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Domestic Outsourcing of Low-Skill Jobs

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Abstract

Firms increasingly contract out a wide range of activities that were previously done in-house, such as cleaning, security, logistics, and catering. This paper provides evidence on the impact of outsourcing on workers' earnings and possible reasons that firms outsource by estimating panel data and event study models using Norwegian administrative data. Workers who become outsourced experience large earnings declines, which are driven by reductions in working hours. Firms are likely to outsource to reduce costs and reduce rigidity in contractual working hours, which is possible as contractor firms operate on lower non-wage costs and have more workers with less than full-time contractual working hours.

Keywords: Domestic Outsourcing, Subcontracting

JEL classification: J24, J31

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Sammendrag

I mange land har bedrifter i økende grad valgt å kjøpe tjenester eksternt fremfor å utføre oppgaver internt. Dette gjelder særlig tjenester innen rengjøring, sikkerhet, logistikk, mat og kantine (FCSL). Innenlandsk outsourcing kan bidra til lavere kostnader, økt fleksibilitet og høyere effektivitet, mens offshoring innebærer å flytte arbeidsoppgaver til lavkostland. Samtidig har mange økonomier sett en nedgang i arbeidets andel av inntekt, noe som har økt interessen for hvordan outsourcing påvirker arbeidsmarkedet.

Denne studien undersøker effektene av innenlandsk outsourcing på lavtlønnede arbeidstakeres lønn og arbeidstid, samt hvilke faktorer som driver bedrifter til å outsource. Analysen baserer seg på norske administrative data for perioden 1995–2019, som kobler arbeidstaker- og bedriftsinformasjon. Outsourcing defineres som at en tradisjonell bedrift begynner å kjøpe tjenester fra en ekstern kontraktør, og arbeidstakere som overføres til kontraktørbedriften betegnes som «outsourcet».

Resultatene viser at outsourcete arbeidstakere opplever en gjennomsnittlig inntektsnedgang på 14 prosent, hovedsakelig som følge av færre arbeidstimer, mens timelønn ikke endres signifikant. Dette tyder på at kontraktørbedrifter reduserer kostnader gjennom kortere kontrakter fremfor lavere lønn.

Når det gjelder bedriftenes motivasjon for outsourcing, finner studien at større bedrifter, bedrifter bundet av tariffavtaler og de som betaler over gjennomsnittslønn, er mer tilbøyelige til å outsource. Analyse av kontraktørbedrifter viser at større leverandører kan tilby tjenester billigere enn små, ikke ved lavere lønn, men gjennom lavere driftskostnader per ansatt, noe som indikerer stordriftsfordeler.

Sammenfattende viser funnene at outsourcing kan være lønnsomt for bedrifter, men samtidig innebære lavere arbeidstid og inntekter for de berørte arbeidstakerne. Resultatene gir ny innsikt i mekanismene bak innenlandsk outsourcing og konsekvensene for både arbeidstakere og bedrifter.

1 Introduction

Firms increasingly contract out a wide range of activities that were previously done in-house. Contractors are used to perform tasks such as cleaning, security, logistics, IT, accounting, or human resources services. In addition to domenstic outsourcing, many firms also engage in offshoring - relocating tasks such as customer service or software development to countries with lower costs. Possible reasons for this could be that firms outsource to reduce labor costs, increase efficiency, or to have more contractual flexibility in order to meet varying demand (Abraham and Taylor, 1996). As many economies have experienced declines in the labor share of income, questions about the consequences of domestic outsourcing on the labor market have gained attention among policymakers; see e.g. OECD (2021).

In this paper, I contribute to an emerging literature that tries to understand how domestic outsourcing of low-skill jobs affects workers' labor market outcomes and the reasons why firms increasingly outsource part of their workforce (see e.g. Goldschmidt and Schmieder, 2017; Bilal and Lhuillier, 2021), by providing evidence from the Norwegian labor market.[1] I define outsourcing as a situation in which a firm starts to buy services from another firm within the food, cleaning, security, or logistics (FCSL) industries, while it earlier catered for its needs for these services using its internal staff. For example, a large bank stops hiring cleaners and starts buying services from a cleaning firm. I call the firm that buys services a *traditional firm* and the service provider a *contractor firm*. A worker is defined as *outsourced* if he switches from employment at a traditional firm to employment at a contractor firm in an outsourcing event. First, I show that workers who become outsourced experience a decline in earnings that is explained primarily by a reduction in working hours. Second, I show that traditional firms are likely to outsource in order to reduce costs. Cost reduction is possible as contractors who offer similar services to multiple firms operate more efficiently and achieve economies of scale by lower operating costs.

Drawing inferences about the effects of outsourcing has been challenging due to a lack of data on linkages between firms that outsource some of their activities and their respective contractors.[2] Another challenge is that workers' choice to be employed by a contractor may be endogenous, and hence estimating the causal effect of outsourcing on earnings could be complicated, due to sorting of workers of different quality. I address these challenges by taking advantage of several sources of administrative data from Norway. I combine the

[1] While outsourcing has become widespread in recent decades, the theoretical literature that investigates when it is more beneficial for firms to write contracts rather than vertically integrate is old, and dates back to Coase (1937) and Grossman and Hart (1986).

[2] One exception in the literature is Drenik et al. (2023), who compare the earnings premia of regular workers and workers employed in temporary agencies using data on linkages between firms in Argentina.

employer-employee registry containing detailed information on all job spells between 1995 and 2019, including working hours, with data from firm accounts which provide information about operating income and operating costs. The employer-employee dataset allows me to identify on-site outsourcing events, which occur when a traditional firm seizes to continue hiring a group of workers (e.g. canteen or cleaning personnel), and the same group of workers becomes employed in a contractor firm, following the method of Goldschmidt and Schmieder (2017). Further, firm accounts enable a detailed analysis of the determinants of outsourcing: I consider the role of economies of scale of contractor firms by analyzing the relationship between firm size and operating costs.

In the first part of the paper, I provide evidence on the impact of becoming outsourced. I identify an outsourcing event when a group of at least five workers in FCLS occupations moves from employment at a traditional firm to a contractor firm between two consecutive years. I assume that firms' decisions to outsource are exogenous from the perspective of workers. This allows me to use an event study design to draw inference on the effects of outsourcing events on workers' outcomes. I find that workers who become outsourced experience a 14 percent decrease in earnings in their main job relative to the control group comprised of workers employed in FCSL occupations who do not experience an outsourcing event. The earnings decrease is explained by a 10 percent decrease in working hours. I do not find a significant impact on hourly wages. Taken together the results suggest that contractor firms reduce workers' earnings by offering contracts with fewer working hours.

In the second part of the paper, I investigate the determinants of outsourcing. I find that larger traditional firms, traditional firms bound by collective agreements, and those paying above-market wages are more likely to outsource. These results are consistent with firms outsourcing services to reduce costs of monitoring, which could be higher at larger firms. Moreover, firms may use outsourcing to avoid paying higher wages in firms with collective bargaining if the firm is bound to pay relatively higher wages to employees in FCSL occupations.

How can traditional firms reduce their costs by buying services from contractor firms, given that I do not find evidence of lower hourly wages in contractor firms? In the last part of the paper, I show that large contractor firms can provide outsourcing services at a lower price than small contractor firms, due to lower non-wage costs. Non-wage costs may include, for instance, recruitment, training, uniforms, and equipment. It is difficult to isolate the non-wage costs of FCSL occupation workers hired by traditional firms. Instead, I show a large variation in operating costs across contractor firms of different sizes by taking advantage of detailed firm account data. I show that larger contractor firms have lower operating costs per worker compared to smaller contractor firms. These results suggest that traditional firms

may use contractor firms to reduce costs, as contractor firms experience economies of scale.

My paper is most closely related to a growing empirical literature on the impact of domestic outsourcing on workers' outcomes. A negative effect on workers' wages has been documented in several countries (see e.g. Berlinski, 2008 and Dube and Kaplan, 2010 for evidence from the US; Goldschmidt and Schmieder, 2017 for Germany; Bilal and Lhuillier, 2021 for France).

The paper proceeds as follows. Section 2 presents the data and outsourcing definitions. Section 3 provides institutional setting and descriptive evidence. Section 4 estimates the impact of outsourcing on worker outcomes. Section 5 focuses on the determinants of outsourcing. Section 6 concludes.

2 Data and outsourcing definitions

In this section, I describe the data sources and how I define and identify outsourcing. Details about the data sources and each of the variables are given in Table A1 in Appendix A.

2.1 Data sources

I base the empirical analysis on several administrative data sources with detailed information on the characteristics and outcomes of workers and firms.

The main data source is the matched employer-employee register, which uses tax registry data for the universe of workers and contains information about yearly earnings. These data are combined with non-pecuniary information about employment from the Norwegian Labor and Welfare Administration (NAV), including information about contracted hours, the number of days in employment, industry and occupation. Data about workers' education level come from National Education Database (NUDB) and immigrant status is from the Central Population Register.

The firm-level data come from the Register of Company Accounts and contain information about firm performance, such as total operating income, total costs and costs of materials. These data cover the universe of limited liability firms. I link the firm-level data to the employer-employee register to calculate the wage bill and to obtain information about the number of employees.

The data about sectoral collective agreements are provided by the three biggest employer organizations: The Confederation of Norwegian Enterprise (NHO), Federation of Norwegian Enterprise (Virke) and Spekter (employer organization; typical in public sector firms). To capture collective agreements signed by smaller organizations, I incorporate data about mem-

bership in the private sector tariff-based pension scheme AFP, as being bound by a collective agreement is a prerequisite for entering AFP.

