of high skill (upper panel) and low skill (lower panel) employees that leave the establishment in the subsequent year. The event study regression controls for region, establishment and year fixed effects.

Figure 6: Nonparametric specification



Appendices

Appendix A Data Processing

A.1 Data Creation and Variable Construction

I draw on two main datasets. In a first step, I collect the relevant survey responses from the Betriebspanel data files over the different years and save the yearly survey datasets. The specific survey questions are discussed in subsection 3 of this appendix section. In a second step, I read in establishment-level LIAB data for every year, with detailed information. I drop observations for which there is a missing establishment or person identifier, and restrict the sample to include only people ages 20 to 60 years old. At this point, I define part-time workers and drop wages that fall above the top coding limit in any given year and perform the data imputation method, discussed in subsection 2 of this appendix section. After imputing these wages, I save a worker-level file with information on the employment and demographics of the worker, and then collapse this file to an establishment-level file. I merge the survey responses to these establishment level files. In a third step, I append all the worker-level datasets and establishment level datasets in order to obtain the panel structure. The establishment level dataset is used to define the outsourcing events, therefore they contain information on total number of workers in the different occupations, and other necessary variables that enable me to create outsourcing event indicators. Two variables need special attention:

1. **Education**: Originally, the education variable takes on seven values: middle school (1), middle school with a vocational degree (2), high school (3), high school with a vocational degree (4), technical university (5), university (6), and missing (.z). I combine middle school and high school (1 and 3) as the number of people with high school degrees was very small for certain outsourcing events, and overall in the workforce. This was problematic both for data review of summary statistics and estimation purposes. Other aggregations are possible, but not considered in this paper.

2. **Part-time**: The part-time indicator is based off of the `stib` variable. Workers are coded as working part-time when this variable takes on value 8 or 9, as is the standard when working with this data.

A.2 Imputation

As mentioned in the text, I follow standard imputation techniques closely, but not exactly: I miss two variables that Card et al. (2013) uses in their imputation method.[24] The imputation algorithm is as follows. I first divide the age variable into 4 age bins (20-30 years; 31-40 year; 41-50 years; 51-60 years). I then

[24]The main reason for this motivation was time management. There was some path dependence in how I had set up my data creation, and the general data imputation method didn't fully align with this.

run several tobit specifications within each year for all year, gender, education group, part-time, and age bin combinations. This yields $23 \times 2 \times 7 \times 2 \times 4 = 2,576$ separate tobit models. The variable in the tobit models are: age, the fraction of censored wages in the establishment of employment, an indicator whether the establishment employs more than 10 people, an indicator whether the establishment is a one-person establishment, the fraction of full-time workers at the establishment of employment (along with a quadratic of this variable), and, finally, the mean of the uncensored wages within the establishment of employment. I then impute wages building on the estimated tobit model, and using a random uniform draw u for each censored observation. In particular, I follow Card et al. (2013) and drop censored values, imputing the upper tail by setting it equal to $y_{imp} = X'\beta + \hat{\sigma}\Phi^{-1}(k + u \times (1-k))$ where y_{imp} stands for imputed value, X is the vector of observables associated with the observation, and $\hat{\sigma}$ represents the estimated standard deviation of the tobit model. Φ^{-1} stands for the inverse normal, u is the random uniform draw, $k = \Phi[(c - X'\beta)/\hat{\sigma}]$, and c is the value at which wages are censored.

In the coming weeks, I plan to adjust the data creation to have imputation fully consistent with the earlier literature. Additionally, the censoring is actually different acros West and East Germany, something I am currently not adjusting for yet.

Appendix B Details on measuring domestic outsourcing

B.1 Industry and Occupation Codes

The occupation codes are consistent throughout the sample period. The industry codes have 4 3-digit variables: the digit codes based on the 1973, 1993, 2003, or 2008 codes. Focusing on the first three covers all workers, so I report the industry codes for these classifications only. I code an establishment being part of a certain business service industry if either of these industry variables takes on a relevant value. For instance, if an establishment is a business service firm only under the 1973 classification code, but not for any of the other classifications, I classify it as a business service establishment. The overview of the occupation codes can be found on the next page in table **??**, while the overview of the industry codes can be found on the page after that, in table **??**. These largely follow Goldschmidt and Schmieder (2015), but not fully, as I don't have five-digit industry codes to my disposal. I have applied for access to these variables, and access has been approved, but not yet granted.

