The Unequal Distribution of Consequences of Contracting Out: Female, Low-skilled, and Young Workers Pay the Highest Price

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Abstract
While the public and private labor markets are marked by significant differences in the institutions of wage formation, very few studies have examined workers' wages and employment in the public and private sectors when solving the same tasks. Focusing on government contracting out, we examine the change in work income, employment, and government income benefits when public workers are transferred from a public to a private employer due to contracting out. Drawing on theories on wage gaps between the public and private sectors and the property rights literature, we develop novel hypotheses about how individual characteristics of workers moderate the impact of contracting out on workers. Using high-quality individual-level Danish register data, we establish a worker treatment group who experienced contracting out and match them with a similar group of public workers who did not. Difference-in-difference estimation with Coarsened Exact Matching suggests that workers overall experience a significant decline in work income and employment, albeit with major intergroup differences across gender, skills, and age. Our sub-group findings show that female, low-skilled, and younger workers pay the highest price for government contracting out, both in terms of salaries and employment. We discuss how economic theories of public–private gaps in wage setting can be combined with public administration theories of contract design and monitoring to develop improved ― and possibly more equitable ― conditions for workers when governments contract out.

Key words: Contracting out; Wage gap; Difference-in-Difference; Workers; Gender.

Introduction

Over the past four decades, a large proportion of public services has been contracted out, divested, and privatized under the idea that the competitive forces of the market increase efficiency and drive down costs (Brunjes 2020; Warner and Hefetz 2020). From the taxpayer perspective, these predictions initially seemed to hold true: early assessments of privately delivered services suggested significant cost reductions – sometimes as high as 20%–30% (Domberger and Jensen 1997; Savas 1987). Even though several later studies challenged the New Public Management orthodoxy (e.g., Bel, Fageda, and Warner 2010; Jensen and Stonecash 2005) and offered evidence of savings in the range of 5%–10% when controlling for transaction costs (Hodge 2000; Petersen, Hjelmar, and Vrangbæk 2018), contracting out continues to be a widely used recipe for government spending management and cutback reform (Pollitt and Bouckert 2017).

While research on the effects of outsourcing on service costs has been extensive in the last decades, much less is known about other types of effects from contracting out, and current research has increasingly centered around broader economic outcomes and, to a lesser extent, service quality (Stolt, Blomqvist, and Winblad 2011; Lindholst 2021). Recently, a small but growing literature has linked public sector contracting out with deteriorating conditions for workers, highlighting firms' stronger incentives to reduce wages, increase the pace of work, and lay off workers (Fernandez, Smith, and Wenger 2006; Lee et al. 2019; Vrangbæk, Petersen, and Hjelmar 2015). While recent studies using high-quality data suggest that, on average, contracting out leads to deteriorating salaries and increasing unemployment (Olsson and Tåg 2021; Petersen et al. 2022), much less is understood about how the individual-level circumstances under which contracting out positively or negatively affect workers. In fact, Petersen et al. (2022) suggested that outcomes may be less severe for workers with more resources, although data limited further inquiry into this important issue and called for further analysis to specifically address this type of unequal consequences depending on

worker skills. Missing, therefore, is a theoretical and empirical understanding of how individual-level characteristics interact with public sector contracting out to create varying outcomes for workers.

In this paper, we examine how public sector contracting out influences workers with different individual characteristics. Drawing on economic theory about wage gaps between the public and private sectors and the property rights literature, we hypothesize that contracting out is associated with declining wages and employment, particularly for low-skilled, female, and older workers. We use high-quality Danish register data to construct a longitudinal dataset of public workers who experienced contracting out and match them with a control group of public workers who did not. Difference-in-difference (DiD) estimation suggests a significant decrease in work income and employment after contracting out for workers overall, albeit with noticeable inter-group variation: female, low-skilled, and younger workers experience the substantially largest decrease in salaries and employment. Further sub-group analyses suggest that low-skilled female workers are particularly worse off after contracting out, both in terms of income and employment. Our findings also indicate that female, low-skilled, and young workers were less compensated with government income transfers than their male, higher-skilled, and older colleagues.

The study contributes to both the theoretical and empirical literature on contracting out in the public sector. For theory, we combine insights from economic theory of wage gaps between the public and private sectors (an under-researched topic in public administration) with insights from theory of contracting out and its effects on workers, which allows broadening the assessment of changing working conditions and employment for government workers experiencing contracting out. Based on these theoretical grounds, we formulate novel hypotheses that extend those in previous studies and provide a deeper and more nuanced perspective on how contracting out affects workers with varying resources and characteristics differently. For practice, our study contributes a critical worker perspective on government contracting practices, which expands the efficiency focus

that has dominated the debate (Savas 1987; Hodge 2000). This study thus contributes the first empirical analysis with incumbent-level data dealing with the intergroup distribution of labor-related consequences of contracting out. While the findings suggest that the overall consequences for workers are negative (consistent with findings in Petersen et al. 2022), the sub-group analyses suggest that female, low-skilled, and younger workers pay the highest price for contracting out. Politicians and administrators can use these findings to provide better working terms when planning and monitoring future contracting out, thereby mitigating these major inequalities among different groups of workers.

The remainder of the paper is structured as follows. The next section examines the theoretical and empirical literatures about the differences in wage-setting in the public and private sectors and develops hypotheses about how contracting out influences workers overall and across different skills, genders, and ages. This is followed by a presentation of the research context, the registry data, and our estimation methods. We then present the empirical results of our DiD-estimations of the general consequences for work income, employment, and government income transfers and the results of several moderation analyses. Finally, we discuss the implications of our findings, their limitations, and offer suggestions for further research.

Theoretical and Empirical Background

Literature on Public–Private Wage Gaps

Governments and markets are fundamentally different in their wage formation institutions and policies (Rattsø and Stokke 2019). Governments are supposedly oriented toward equalitarian wage formation and high employment, whereas private firms reward workers based on productivity and supply–demand in the labor market. Criticism of government failures was on the rise since the 1960s regarding many areas of government intervention (e.g., Stigler 1971), and the criticism of

costs incurred by public services extended to labor costs and public wages. In his review of the bureaucratic production of public services, Niskanen (1971, 1994) characterized the relationship between the bureau delivering public services and its sponsor as a bilateral monopoly. In such a setting, bureaucrats maximize their budgets, which leads to oversupply of output and employment. Instead, when the delivery of public services is open to private contractors, Niskanen argued that private contractors tend to require more work from their employees for equivalent salary and that they benefit from more organizational flexibility, enabling them to reduce labor costs. Therefore, public sector salaries would be higher than private sector salaries. Later studies showed how the degree of unionization was a driver of higher public sector salaries (Schmenner 1973), which was later theoretically developed in Holmlund (1993) and empirically supported by Robinson and Tomes (1984) and Anzia and Moe (2015).

Parallel to the initial insights into the public–private wage differential, empirical research has tried to shed light on the direction and dimension of that wage gap. In so doing, Lewin (1974) found higher wages in the U.S. local public sector than in the private sector for unskilled, semi-skilled, and skilled craft workers, whereas wages for managers, high-level professionals, and executive employees in local government were lower than in the private sector. Both Fogel and Lewin (1974) and Smith (1976) found overall higher wages for federal employees than for private employees in the US. In the 1980s, empirical studies expanded to the United Kingdom (Elliot and Murphy 1987) and other developed economies. These findings were generally in line with those from the U.S. (Bender 1998), while studies in developing economies have yielded less consistent results (e.g., Terrell 1993).