2.2 Outsourcing definitions

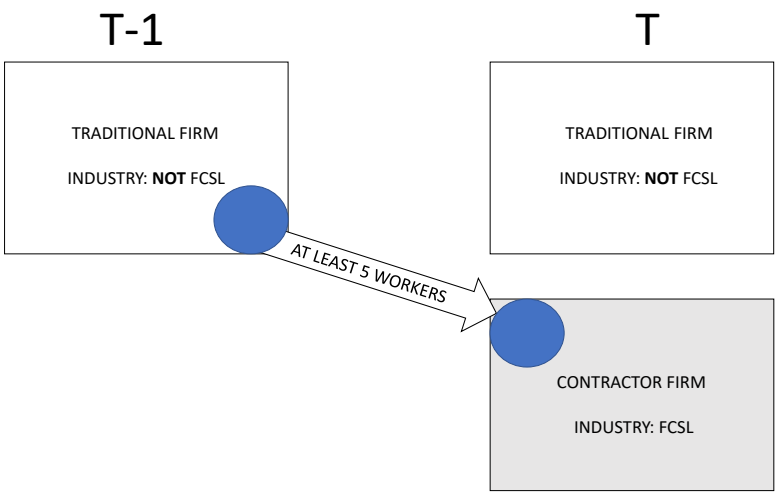
Outsourcing is a broad term used to describe firms' practice to hire a third party to perform certain tasks, for example by relocating work or services to a lower-cost location overseas. In this paper, I narrow down the definition and define outsourcing as a situation in which a traditional firm buys services from a domestic contractor firm within food, cleaning, security and logistics (FCSL) industries, instead of hiring workers directly to perform the task.

To identify contractor firms and outsourced workers, I rely on industry codes and occupation codes, following the method of Goldschmidt and Schmieder (2017). Specifically, *contractor firms* are identified based on industry codes as described in Table A2 in Appendix A. *Contractor workers* are defined as workers in contractor firms employed in FCSL occupations as provided in Table A3 in Appendix A.

I use two different panel data approaches to study the impacts of outsourcing. First, using worker fixed effects in Section 4.1, I compare contractor workers in FCSL occupations to workers in FCSL occupations hired by traditional firms (firms that do not belong to the FCSL industry). Second, I employ an event study design relying on on-site outsourcing events in Section 4.2, based on flows of workers in FCSL occupations from traditional firms to contractor firms between two consecutive years, as illustrated in Figure 1. The advantage of this method is that it provides linkages between traditional firms and contractors, and arguably exogenous variation in workers' outsourcing status. The drawback of this method is that on-site outsourcing events are rare. To identify a larger sample of traditional firms which buy outsourcing services in Section 5.1, I define a general outsourcing event when a traditional firm stops hiring workers in the FCSL occupations.

An *on-site outsourcing* event happens when a traditional firm decides to outsource the FCSL services: A traditional firm (e.g. a bank) seizes to continue hiring a group of workers (e.g. canteen or cleaning personell), and the same group of workers becomes employed in a contractor firm. Such events are not directly observed in the data, but they can be identified by using worker flows between firms. To ensure that I am not capturing the usual flows of workers between firms, I impose the following additional conditions: at least 5 employees are observed flowing from one firm in year $t-1$ to another firm in year t. The traditional firm must have at least 25 workers in $t-1$ and must continue to exist in year t and the number of workers cannot shrink by more than 50 percent. This is to avoid capturing a closing or downsizing of a firm. Moreover, the flow must represent less than 30 percent of workers in

Figure 1: Illustration of an on-site outsourcing event



Notes: At least five workers move from a traditional firm to a contractor firm in the FCSL industry between two consecutive years. Workers are employed in the FCSL occupation in both $t-1$ and t. Less than 30 percent of workers from a traditional firm move. The traditional firm has at least 25 workers in $t-1$ and does not shrink by more than half in t.

the traditional firm at $t-1$ so that outsourced employees represent only a small fraction of the firm. Additionally, the flow must happen between two firms that do not belong to the same business group,[3] to avoid capturing a reshuffling of workers across firms within the same business group. Importantly, employees flow from firms that do not belong to any of the FCSL industries and end up in a firm that belongs to one of the FCSL industries and are employed in an FCSL occupation in both years $t-1$ and t.

I use the on-site outsourcing events to identify the effects of outsourcing on workers' outcomes in Section 4.2. I identify 54 such events, with 664 workers becoming outsourced. To analyze the outsourcing decision of traditional firms in Section 5.1, I employ a more general definition of outsourcing, to capture more cases of contracting. A firm is identified to outsource cleaning personnel if it does not employ any workers within a cleaning occupation in year t and has hired at least five such workers in any of the past five years, and is not reducing the number of workers by more than 50 percent (to avoid capturing downsizing of firms). Analogous *general outsourcing* events are identified for food, logistics and security services.

[3]A business group consists of a parent firm and one or more subsidiaries (*konsern* in Norwegian).

2.3 Sample selection

I construct the baseline sample using workers between 18 and 67 years old. For each worker, I keep the highest-paying job which is active in December. I drop firms with missing data on operating income, costs, location or industry. The baseline sample consists of about 4.3 million workers, 390 thousand firms and 450 thousand establishments.

Table 1 summarizes the sample restrictions and reports the number of workers, establishments or firms for each subsample. The first subsample, which I refer to as the *FCSL occupation sample*, restricts the baseline sample to workers employed in the FCSL occupations as defined in Table A3 in Appendix A. I drop workers with less than 4 or above 50 contracted hours per week and workers whose hourly wage is above the 95th percentile or below the 5th percentile. This sample is used to compare the characteristics of contractor workers employed in the food, cleaning, security and logistics occupations to workers in the same occupations employed by traditional firms, as well as in the panel data estimation.

The second subsample, which I refer to as the *event study sample*, restricts the baseline sample to workers who experience an on-site outsourcing event (664 workers) and the respective control group consisting of workers employed in the same industry and occupation one year before the event who are never employed at a firm which undertakes on-site outsourcing events. I drop workers with less than 4 or above 50 contracted hours per week and drop workers whose hourly wage is above the 95th percentile or below the 5th percentile and which results in a sample of 589 workers.

In the third subsample, the *traditional firms sample*, the data are at the establishment level. This sample is used to analyze the probability of traditional firms outsourcing the FCSL services to contractor firms. Here, I keep establishments that have at least 50 workers and are not operating in the FCSL industries.

The last subsample, the *contractor firms sample*, is restricted to firms operating in the FCSL industries. The data are at the firm level.

Table 1: Overview of the sample size

		Worker level		Establishment level	Firm level
	Baseline	FCSL occupation	Event-study	Traditional	Contractor
	(1)	(2)	(3)	(4)	(5)
A. Observations					
Unique workers	4,341,066	499,214	71,414		
Workers × year	45,065,316	2,055,946	623,620		
Unique establishments	454,548			13,579	
Establishments × year	3,563,005			107,345	
Unique firms	393,031				4,493
Firms × year	2,563,073				26,061
B. Subsample treated					
Unique workers		32,226	589		
Workers × year		210,686	5,539		
C. Subsample restrictions					
Not FCSL industry, $\geq$ 50 workers				✓	
FCSL industry					✓

Notes: This table provides an overview of the baseline sample and the sample restrictions imposed to construct each of the four subsamples used in the analysis. In panel (B), the subsample treated in column (2) refers to the number of observations which identify the parameter of interest in estimation with worker fixed effects.

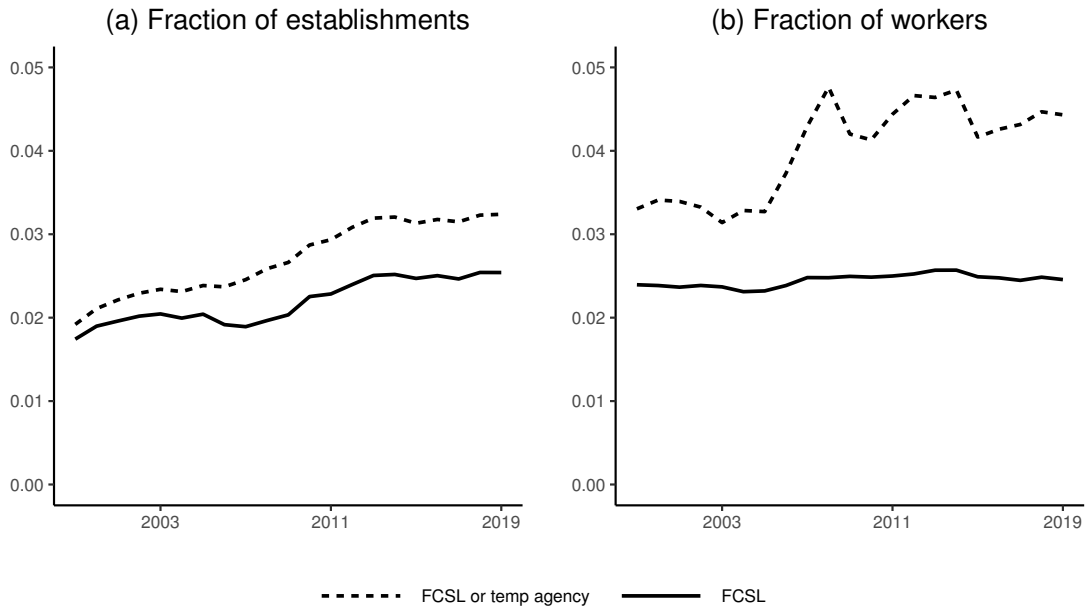
3 Institutional setting and descriptive evidence

The Norwegian labor market is characterized by high protection of employees, with strong labor market institutions and labor unions. While there is no minimum wage, certain industries have wage floors that are agreed upon in generally applicable collective agreements (extensions) and apply to all workers employed in specific sectors (e.g. catering, cleaning and freight transport sectors), regardless of workers' unionization status (see e.g. Arbeidsmiljøloven, 2022). Firms operating in an institutionalized labor market that bounds to pay wages according to collective agreements and makes it difficult to lay off workers, may have incentives to reduce the number of full-time employees by relying on non-traditional employment arrangements such as outsourcing, temporary or contingent work, offshoring, and contracting.[4]

Figure 2 shows the share of the labor force employed in the FCSL industries and temporary agencies. There has been an increase in the fraction of temporary agencies and the FCSL group, with almost 4 percent of firms and 5 percent of workers being employed in these industries in 2019. As pointed out by Riise (2022), temporary agencies in Norway are normally used for a limited duration. Moreover, firms that buy services from temporary agencies are bound by law to provide the same working conditions including working hours and wages as to workers hired in-house, see Arbeidsmiljøloven (2005). I provide descriptive

[4]An association between centralized bargaining and higher incidence of temporary employment has been shown for the OECD countries (OECD, 2018).