B.2 Descriptive facts on outsourcing

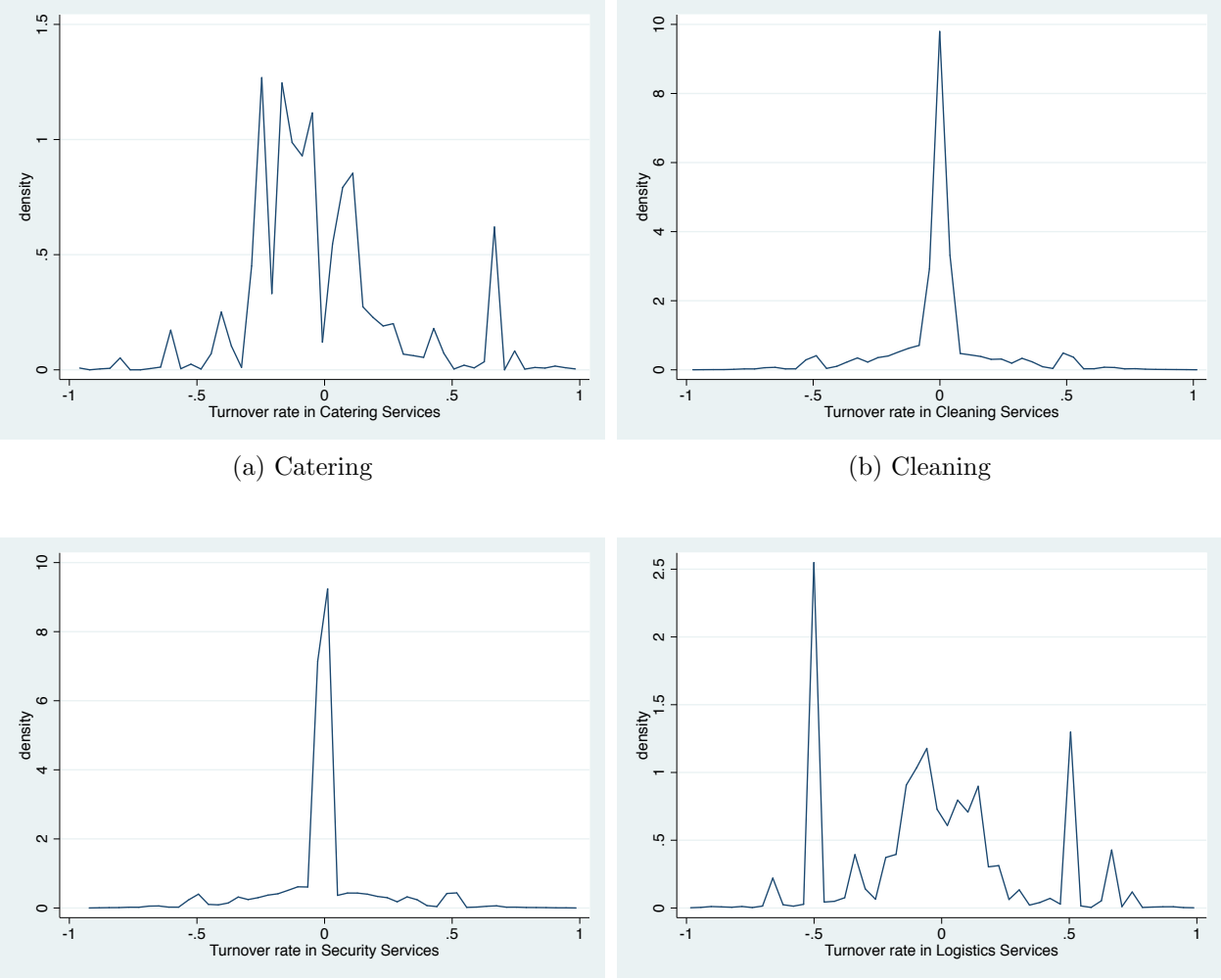
The first three facts describe the stability of CCSL employment at the establishments level, using a fixed effects regression where the employment for each occupation at the establishment level is regressed on a set of establishment fixed effects. Since the population of interest here is establishments that employ these occupations, all establishments not employing the occupation of interest are dropped from the sample.[25] The first panel of table B.3 shows that simple establishment fixed effects explain the majority (about 90 to 95%) of the variation in the employment level of these occupations. Since these numbers may be hard to interpret, I impose an AR(1) structure on the error to test the persistent of employment, presented in the second panel of figure B.3. An autocorrelation coefficient close to one provides evidence that employment within the establishment is highly persistent and stable. As the second panel of table highlights, the autocorrelation for all occupations is about 0.75, indicating the employment level is relatively stable. The third panel repeats this exercise, but for employment shares rather than employment levels. While the fixed effects still explain a majority of the variance, the estimated autocorrelation coefficients are substantially lower. The finding that employment levels are more stable than employment shares indicate that employment of these occupations does not increase one-to-one with the size of the establishment. For instance, a manufacturing plant may need only one security agent, regardless of whether it employs one hundred or two hundred workers.