Empirical studies published in the last two decades have used more complete databases and increasingly robust statistical techniques to analyze the public–private wage gap, controlling for observed characteristics to assess the productivity unrelated wage premium. The results for most countries are generally that unexplained positive differentials between public and private wages

tend to be larger for female workers, workers at the lower end of the wage distribution, and younger workers (Campos et al. 2017). In contrast, a negative premium for public workers in high-skilled positions is often found—particularly high-skilled male workers and managers (e.g., García Pérez and Jimeno 2007; Depalo, Giordano, and Papapetrou 2015; Lucifora and Meurs 2006). However, a few recent studies do not find any public wage premium (e.g., Rattsø and Stokke 2019 for Norway). The apparent trend regarding the reduction or disappearance of a public sector wage premium is possibly related to public sector wage cuts in some European countries, particularly those with higher public wage premiums before the Great Recession in 2008 (Michael and Christofides 2020).

Contracting Out and Its Effects on Workers

Government contracting out denotes the process whereby the responsibility for delivering a service, which was previously delivered by public workers, is temporarily transferred to a private firm in return for financial compensation (Domberger and Jensen 1997; Lindholst 2021). This is different from privatization through the sale of public assets, which involves a permanent transfer of ownership (Savas 1987; Hodge 2000). In addition to transferring the responsibility for producing and delivering the service, government contracting out also transfers the employer responsibility to the private supplier winning the contract. Thereby, workers who were formerly employed under public wage-setting institutions become employed in the private labor market (Petersen et al. 2022).

Building on public choice theory about incentives for higher labor costs associated with government production (Niskanen 1971, 1994), labor cost savings constitute a potentially important source of cost savings when governments contract out (Kettl 2011). Significant theoretical work focuses on the relationship between public ownership/production and excess labor costs. Boycko, Shleifer, and Vishny (1996) provide a theory of privatization based on higher spending in labor under public ownership coming from excess wages (compared to private market levels) and excess employment, which politicians use to obtain political support from unions and public workers

(Christoffersen, Paldam, and Würtz 2007). Under public ownership, excess labor costs are paid for with subsidies from the foregone profits from the activity. Privatization implies profit-maximizing incentives for private managers, for which purpose the reduction of excess labor costs would be a tool. If politicians want to preserve political benefits from excess labor costs, they need to subsidize the firm (Shleifer and Vishny 1994).

Focusing on public sector contracting out rather than sale of asset ownership in traditional privatization, Hart, Shleifer, and Vishny (1997) emphasize the distribution of residual control rights over the firms' non-human assets; that is, "the right to decide how these assets should be used, given that a usage has not been specified in an initial contract" (Hart 1995: 680). The central issue involved in the dilemma between public production and contracting out is that once the production is formed and monetary compensations established, private managers have strong incentives to invest effort in cost reduction, as they are likely to reap personal benefits of reduced costs. At the same time, private managers lack incentive to invest in quality improvements, as they would need government authorization to obtain pecuniary benefits from it. Therefore, private managers have stronger incentives to reduce costs by means of lowering service quality (see also Levin and Tadelis 2010 on the cost–quality tradeoff in government contracting).

Based on these theoretical propositions, labor cost reductions via lower wages and decreasing employment were expected outcomes of privatization (Kettl 2011). Early studies of the impact of privatization of state-owned firms on workers yielded mixed results (Megginson and Netter 2001), with declining employment and wages slightly changing, depending on the characteristics of the workers (Haskel and Szymanski 1993), or no wage reductions (Pendleton 1997). More recent studies have conducted worker incumbent-level analysis of asset sale privatization (Olsson and Tåg 2021), which is more robust than previous studies at the firm or industry level. Focusing on Ukraine, Brown et al. (2006) found that wages were reduced by 5%, with low-skilled workers bearing the adverse effects. Melly and Puhany (2013) compared the personnel records of

Swisscom and Swiss Railways, still under state ownership, and found decreasing wages, particularly for older and longer-tenured, female, and part-time workers. However, low-skilled workers had a transitory increase in wages after privatization, although that increase eroded in the following years. Bastos, Monteiro, and Straume (2014) analyzed administrative firm workers in Portugal, finding that wages increase after privatization for high-skilled workers and newly hired personnel due to an increase in higher level floor and higher mark-ups concerning union wage floors. For Brazil, Arnold (2019) found that wages fell by 26% after privatization; low-skilled workers' wages falling even more. Finally, Olsson and Tåg (2021) analyzed the effects of privatization in Sweden in 1990–2011 and find transitory wage declines in the short and medium term and permanent unemployment increases. Falling wages are particularly acute for unskilled and older workers, who were hit hardest by privatization.

Concerning contracting out of public services, early studies by Ascher (1987) claimed that contracting reduced wages and increased unemployment, whereas Cubbin, Domberger, and Meadowcrowft (1987) suggested that the negative effects on labor conditions were not significant. Dube and Kaplan (2010) analyzed the impact on janitor and safety guard wages, finding wage cuts of 4–7% for janitors and 8–24% for guards. Fernandez et al. (2006) find that government contracting out significantly shifted workers from full- to part-time employment. In a recent analysis using incumbent worker data, to our knowledge the only study so far for contracting out, Petersen et al. (2022) find that government contracting out reduced worker wages by 11.3–15.8% the first three years, although their additional analyses suggested that negative outcomes were mainly significant for the lowest-skilled workers (ibid.: 29–30).

Theories of the public–private wage gap (Holmlund, 1993) and property rights (Boycko, Shleifer, and Visny 1996; Shleifer and Vishny 1994) are consistent with the empirical literature, suggesting that privatization is likely to reduce labor costs (e.g., Brown et al. 2006; Arnold 2019) and the number of workers to solve the task (e.g., Haskel and Szymanski 1993; Olsson and Tåg

2021). More specifically for government contracting out, Fernandez et al. (2006) and Petersen et al. (2022) found a significant decrease in employment after public services were contracted out to third-party providers. These theories and empirical studies lead to our first two hypotheses about the impact of contracting out on wages and employment.

H1: Public sector contracting out is likely to reduce work income for workers being transferred to the private contractor.

H2: Public sector contracting out is likely to reduce employment for workers being transferred to the private contractor.

Unequal Distribution of the Consequences of Contracting Out

Besides these general effects, there are strong theoretical reasons to expect the consequences of contracting out to be unevenly distributed between workers with high and low skills, female and male workers, and workers of different ages, based on evidence on the differential wage gap (e.g., Campos et al. 2017) and differential effects from asset privatization (e.g., Melly and Puhany 2013). Next, we develop additional hypotheses about how government contracting out is likely to have more severe negative consequences for low-skilled, female, and older workers. To our knowledge, these hypotheses offer the first account of the unequal distribution of consequences of government contracting out for workers.