Figure 2: Fraction of firms and workers operating in the FCSL industry or temporary agency



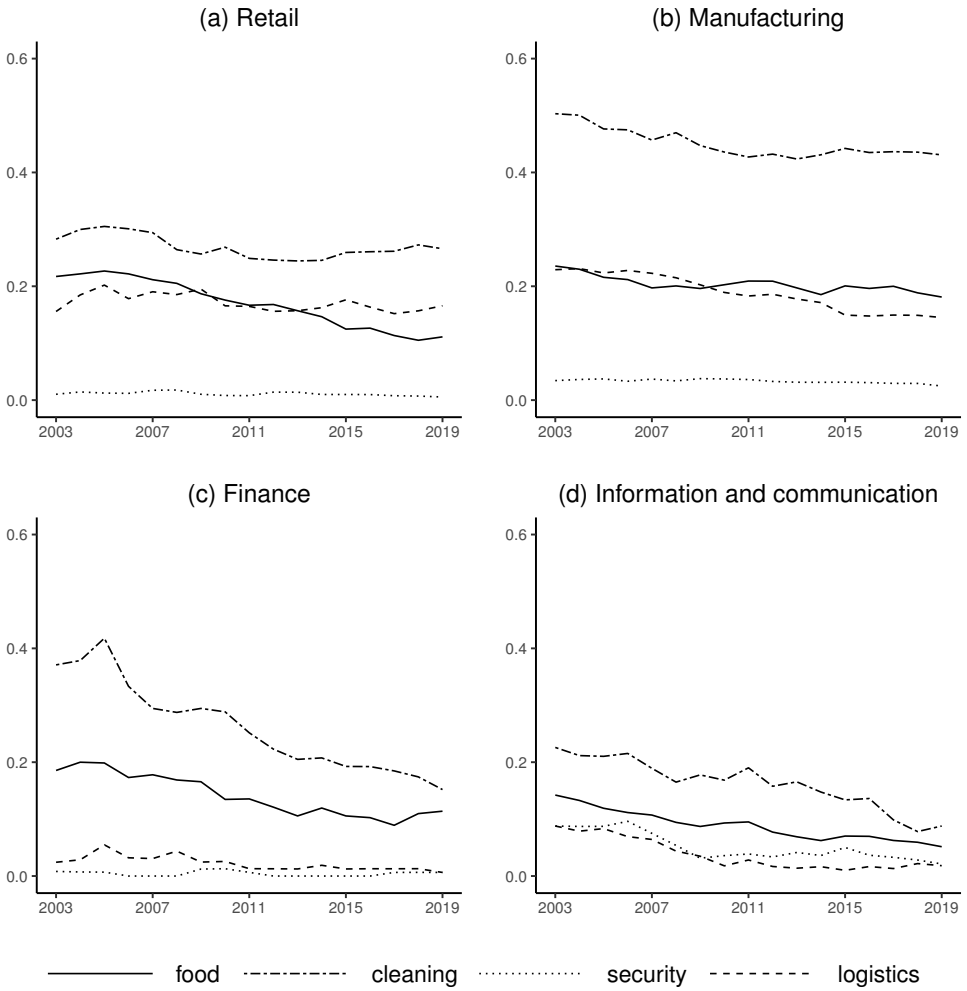
Notes: The figure shows the fraction of firms and workers employed either in the food, cleaning, security or logistics industries or in temporary agencies. The figure is constructed using the baseline sample defined in Table 1.

evidence on workers in FCSL occupations employed by temporary agencies (over 26 thousand observations). However, in the main analysis, I focus on workers employed in FCSL industry firms (over 460 thousand observations) and exclude FCSL occupation workers in temporary agencies to avoid capturing the effect of buying short-term FCSL services.

Even though the fraction of workers employed by FCSL firms has not increased as rapidly as in other countries (see e.g. Goldschmidt and Schmieder, 2017 for evidence from Germany), Figure 3 shows that among large firms in the retail, manufacturing, finance and ICT sectors, a decreasing fraction hires workers within the FCSL occupations in-house. This suggests that an increasing fraction relies on contracting these services. For instance, about 40% of large finance sector firms hired at least one cleaner in the early 2000s, while this fraction fell to about 20 percent in 2019.

Table 2 further explores some basic demographic and economic characteristics of workers employed in the food, cleaning, security and logistics occupations. I contrast the characteristics of workers employed by contractor firms to workers employed by traditional firms. Moreover, I provide the characteristics of workers in FCSL occupations employed by temporary agencies. Workers employed by contractor firms earn 19 percent less than workers in traditional firms. Part of this difference in earnings is explained by fewer hours in contractor firms, with 20 percent of workers employed part-time, compared to 15 percent at the

Figure 3: Fraction of firms with any worker in the FCSL occupations



Notes: The figures show the fraction of firms that employ at least one worker in the food, cleaning, security or logistics occupation. The figure is constructed using the traditional firms' sample as defined in Table 1 and restricted to firms in retail, manufacturing, finance and ICT industries.

traditional firms. Hourly wage is 5 percent lower at contractor firms. The table reveals a large difference in other observable characteristics. Workers in contractor firms are about 5 years younger. 47 percent are born outside of Norway compared to 27 percent of workers employed by traditional firms. Only 1 percent of contractor workers are employed in the public sector, as opposed to 30 percent in traditional firms. 62 percent of the contractor workers are employed in one of the five biggest Norwegian cities, compared to only 29 percent of workers in traditional firms. Likely, outsourcing is more widespread in urban areas, where it is easier for an outsourcing firm to find a contractor.

Table 2: Characteristics of workers in the FCSL occupations by firm type

	Contractor firm		**Traditional firm**		**Temporary agency**	
	Mean	SD	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)	(5)	(6)
Log earnings	12.09	0.88	12.28	0.85	11.71	1.10
Log hourly wage	5.15	0.37	5.20	0.35	5.13	0.41
Log hours	7.00	0.65	7.12	0.62	6.71	0.75
Hours per week	28.54	9.64	30.74	9.46	29.37	9.70
Average age	37.59	12.00	42.84	12.96	36.59	11.97
Share foreign-born	0.47	0.50	0.27	0.44	0.59	0.49
Share college	0.11	0.31	0.07	0.26	0.10	0.30
Share part-time	0.20	0.40	0.15	0.36	0.19	0.39
Share male	0.49	0.50	0.57	0.49	0.65	0.48
Share in public sector	0.01	0.09	0.30	0.46	0.00	0.00
Share urban	0.62	0.48	0.29	0.45	0.72	0.45
Number of observations	462,929		1,593,017		26,089	
Number of unique workers	141,955		389,485		16,592	

Notes: This table presents summary statistics for the FCSL occupations sample as defined in Table 1. Additionally, I include workers employed in FCSL occupations in temporary agencies. All variables are defined in Table A1. The variable Contractor takes the value 1 if the worker is employed in a firm in FCSL industries (Table A2), and 0 otherwise. Similarly, Temporary agency takes the value 1 if the worker is employed in a firm with industry code 78.200, and 0 otherwise.

4 Effects of outsourcing on workers' outcomes

In this section, I apply two research designs to estimate the impacts of outsourcing on workers in FCSL occupations. Using a panel data approach, I first show that employment at a contractor firm is associated with lower earnings and working hours. I then turn to an event study design to analyze the outcomes of workers who experience on-site outsourcing. The estimates show that outsourced workers experience large declines in earnings and working hours but no reduction in hourly wages, relative to the control group comprised of workers who are never employed in firms that undergo on-site outsourcing.

4.1 Panel data regression

I analyze whether the outcomes of employees in the food, cleaning, security and logistics occupations depend on whether a worker is employed by a contractor firm. To this end, I estimate the following fixed effect regression model:

$$Y_{it} = \alpha_i + \beta \text{Contractor}_{it} + X'_{it}\gamma + \phi_t + \epsilon_{it}, \tag{1}$$

where Y_{it} is the outcome of worker i in year t, e.g. (log) earnings, and Contractor_{it} indicates whether worker i is employed in a firm within the FCSL industries in year t.[5] In this specification, β is the parameter of interest, α_i are worker-specific fixed effects, ϕ_t are calendar year fixed effects, X'_{it} is a vector of firm-level and individual specific controls, and ϵ_{it} is an error term.

The parameter of interest β is identified by workers in FCSL occupations who switch between working for a traditional firm and a contractor firm. Table 1 reveals that only 2 percent of all workers in FCSL occupations switch between the two types of firms. Thus, the estimates based on the worker fixed effects specification should be interpreted as the 'local' treatment effect which applies to the sub-population of workers who experience a change in contractor status.

A causal interpretation of estimates of β requires that workers' potential outcomes are independent of changes in contractor status, conditional on X'_{it}, α_i and ϕ_t. The identifying assumption would be violated for example if a worker whose potential outcomes at a contractor firm are higher is more likely to switch from a traditional firm to a contractor firm relative to workers who never switch. As switching between employment at contractor and traditional firms is rare, I supplement the results with estimates from a 'pooled OLS' estimation, where I do not include the worker fixed effects.

Panel A in Table 3 provides estimates from a pooled OLS specification. The estimate in Column 1 shows that the mean yearly earnings of workers in FCSL occupations are 7 percent lower in contractor firms than in traditional firms. By comparison, the descriptive evidence in Table 2 shows a raw earnings differential of about 19 percent. This implies that approximately 65 percent of the raw earnings differential is explained by the differences in workers' and firms' observed characteristics.

Columns 2 and 3 in Table 3 report the impact of working for a contractor firm on hourly wages and working hours and reveal that the decrease in earnings is explained by a 6 percent decrease in working hours.

[5]The variation in Contractor_{it} is almost only due to workers changing firms. In my sample, only 24 out of 449,428 firms change between being a contractor firm and a non-contractor firm.

Table 3: The impact of contractor employment on workers' outcomes

	(Log) Earnings	(Log) Hourly wage	(Log) Hours
	(1)	(2)	(3)
A. Pooled OLS Estimation			
Contractor	-0.07***	-0.01	-0.06***
	(0.00)	(0.00)	(0.00)
Number of observations	2,030,764	2,030,764	2,030,764
B. Worker Fixed-Effects Estimation			
Contractor	-0.03**	0.01	-0.03***
	(0.00)	(0.00)	(0.00)
Number of observations	2,030,764	2,030,764	2,030,764

Notes: This table shows estimation results from regressions of different outcomes, which include log earnings (column 1), log hourly wage (column 2) and log hours (column 3) on Contractor dummy, where $\text{Contractor}_{it} = 1$ for worker i employed in FCSL industry firm in year t. Panel A includes year FE, a dummy for an urban area, a log of firm size, age cubic, foreign-born indicator, and the level of education (6 categories). Panel B additionally includes worker FE. Standard errors are clustered at the establishment level. The sample used is FCSL occupations sample as defined in Table 1.