Another way to consider the stability of these occupations is by considering the turnover rates at the establishment level. Figure B.1 shows this graphically: they plot the turnover rates at the establishment level

[25] Adding in the establishments that do not employ these occupations, or have outsourced these occupations, would mechanically increase the persistence of employment of these occupations.

with the share of the workforce leaving on the horizontal axis, and the frequency on the vertical axis.[26] As the pictures show, cleaning and security jobs in particular seem to be very stable, but also catering and logistics show spikes around zero. Finally, the bottom panel of table B.3 shows the rate at which establishments end up rehiring the occupation after outsourcing, sometimes dubbed "insourcing".[27] For all CCSL occupations, this probability is fairly small and hovers around 8%.

Figure B.1: Firing Rate by Occupation



(a) Catering

(b) Cleaning

(c) Security

(d) Logistics

Notes: Frequency graphs for the turnover rate in the different occupations of interest. The sample

[26] As the object of interest here involves the stability of turnover rates before establishments engage in outsourcing or contracting out, the outsourcing events are precluded from this sample. Including them would mechanically generate a spike at -1. The turnover rates are calculated for all establishments that either have positive employment for the specific occupation or have not engaged in outsourcing of the occupation just yet. The rationale here is similar to that of the fixed effects regressions discussed above.

[27] In contrast to the four descriptive facts above, these probabilities are based on the sample of establishments that decided to outsource. Employment in the occupation of interest was positive at some point in time, but has fallen to zero due to outsourcing. I then compute the probability of seeing positive employment in the relevant occupation any given year after outsourcing.

Table B.1: Occupation Codes for different Business Service Occupations

Category	**Code**	**Description (EN)**
Catering	411	Köche (Cooks)
	412	Fertiggerichte-, Obst-, Gemüsekonservierer, -zubereiter (Ready-made meals-, fruit- and vegetable-processing machine operators)
	911	Gastwirte, Hotelliers, Gaststättenkaufleute (Hoteliers, innkeepers, restaurateurs, and management assistants in hotels and restaurants)
	912	Kellner, Stewards (Waiters, waitresses, stewards, stewardesses and buspersons)
	913	Übrige Gästebetreuer (Porters, bartenders, and other hotel and restaurant attendants)
Cleaning	923	Hauswirtschaftliche Betreuer (Valets, chambermaids, and other housekeeping attendants)
	933	Raum-, Hausratreiniger (Dishwashers, room and domestic cleaners)
	934	Glas-, Gebäudereiniger (Windows, frontages and building cleaners)
	936	Fahrzeugreiniger, -pfleger (Car washers, vehicle cleaners, car and vehicle carers)
	937	Maschinen-, Behälterreiniger un verwandte Berufe (Machinery, plant, tube and container cleaners)
Security	791	Werkschutzleute, Detektive (Factories security offices, store, hotel and other detectives)
	792	Watchpersons, custodians, attendants, and related workers
	793	Pförtner, Hauswarte (Door-, gatekeepers, and caretakers)
Logistics	714	Kraftfahrzeughführer (Car, taxi, bus, (heavy) truck and other motor vehicle drivers)
	741	Lagerverwalter, Magaziner (Stocks administrators, and clerks)
	742	Transportgeräteführer (Lift, lifting-trucks, and other materials handling equipment operators)
	743	Stauer, Möbelpacker (Longshoreman, furniture removers)
	744	Lager-, Transportarbeiter (Stock, loading, and other transport workers)