Government contracting out is a fundamental organizational change process in which public jobs are transferred to a private employer (Donahue 1989; Kettl 2011). Workers experience not only the termination of their current employment but also a job transfer to a different employment sector with different productivity requirements, leadership style, work culture, and rewards system (e.g., more performance-related pay). Higher-skilled workers (Wasmer 2006), for

example obtained through education enabling workers to perform more advanced job-functions, are likely to have more human resources to adapt to the changing work requirements and to negotiate salaries and working conditions with their new employer. This is consistent with Petersen et al. (2022), suggesting that medium-skilled workers experienced fewer negative consequences of contracting out than did low-skilled workers. We therefore expect workers with shorter education and consequently a lower level of skills to be affected by contracting out more severely, as was the case with asset privatization (e.g., Brown et al. 2006; Arnold 2019; Olsson and Tåg 2021). This forms the basis for our third hypothesis:

H3: Lower-skilled workers are likely to experience more severe consequences of contracting out than higher-skilled workers.

In addition, there is reason to expect that government contracting out may affect female workers more severely than males. For example, Hebdon (2006) showed how female workers are more likely to be exposed to government contracting out than male workers. Despite reforms toward more gender equality in many countries in recent years, there is still an unequal gender distribution in salaries (Adda, Dustmann, and Stevens 2017), maternity leave (Bana, Bedard, and Rossin-Slater 2018), and housework responsibilities (Tower and Alkadry 2008). The public sector's equalitarian wage structure and formal rights to maternity leave and other family-related tasks (e.g., the child's sick day) partly compensate female workers for the productivity loss of taking a larger share of domestic work. Given the less egalitarian approach taken in the private sector to wage structures and family-related issues (Melly and Puhany 2013; Campos et al. 2017), we expect that private managers are likely to put a larger wage penalty on female workers when shifting to private employment compared to male workers. In fact, a lower gender gap in the public sector has been found by Shi, Kay, and Somani (2019) and Tansel, Keskin, and Ozdemir (2020), which is

particularly due to a much lower gender gap at the bottom of the earnings distribution (Moreno-Mencía, Fernández-Sainz, and Rodríguez-Poo 2020). This is consistent with a stronger effect on wages for female workers after the privatization of public companies (Melly and Puhani 2013). Based on these insights, we expect that government contracting out may have more severe consequences for female workers, which forms the basis of our fourth hypothesis:

H4: Female workers are likely to experience more severe consequences of contracting out than male workers.

Finally, there are several reasons to expect government contracting to involve more severe consequences for older workers. The contracting out process itself often involves cost reductions and, consequently, demands higher worker productivity (Jensen and Stonecash 2005; Petersen et al. 2022). The literature on firm productivity suggests that young workers are generally more productive than older workers (Göbel and Zwick 2013), which allegedly is a consequence of the declining individual skills and abilities of older workers (Skirbekk 2008; Lallemand and Rycx 2009). While older workers have acquired more job-specific skills over their many years of employment, these skills are at greater risk of becoming outdated if private contractors introduce new technologies, routines, and workflows (Olson and Tåg 2021: 2). This is consistent with the empirical literature suggesting that contracting out is likely to increase employee turnover (Camp and Gaes 2002), replacing older workers with younger workers (Reeves and Barrow 2000). This leads to our fifth and final hypothesis:

H5: Older workers are likely to experience more severe consequences of contracting out than young and middle-aged workers.

Institutional Context

As in most other industrialized countries (Rattsø and Stokke 2019), the Danish public labor market is an integrated part of the general labor market, with just under one-third of the total labor force being employed in the public sector (Statistics Denmark 2021). The fundamental wage-setting institution consists of collective labor agreements between representatives of employers and the respective trade unions of different professions (e.g., teachers, nurses, technical workers, cleaning personnel). The collective labor agreements run for two or three years and set the framework for wages, hours, and working conditions in both the public and private labor markets. In addition, employers and employees can locally negotiate individual salaries and other benefits on top of the minimum requirements in the collective labor agreements. General conditions (e.g., pension age, early retirement pay, holidays, unemployment benefits) are regulated through law and are in most instances identical across the public and private sectors.

The Danish labor market is characterized by relatively high mobility between the public and private public sectors. The so-called Danish flexicurity model makes it relatively easy and costless to enter and leave jobs: employers can easily hire and fire workers (flexibility), and the social welfare system offers workers a relatively high compensation in the event of unemployment (security). In addition, due to the relatively large size of the public sector, many services have equivalent jobs in the public and private sectors, meaning that workers can relatively easily switch jobs between sectors. This is especially true for low- and medium-skilled work (e.g., building services, manual office jobs, security services, craftsmen), which is our focus in this study, where employees perform almost equivalent work in public and private sector employment.

Despite these similarities, there are also important differences in public and private sector wage formation. Public sector wage formation is generally based on seniority-based wage levels in the collective labor agreements and a small component of individually negotiated salaries (often a

few percent of the total salary). In comparison, private sector wage formation makes comparatively greater use of individual wage negotiations and a larger share of performance-related pay. Another difference in working conditions is that full-time public employment is defined as 37 working hours per week, including paid lunch breaks, whereas full-time private employment is defined as 37 working hours excluding lunch breaks. Other differences between public and private labor agreements include flexibility, task composition, and work pace, which in some professions (e.g., cleaning services) define a faster work pace for private than for public workers.

Contracting out by Danish government agencies is regulated by Danish law and EU regulations. The law on "Company Transfer of Employees" requires that workers whose jobs are contracted out are offered employment with the private contractor according to the wages and working conditions of the private labor market (Danish Ministry of Employment 2002). The regulations on the transfer of workers after contracting out stipulate several minimum rights for workers. Most importantly, workers are transferred to the private employer with their wages and employment rights until the end of the collective labor agreement. When the public labor agreement expires (e.g., one year after the contracting out), the workers are transferred to the private sector collective labor agreement for the relevant profession. In many cases, there is no major difference in hourly salaries in public and private collective agreements. Nevertheless, workers may experience higher productivity demands, reduced employment, and greater use of part-time labor after being transferred to a private contractor (Fernandez, Smith, and Wenger 2006; Petersen et al. 2022).

Data and Estimation

Our empirical strategy for estimating the consequences of contracting out on workers is to identify a group of workers who experienced contracting out and exactly match them with a similar group of public workers who did not. This involves identifying instances of contracting out involving worker

transfers and matching them with non-contracted public workers on key background characteristics to establish a control group. Because there is no central register of public contracts, we conducted extensive desk research to identify government contracting out involving worker transfers. We identified four major contracts where we were able to identify the contracting agency, the private contractor, and the exact worker transfer date. Focusing on these major contracts bolstered our treatment group identification by providing the information necessary to identify workers who transferred because of contracting out: company name, company identification number of the releasing public employer and the receiving private employer, and the exact dates when workers were transferred. This information was scarcer for minor outsourcing contracts. Using this information enables us to identify workers who changed employment from the public contracting authority to the private contractor on the specific date of the contract start, thereby increasing our confidence that transfers were due to contracting out and not random shifts from public to private employment.

We loaded the company identification numbers and worker transfer dates onto the Statistics Denmark micro-level data platform. We used the individual-level registry *"Employment for employees"* (BFL), a business cycle statistic containing exact information on workers' monthly employment from 2008-2020. By linking the public and private employer IDs and the monthly dates of contracting out, we identified 452 "treated" workers who moved from a government employer to a private employer on a specific date due to contracting out. To support that the 452 worker-transfers were due to contracting out, we conducted an alternative identification strategy. By using the same public and private employers, but setting time 6 and 12 months earlier, respectively, we identified 4 and 9 additional transfers (0.88–1.99% of the 452 worker-transfers we identified). The low number of worker-transfers 6 and 12 months prior to the contracting event supports that the workers we identified in the treatment group transferred to the private employer due to contracting out.

