

Online Appendix

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A Data Processing

We start with the universe of social security records from 1975 to 2009 in Germany, from the Integrated Employment Biographies (IEB) database. The data is provided at the employment spell level, and each record includes a person ID, establishment ID, employment spell start and end date, wage, and various other information on the worker (birth year, sex, education, occupation), employer (industry, county) and job type (full-time, part-time, apprentice).

A.1 Identifying On-site Outsourcing Events

To identify on-site outsourcing events, we take one record for each worker in each year, using the employment spell that includes June 30 of that year. If a worker has multiple employment spells that include June 30, we use the spell with the highest wage. We then track year-to-year worker movements between establishments, noting the number of employees that move between any pair of establishments from one year to the next. We create a file that consists of these yearly flows between establishment pairs, dropping any flow that consists of fewer than 10 workers.

A flow of workers from one establishment - the predecessor - to another establishment - the successor - is defined as an on-site outsourcing event in year t if the following conditions hold:

- the size of the outflow from the predecessor establishment is less than or equal to 30% of the predecessor's total employment in time $t - 1$

- If the successor is a new establishment (i.e. the establishment ID shows up for the first time in time t), then the inflow from the predecessor to the successor makes up 65% or more of the successor’s total employment in time t
- The number of workers at the predecessor in time t is not less than half the number of workers at the predecessor in time $t - 1$
- The successor is in either a food, cleaning or security industry (industry codes used are listed in table A-4)
- The predecessor is not in a food, cleaning or security industry, more broadly defined (industry codes provided in table ??)

For all flows between establishment pairs that are identified as outsourcing events, we call the predecessor establishment the mother, and the successor establishment the daughter.

A.2 Identifying the control group

We use propensity score matching to create an appropriate control group for the outsourced workers. We start with the universe of outsourced workers (i.e. all workers who were employed by the mother establishment in year $t - 1$ and by the daughter establishment in year t , for all mother-daughter pairs that were identified as on-site outsourcing events in year t). For each industry-occupation-year cell¹ that contains at least one outsourced worker in the year prior to outsourcing (year $t - 1$), we take all non-outsourced workers in the same cell to be the potential control group. We restrict this sample to workers with at least two years of tenure at their current establishment, and exclude workers who changed establishments between time $t - 1$ and time t from the control group. Using this sample, we estimate a probit regression of whether a worker is outsourced or not, including controls for tenure and establishment size in the current year (i.e. the year prior to outsourcing), and wages in the two previous years. For each outsourced worker, we take the non-outsourced worker with the closest estimated propensity score as the control.

B Alternative Outsourcing Definition: Occupational Lay-off Outsourcing

B.1 Definition

The methodology used to identify on-site outsourcing events is certain to miss many occurrences. In particular, our method only finds outsourcing events where the outsourced

¹We use 3-digit occupation codes and the most detailed industry codes available: 3-digit codes in years 1975-1998, and 5-digit codes starting in year 1999.

employees are all employed together by another establishment. This likely captures many events where entire units of workers are outsourced to contracting firms, but it will not capture situations where an employer lays off all workers who are providing a certain task and contracts out this task to a business service provider. In this case the workers who are affected by outsourcing are laid off and may or may not find jobs in similar occupations. In our data such outsourcing events should be represented as cases where groups of workers of similar occupations are jointly leaving an establishment, but rather than being employed together in the next period at a different establishment identifier, they are dispersed among many other firms and possibly unemployment.

We call these outsourcing events occupational lay-off (“OL”) outsourcing and formulate an alternative specification to identify these events. Instead of using movements of workers between establishments, we look at the movements of certain occupational groups out of an establishment. In particular, an establishment is said to have experienced a OL outsourcing event for a particular occupation group, say cleaning, in year t if:

- the establishment loses its last cleaning worker in time t ; that is, it had at least 1 worker in a cleaning occupation in time $t - 1$ and zero workers in these occupations in time t
- the establishment had at least 5 workers in cleaning occupations in any of the previous 5 years
- it had at least 50 workers in time $t - 1$ and did not shrink by more than 50% between time $t - 1$ and t
- the establishment is not in an industry related to cleaning

In addition, if the same establishment has multiple instances of OL outsourcing, we keep only the first one. We define OL outsourcing of food and security occupations in the same way.

Figure A-9 (a) shows the frequency of occupational lay-off outsourcing events by year. These occurrences are more common than on-site outsourcing events, with around 50-60 per year in West Germany and increasing to around 70 per year in the late 1990s. The increase in outsourcing over time is less pronounced which seems in particular due to a large number of cleaning OL outsourcing events at the beginning of our sample period as revealed in Figure A-9 (b).

The two spikes in food service outsourcing in 1983 and 1988 are also present in the OL outsourcing measures and likely due to the same events that explain the spikes in the on-site outsourcing figures.

B.2 The Effect of Occupational Lay-off Outsourcing on Workers

While the wage effects of on-site outsourcing captures the impact of changing the identity of the employer of record while holding job characteristics constant, the effect of OL outsourcing on wages must be interpreted differently. OL outsourced workers are groups of workers who are laid off together with all other workers of their occupation and presumably replaced by a business service firm, and the effect on their wages captures not only the cost of outsourcing but also the impact of being laid off and potentially experiencing an unemployment spell, losing human capital, and perhaps having to change occupations in order to find a new job.

In order to analyze the effect of OL outsourcing on workers, we need to modify our definition of OL outsourcing slightly so that we can better identify the affected workers. Instead of allowing the outsourcing to occur gradually over time, we require that it happens all at once. Specifically, we say that a modified OL outsourcing of cleaning workers has occurred at an establishment at time t if the establishment had at least 10 workers in cleaning occupations in time $t - 1$ and has 75% fewer cleaning workers in time t . In addition, the establishment must have at least 50 workers in time $t - 1$. We also check years $t + 1$ and $t + 2$ and make sure that the establishment does not shrink to less than half of its $(t - 1)$ -size in those years, and that it does not hire back 10% more of its cleaning workers. Finally, the establishment must not be in a cleaning-related industry. Food and security OL outsourcing events are defined analogously.

We repeat the process of using propensity score matching, described above, to find a control group for workers outsourced in this type of event. In the interest of space, we present only the regression estimates of the effect of occupational lay-off outsourcing on log wages and employment in Figure A-12. In panel (a), we see that, similar to what we saw with the on-site outsourcing definition, wages drop sharply relative to the control group after outsourcing. In this case, they fall by about 8% and remain permanently lower. While the number of days worked per year starts to dip slightly even before outsourcing occurs, at the time of outsourcing the number of days working drops by more than 40 days per year, likely reflecting the fact that many of these workers experience at least some spell of unemployment after leaving the outsourcing firm. Days worked starts to recover immediately, and after 10 years is only slightly lower relative to non-outsourced workers.