Table B.2: Industry Codes for different Business Service Industries

Category	**Code**	**Year**	**Description (EN)**
Catering	703	1973–1993	Gast- und Speisewirtschaften (Restaurants)
	553	1993–2003	Restaurants, Cafes, Eisdielen und Imbißhallen (Restaurants)
	554	1993–2003	Sonstiges Gaststättengewerbe (Bars)
	555	1993–2003	Kantinen und Caterer (Canteens and catering)
	553	2003–2010	Speisengeprägte Gastronomie (Restaurants)
	554	2003–2010	Getränkegeprägte Gastronomie (Bars)
	555	2003–2010	Kantinen und Caterer (Canteens and catering)
Cleaning	721	1973–1993	Reinigung von Gebäuden, Räumen, Inventar (Industrial cleaning)
	747	1993–2003	Reinigung von Gebäuden, Inventar und Verkehrsmitteln (Industrial cleaning)
	747	2003–2010	Reinigung von Gebäuden, Inventar und Verkehrsmitteln (Industrial cleaning)
Security	861	1973–1993	Bewachung, Aufbewahrung, Botendienste (Security and storage activities; courier services)
	746	1993–2003	Detekteien und Schutzdienste (Investigation and security activities)
	746	2003–2010	Wach- und Sicherheitsdienste sowie Detekteien (Investigation and security activities)
Logistics	651	1973–1993	Güterbeförderung mit Kraftfahrzeugen (Carriage of goods by motor vehicles)
	670	1973–1993	Spedition, Lagerei, K"uhlhäuser (Forwarding agencies, storage and refrigerating storage houses)
	602	1993–2003	Sonstiger Landverkehr (Other land transport)
	631	1993–2003	Frachtumschlag und Lagerei (Cargo handling and storage)
	632	1993–2003	Sonstige Hilfs- und Nebentätigkeiten für den Verkehr (Other supporting transport activities)
	634	1993–2003	Spedition, sonstige Verkehrsvermittlung (Activities of other transport agencies)
	602	2003–2010	Sonstiger Landverkehr (Other land transport)
	631	2003–2010	Frachtumschlag und Lagerei (Cargo handling and storage)
	632	2003–2010	Sonstige Hilfs- und Nebenttigkeiten fr den Verkehr (Other supporting transport activities)
	634	2003–2010	Spedition, sonstige Verkehrsvermittlung (Activities of other transport agencies)
Temp	865	1973–1993	Arbeitnehmerüberlassung (Labour recruitment and provision of personnel)
	745	1993–2003	Gewerbsmäßige Vermittlung und Überlassung von Arbeitskräften (Labour recruitment and provision of personnel)
	745	2003–2010	Personal- und Stellenvermittlung, Überlassung von Arbeitskräften (Labour recruitment and provision of personnel)

Table B.3: Descriptives of Employment

	Outsourcing Category							
	Catering		**Cleaning**		**Security**		**Logistics**	
	Variance Decomposition of Employment Levels							
	Variance	%	Variance	%	Variance	%	Variance	%
Between	45.143	0.993	26.068	0.871	18.358	0.948	48.375	0.905
Within	3.912		10.048		4.287		15.641	
	Variance Decomposition of Employment Levels with AR(1) Error							
ρ	0.731		0.823		0.739		0.752	
	Variance	%	Variance	%	Variance	%	Variance	%
Between	54.466	0.997	28.068	0.956	22.205	0.982	54.565	0.955
Within	2.912		6.000		2.971		11.782	
	Variance Decomposition of Employment Shares with AR(1) Error							
ρ	0.303		0.467		0.497		0.409	
	Variance	%	Variance	%	Variance	%	Variance	%
Between	0.110	0.930	0.085	0.879	0.053	0.899	0.119	0.925
Within	0.030		0.032		0.018		0.034	
	Probability of Insourcing after Outsourcing							
$P(Insource)$	0.0615		0.0912		0.0807		0.0849	

Notes: Panel one through three report a variance decomposition based on a regression of employment levels or shares on establishment fixed effects, where the estimation sample only includes establishments with strictly positive employment in the occupation of interest. The between variance is accounted for by differences between establishments, the within variance is accounted for by differences within establishments. The percentage reports the fraction of variance that is explained between firms. Panel two through three additionally impose an AR(1) model on the error term and report a point estimate for the autocorrelation coefficient. Standard errors are not reported yet, as Stata does not readily report these, but will be calculated for future versions of this paper. Panel four reports the probability of seeing positive employment in the occupation of interest in any given year, after the establishment has outsourced this category according to my outsourcing measure.

for which these turnover rates are calculated include only establishments with strictly positive employment in the occupation of interest, and do not include the year when the employment in the relevant occupation drops to zero.