Next, to identify a control group of workers who remained employed in the public sector and are similar to the treatment group, we divided all public employees (approximately 850,000 employees) into four different-sized groups according to the number of workers transferred in each contract. We specified that treated individuals from one instance of contracting out could not become controls in another instance of contracting out. Without this restriction, the calculated effect of contracting out could become biased if previously treated individuals are used as controls (Goodman-Bacon 2018). We also specified that individuals could not serve as a control more than once.

We then relativized time by recentering the treatment date to account for the differential treatment timing in our four contracts. The relativized time was captured in a variable with a value of T-2 two years before contracting out, T-1 one year before, T0 when contracting out occurred, T1 one year after, and T2 two years after contracting out. We then trimmed the data, so only treated and control individuals who have observations from T-2 to T2 were included. Here, we need two pretreatment periods to adequately assess the parallel trends assumption, and two posttreatment periods to estimate the influence of contracting out, as the entire effect is not expected immediately after contracting out (e.g., due to the collective labor agreement). To examine the long-term consequences, we extend the analysis to five years after the contract implementation (T5), although this reduces the sample size because we cannot include workers from the most recent contracts.

Together, these procedures provided us with a balanced panel dataset to perform a DiD analysis of the outcome over time for our treatment and control groups. As specified below, we used Coarsened exact matching (CEM) to identify a control group that is similar to the treatment group but remained employed in the public sector.

Matching and Estimation

Comparing the treatment and control groups without matching would neglect that contracting out may occur to individuals with specific socio-demographic characteristics (Hebdon 2006). We use a CEM procedure to address this challenge and make the treatment and control groups more comparable (Blackwell et al. 2009). The combination of DiD and CEM is used in many studies across different fields, including Gurantz (2020) and Petersen et al. (2022). CEM has been criticized for dropping too many observations from the control group, thereby losing statistical power (Black et al. 2020). In our study, however, the reservoir of potential control individuals is around 850,000 public workers, which renders this problem much less severe.

Our matching is based on a six-variable setup: sector (public and private), month, job function, gender, education, and age. The first two variables stipulate that a worker experiencing contracting out is matched with workers who were publicly employed three months before contracting out. We then exactly match on job type. The job type variable is called DISCO, and the gross sample contains more than 1200 unique job codes. The variable is very detailed, differentiating *between* industries (e.g., waste collectors, cleaning assistants, property inspectors) and *within* industries (e.g., workers cleaning at hospitals, offices, hotels, and trains). Matching on the DISCO code enables us to control for variation between industries while differentiating between specific job functions (e.g., cleaning offices versus cleaning homes) within industries. We also exactly match on gender (male and female workers) and education (nine categories, ranging from primary school to PhD).

Finally, we split age into five groups and match workers accordingly. This procedure resulted in a list of strata containing minimum one treated and control individual similar on these parameters. We use CEM weights to adjust for the different number of treated and control individuals in the strata (Iacus et al. 2011). Table A1 in the online appendix documents the efficacy of the match with and without CEM weights: The table shows that the treatment and control groups

are balanced on all four treatment variables after matching and application of CEM weights.[1] The final treatment group size is 390 individuals, whom we could track in our data at least two years before and two years after they experienced contracting out. The reduction from 452 to 390 individuals was caused by a lack of exact matches and some treated and control individuals not having full panel data from T-2 to T2.[2]

After matching, we use Pooled Ordinary Least Squares (POLS) to conduct our analysis, which is equivalent to Two-way Fixed Effects without time-varying control variables. We specify the following model:

$$Y_{i,t} = \beta_0 + \beta_1 Treatment_i + \beta_2 Time_t + \beta_3 Treatment_i * Time_t + u_{i,t}$$

Time indicates the standardized time variable (T-2,… T2/T5), *Treatment* is a dummy indicating control or treatment, *Time***Treatment* is the DiD coefficient (i.e., the treatment effect). The DiD coefficient compares the means of two groups before treatment (T-1) and again after treatment (T1, T2, or T5, depending on the analysis).[3] We also cluster each individual to account for observations of each individual not being independent over time (we have also attempted two-way clustering with individuals and municipalities (Cameron et al. 2006), but doing so did not improve our standard errors markedly and had too few clusters to calculate a robust covariance matrix).

Calculating an internally valid DiD estimate requires that the only posttreatment difference between the treated and control individuals is caused by the treatment. This assumption necessitates that the trend in the two groups before the treatment is parallel: the so-called parallel trends assumption. As previously discussed, the CEM strategy has enabled us to reduce heterogeneity between the treatment and control group on the matching variables. We keep the parallel trends assumption in mind when examining the analysis and visually inspect for pre-treatment differences between the treatment and control groups. We are not looking for exactly parallel lines, which

rarely occur in the real world; instead, we seek slopes that are close enough for practical purposes by asking whether pre-treatment differences are substantive or negligible. Moreover, we perform formal robustness checks of the parallel trends as presented in the results section. This includes empirical tests of differences between the treatment and control groups in the pretreatment periods, showing that 3 out of 36 parallel trends assumptions call for caution. Finally, we run a Poisson regression to obtain the percentage change in the outcome variables. This accounts for the different baselines (e.g., wages for male and female workers), enabling a stronger substantial interpretation of the DiD coefficients (see online appendix, Tables A2–A4).

Outcome Variables

The first hypothesis examines the relationship between contracting out and work income. The primary source of work income data is SKAT (the Danish tax authority), which registers and validates work income for all Danish citizens. The registry is BFL, which measures the total monthly work income and employment of individual workers.[4] The registry contains a variable (AJO_BREDT_LOENBELOEB), which measures the work income from all employers that a worker has had each month. Our main analysis only includes data from the primary employer, however, as we are also interested in general changes in work income from shifting from public to private employment, we provide a robustness analysis with work income from up to three employers (see online appendix, Figure A1).

The second hypothesis tests whether government contracting out reduces employment. Our analysis of employment is also based on the BFL registry. We use a variable (AJO_FULDTID_BESKAEFTIGET), which measures average working hours per month per year (again with SKAT as the main source of data). A contracted-out worker may have had multiple jobs in the same period at different workplaces. Initially, we only consider the primary employer,

however, in the online appendix, we provide an additional analysis with up to three employers (see online appendix, Figure A2).

Moreover, we perform an additional analysis, examining whether contracting out increases workers use of government income transfers. The outcome is also based on SKAT's annual statement but comes from the income registry (IND). The variable (OFF_OVERFORSEL_13) consists of all public transfers, including unemployment benefits, early retirement pay, and national pension, but excluding civil service pension. Unlike the other primary outcome variables, data for government income transfers was unavailable for 2020, which limits our moderation analyses for this outcome to changes from two years before the contracting out (T-2) to one year after (T1).