Appendix

Table A-1: Establishment Characteristics in Year 2000 by Outsourcing / BSF Status

	Establishments outsourcing on-site 2000-2010	All Non-OS Estab.	Business Service Firms
# Employees	902.70 (2,594.93)	174.10 (408.22)	127.11 (152.88)
Avg Wage in Euro	85.39 (19.98)	81.77 (21.34)	57.59 (20.01)
AKM Effect	0.03 (0.16)	-0.01 (0.17)	-0.21 (0.21)
Avg Yrs of Education	10.67 (1.01)	10.64 (1.22)	9.84 (0.83)
Share College	0.09	0.09	0.02
Share Female	0.41	0.41	0.35
Share West Germany	1.00	1.00	1.00
Firm Age in Yrs	18.41 (9.24)	18.77 (8.75)	13.78 (9.24)
Share Food Workers	0.04	0.02	0.06
Share Cleaning Workers	0.03	0.04	0.19
Share Security Workers	0.01	0.01	0.05
Share Logistics Workers	0.08	0.07	0.23
Industry Shares			
Agriculture	0.00	0.00	0.00
Mining, Energy	0.01	0.01	0.00
Investment, Production	0.29	0.21	0.00
Consumption Goods	0.12	0.10	0.00
Construction	0.03	0.05	0.00
Retail	0.18	0.14	0.00
Traffic, Telecom	0.04	0.05	0.33
Health	0.02	0.04	0.00
Services	0.29	0.30	0.65
Other	0.02	0.08	0.00
Observations	678	58554	4959

Notes: Table shows mean of each variable with standard deviation in parentheses. All characteristics as of 2000. Outsourcing Establishments are included if they were involved in an outsourcing events between 2000 and 2010. Business Services Firms includes temp firms. Excludes establishments with less than 50 employees.

Table A-2: Outsourcing Establishment Characteristics by Daughter Type

	Food	Cleaning	Security	Logistics
# of Employees	604.00 (1,924.12)	614.07 (1,229.02)	1,237.00 (2,789.90)	1,163.20 (3,014.05)
Avg Wage in Euro	64.93 (18.55)	71.38 (18.18)	86.18 (22.29)	85.79 (19.03)
AKM Effect	-0.07 (0.12)	-0.06 (0.15)	0.07 (0.16)	0.08 (0.14)
Avg Yrs of Education	10.43 (0.90)	10.45 (0.89)	10.62 (1.23)	10.48 (0.90)
Share College	0.05	0.07	0.09	0.07
Share Female	0.68	0.61	0.36	0.32
Share West Germany	1.00	1.00	1.00	1.00
Firm Age in Yrs	15.74 (9.14)	15.79 (10.92)	15.04 (7.66)	13.95 (9.31)
Share Food Workers	0.10	0.07	0.01	0.01
Share Cleaning Workers	0.04	0.16	0.01	0.01
Share Security Workers	0.01	0.02	0.07	0.00
Share Logistics Workers	0.03	0.03	0.14	0.13
Industry Shares				
Agriculture	0.00	0.00	0.00	0.00
Mining, Energy	0.00	0.00	0.01	0.01
Investment, Production	0.06	0.12	0.18	0.30
Consumption Goods	0.04	0.02	0.18	0.20
Construction	0.00	0.04	0.03	0.05
Retail	0.55	0.01	0.04	0.30
Traffic, Telecom	0.00	0.03	0.08	0.06
Health	0.12	0.23	0.02	0.01
Services	0.20	0.44	0.39	0.07
Other	0.02	0.11	0.06	0.01
Observations	440	215	98	1162

Notes: Mean of each variable with standard deviation in parentheses. Data includes all outsourcing mother establishments. Excludes East Germany prior to 1997. Statistics calculated in year before outsourcing. For firms that outsource multiple times, the first outsourcing incident is used.

Table A-3: Cleaning, Food, Security and Logistics Occupation Codes

Occupation Type	Occupation code	Label
food	911	Restaurant, inn, bar keepers, hotel proprietors, catering trade dealers
food	912	Waiters, stewards
food	913	Others attending on guests
food	411	Cooks
food	412	Ready-to-serve meals, fruit, vegetable preservers, preparers
cleaning	923	Other housekeeping attendants
cleaning	933	Household cleaners
cleaning	934	Glass, buildings cleaners
cleaning	936	Vehicle cleaners, servicers
cleaning	937	Machinery, container cleaners and related occupations
security	791	Factory guards, detectives
security	792	Watchmen, custodians
security	793	Doormen, caretakers
logistics	714	Motor vehicle drivers
logistics	741	Warehouse managers, warehousemen
logistics	742	Transportation equipment drivers
logistics	743	Stowers, furniture packers
logistics	744	Stores, transport workers

Table A-4: Daughter Establishment Industry Codes

Type	Valid Years	Industry Code	Label
food	1975-1998	703	Restaurants
food	1999-2009	55301	Restaurants with service
food	1999-2009	55302	Self-service restaurants
food	1999-2009	55303	Cafes
food	1999-2009	55305	Snack bars
food	1999-2009	55404	Refreshment stalls
food	1999-2009	55510	Canteens
food	1999-2009	55520	Catering
cleaning	1975-1998	721	Industrial cleaning
cleaning	1999-2009	74701	Cleaning of buildings, rooms and equipment
cleaning	1999-2009	74703	Cleaning of means of transport
security	1975-1998	861	Security and storage activities; courier services
security	1999-2009	74602	Security activities
Logistics	1975-1998	651	Carriage of goods by motor vehicles
Logistics	1975-1998	670	Forwarding agencies, storage and refrigeration
Logistics	1999-2002	60241	Short-distance freight transport by road
Logistics	1999-2002	60242	Long-distance freight transport by road
Logistics	1999-2002	60244	Freight transport by road, other
Logistics	2003-2009	60245	Commercial freight haulage
Logistics	2003-2009	60246	Road haulage
Logistics	2003-2009	63110	Cargo handling
Logistics	1999-2009	63121	Storage and warehousing
Logistics	1999-2009	63122	Refrigerated warehouses
Logistics	1999-2009	63211	Car parks and garages
Logistics	1999-2009	63401	Freight forwarding
Logistics	1999-2009	63402	Group consignments by sea
Logistics	1999-2002	63403	Other transport agencies
Logistics	2003-2009	63404	Other logistics services
Temp	1975-1998	865	Labour recruitment and provision of personnel
Temp	1999-2002	74501	Labour recruitment
Temp	1999-2002	74502	Provision of personnel