In panel B, I report estimates from the worker fixed effects specification in Equation (1). Comparing the estimates in the two panels, the earnings penalty is reduced to 3 percent. This implies that selection is a key concern when examining the effects of working at contractor firms. Columns (2) and (3) reveal that lower earnings are largely explained by a 3 percent decrease in working hours. I do not find a significant effect on the hourly wage.[6]

What explains no difference in hourly wages?

Recent empirical literature documents that working for a contractor firm is associated with a lower wage. Here, I find that the hourly wages of workers employed by contractor firms are not significantly different from hourly wages of workers employed by traditional firms. One explanation is that contractor firms cannot lower wages because of wage floors and instead offer contracts with fewer working hours. Another explanation is that there is a selection on gains - only workers whose wage is relatively high enter contractor firms. Lastly, the measure of hourly wage is calculated based on contracted rather than actual hours worked, which may

[6]Riise (2022) investigates the impact of domestic outsourcing in Norway by using panel data estimation with worker fixed effects focusing on workers in FCSL occupations. Consistently with my results, the author finds no impact on hourly wages in the baseline specification with worker fixed effects. However, the impact varies across the occupation groups, between a 6 percent decrease in hourly wages for security guards a and 0.5 percent increase in hourly wages for cleaning workers. My paper provides new evidence from an event study design using flows of workers and investigates additional outcomes such as yearly earnings and working hours. It also provides a new analysis of the determinants of outsourcing.

introduce measurement error. The hourly wages in contractor firms may be upward biased relative to hourly wages in traditional firms if outsourced workers, whose contracts have fewer contracted hours, are more likely to work overtime.

The results from panel data estimation give insights into the differences in outcomes of workers employed by contractor firms and traditional firms. The advantage of applying this method is external validity and a large sample size. However, the causal interpretation of the coefficients hinges on the assumption of exogenous mobility which is violated if the choice to switch between working for a contractor firm and a traditional firm depends on potential outcomes.

4.2 Event study approach

In this section, I follow Goldschmidt and Schmieder (2017) and complement the analysis by providing evidence from an event study design around the time of on-site outsourcing events, which are identified from workers' flows between traditional firms and contractor firms (see Section 2 for details). I compare the outcomes of workers who experience on-site outsourcing events to the outcomes of workers in a control group.

For any year $e \in \{2004, 2005, \ldots, 2018\}$, the treatment group consists of all workers who experience an on-site outsourcing event between years $e-1$ and e. The average change in outcomes between time $e+s$ and the reference year $e-s'$ in the treatment group is denoted by $E[Y_{i,e+s} - Y_{i,e-s'}|E_i = e]$, where E_i denotes the year in which worker i experienced an on-site outsourcing event. For each treated worker, I find workers in the control group among workers who are employed in the same industry and occupation as the treated workers one year before the event, and who are never employed by a traditional firm that undergoes an outsourcing event.

Under the parallel trends and no-anticipation assumptions, the event study estimator recovers the average effect of outsourcing for cohort e at event time s, corresponding to year $e+s$.

I estimate the following regression model:

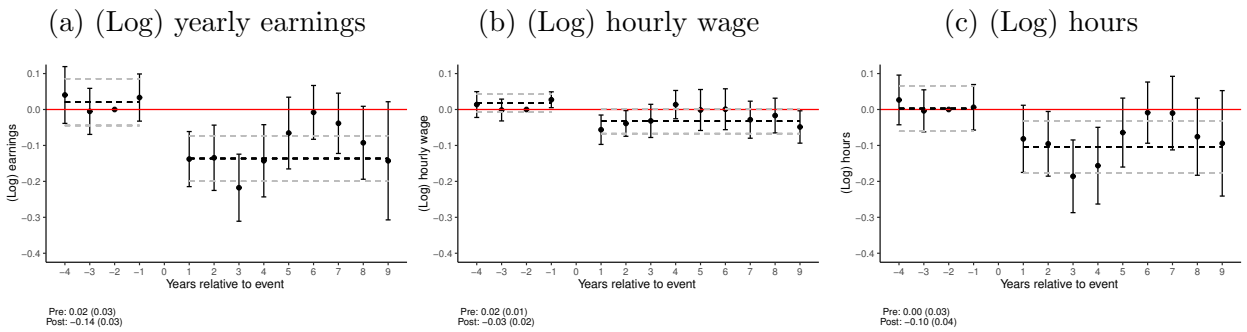
$$Y_{is} = \alpha_i + \sum_{\substack{k=-4 \\ k\neq -2}}^{9} \beta_k \mathbb{1}(s=k)\text{Outsourced}_i + \phi_{es} + \epsilon_{is}, \tag{2}$$

where Y_{is} is the outcome of worker i at event time s, Outsourced_i is an indicator for whether an individual i experienced an on-site outsourcing event, α_i denotes an individual fixed effect,

ϕ_{es} represent the event time fixed effects interacted with the cohort, end ϵ_{is} is the error term.[7] Assuming that the treatment effect is the same across cohorts, the parameters of interest β_k measure the average impact of an outsourcing-event k years relative to the reference year, $s = -2$.

Figure 4 plots the DiD estimates β_k based on the specification in Equation (2) of the earnings, hourly wage, and working hours impacts of experiencing an outsourcing event. Panel (a) shows that on-site outsourcing leads to a large decrease in yearly earnings up to 9 years after the event. Replacing the period-specific indicators with a single post-treatment indicator $\mathbb{1}(s \geq 0)$ leads to an estimate $\beta_{post} = -0.14$. Panels (b) and (c) show that the drop in yearly earnings is explained by a 10 percent decrease in working hours, while the hourly wages decrease by 3 percent (though the estimate is insignificant).[8]

Figure 4: Effect of on-site outsourcing on workers' outcomes



Notes: These figures plot the estimated β_k coefficients from the specification in Equation (2). The treatment group consists of workers who experience an on-site outsourcing event between years $s = -1$ and $s = 0$. The control group consists of workers employed in the same industry (2-digit; 48 groups) and occupation (3-digit; 61 groups) as the treated group in year $s = -1$ and who never experience an on-site outsourcing event. The dashed horizontal lines indicate the average treatment effects estimated by using single pre- and post-treatment indicators. The sample used is the event study sample as defined in Table 1.

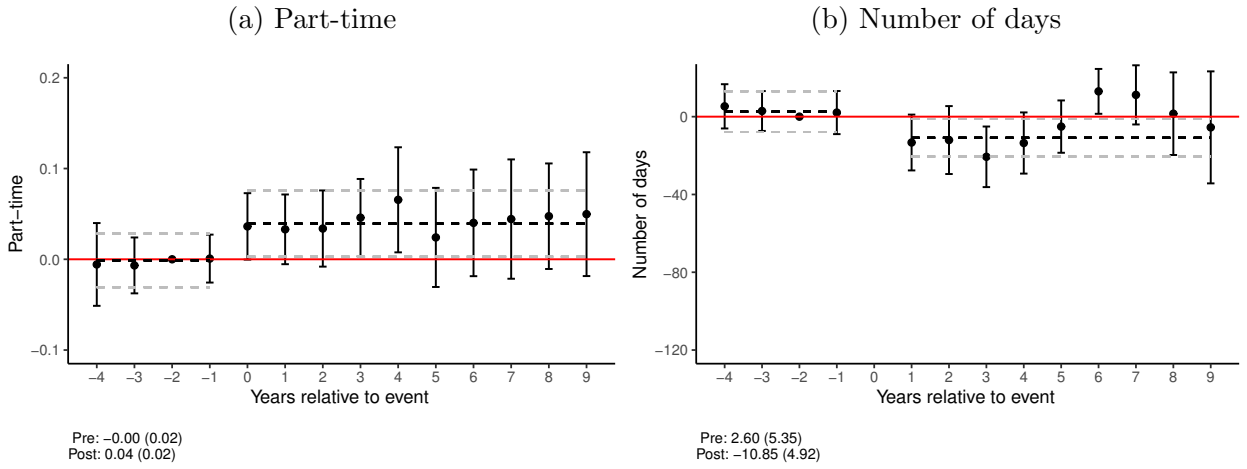
I show that the large decrease in earnings among workers who experience on-site out-

[7] By estimating the parameter ϕ_{es} separately for each cohort, I ensure that the parameters of interest β_k measure an average of causal effects with positive weights as discussed in Sun and Abraham (2021).

[8] In my main specification I select a control group using matching on predetermined characteristics (industry and occupation one year before the event). For comparison, in Figure A1 in Appendix A I provide the DiD estimates when using a control group selected by propensity score matching as in Goldschmidt and Schmieder (2017) who additionally match on earnings two and three years before the outsourcing event. The estimated impact on yearly earnings is equal to $\beta_{post} = -0.11$. Using a control group selected by coarsened exact matching, the estimated impact of outsourcing events on yearly earnings and working hours is equal to $\beta_{post} = -0.6$. While the magnitude of the estimated effects varies across the specifications (e.g. due to small sample size or due to matching on earnings), the main conclusion is the same across specifications: there is a negative impact on yearly earnings which is mostly explained by a decrease in working hours.

sourcing is explained both by fewer contracted hours per week and a decrease in the number of days in employment. Figure 5 shows that following an on-site outsourcing event, workers experience an increase in the prevalence of part-time employment by 4 percentage points (11 percent of treated workers are employed part-time in the reference year). Moreover, workers experience a 10-days decrease in the number of days in employment (on average, treated workers are employed for 347 days in the reference year).[9]

Figure 5: Effect of on-site outsourcing on workers' employment



Notes: These figures plot the estimated β_k coefficients (along with 95% confidence intervals) based on the specification in Equation (2). The treatment group consists of workers who experience an on-site outsourcing event between years $s = -1$ and $s = 0$. The control group consists of workers employed in the same industry (2-digit; 48 groups) and occupation (3-digit; 61 groups) as the treated group in year $s = -1$ and who never experience an on-site outsourcing event. The dashed horizontal lines indicate the average treatment effects estimated by using single pre- and post-treatment indicators. Part-time defined as working less than 37.5/2 hours per week. The sample used is the event study sample as defined in Table 1.