Moderator Variables

Besides analyzing the main effects on work income, employment, and government income transfers, we also examine how specific individual characteristics moderate the consequences of contracting out. Moderations operationalize the fundamental sociological principle that social processes are context-dependent and shaped by, for example, social and cultural conditions (Aneshensel 2013). The moderating effects are calculated by interacting the time- and treatment variables with the respective moderator. From the individual-level register (BEF), we build moderators corresponding to our hypotheses about different outcomes according to workers' skills, gender, and age. The moderating variables are:

- Skill level: low-skilled (primary school and high school) and medium-skilled (vocational training and higher education)
- Gender: dummy variable for male and female workers
- Age groups: 20–29, 30–59, and 60–69 years

Skill level is operationalized by using education levels, distinguishing between workers with primary school and high school as the highest-attained education versus workers with vocational training and short-, medium-, and long educations.[5] This variable is coded with contracting out and our hypothesis in mind. For example, workers with only high school are classified as low-skilled workers, because they cannot apply their educational background to the same extent as, for example, vocationally trained workers to solve tasks that are contracted out. Moreover, there are very few workers with university or college degrees in our sample (four with a bachelor-degree; seven with a master-degree or similar), which corresponds with Petersen et al.'s (2022) assertion that contracting out in Denmark does not usually affect high-skilled jobs.[6] Second, the gender variable is coded as a binary male/female dummy variable, because these are the categories available from the micro-level data from Statistics Denmark.

Moreover, following our hypothesis on age, we have drawn a line between the youngest, the middle-aged, and the oldest workers, as we expect the effects to be relatively homogenous across the middle-aged. However, we conduct a robustness check to see whether results differ with four age groups (see online appendix, Figures A3–A5). In a further check, we combine skills and gender to examine whether low-skilled women bear the adverse consequences. We will comment on these checks as we go through the different outcomes (see online appendix, Figures A6–A8). Because of the limited sample size, we could not subdivide the age groups into male and female workers although, for instance, Goldin (2014) shows that wages increase less with age for women than for men.

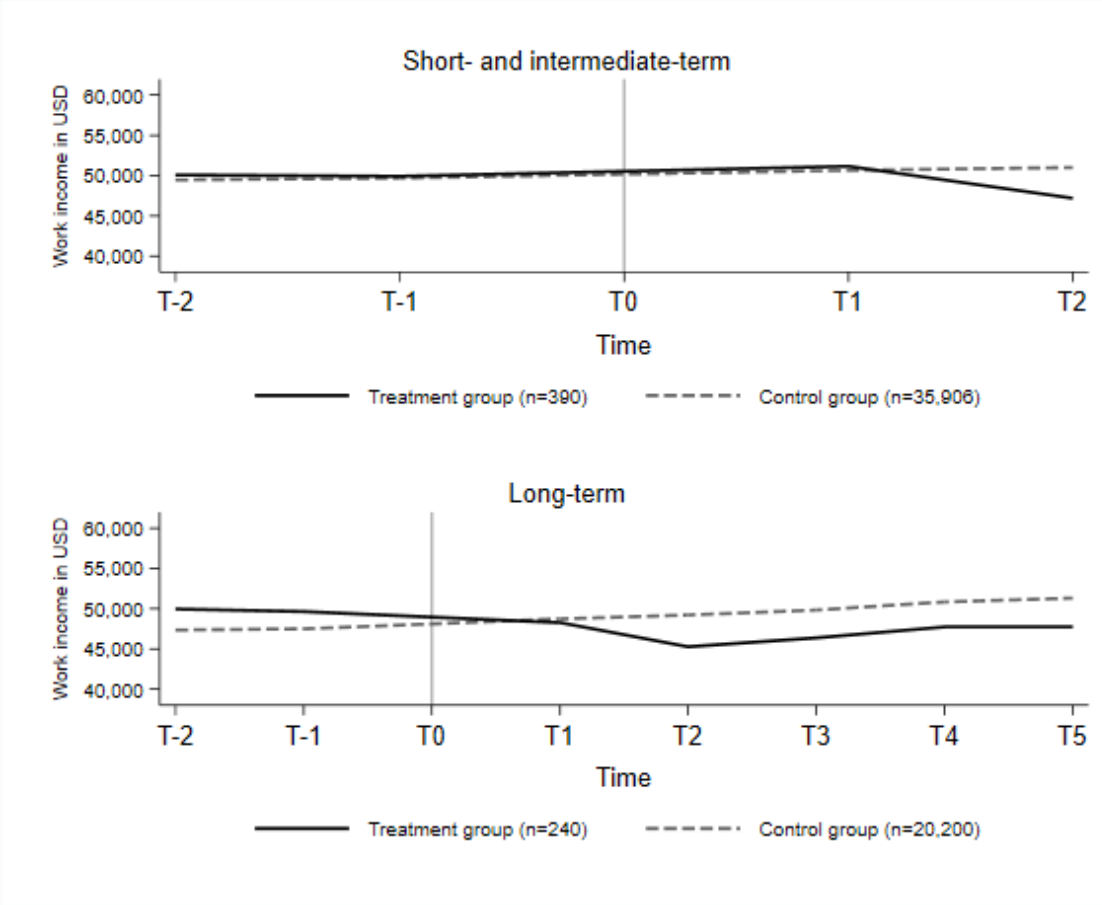
Empirical Findings

This section presents the results of our DiD analyses of how contracting out influences work income, employment, and public income transfers. The analyses of the short-term change (from T-1 to T1) and intermediate change (T-1 to T2) draw on the entire treatment group of 390 workers experiencing contracting out, whereas the analysis of the longer-term changes (T-1 to T5) draws on the reduced sample of 240 workers for whom data for the full period is available.[7] After the main analysis, we decompose the aggregate effects by testing the relationship across different subgroups (skills, gender, age). We only analyze subgroups in the short- and intermediate-term, as many subgroups become too small to examine long-term changes in T5. All results are after matching and with CEM weights.

The Influence of Contracting Out on Work Income

The Figure 1 results suggest that the treatment- and control-group trends in the short- and intermediate-term are almost parallel before contracting out (T-2 to T-1) and that contracting out has no significant short-term effect (T1) on work income. Two years after contracting out (T2), however, workers experience a significant decrease in work income of $4,040.6 (corresponding to –7.9%). A plausible explanation for the T1–T2 decline in work income is that workers are transferred on their public labor agreements until the expiration of the agreement period, as described in the institutional context section, and thereafter transferred to the private labor agreement. Five years after the contracting out, the work income decline increases to $5,698.0 (–11.7%).[8] These results are consistent with our Hypothesis 1, suggesting that government contracting out reduces work income. We further analyze the developments in all work income, including income from primary, secondary, and tertiary employers (see online appendix, Figure A1), which produces results similar to the main analysis.