Table A-5: Business Service Firm Industry Codes

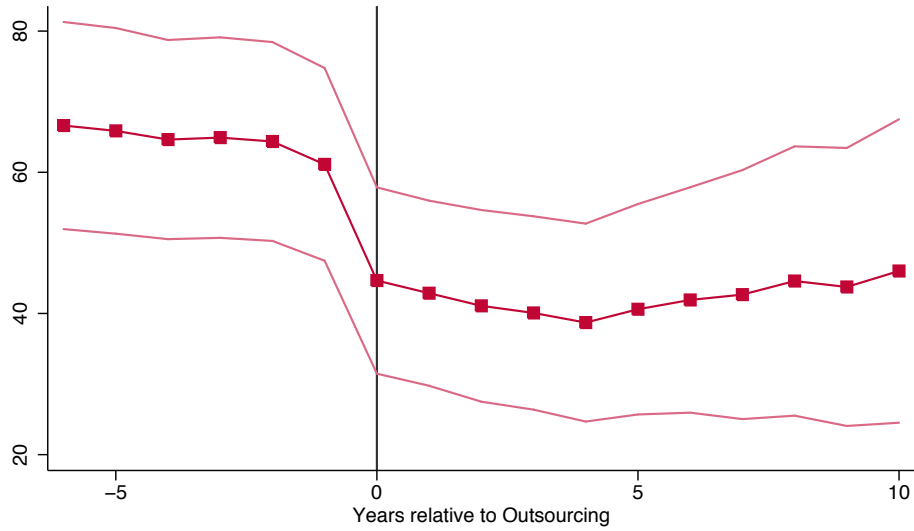
Type	Valid Years	Industry Code	Label
food	1999-2009	55510	Canteens
food	1999-2009	55520	Catering
cleaning	1975-1998	721	Industrial cleaning
cleaning	1999-2009	74701	Cleaning of buildings, rooms and equipment
cleaning	1999-2009	74703	Cleaning of means of transport
security	1975-1998	861	Security and storage activities; courier services
security	1999-2009	74602	Security activities
Logistics	1975-1998	651	Carriage of goods by motor vehicles
Logistics	1975-1998	670	Forwarding agencies, storage and refrigeration
Logistics	1999-2002	60241	Short-distance freight transport by road
Logistics	1999-2002	60242	Long-distance freight transport by road
Logistics	1999-2002	60244	Freight transport by road, other
Logistics	2003-2009	60245	Commercial freight haulage
Logistics	2003-2009	60246	Road haulage
Logistics	2003-2009	63110	Cargo handling
Logistics	1999-2009	63121	Storage and warehousing
Logistics	1999-2009	63122	Refrigerated warehouses
Logistics	1999-2009	63211	Car parks and garages
Logistics	1999-2009	63401	Freight forwarding
Logistics	1999-2009	63402	Group consignments by sea
Logistics	1999-2002	63403	Other transport agencies
Logistics	2003-2009	63404	Other logistics services
Temp	1975-1998	865	Labour recruitment and provision of personnel
Temp	1999-2002	74501	Labour recruitment
Temp	1999-2002	74502	Provision of personnel

Table A-6: The Evolution of the West German Wage Structure from 1985 to 2008 for Women

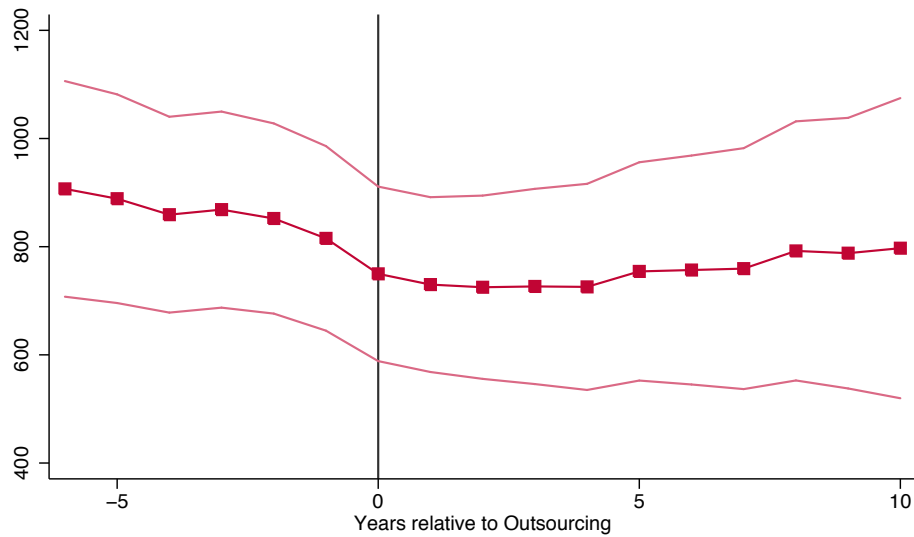
	Wage Structure 1985	Wage Structure 2008	Change from 1985 - 2008	Percent of Change explained by Counterfactual
Panel A: Observed				
Total Variance of Log Wages	0.157	0.225	0.068	
Variance of Estab Effects	0.0471	0.0703	0.0233	
$2 \times \text{Cov}(\text{person, estab effect})$	-0.0099	0.0321	0.0419	
85-15 log wage percentile gap	0.761	0.993	0.233	
85-50 log wage percentile gap	0.341	0.429	0.088	
50-15 log wage percentile gap	0.420	0.565	0.145	
Panel B: Counterfactual I: DFL Reweighting of CSL Workers				
Total Variance of Log Wages	0.157	0.220	0.063	7.0%
Variance of Estab Effects	0.0471	0.0687	0.0216	7.1%
$2 \times \text{Cov}(\text{person, estab effect})$	-0.0099	0.0284	0.0383	8.7%
85-15 log wage percentile gap	0.761	0.980	0.220	5.6%
85-50 log wage percentile gap	0.341	0.427	0.086	2.1%
50-15 log wage percentile gap	0.420	0.553	0.134	7.8%
Panel C: Counterfactual II: Adjusting Wage and AKM Effect of Additional Outsourced Workers				
Total Variance of Log Wages	0.157	0.222	0.065	3.9%
Variance of Estab Effects	0.0471	0.0687	0.0217	6.8%
$2 \times \text{Cov}(\text{person, estab effect})$	-0.0099	0.0315	0.0414	1.3%
85-15 log wage percentile gap	0.761	0.985	0.225	3.4%
85-50 log wage percentile gap	0.341	0.428	0.087	0.7%
50-15 log wage percentile gap	0.420	0.558	0.138	5.0%
Percent working in CLS occupations	0.066	0.055	-0.011	
Percent outsourced	0.017	0.058	0.041	

Notes: Sample are all fulltime female workers in West Germany, excluding workers in food occupations or food industries. Panel A shows the observed wage structure in 1985 and 2008 as well as the estimated components due to the variance of establishment effects and the covariance of establishment with person effects. Panel B shows the counterfactual where workers in cleaning, security and logistics (CSL) occupations in 2008 are reweighted in order to keep them at the same percentiles of the AKM distribution as in 1985 using DFL reweighting (see text). Panel C shows the counterfactual where a random fraction of workers in CSL business service firms and temp agencies are 'insourced' in 2008 by adding 10 log points to their log wage and establishment effect. The fraction to be insourced is picked so that the fraction of outsourced workers remains at the 1985 level.