Understanding the differences between panel data and event study estimates

A discrepancy between results obtained in the panel data and the event study design can arise if there is heterogeneity in the treatment effects and the two methods rely on different samples for estimation. The estimated impact of working for a contractor firm in the panel

[9]While Section 4.2 focuses on outcomes conditional on being employed, Figure A2 in Appendix A provides evidence on the impact of on-site outsourcing on the total number of days in employment (in any firm) without conditioning on having earnings greater than zero (I impute 0 for workers observed in tax register). I find that treated workers are employed 14 days less compared to the control group following an on-site outsourcing event. Moreover, treated workers experience an increase in the uptake of unemployment benefits by 4 percentage points (the uptake is 4 percent among the treated in the reference year), though the estimates are noisy.

data may be smaller than the estimated impact of becoming outsourced if the majority of workers who identify the parameter of interest in the event study move from low-paying traditional firms. In what follows, I show that the impacts of on-site outsourcing on earnings and hourly wages are much larger among workers who become outsourced from high-paying establishments.

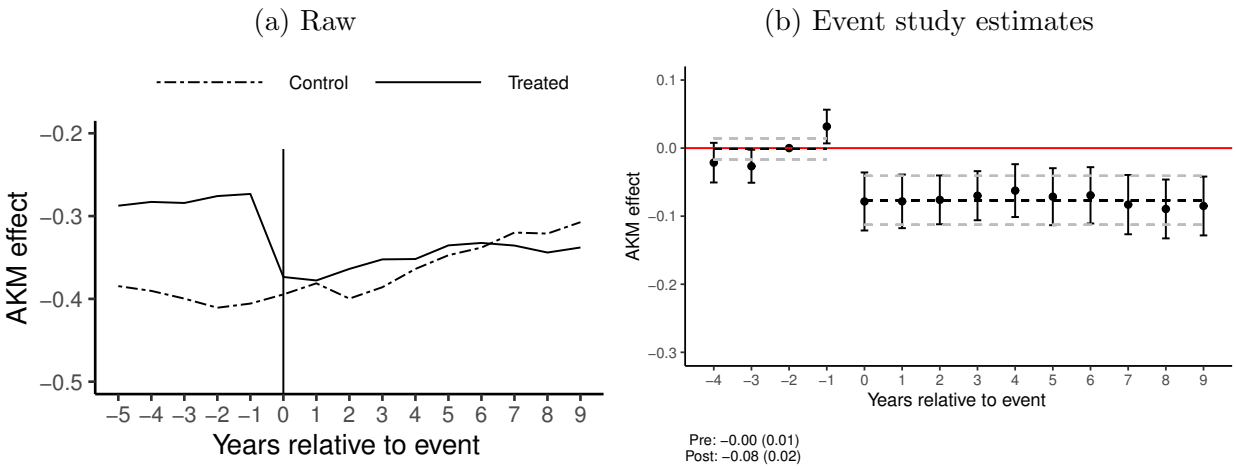
To define high-paying and low-paying traditional firms, I rely on establishment fixed effects from an AKM model (Abowd et al., 1999). I estimate the model using all workers employed full-time in the years $2003 - 2019$:

$$log(\text{earnings})_{it} = \psi_{J(i,t)} + \alpha_i + \phi_t + s_{jt}\gamma + X_{it}\beta + \epsilon_{it}, \tag{3}$$

where $\psi_{J(i,t)}$ represents the establishment fixed effect of establishment where worker i was employed in year t, α_i denotes individual fixed effects, ϕ_t denotes year fixed effects. s_{jt} represents the (log) establishment size defined as the number of employees, X_{it} represents worker-level covariates: age (cubic) and education (5 categories), and ϵ_{it} is the error term. Panels (a) and (b) in Figure 6 plot the raw establishment AKM effects and the DiD estimates β_k based on the specification in Equation (2), with the estimated establishment AKM effects $\hat{\psi}_{J(i,t)}$ as outcomes. Before the outsourcing event, treated workers are employed by establishments with higher AKM fixed effects. Following an outsourcing event, workers move to establishments with lower $\hat{\psi}$.

Figure 7 shows that the workers experience a 25 percent decrease in earnings and a 8 percent decrease in hourly wages if they become outsourced from a traditional firm in the top quartile of the AKM establishment fixed effects. Among workers previously employed by a firm in the bottom quartile, I do not find evidence of a decrease in earnings or hourly wages though the estimates are noisy.

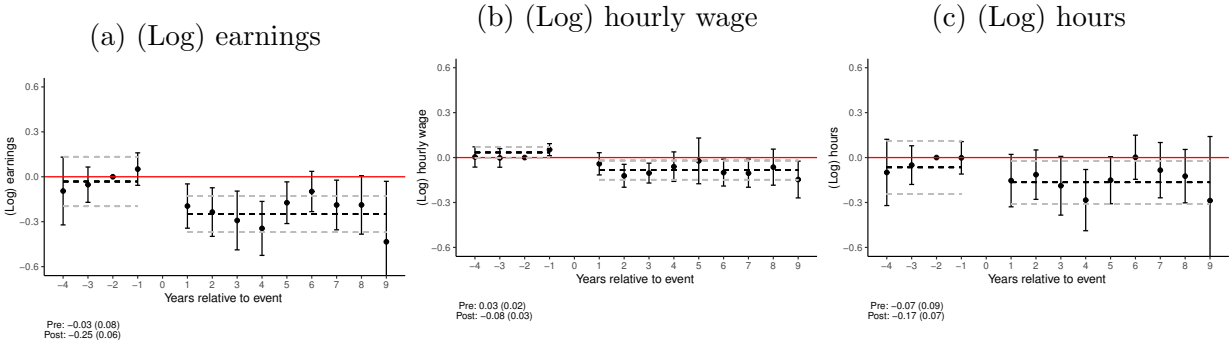
Figure 6: On-site outsourcing and firm rents



Notes: These figures plot the estimated β_k coefficients (along with 95% confidence intervals) based on the specification in Equation (2), with $\hat{\psi}_{J(i,t)}$ as the outcome variable. The treatment group consists of workers who experience an on-site outsourcing event between years $s = -1$ and $s = 0$. The control group consists of workers employed in the same industry (2-digit; 48 groups) and occupation (3-digit; 61 groups) as the treated group in year $s = -1$ and who never experience an on-site outsourcing event. The dashed horizontal lines indicate the average treatment effects estimated by using single pre- and post-treatment indicators. The sample used is the event study sample as defined in Table 1.

Figure 7: Outsourcing effects by establishment wage premium

A. On-site outsourcing from top quartile $\hat{\psi}_{J(i,t)}$



B. On-site outsourcing from bottom quartile $\hat{\psi}_{J(i,t)}$

Notes: These illustrations plot the estimated β_k coefficients (along with 95% confidence intervals) based on the specification in Equation (2). The treatment group consists of workers who experience an on-site outsourcing event between years $s = -1$ and $s = 0$. The control group consists of workers employed in the same industry (2-digit; 48 groups) and occupation (3-digit; 61 groups) as the treated group in year $s = -1$ and who never experience an on-site outsourcing event. The dashed horizontal lines indicate the average treatment effects estimated by using single pre- and post-treatment indicators. The sample used is the event study sample as defined in Table 1.

Why do workers choose employment at contractor firms?

Evidence from panel data regressions and event study design suggests that working for a contractor firm and becoming outsourced leads to a decline in earnings. While some workers may prefer contracts with fewer working hours, for example, if they combine part-time work with studying, other workers may be willing to accept contracts with few working hours because of limited outside options. In Appendix A1, I provide a model of outsourcing decisions of workers and firms, which incorporates workers' preferences for amenities, and a parameter that reflects cost of job search. This model is intended only to illustrate potential mechanisms and is not used in the empirical analysis.

The model shows that workers may seek employment at a contractor firm even though it pays relatively lower wages compared to traditional firms because they value amenities or due to lower job-search costs. For instance, workers may value flexible work, the co-workers, or can get a job more easily when the administrative staff speaks the same language. Moreover, the model looks at the firms' decision to outsource and predicts that propensity to outsource by traditional firm increases as the price of outsourcing is lower. Here, the 'price of outsourcing' captures the cost to the traditional firm of contracting work out, including contractor fees and any administrative or transaction costs associated with the outsourcing arrangement. The next section investigates the determinants of outsourcing.

5 Determinants of outsourcing

Why do firms outsource? Traditional firms may outsource part of their workforce to reduce costs or to increase efficiency and productivity. In this section, I first analyze the relationship between the propensity to outsource and firm characteristics, and show that traditional firms which are larger and which have adopted collective bargaining agreements are more likely to outsource.

Earlier, I did not find evidence of lower hourly wages in contractor firms, which is difficult to reconcile with the cost-saving argument for using outsourcing. In the second part of this section, I show that larger contractor firms have lower operating costs per worker compared to smaller contractor firms. I find that a 1 percent increase in firm size is associated with a 5 percent reduction in the operating costs per worker, which suggests that larger firms can offer services at a lower price due to economies of scale. Moreover, I argue that contractor firms may be better at flexibly adjusting their use of labor by offering contracts with fewer working hours and giving workers extra working hours when demand for the firm's services is higher.

5.1 The outsourcing decision of traditional firms

I examine the relationship between the propensity to outsource and the characteristics of traditional firms and ask whether traditional firms which are bound to pay more are also more likely to outsource. For instance, the wage-setting of firms can be bound by efficiency wages, fairness, equity or collective bargaining (Abraham and Taylor, 1996).

As in Goldschmidt and Schmieder (2017), I use different variables as proxies for firm rents. First, firm size, since larger firms may pay higher wages either because they face an upward-sloping labor supply curve or because monitoring many employees is costly, so offering higher pay can reduce shirking and turnover. Second, I use an AKM firm fixed effect, which captures the establishment-specific wage premium. Third, I use the average earnings of workers in a given firm. And lastly, I use an indicator for being bound by a sectoral collective agreement. I estimate the following models:

$$\text{Outsourced}_{jt} = \gamma r_{jt} + X_{jt}\beta + \phi_t + \epsilon_{jt}, \tag{4}$$

where r_{jt} represents a variable that is a proxy for the firm rents. X_{jt} is a vector of establishment-level covariates: industry (2-digit) and local labor market. ϕ_t is the year fixed effect. Outsourced_{jt} is a dummy variable that indicates whether establishment j experienced a general outsourcing event in any year prior to or in year t, and ϵ_{jt} is the error term.