Figure 1. Short-, Intermediate-, and Long-Term Changes in Work Income

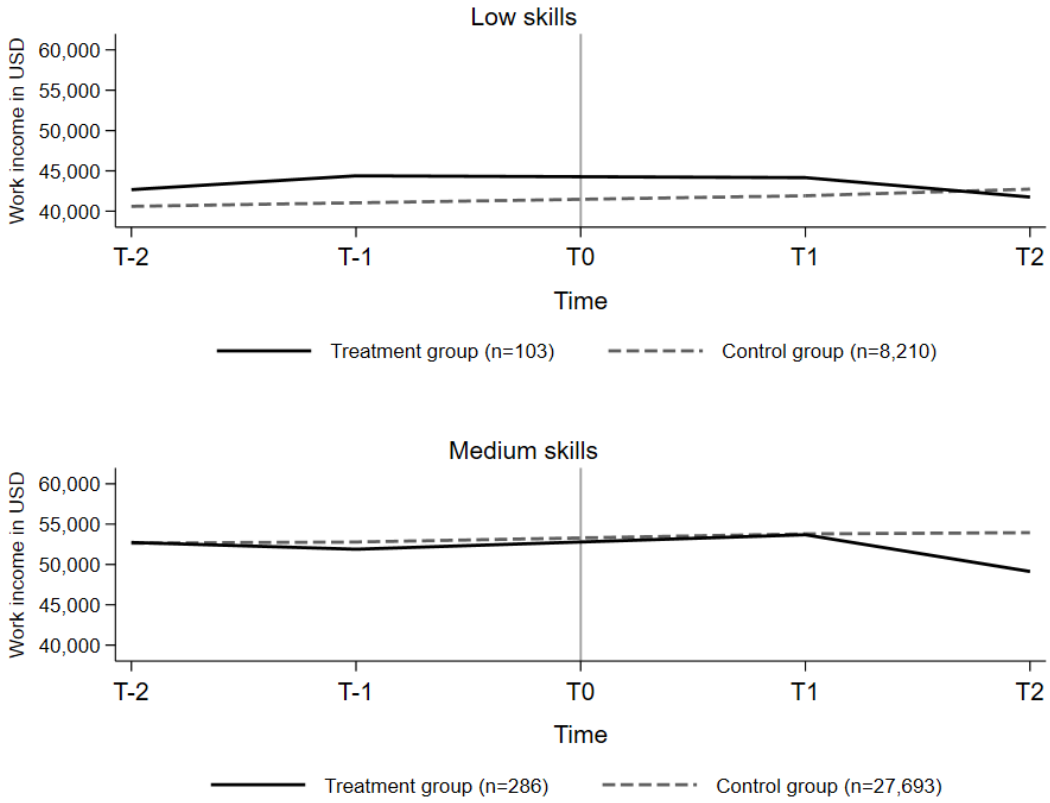


T-1 to T1	T-1 to T2	T-1 to T5
271.4 (0.709)	–4,040.6 (0.000)	–5,698.0 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Second, we examine whether workers skill levels moderate the influence of contracting out on work income. Consistent with the Figure 1 results, Figure 2 suggests that contracting out has no significant short-term influence on low- and medium-skilled workers. In the intermediate term, however, both low- and medium-skilled workers experience significant wage reductions, which are smaller for the medium-skilled workers (–7.4%) than for low-skilled workers (–9.6%).

Figure 2. Contracting Out and Work Income Moderated by Worker Skills



	T-1 to T1	T-1 to T2
Low skills	–1,099.7 (0.442)	–4,335.7 (0.007)
Medium skills	781.7 (0.356)	–3,928.1 (0.000)

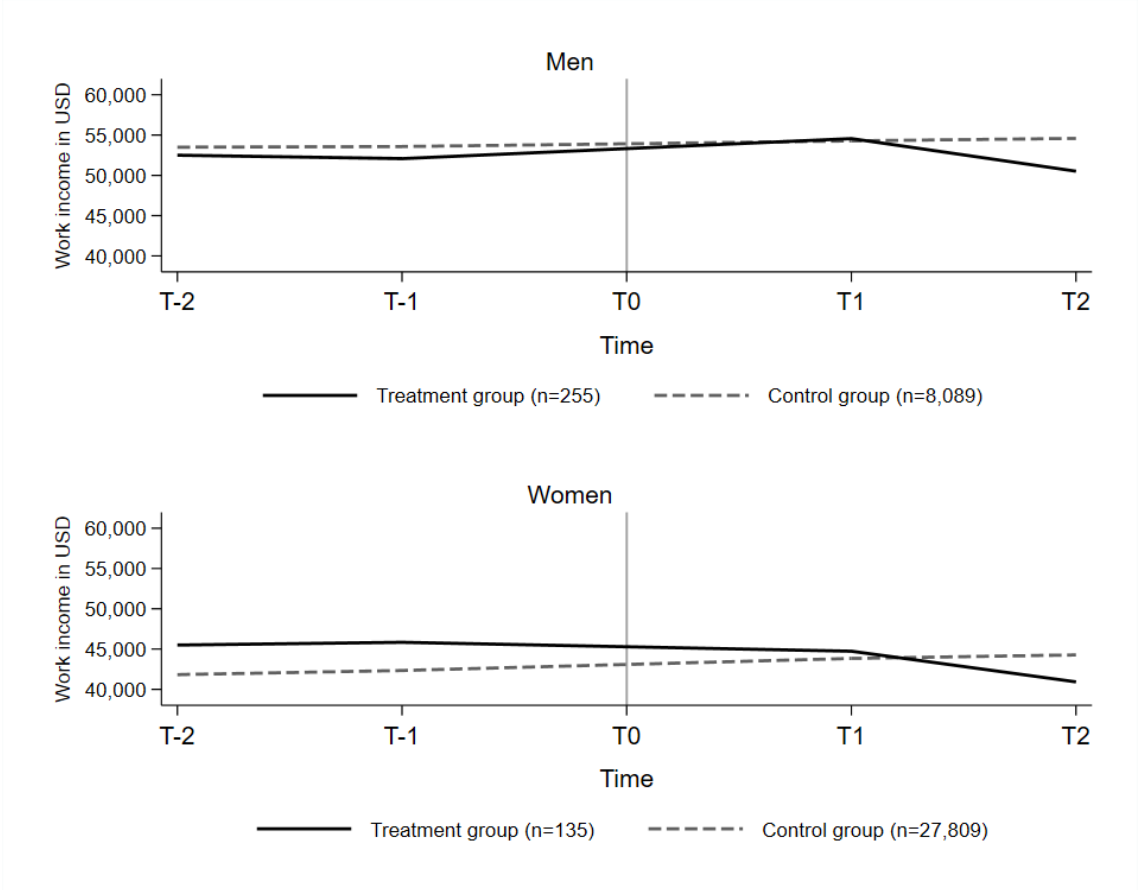
Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Third, we examine work income for male and female workers. Figure 3 illustrates that contracting out hits female workers harder than males. Focusing on the short-term development, female workers experience a statistically significant decrease in work income of $2,601.9 (corresponding to –5.7%), whereas male workers experience a statistically significant increase of $1,778.8 (3.4%). Turning to the intermediate-term effects from T-1 to T2, female worker income decreases by $6,849.1 (–14.6%). While male worker income also significantly decreases in the intermediate term, the coefficient is markedly lower: $2,579.8 (–4.8%). These findings suggest that

female workers experience a more than three times larger decline in work income two years after contracting out than male workers.

We also interact gender and skills to examine whether low-skilled women bear the adverse consequences (see online appendix, Figure A6). This analysis indicates that low-skilled women are worse off in the short-term; in the intermediate-term, however, low- or medium-skilled female workers are more or less equally negatively affected. Together, these results suggest that the difference in work income after contracting out mainly relates to gender and to a lesser extent to skills.