Figure A-1: Characteristics of Outsourcing Establishments, before and after outsourcing



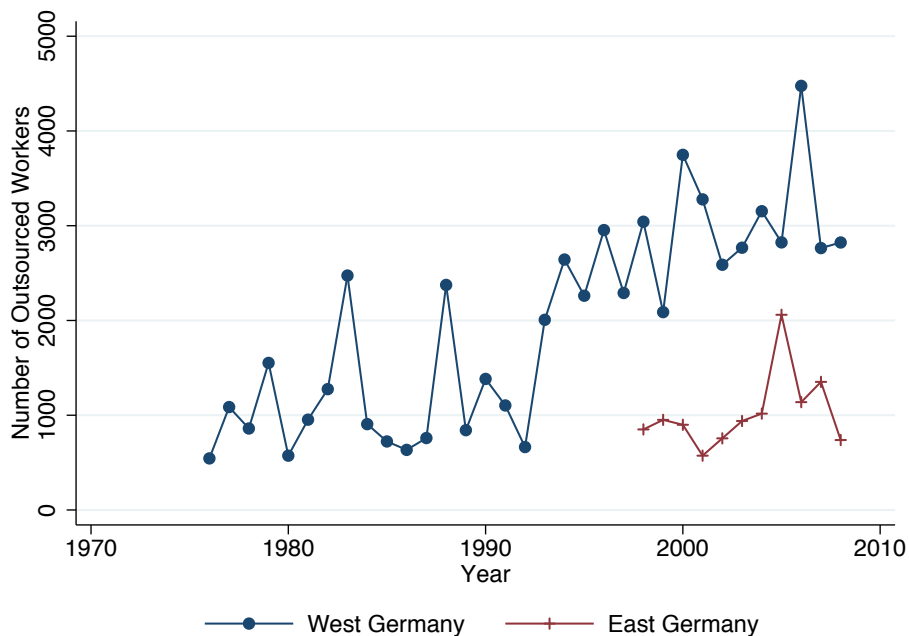
(a) Number of workers in occupations of outsourcing-type



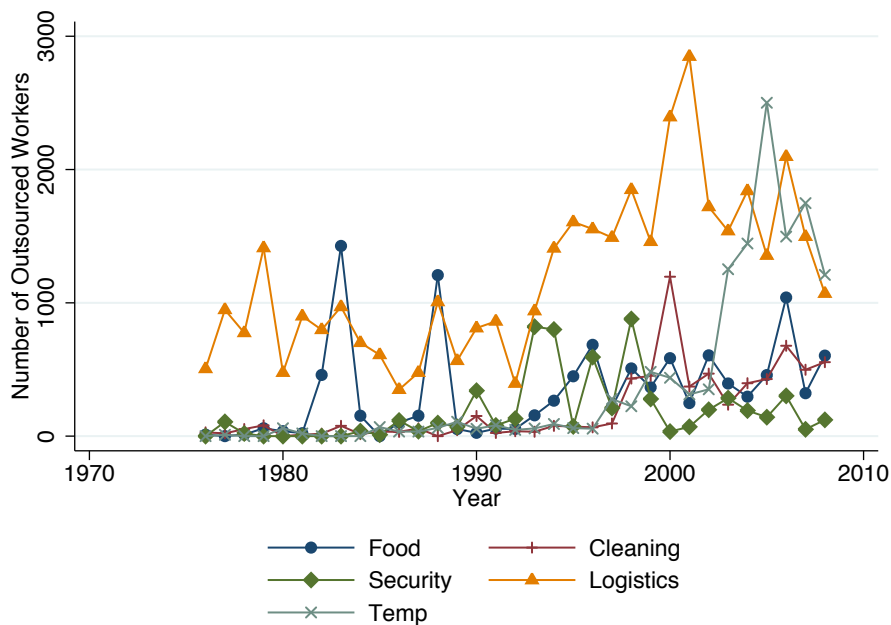
(b) Total Number of Workers

Notes: Graphs show average characteristics of outsourcing establishments, in each year before and after outsourcing. The first graph shows the number of workers in occupations of outsourcing type; for example, for a firm that outsources to a foodservices firm, the dependent variable would be the number of workers in food occupations, such as waiter and cook.

Figure A-2: Outsourced Workers by Year



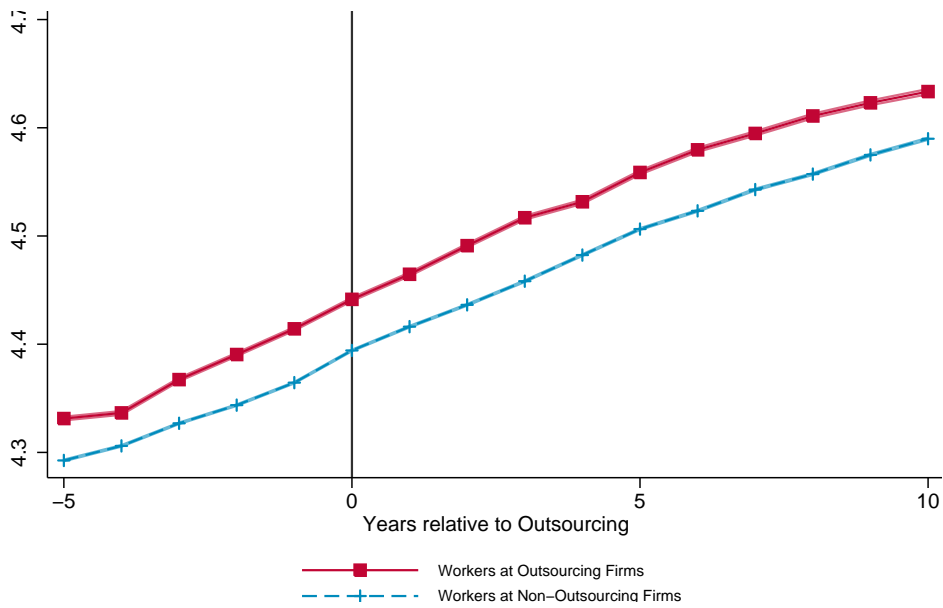
(a) Number of Outsourced Workers in East and West Germany



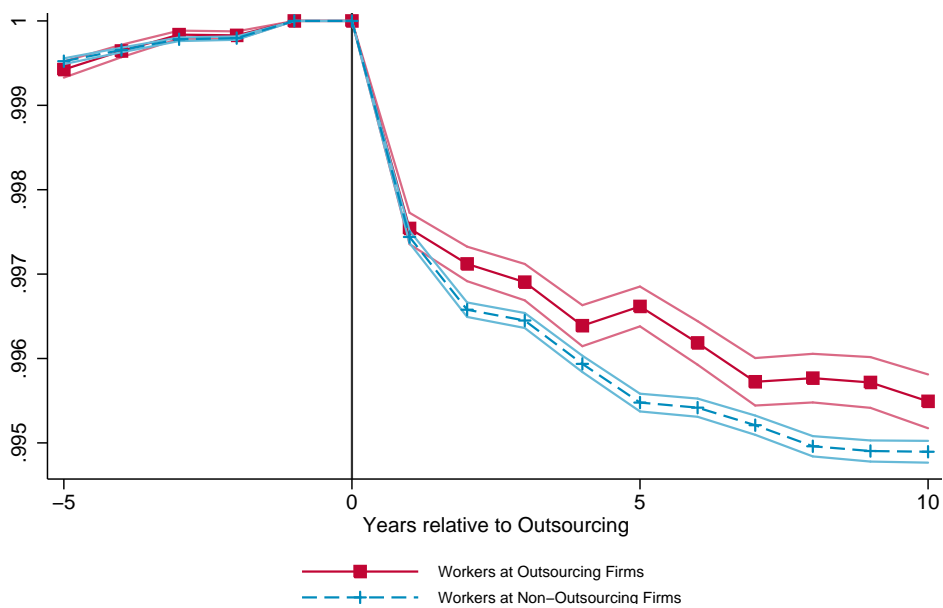
(b) Number of Outsourced Workers by Daughter Type

Notes: Own Calculations, using method tracking flows of workers as described in the text.