Table 4 shows estimates of γ based on Equation (4), where an indicator for an outsourcing event is regressed on different proxies for firm rents and additional control variables. Outsourcing is more likely among larger firms, firms that pay higher earnings, and firms that adopted sectoral-level collective agreements. The relationship between the probability of outsourcing by a traditional firm and the AKM effect is not significant. Including all covariates in column (5), the coefficient on the AKM effect becomes negative due to multicollinearity between the covariates.

The results suggest that firms may use outsourcing services to avoid higher costs of monitoring which could be higher at larger firms. Moreover, firms may use outsourcing to avoid paying higher wages in firms with collective bargaining in case the firm is bound to pay higher wages to all employees. Taken together, the results suggest that outsourcing is more common among firms that face a higher cost of hiring workers in-house.

Table 4: Firm wage premia and the likelihood of outsourcing

	Probability of outsourcing by traditional firm				
	(1)	(2)	(3)	(4)	(5)
(log) Establishment size	0.0233^{***}				0.0224^{***}
	(0.0031)				(0.0031)
AKM effect		0.0065			-0.0192^{*}
		(0.0088)			(0.0105)
Collective agreement			0.0220^{***}		0.0168^{***}
			(0.0032)		(0.0031)
Average (log) earnings				0.0086^{***}	0.0066^{**}
				(0.0026)	(0.0029)
Number of observations	107345	107345	107345	107345	107345

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Notes: This table shows the estimation results from regressions at the firm level of an indicator for whether a firm experienced a general outsourcing event in any year prior to or in year t as defined in Section 2 on different characteristics of a firm in a given year. The characteristics include (log) establishment size in column (1), AKM effect obtained from Equation (3) in column (2), a dummy for whether a firm adopted a collective agreement in column (3), average (log) earnings in a firm in column (4) and all characteristics from columns (1)-(4) in column 5. All regressions control for industry FE (2-digit), labor market region FE and year FE. Standard errors (reported in parentheses) are clustered at the establishment level. The sample used is the traditional firms sample as defined in Table 1.

5.2 Performance of contractor firms

In Section 4, I did not find evidence of lower hourly wages at contractor firms compared to traditional firms. In this section, I assert that the cost of buying services from contractor firms may be lower than the cost of hiring workers in-house although the hourly wages at contractor firms are similar to the hourly wages at traditional firms. It is difficult to isolate the operating costs due to workers hired in-house in FCSL occupations. Instead, I take advantage of detailed firm account data and show a large variation in operating costs across contractor firms of different sizes.

Table 5: Characteristics of contractor firms for firms above and below the median size

	Firm size					
	Below median		Above median		**Difference**	
	Mean (1)	SD (2)	Mean (3)	SD (4)	Mean (5)	t-value (6)
A. Firm performance per worker						
(Log) Total operating income per worker	13.89	1.02	13.65	0.94	-0.24	19.35
(Log) Total operating costs per worker	13.90	1.00	13.65	0.93	-0.25	20.94
(Log) Wage bill per worker	12.08	0.96	12.07	0.68	-0.01	1.39
(Log) Wage bill FCSL occupations per worker	11.73	1.05	11.85	0.72	0.11	-7.44
(Log) Wage bill per hour	5.13	0.47	5.16	0.35	0.02	-4.63
(Log) Wage bill per hour FCSL occupations	5.09	0.44	5.14	0.32	0.05	-7.82
(Log) Costs of materials per worker	12.03	2.21	11.67	2.10	-0.36	13.48
B. Characteristics:						
(Log) Firm size	0.81	0.56	2.93	1.17	2.12	-190.41
Share in FCSL occupation	0.39	0.43	0.48	0.41	0.09	-16.78
Share full-time	0.84	0.28	0.81	0.22	-0.04	12.40
Share full-time FCSL occupations	0.75	0.37	0.74	0.27	0.00	0.42
Share foreign-born	0.26	0.38	0.35	0.34	0.09	-19.62
Share foreign-born FCSL occupations	0.40	0.45	0.48	0.38	0.08	-11.63
Share urban	0.31	0.46	0.39	0.49	0.09	-14.90
Number of observations	12,086		13,975			
Number of firms	3,211		2,438			

Notes: This table presents summary statistics of contractor firms. Above and below the median are defined separately in each calendar year. The sample used is the contractor firms sample defined in Table 1. SD refers to standard deviation. I define all variables in Table A1 in Appendix A.

Combining firm account data with data from the employer-employee register enables testing the hypothesis of economies of scale by looking at firms' total operating income, total operating costs, wage costs, and costs of materials across contractor firms of different sizes. I can calculate the average price of contractor services per worker assuming that operating total operating income revenues reflect the price that traditional firms pay for the provision of the services. Table 5 reveals that the average operating income and operating costs per worker are approximately 25 percent lower for firms above the median compared to firms below the median size.

The table reveals that workers in FCSL occupations have 11 percent higher wage bill and 5 percent higher hourly wages in firms above the median size. However, comparing the wage bill of workers in all occupations, there is no difference in the average wage bill which is driven by a larger share of workers in FCSL occupations employed in larger firms (48 percent in firms above the median compared to 39 percent in firms below the median). Larger firms are more likely to hire workers with an immigrant background. Since large firms are also more likely to be located in urban areas, to ensure that larger wage costs in FCSL occupations do not reflect the differences in wages across labor markets, Table 6 reports the coefficients from a log-linear model of firms' outcomes on (log) firm size, controlling for year, labor market (46 regions), FCSL industry fixed effects (4 groups: food, cleaning, security, logistics) and share of foreign-born workers.

Table 6: Relationship between the price and cost of outsourcing, and contractor firm size

			Costs				
	Operating income per worker	**Operating costs per worker**	Wage bill		Wage bill per hour		Costs of materials
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(log) Firm size	−0.05***	−0.05***	0.07***	0.11***	0.03***	0.04***	−0.04*
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.02)
Number of observations	25844	25844	25844	15296	25844	15296	25844

***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Notes: This table shows the estimation results from regressions at the firm level of different performance measures of contractor firms on firm size measured as the (log) number of workers. The outcomes include (log) operating income per worker, (log) operating costs per worker, (log) wage bill per worker, (log) hourly wage bill, and (log) cost of materials per worker. In columns (4) and (6) the outcomes are calculated for the subsample of workers in FCSL occupations. All regressions control for labor market size measured as the (log) total number of firms (in any industry) in a labor market region, foreign-born worker share, FCSL industry FE (4 groups), labor market region FE and year FE. Standard errors are clustered at the firm level. The sample used is the contractor firms sample as defined in Table 1.

Column (1) shows that a 1 percent increase in firm size is associated with a 5 percent decrease in operating income per worker. This suggests that larger firms can provide services at a lower price. Further, column (2) shows that a 1 percent increase in firm size is associated with a 5 percent lower operating costs per worker.

Next, I investigate the relationship between firm size and wage bill per worker. Column (3) shows that a 1 percent increase in firm size is associated with a 7 percent increase in wage bill per worker. To ensure that I am not conflating the earnings of workers in the FCSL occupations and the managers, who constitute a smaller fraction in the larger firms, I include a regression where the outcome is the wage bill for the subsample of workers in FCSL occupations. Column (4) confirms that the difference in wage bill per worker is even higher for workers in FCSL occupations. Similarly, columns (5) and (6) investigate the relationship between the firm size and wage bill per hour and find that larger firms pay higher hourly wages. Column (7) shows that economies of scale are possible due to lower operating costs per worker.

The evidence suggests that larger contractor firms can provide outsourcing services at a lower price, even though they have higher wage bills. Taken together, these results suggest

that traditional firms use contractor firms to reduce costs, which is possible, as contractor firms experience economies of scale.

6 Conclusion

How does domestic outsourcing affect workers' outcomes and why do firms outsource? Policymakers are interested in this question, as labor markets across many economies have seen an increase in the prevalence of domestic outsourcing in recent decades. In this paper, I have focused on four types of outsourced services: canteen operation, cleaning, security and logistics. I have provided evidence that outsourcing leads to earnings declines among outsourced workers, which is mostly explained by fewer contracted hours. I further provided evidence that suggests that firms are likely to outsource to reduce costs, which is possible as contractors experience lower average costs due to economies of scale. Taken together, these findings suggest that outsourcing may be beneficial for firms, and could potentially harm the affected workers.

References

Abowd, John M., Francis Kramarz, and David N. Margolis (1999) "High Wage Workers and High Wage Firms," *Econometrica*, 67 (2), 251–333, 10.1111/1468-0262.00020.

Abraham, Katharine G. and Susan K. Taylor (1996) "Firms' Use of Outside Contractors: Theory and Evidence," *Journal of Labor Economics*, 14 (3), 394–424, 10.1086/209816.

Arbeidsmiljøloven (2005) "Lov om arbeidsmiljø, arbeidstid og stillingsvern mv. (arbeidsmiljøloven)," `https://lovdata.no/pro/NL/lov/2005-06-17-62`, (Act relating to the working environment, working hours and employment protection, etc. (Working Environment Act)).

——— (2022) "Forskrift om delvis allmenngjøring av tariffavtale for renholdsbedrifter," `https://lovdata.no/pro/LTI/forskrift/2022-12-09-2169`, (Regulation on the partial extension of the collective agreement for the cleaning industry).

Berlinski, Samuel (2008) "Wages and Contracting Out: Does the Law of One Price Hold?" *British Journal of Industrial Relations*, 46 (1), 59–75, 10.1111/j.1467-8543.2007.00665.x.

Bhuller, Manudeep (2009) "Inndeling av Norge i arbeidsmarkedsregioner.," *Notater 2009/24. Statistics Norway*, (Division of Norway into labor market regions).

Bilal, Adrien and Hugo Lhuillier (2021) "Outsourcing, Inequality and Aggregate Output,"Technical report, 10.3386/w29348.

Coase, R. H. (1937) "The Nature of the Firm," *Economica*, 4 (16), 386–405, 10.1111/j.1468-0335.1937.tb00002.x.

Drenik, Andres, Simon Jäger, Pascuel Plotkin, and Benjamin Schoefer (2023) "Paying Outsourced Labor: Direct Evidence from Linked Temp Agency-Worker-Client Data," *The Review of Economics and Statistics*, 105 (1), 206–216, 10.1162/rest_a_01037.

Dube, Arindrajit and Ethan Kaplan (2010) "Does Outsourcing Reduce Wages in the Low-Wage Service Occupations? Evidence from Janitors and Guards," *ILR Review*, 63 (2), 287–306, 10.1177/001979391006300206.