Figure 3. Contracting Out and Work Income Moderated by Gender

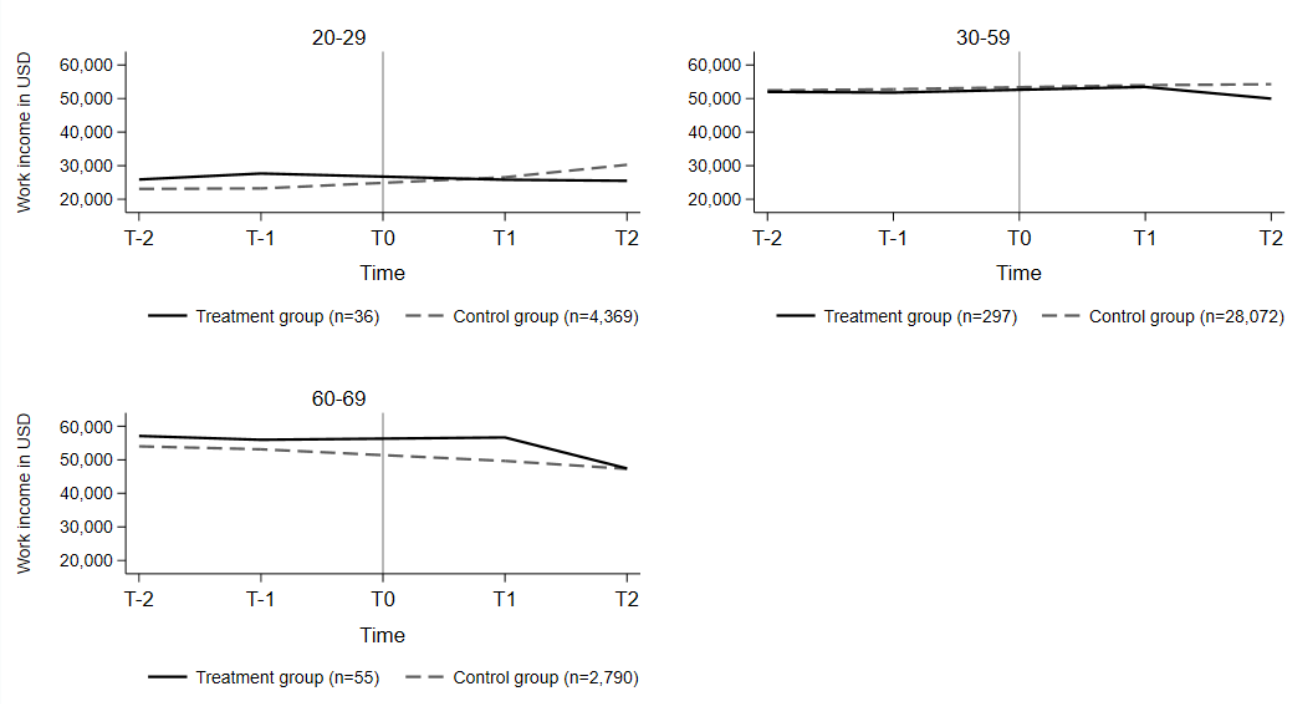


	T-1 to T1	T-1 to T2
Men	1,778.8 (0.066)	–2,579.8 (0.020)
Women	–2,601.9 (0.010)	–6,849.1 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Finally, we examine whether age moderates the effect of contracting out on work income. Focusing on the short-term effects, Figure 4 reveals how the youngest workers experience a statistically significant decrease in work income of $5,166.5 (–18.3%). We also see that workers aged 30–59 do not experience any significant effects, while the oldest group experiences a significant increase of $4,128.7 (8.2%). In the intermediate-term, we also see that the youngest workers are worst off, with a significant decrease in work income of $9,208.7 (–29.2%). The 30–59-year-olds also experience a reduction in their work income of $3,313.4 (–6.2%). In contrast to the increased wages at T1, the oldest group experiences no significant effects in the intermediate term.

Figure 4. Contracting Out and Work Income Moderated by Age



	T-1 to T1	T-1 to T2
Age 20–29	–5,166.5 (0.067)	–9,208.7 (0.002)

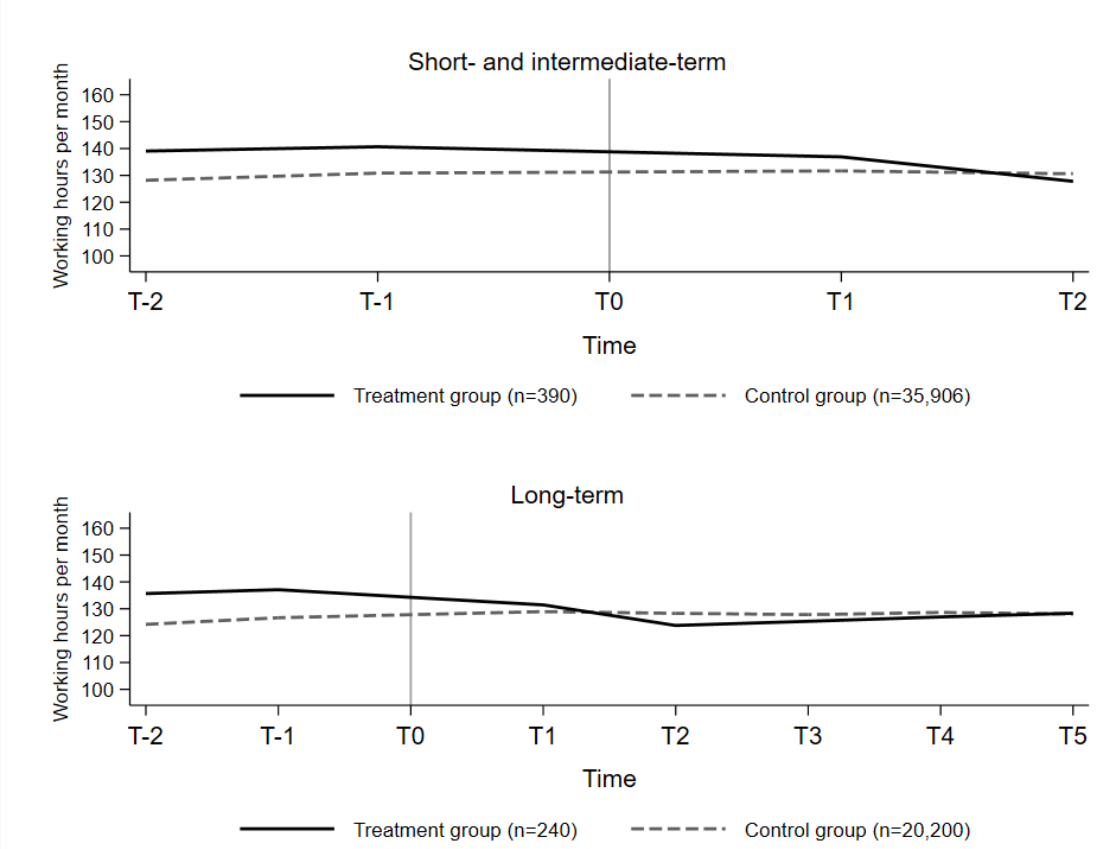
Age 30–59	473.0 (0.578)	–3,313.4 (0.001)
Age 60–69	4,128.7 (0.006)	–2,730.5 (0.265)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

The Influence of Contracting Out on Employment

This section examines whether contracting out influences worker employment. Figure 5 suggests that contracting out is associated with a significant decline in employment throughout the whole period: In the short term, employment is reduced by 4.6 working hours (–3.3%), in the intermediate term it drops by 12.7 working hours (–9.0%), while employment is reduced in the longer term by 10.2 working hours (–7.9%). These results are consistent with our Hypothesis 2; that government contracting out is associated with reduced employment for workers. We also analyze secondary and tertiary employment (see online appendix, Figure A2) and find results similar to the main analysis.