Figure A-3: Workers Who Remained at Outsourcing Firms



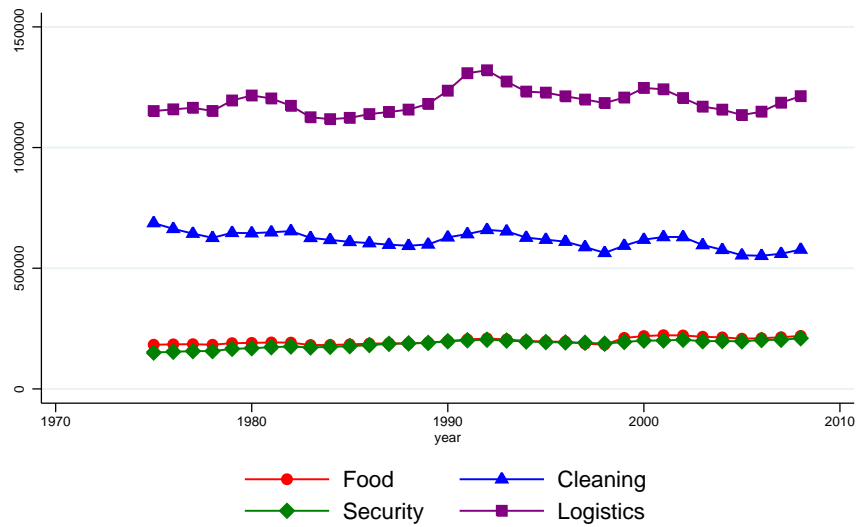
(a) Log Daily Wage



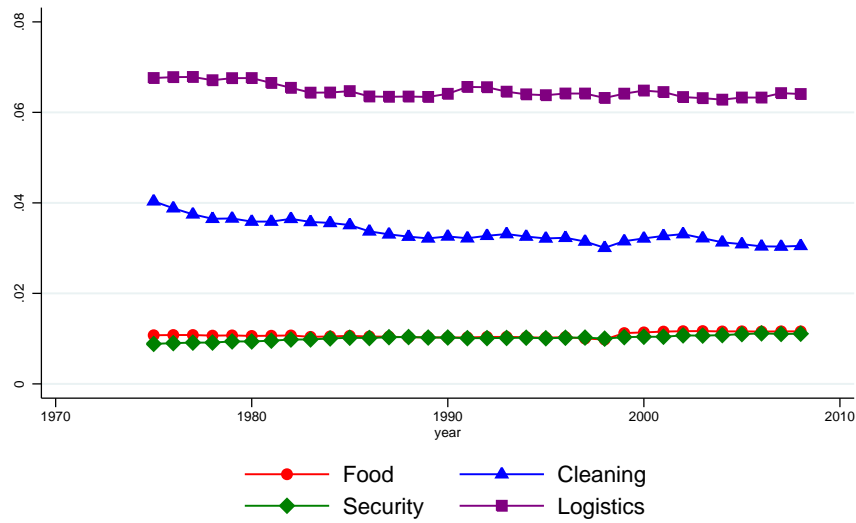
(b) Employment

Notes: The figures show mean daily wage and employment for workers who were employed by firms involved in an on-site outsourcing event in the year before outsourcing (time -1), who remained at that firm after outsourcing (time 0). The comparison group is made up of all workers at the same establishment as the matched non-outsourced workers (using the propensity-score matched group of outsourced and non-outsourced workers described in the text). Bands represent 95 percent confidence intervals.

Figure A-4: Workers in FSCL Occupations By Year



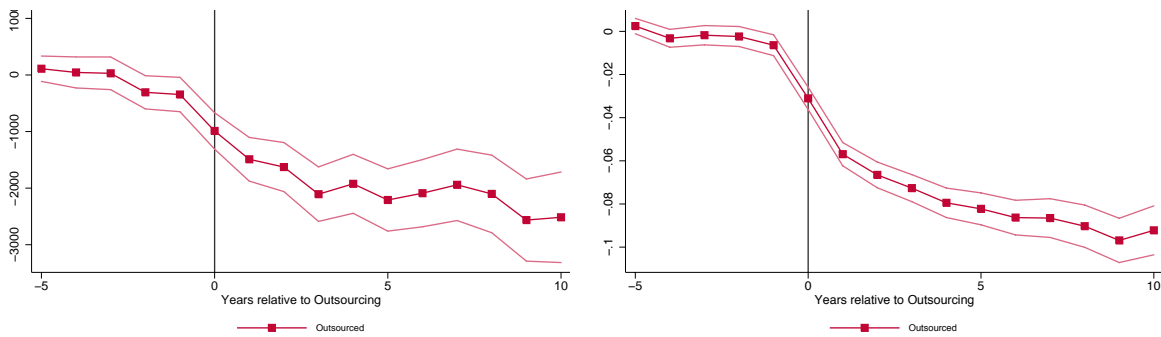
(a) Number of FSCL Workers



(b) FSCL Workers as Share of Total Workforce

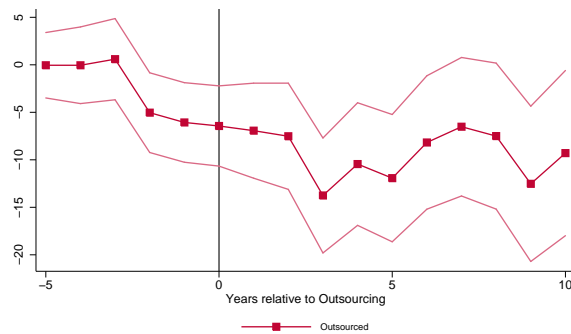
Notes: Includes West Germany only. Food category excludes workers in food occupations who are employed by restaurants and hotels.