Goldschmidt, Deborah and Johannes F. Schmieder (2017) "The Rise of Domestic Outsourcing and the Evolution of the German Wage Structure," *The Quarterly Journal of Economics*, 132 (3), 1165–1217, 10.1093/qje/qjx008.

Grossman, Sanford J. and Oliver D. Hart (1986) "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94 (4), 691–719, 10.1086/261404.

Lamadon, Thibaut, Magne Mogstad, and Bradley Setzler (2022) "Imperfect Competition, Compensating Differentials, and Rent Sharing in the US Labor Market," *American Economic Review*, 112 (1), 169–212, 10.1257/aer.20190790.

OECD (2018) "OECD Employment Outlook 2018," *OECD Publishing, Paris.*

OECD (2021) *OECD Employment Outlook 2021: Navigating the COVID-19 Crisis and Recovery*: OECD Publishing, Paris, 10.1787/5a700c4b-en.

Riise, Olav (2022) "Å være eller ikke være outsourcet - hva har det å si for lønna?", Master's thesis, Department of Economics, University of Oslo, ("To be or not to be outsourced – what does it mean for your salary?). Accessed through https://www.duo.uio.no/.

Sun, Liyang and Sarah Abraham (2021) "Estimating dynamic treatment effects in event studies with heterogeneous treatment effects," *Journal of Econometrics*, 225 (2), 175–199, 10.1016/j.jeconom.2020.09.006.

Appendix A. Definitions and supplemental results

Table A1: Variable definitions

Variable	Description
Labor market outcomes	Source: The Employer and Employee Register
Earnings	Annual pre-tax labor earnings measured at the worker-year level for highest paying spell in December. Earnings include fixed salary, bonus, overtime, and vacation and severance pay, but exclude sickness benefits.
Part-time	Less than 37.5/2 hours per week.
Hours	Contracted hours per week times the number of weeks in employment. Measured at the worker-year level for highest paying spell in December. Observations with contracted hours below 4 hours a week or above 50 hours a week are censored.
Hourly wage	Earnings divided by hours. Outliers below the 5th and above the 95th percentile are censored.
Total earnings	Annual pre-tax labor earnings at the worker-year level for all active spells in a given year.
Unemployemnt benefits	Indicator for individuals who received unemployment benefits in a given year.
Worker characteristics	Source: National Education Database, and Tax Returns
Age	Age in years, measured at the beginning of each year.
College degree	Indicator for individuals with a college degree.
Foreign-born	Indicator for individuals having a country of birth other than Norway.
Male	Indicator variable for male workers.
Establishment characteristics	Source: Central Register of Establishments and Enterprises and the Norwegian Labor and Welfare Administration
Establishment size	Number of employees in December.
Industry	2-digit code classifying a firm's main activity according to the Nomenclature of Economic Activities (first two digits of NACE2007) system.
Local labor market	46 labor market regions as defined in Bhuller (2009).
Urban	Located in one of the five biggest Norwegian cities.
Firm accounts	Source: The Register of Company Accounts
Costs of materials	Costs relating to the purchase of and the manufacture of goods. Customs duties and taxes are included, but value added taxes are excluded. *(In Norwegian: varekostnader.)* Outliers below the 5th and above the 95th percentile are winsorized.
Total operating costs	Total costs from the ordinary activities of the business, except financial costs. *(In Norwegian: sum driftskostnader.)* Outliers below the 5th and above the 95th percentile are winsorized.
Total operating income	Income from ordinary operations. Operating income includes, among other things, sales revenues, government subsidies, income from rent and profit on disposals of fixed assets. *(In Norwegian: sum driftsinntekter.)* Outliers below the 5th and above the 95th percentile are winsorized.
Wage bill per worker	Total wage bill divided by the firm size. Equivalent to average earnings per worker.
Wage bill per hour	Total wage bill divided by the firm size multiplied by average hours per worker. Equivalent to the average hourly wage.

Table A2: FCSL industry codes

Industry code	Industry name
Food:	
56.210	Event catering activities
56.290	Other food services
Cleaning:	
81.210	General cleaning of buildings
81.220	Other building and industrial cleaning activities
Security:	
80.100	Private security activities
80.200	Security systems service activities
Logistics:	
52.21	Service activities incidental to land transportation
52.24	Cargo handling
52.29	Other transportation supply services

Notes: Classification of Standard Industrial Classification - SIC 2007.

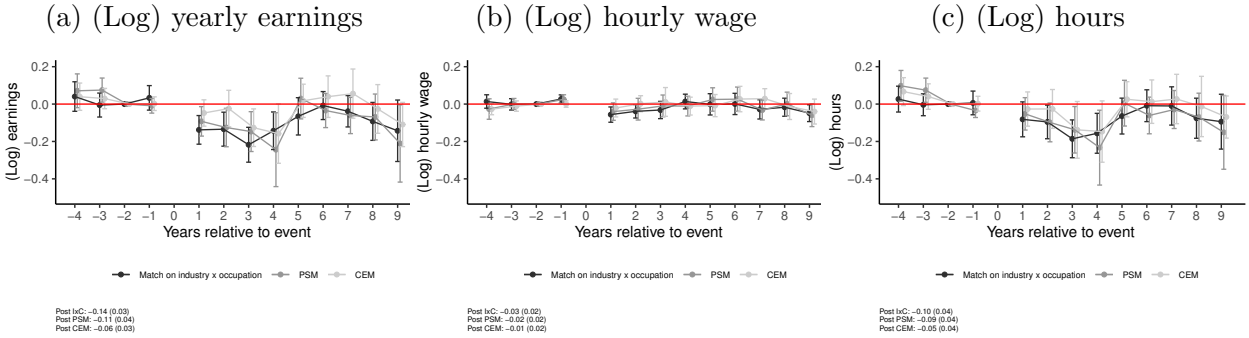
Table A3: FCSL occupation codes

Occupation code	Occupation name
Food:	
5120	Cooks
5131	Waiters
5246	Food service counter attendants
9412	Kitchen helpers
Cleaning:	
5151	Cleaning and housekeeping supervisors in offices, hotels
5152	Domestic housekeepers
5153	Building caretakers
9112	Cleaners and helpers in offices, hotels
9122	Vehicle cleaners
9123	Window cleaners
9129	Other cleaning workers
Security:	
5414	Security guards
5419	Protective services workers not elsewhere classified
Logistics:	
8322	Car, taxi, van and motorcycle drivers
8332	Heavy truck and lorry drivers
9331	Hand and pedal vehicle drivers
9333	Freight handlers
9334	Shelf fillers

Notes: Classification of occupations based on the International Standard Classification of Occupations - ISCO-08, prepared by the International Labour Organization (ILO). The standard classification of occupations is designed for official statistics of Norway, and occupations are classified by 4 digits.

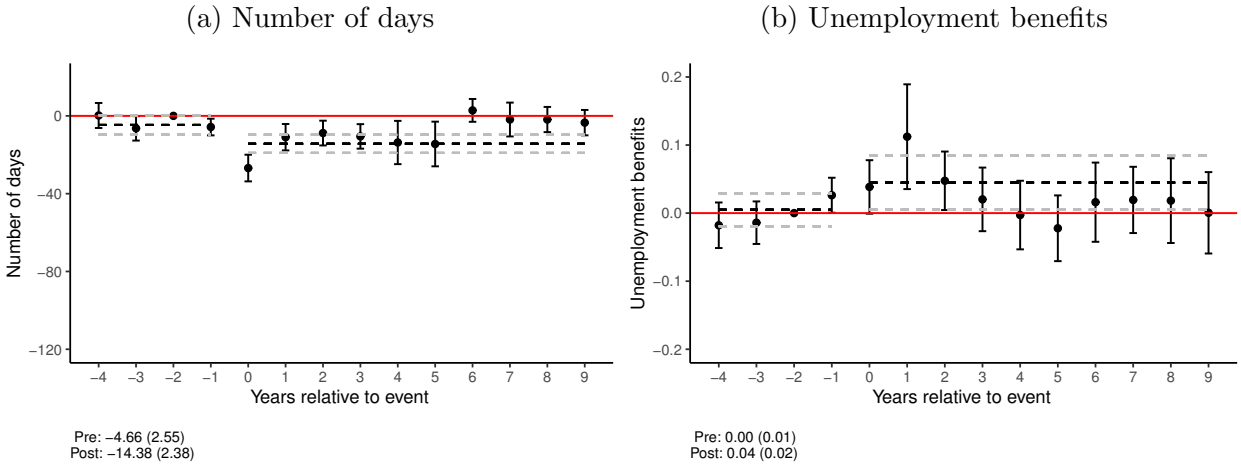
A1 Supplementary estimation results

Figure A1: Robustness: alternative control groups



Notes: These figures plot the estimated β_k coefficients (along with 95% confidence intervals) based on the specification in Equation (2). All control group workers are employed in the same establishments in years $s = -2$, $s = -1$ and $s = 0$. The first control group (I×O) is matched exactly on industry (2-digit) and occupation (3-digit) in year $s = -1$. The second control group (PSM) consists of workers matched exactly on occupation and industry in year $s = -1$. Within each occupation × industry stratum, I estimate a probit regression of whether a worker is treated, controlling for tenure and establishment size in year $s = -1$ as well as earnings in years $s = -2$ and $s = -3$ and match on worker with the closest propensity score (similar to Goldschmidt and Schmieder, 2017). The third control group (CEM) is matched exactly on industry (2-digit) and occupation (3-digit) in year $s = -1$. Moreover, I match on the coarsened groups of workers' tenure in year $s = -1$, establishment size in year $s = -1$, employer earnings in year $s = -3$, and earnings in year $s = -2$. Each category includes five equally populated groups.

Figure A2: Effect of on-site outsourcing on workers' employment



Notes: These figures plot the estimated β_k coefficients (along with 95% confidence intervals) based on the specification in Equation (2). Outcome number of days refers to the total number of days in employment (in any firm) without conditioning on having earnings greater than 0. The treatment group consists of workers who experience an on-site outsourcing event between years $s = -1$ and $s = 0$. The control group consists of workers employed in the same industry (2-digit; 48 groups) and occupation (3-digit; 61 groups) as the treated group in year $s = -1$ and who never experience an on-site outsourcing event. The dashed horizontal lines indicate the average treatment effects estimated by using single pre- and post-treatment indicators. The sample used is the event study sample 1, combined with data on unemployment benefits.