Appendix C Proofs

C.1 Wages: Fairness Considerations

Consider equation **??** and **??**. First, note that $\frac{w_2'}{w_1'} = \frac{w_2'}{w_2}\frac{w_2}{w_1}\frac{w_1}{w_1'}$. Substituting equation **??** into **??** then leads to

$$\ln\left(\frac{w_1'}{w_1}\right) = \beta \ln\left(\frac{A_1'\sigma - A_2'\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\left(\frac{A_2'}{A_2}\right)^{\theta(a+\rho\sigma)}\left(\frac{w_1}{w_1'}\right)^{\theta a(a+\rho\sigma)}\xi_2^{\rho,\rho}}{A_1\sigma - A_2\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\xi_2^{\rho,\rho} - a\gamma\frac{w_3^{a+\alpha\sigma}}{w_1^{a+\rho\sigma}}\xi_3^{\alpha,\rho}}\right) \tag{C.1}$$

where $\theta = \frac{1}{1+(1-\rho)\sigma-a}$ and $\beta = \frac{1}{1+(1-\rho)\sigma}$. In order to get a sense of the value of θ and β, set $\rho \approx 0.5$ and $\sigma \approx 0.7$, where the second number draws from the study by Pistaferri (2003). From the empirical results in this paper, a lower bound on $a \approx 0.3$, since wages of high skill workers increase by about 3 log points in the aftermath of an outsourcing event and the wages of low skill workers decrease by about 1 log point. This is a lower bound if $A_2' \geq A_2$. Taken together this indicates that $1+(1-\rho)\sigma \approx 1.35$ and $1+(1-\rho)\sigma - a \approx 1.05$. β is therefore likely positive and smaller than one θ is therefore very likely positive, but might be larger than one depending on the parameterization.

Define the following two objects, that equal the right hand side of C.1 evaluated at $w_1' = w_1$ and $w_1' \to \infty$ respectively.

$$d^* = \beta \ln\left(\frac{A_1'\sigma - A_2'\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\left(\frac{A_2'}{A_2}\right)^{\theta(a+\rho\sigma)}\xi_2^{\rho,\rho}}{A_1\sigma - A_2\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\xi_2^{\rho,\rho} - a\gamma\frac{w_3^{a+\alpha\sigma}}{w_1^{a+\rho\sigma}}\xi_3^{\alpha,\rho}}\right) \tag{C.2}$$

$$d^{**} = \beta \ln\left(\frac{A_1'\sigma}{A_1\sigma - A_2\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\xi_2^{\rho,\rho} - a\gamma\frac{w_3^{a+\alpha\sigma}}{w_1^{a+\rho\sigma}}\xi_3^{\alpha,\rho}}\right) \tag{C.3}$$

Additionally, define the cut-off value w_1^* for which there is a positive labor supply for high skill workers denoted by

$$w_1^* = \left\{w : A_1'\sigma = A_2'\frac{a}{\rho}\left(\frac{w_2}{w_1}\right)^{a+\rho\sigma}\left(\frac{A_2'}{A_2}\right)^{\theta(a+\rho\sigma)}\left(\frac{w_1}{w}\right)^{\theta a(a+\rho\sigma)}\xi_2^{\rho,\rho}\right\} \tag{C.4}$$

If A_2' and A_2 behave sufficiently nice such that d^* exists and is positive, there will be one or two solutions to equation C.1. In particular, as long as $A_2' \geq A_2$ this holds. If A_2' is sufficiently smaller than A_2, there is no equilibrium. However, as pointed out, it is unclear why the level of productivity should go down for a certain skill type, as that would imply productivity destruction. Under such regularity conditions, it is easy to see that $w_1^* < w_1$.

Now consider the left and right hand side of equation C.1 and figure C.1. The solid line is the right hand side, while the dashed black line represents the left hand side of C.1. It follows simply that $\lim_{0\leftarrow w_1'} \ln\left(\frac{w_1'}{w_1}\right) = -\infty$ and $\lim_{w_1'\to\infty} \ln\left(\frac{w_1'}{w_1}\right) = \infty$. Additionally, at $w_1' = w_1$ it takes on value 0.