Figure A-5: Regression Estimates of the Effects of being Outsourced on Workers



(a) Yearly Earnings

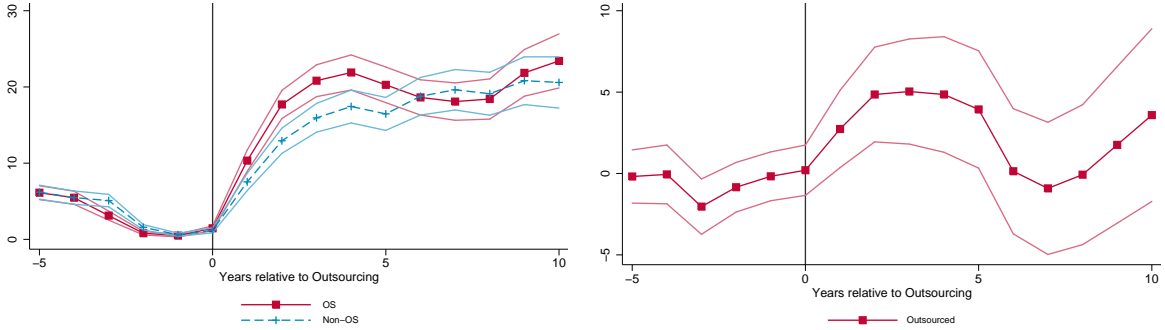
(b) Log Daily Wage



(c) Days Worked Per Year

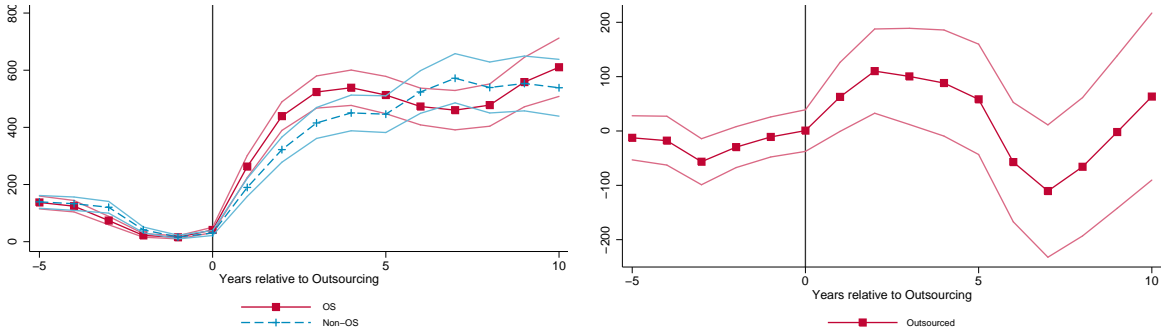
Notes: The figures show regression estimates of the effects of being outsourced on wages, earnings and days worked before and after the outsourcing event, using the matched sample of outsourced and non-outsourced workers. All regressions include individual fixed effect and year dummies. Bands represent 95 percent confidence intervals. The wage regression uses the full universe of workers, while the earnings and days regressions use a 25pct sample (to be updated using the full universe of workers soon).

Figure A-6: Employment Outcomes of Outsourced and Non-Outsourced Workers Before and After Outsourcing



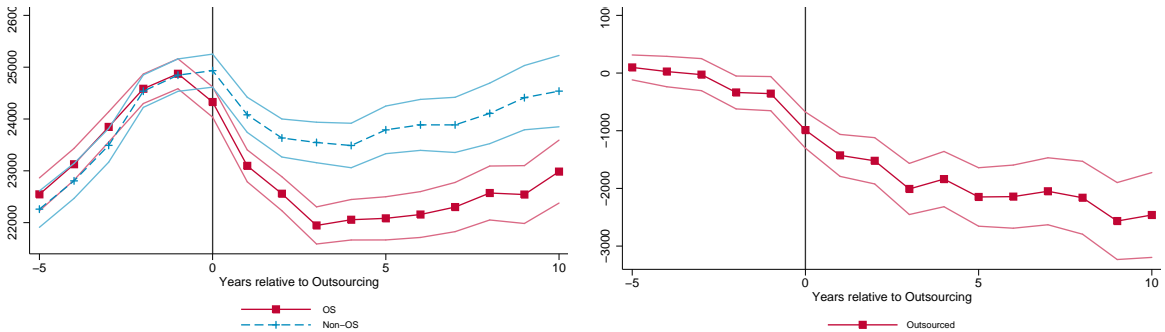
(a) Days per Year Receiving UI Benefits - Means

(b) Days per Year Receiving UI Benefits - Regression Adjusted



(c) Total Yearly UI Benefits Received - Means

(d) Total Yearly UI Benefits Received - Regression Adjusted

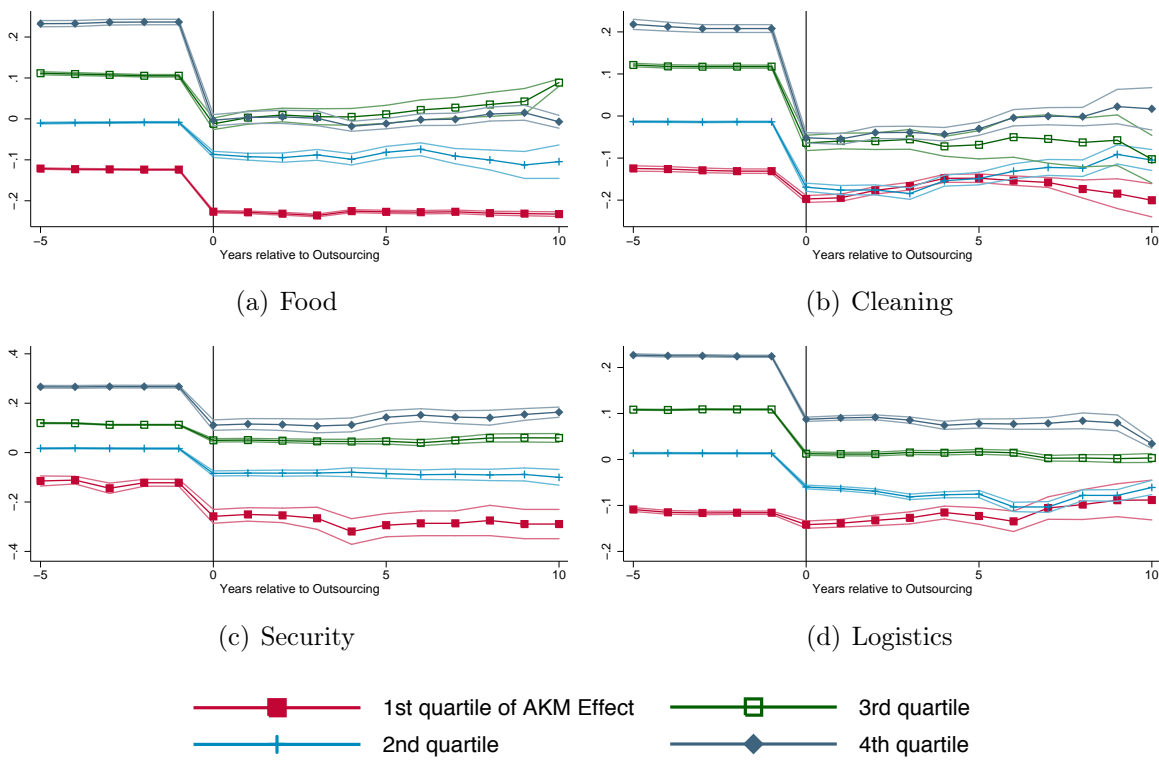


(e) Total Yearly Income - Means

(f) Total Yearly Income - Regression Adjusted

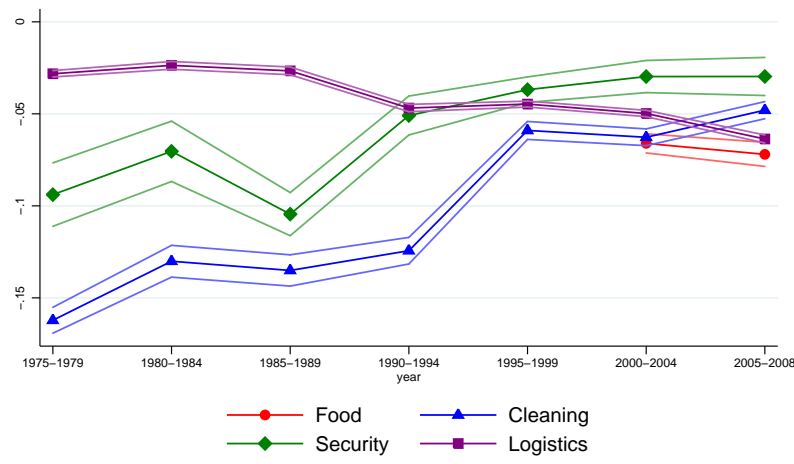
Notes: The figures follow two group of workers who in year $t=-1$ are employed at an establishment that outsources part of its workforce in year $t=0$. The first group are all the outsourced workers, while the second group is a control group of workers who are working in the same industry and occupation 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 on the left show average characteristics of the workers in the two groups before and after the outsourcing event, while the figures on the right show regression-adjusted estimates, controlling for individual fixed effects and year dummy variables. These figures were created using a 25pct sample of the universe of data (to be updated using the full universe of workers soon).