Appendix B. Model of the firm outsourcing decision

This section presents an equilibrium model of the labor market with outsourcing. The labor market is characterized by imperfect competition and is based on the model provided by Lamadon et al. (2022). Contractor firms are introduced similarly to the model in Bilal and Lhuillier (2021), where traditional firms face a choice between hiring workers in-house or through a contractor firm.

In the following, I first introduce workers with heterogeneous preferences, productivity, and beliefs. Next, I describe the profit maximization of traditional firms. Last, I show the profit maximization of the contractor firms.

B1 Workers

The economy consists of i workers and $j \in J$ firms.

Workers differ by their level of productivity X_i. In each period, the utility of workers is characterized as follows:

$$u_{it}(j, W) = \log W + \log G_j(X_i) + \log \delta_j(X_i) + \epsilon_{ijt}, \tag{B1}$$

where W is the worker's wage, $G_j(X_i)$ denotes the utility derived from the amenities of firm j for worker of quality X. The amenities include several characteristics, such as flexibility in working hours, the social environment in the workplace (e.g. characteristics of the co-workers), or the proximity to the worker's home. The function δ reflects the cost of searching for a job in firm j (e.g. the worker's knowledge of workplace j and expectation about the probability of getting a job). The parameter ϵ_{ijt} denotes idiosyncratic heterogeneity. The idiosyncratic component is private information to the worker, and all workers are hired in a spot market, which implies that the earnings may depend on the worker's type X, but not the value of ϵ_{ijt} (Lamadon et al., 2022).

In each period, worker i chooses a firm j to maximize utility u_{it}:

$$j(i, t) \equiv \underset{j}{\operatorname{argmax}}\, u_{it}(j, W_{jt}(X_i)).$$

Workers have heterogeneous preferences over amenities and different costs associated with job search, which explains why workers may choose to work for a given firm j, even though it pays less than other firms.

B2 Traditional firms

The economy consists of J^T traditional firms and J^S contractor firms, where $J^T \cup J^S = J$. Traditional firms may hire workers in-house or buy outsourcing services from a contractor firm.

Both traditional firms and contractor firms hire labor in an imperfectly competitive labor market. Employers compete with one another for workers who have heterogeneous preferences over amenities. As a result of the preference heterogeneity, employers face an upward-sloping labor supply curve, which implies that earnings are an increasing function of firm size. The firm-specific labor supply curve of workers of type X is given by:

$$S_{jt}(X,W) \equiv NM(X) \underbrace{\left(\frac{W_{jt}(X)G_j(X)\delta_j(X)}{\sum_{j' \in J} W_{j't}(X)G_{j'}(X)\delta_{j'}(X)} \right)}_{Pr[j(i,t)|X_i=X,\mathbf{W_t}]},$$

where N is the number of workers and $M(X)$ is the cross-sectional distribution of X. $I_t(X) \equiv \sum_{j' \in J} W_{j't}(X)G_{j'}(X)\delta_{j'}(X)$ is the earnings index across all firms in year t. From I_t, one can derive $Pr[j(i,t)|X = x, \mathbf{W_t}]$, which is the probability that a worker with skill X chooses to work in firm j, given a vector of wages $\mathbf{W_t}$ offered in the economy and conditional on how much workers value amenities of firm j compared to other firms.

Hiring workers in-house involves an additional cost $C_t(D_{jt})$, which depends on the number of workers hired in-house, D_{jt}. The cost reflects the cost of hiring, administrative costs, costs of buying equipment, etc. I assume that $\frac{dC(D_{jt})}{dD_{jt}} \geq 0$, where an increase in the number of workers may yield a higher cost due to an increased cost of monitoring, the need to hire more administrative personnel, and the cost of equipment.

Additionally, a firm can hire a part of the workforce from a contractor firm. Contractors sell the labor of a given type X at price $P_t(X)$. I assume that the number of workers that a traditional firm j wants to hire through a contractor is small relative to the size of the contractor market, and hence that the demand of one traditional firm in isolation does not directly influence the price $P_t(X)$.

Each firm chooses labor demand D_{jt} by setting wages $W_{jt}(X)$ for each type of worker X hired in-house, as well as by choosing the number of workers hired through a contractor

firm, Q_{jt} to maximize profits subject to labor supply $S_{jt}(X, W)$:

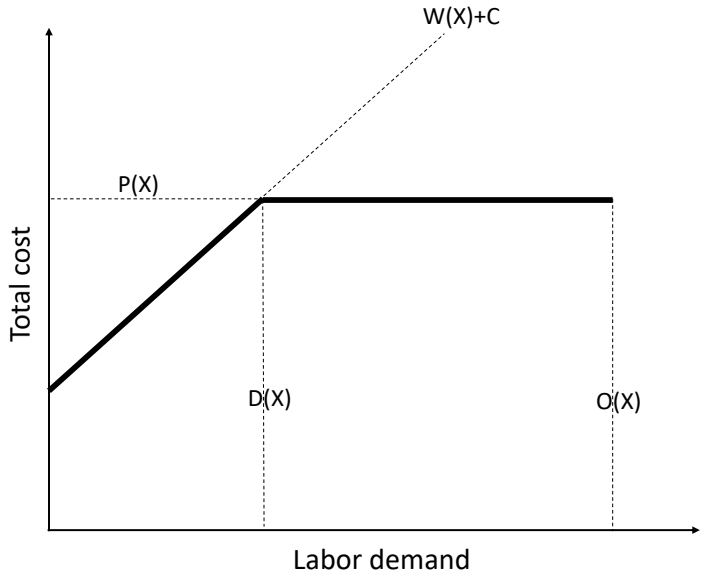
$$\pi_{jt} = \max_{\{W_{jt}(X)\}_X, Q_{jt}(X)} A_{jt} \left(\int X \left(D_{jt}(X) + Q_{jt}(X) \right) dX \right)^{1-\alpha} - \int \left((W_{jt}(X) + C_t(D_{jt})) D_{jt}(X) + P_t(X) Q_{jt}(X) \right) dX,$$

subject to:

$$D_{jt}(X) = S_{jt}(X, W_{jt}(X)). \tag{B2}$$

A_{jt} is the firm's total factor productivity and $1 - \alpha$ is the returns to scale. As illustrated in Figure B1, a traditional firm hires in-house if its demand for workers is below $D(X)$ and contracts out if demand is above $D(X)$. A firm chooses to hire workers in-house up to the point when it becomes cheaper to hire workers at price $P_t(X)$ from a contractor firm, which is illustrated in figure B1.

Figure B1: The cost of hiring workers in-house vs. contracting as a function of labor demand



Notes: This figure illustrates an example of a cost curve faced by a firm for a given slope of the labor supply curve and outsourcing price. Firm hires workers in-house if labor demand is below $D(X)$ and outsources if labor demand is above $D(X)$.

B3 Contractor firms

There are J^S contractor firms. Contractor firms hire workers in the same imperfectly-competitive market for skill X as the traditional firms, and face an upward-sloping labor supply curve $\frac{dW_{jt}(X)}{dO_{jt}} > 0$. Moreover, there is an additional cost per worker, due to administrative costs, equipment replacement, etc. I assume that the average cost per worker decreases with the firm size, $\frac{dC(O_{jt})}{dO_{jt}} < 0$. This is in contrast to the increasing costs of traditional firms. The justification for decreasing costs is that the firms specialize and thus can allocate the resources more efficiently (for instance, in case of a temporary closure of one plant, a cleaner of a contracted firm may be instructed to clean at another plant or clean multiple offices on the same day; lower cost of replacing workers who are on sick leave, etc.). Whether a contractor experiences economies of scale depends on the relative slopes of the labor supply curve and the cost curve.

The price at which the services are sold is determined in equilibrium and depends on the aggregate demand of traditional firms in the local labor market l, as well as the number of contractor firms. The slope of the supply curve depends on the worker type. For low skill-workers, the labor supply is relatively elastic, as low-skill workers have limited outside options.

The contractor firms choose labor demand O_{jt}, by setting wages $W_{jt}(X)$ for each type of worker X to maximize profits subject to labor supply $S_{jt}(X, W)$:

$$\pi_{jt} = \max_{\{W_{jt}(X)\}_X} \int P_t(X) O_{jt}(X) dX - \int \left(W_{jt}(X) + C_t(O_{jt})\right) O_{jt}(X) dX,$$

subject to

$$O_{jt}(X) = S_{jt}\left(X, W_{jt}(X)\right). \tag{B3}$$

B4 Equilibrium and model predictions

Definition 1. Given firm characteristics $\{A_{jt}, \alpha\}$, worker distributions $N, M(\cdot)$ and parameters $(G_j(\cdot)), \delta_j(\cdot)$; the equilibrium is defined as the workers' decisions $j(i,t)$, market earnings indices $I_t(X)$, firm-specific labor supply curves $S_{jt}(X, W)$, wages $W_{jt}(X)$, and labor demands $D_{jt}(X)$, $Q_{jt}(X)$, $O_{jt}(X)$, such that:

(i) Workers choose firms that maximize their utility, as defined in equation B1.

(ii) Traditional firms choose labor demand D_{jt} by setting wages $W_{jt}(X)$, and choose labor demand Q_{jt} for each worker quality X to maximize profits subject to the labor supply constraint $S_{jt}(X, W)$, as defined in equation (B2).

(iii) Contractor firms choose optimal output and labor demand O_{jt}, by setting wages $W_{jt}(X)$ for each worker quality X to maximize profits subject to the labor supply constraint $S_{jt}(X, W)$, as defined in equation B3.

(iv) The market earnings indices $I_t(X)$ are generated from the workers' optimal decisions $j(i, t)$.

(v) The price of outsourcing l, $P_t(X)$, is such that the total demand for the outsourced workers of traditional firms, $j \in J^T$, is equal to the total supply of outsourcing services of the contractor firms, $j \in J^S$; $\sum_{j \in J^T} Q_{jt}(X) = \sum_{j \in J^S} O_{jt}(X)$.

The price of outsourcing is determined by the aggregate demand for outsourcing across traditional firms and the aggregate supply of outsourcing across contractor firms. The model predicts that workers may seek employment at a contractor firm even though it pays relatively lower wages compared to traditional firms because they value amenities or due to lower job-search costs. For instance, workers may value flexible work, the co-workers, or can get a job more easily when the administrative staff speaks the same language. Moreover, the model predicts that all else equal, the propensity to outsource will be higher when the price of outsourcing is lower.