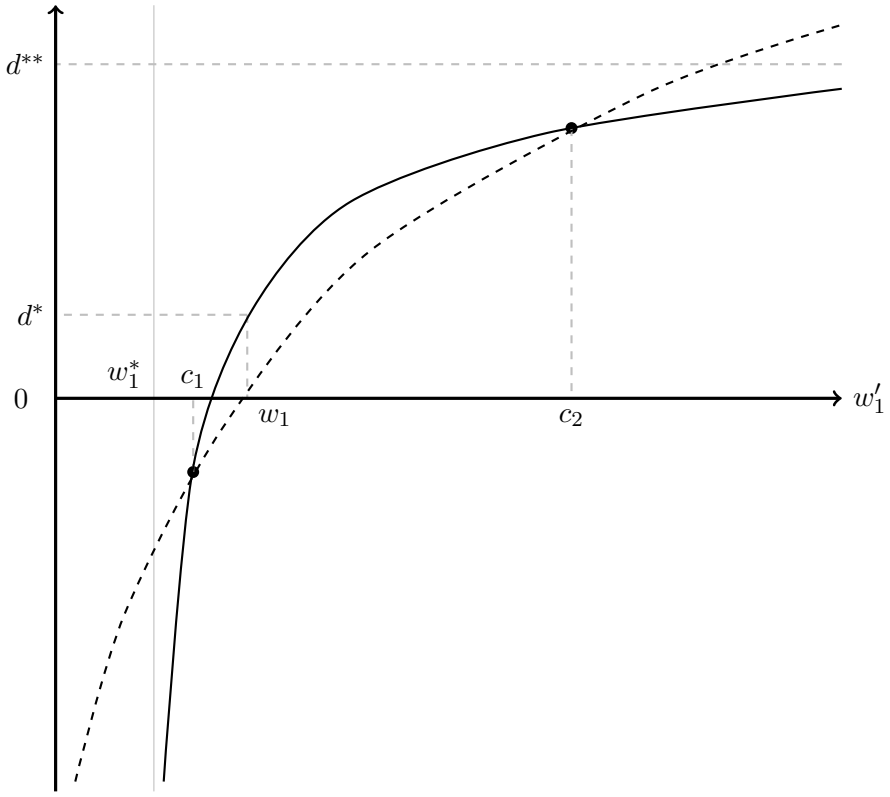
Now consider the right hand side. As highlighted above, this is only defined for $w_1' > w_1^*$, with $\lim_{w_1^*\leftarrow w_1'} \text{RHS}\left(\frac{w_1'}{w_1}\right) = -\infty$ and $\lim_{w_1'\to\infty} \text{RHS}\left(\frac{w_1'}{w_1}\right) = d^{**}$. Finally, consider d^*. If this value is defined, the right hand side of C.1 takes on a positive value at $w_1' = w_1$. This implies that the lines cross and there are two solutions to the equality.[28] This generates two equilibria c_1 and c_2.

Both these equilibria imply sorting of high skill workers and low skill workers, i.e. the education levels within the establishment become more concentrated. Additionally, the equilibrium point where high skill

[28] If the productivity parameters A_1 and A_2 do not change and there is no effect of fairness considerations of business service workers on high skill workers, there is a single equilibrium in which wages do not change. The lines then touch in one single point, at $w_1' = w_1$.

workers are paid less was available before the outsourcing event. Therefore, the unique equilibrium is c_2. Therefore, in the aftermath of an outsourcing event, wages go up for high skill workers, and go down for low skill workers under fairness considerations.

Figure C.1: Graphical Solution to wage setting problem after outsourcing event



C.2 Wages: Technological Change

Disregard the effect of fairness considerations. Then equation **??** and **??** simplify to

$$(1 + (1 - \rho)\sigma) \ln\left(\frac{w_1'}{w_1}\right) = \ln\left(\frac{A_1'}{A_1}\right) \tag{C.5}$$

$$(1 + (1 - \rho)\sigma) \ln\left(\frac{w_2'}{w_2}\right) = \ln\left(\frac{A_2'}{A_2}\right) \tag{C.6}$$

Therefore, wages here follow the movement of the productivity parameter levels for each skill group.