Figure A-7: Change in AKM Effect by Pre-Outsourcing AKM Effect Quartile



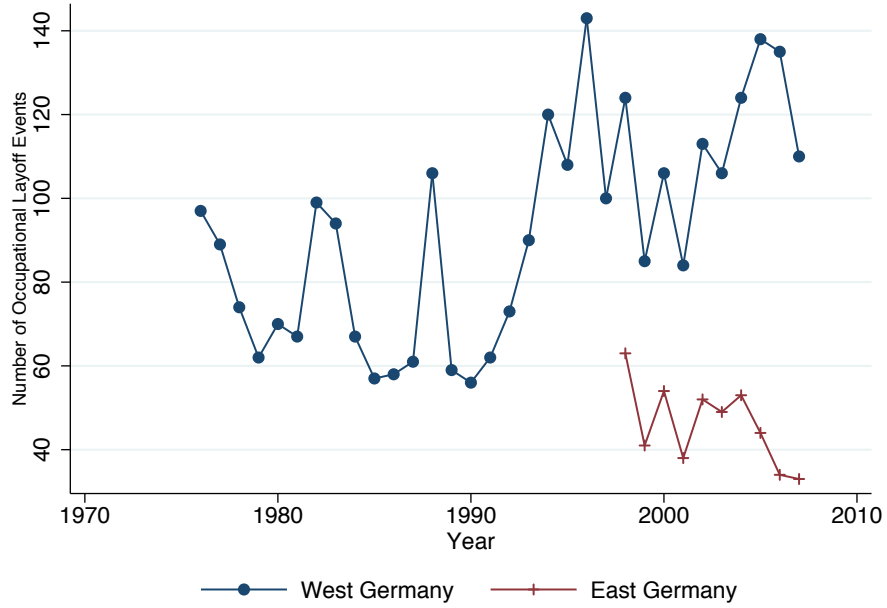
Notes: Figures show the average AKM effect of the establishments that employ each (on-site) outsourced worker in each year, by outsourcing type. Sample divided into quartiles of AKM effect of outsourcing (mother) establishment.

Figure A-8: Effect of Working at a Business Services Firm on Log Wages

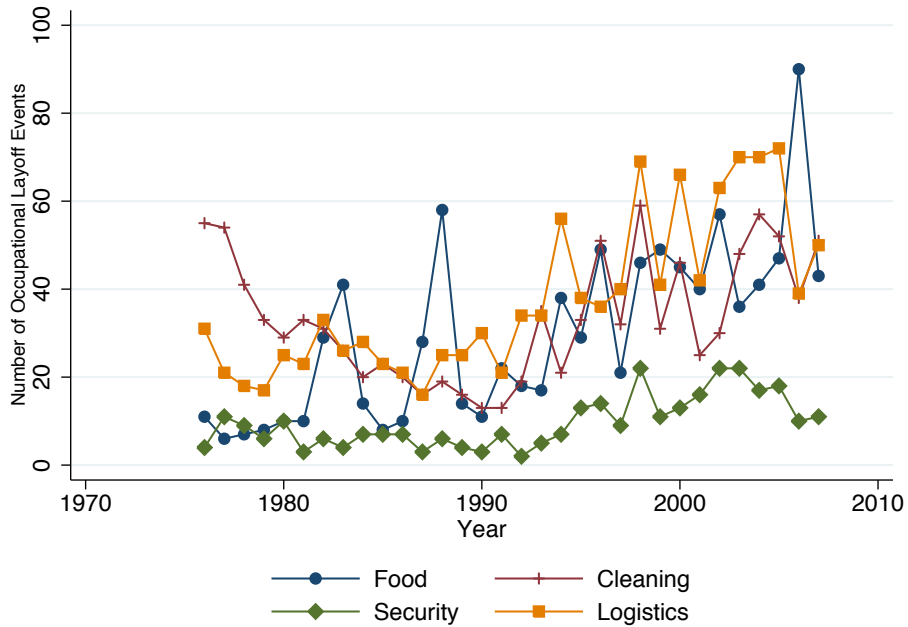


Notes: Each point is the estimated coefficient from a separate regression of log wages on an indicator variable which equals one if the worker is employed at a business services firm and zero otherwise. All regressions include individual fixed effects and year dummy variables. Before 1999, industry codes did not differentiate between restaurants and food business services industries, such as canteens and catering. Excludes food workers employed in the restaurant and hotel industries.

Figure A-9: Frequency of Occupational Layoff Outsourcing Events by Year



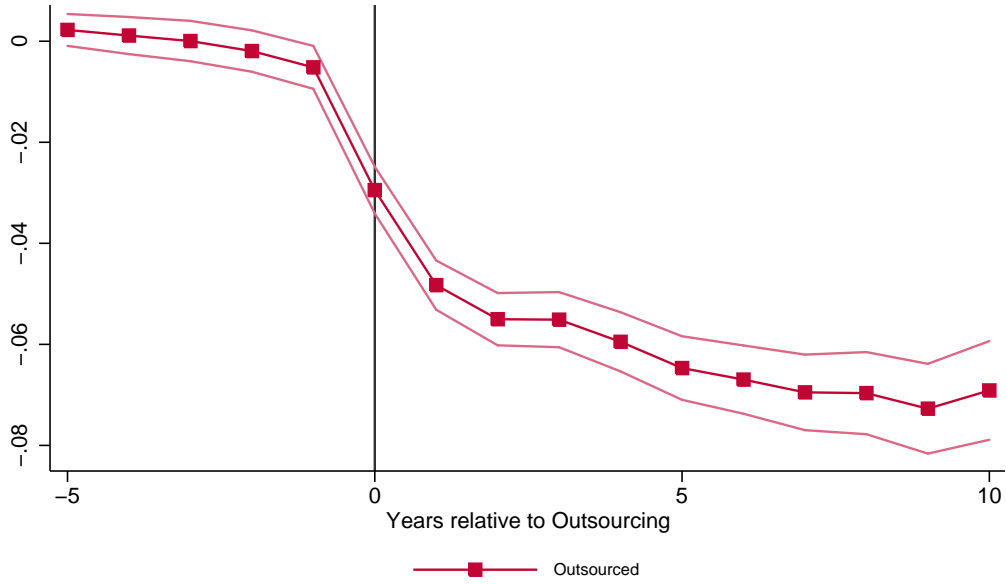
(a) Number of Outsourcing Establishments in East and West Germany



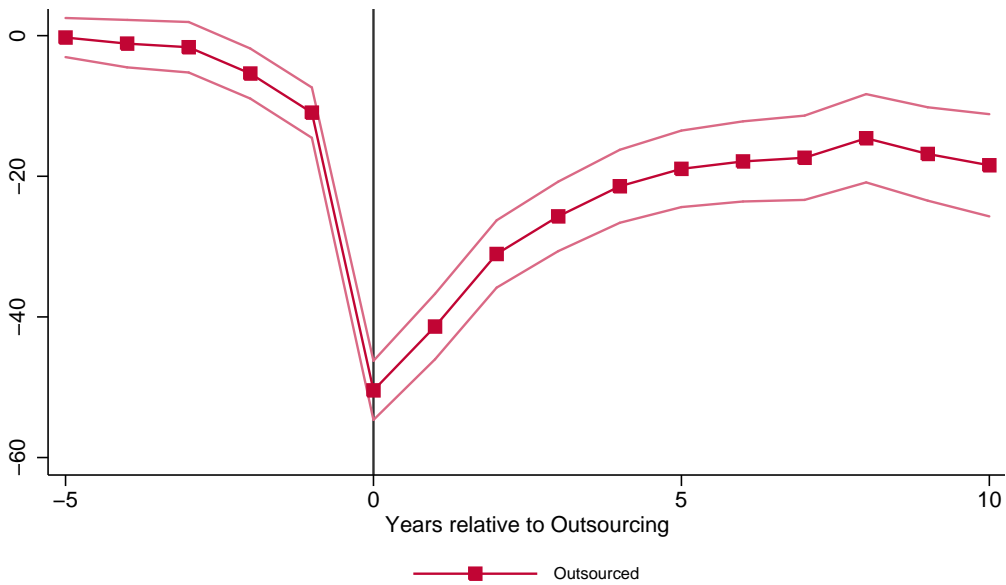
(b) Number of Outsourcing Establishments by Type of Outsourcing

Notes: Own Calculations

Figure A-10: Regression Estimates of the Effects of being Outsourced on Employment Outcomes, using Occupational Layoff Outsourcing



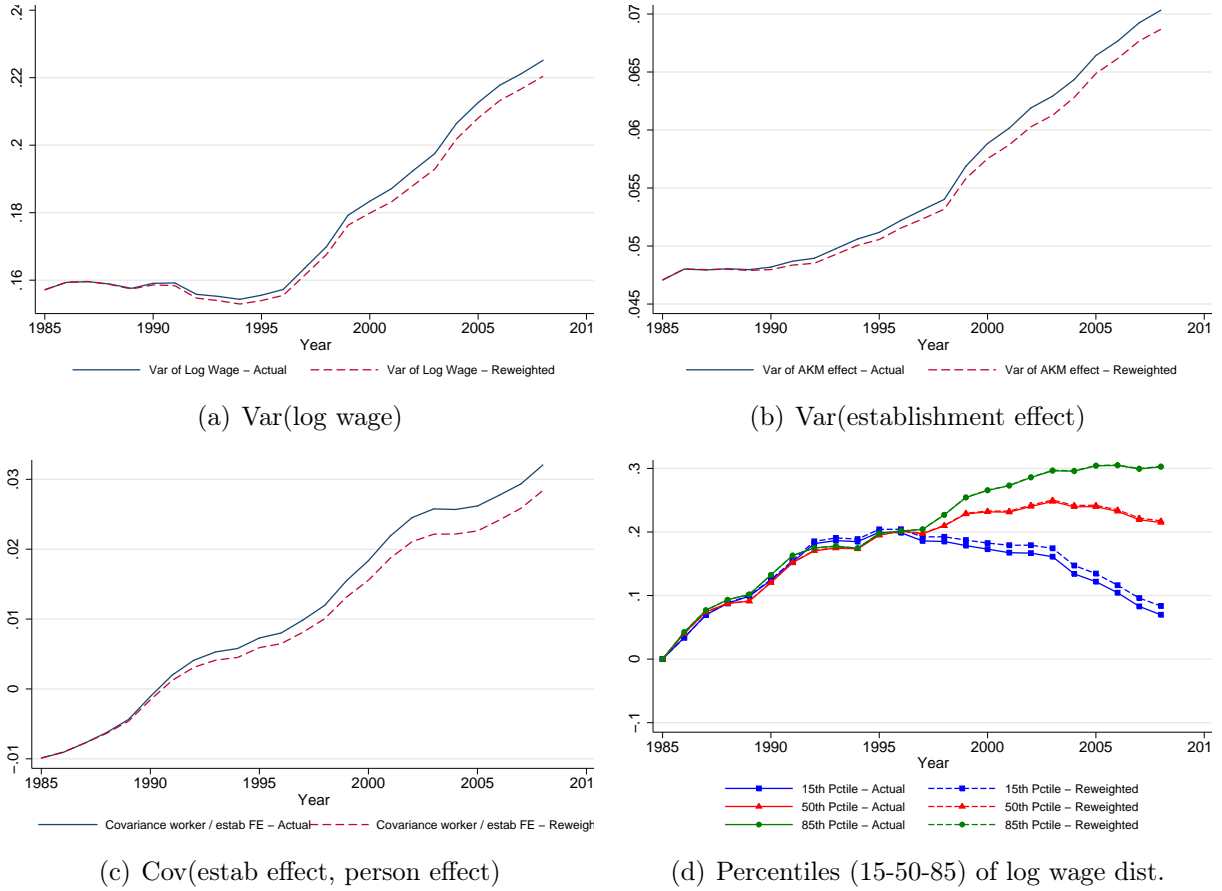
(a) Log Daily Wage



(b) Days Working Per Year

Notes: The figures show regression estimates of the effects of being outsourced on wages and employment before and after the outsourcing event, using the matched sample of outsourced and non-outsourced workers and the occupational layoff definition of outsourcing, described in the text. All regressions include individual fixed effect and year dummies. Bands represent 95 percent confidence intervals.

Figure A-11: The Evolution of the West German Wage Structure for Women



Notes: The figures shows how the variance of log wages and its components has evolved over time. The Figure replicates Figure 11 in the main paper for women. Panel (a) shows the variance of log wages, panel (b) shows the variance of the estimated establishment effect (AKM effect) over time, and panel (c) the covariance between establishment effects and the individual fixed effect. Panel (d) shows percentiles of the log wage distribution. The solid line is the actual evolution over time, while the dashed line shows the counterfactual evolution if outsourcing had remained constant at the 1985 level, where the counterfactual is constructed using DFL reweighting (see text).

Figure A-12: The Frequency of the term 'Outsourcing' on Google Books Analysis Site Ngram over Time



(a) Search hits for the term 'outsourcing' on Google Ngram

Notes: The figures shows how often the term 'outsourcing' appears in all books in the Google Books database by year. Accessed October 16, 2014.