Figure 5. Short-, Intermediate-, and Long-Term Changes in Employment

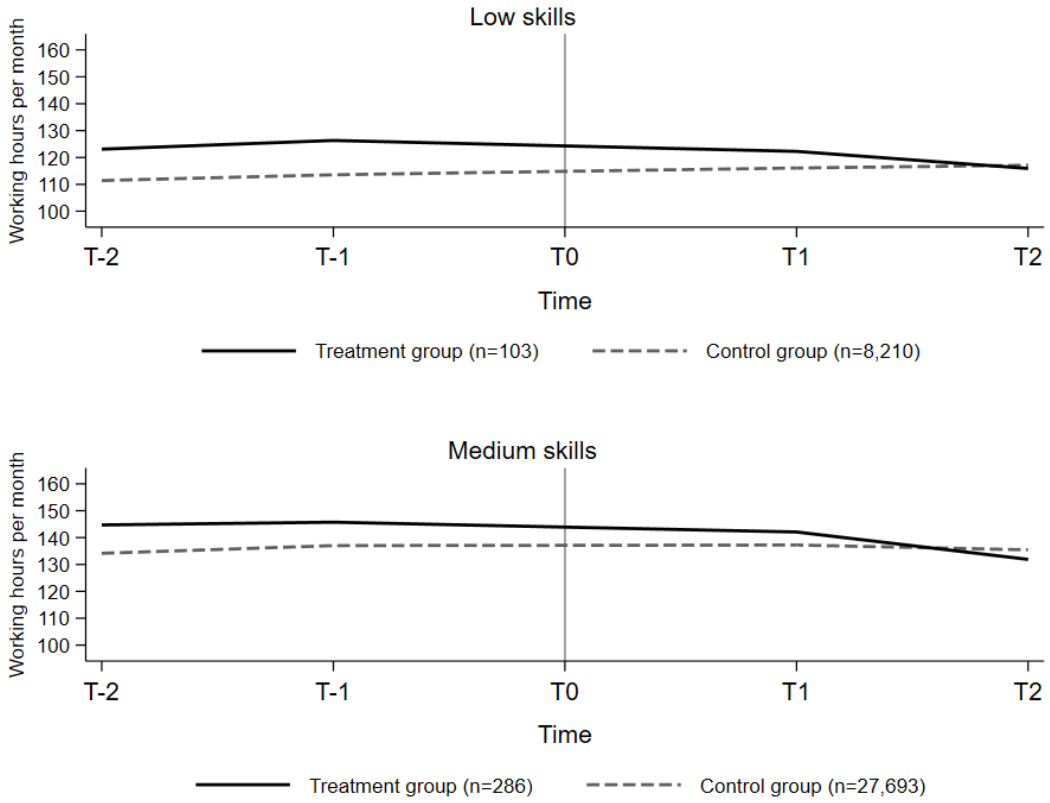


T-1 to T1	T-1 to T2	T-1 to T5
–4.6 (0.007)	–12.7 (0.000)	–10.2 (0.008)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Next, we examine whether skills, gender, and age moderate the effect of contracting out on employment. Figure 6 shows the employment for low- and medium-skilled workers. In the short term, we see that low- and medium-skilled workers experience a statistically significant decline in employment of, respectively, 6.6 and 3.9 working hours (–5.3%, –2.7%). Turning to the intermediate term, the two groups experience a statistically significant decline in employment of, respectively, 14.0 working hours (–11.0%) for low-skilled workers and 12.3 working hours (–8.4%) for medium-skilled workers.

Figure 6. Contracting Out and Employment Moderated by Worker Skills



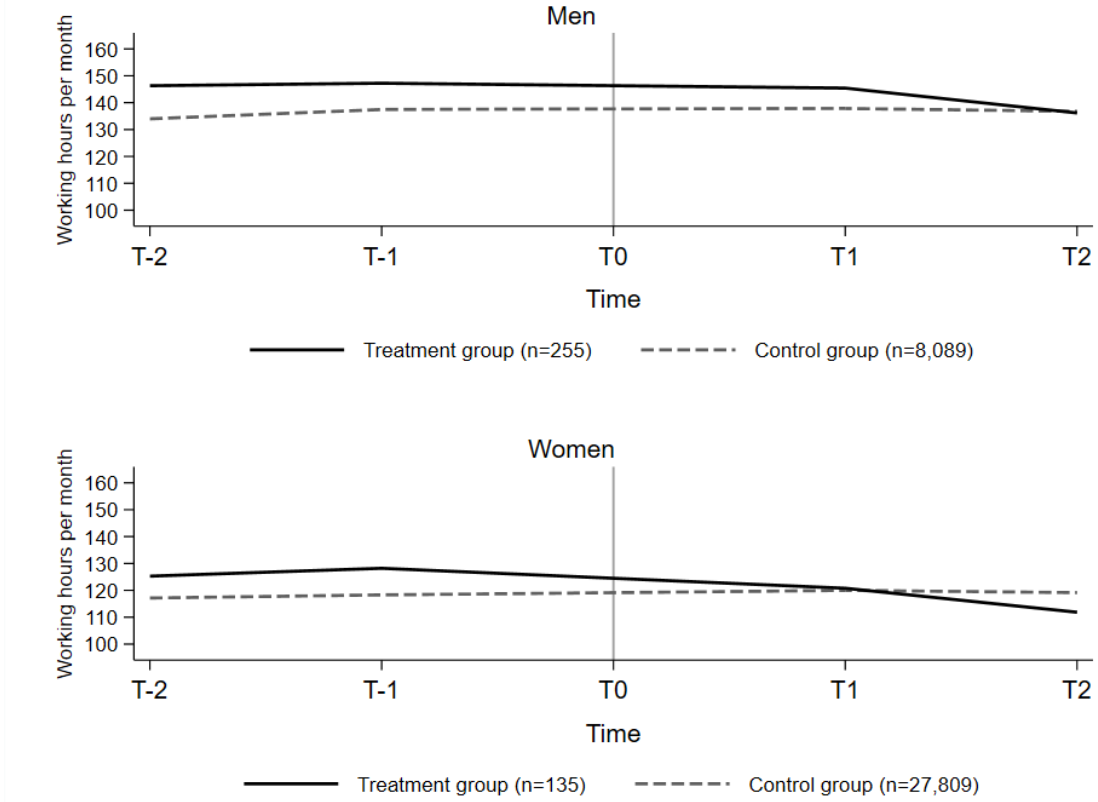
	T-1 to T1	T-1 to T2
Low skills	–6.6 (0.035)	–14.0 (0.001)
Medium skills	–3.9 (0.056)	–12.3 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Turning to gender as a moderator of contracting out on employment, Figure 7 illustrates how female workers are substantially worse off than males. Male workers are not significantly affected in the short term, whereas female workers experience a significant decrease in employment of 9.1 working hours (–7.1%). In the intermediate term, men and women alike experience a significant decline in employment, although more so for females than males. In the intermediate term, male workers experience a decrease of 10.3 working hours (–7.0%), while female workers experience a reduction of 17.2 working hours (–13.3%). These results suggest that contracting out hits female workers harder than males.

Again, we partitioned low- and medium-skilled women to test whether low-skilled women experienced more negative consequences of contracting out (see online appendix, Figure A7). We find that low-skilled women have noticeably lower employment in the short-term; in the intermediate term, however, both groups of women experience more or less similar adverse effects.

Figure 7. Contracting Out and Employment Moderated by Gender



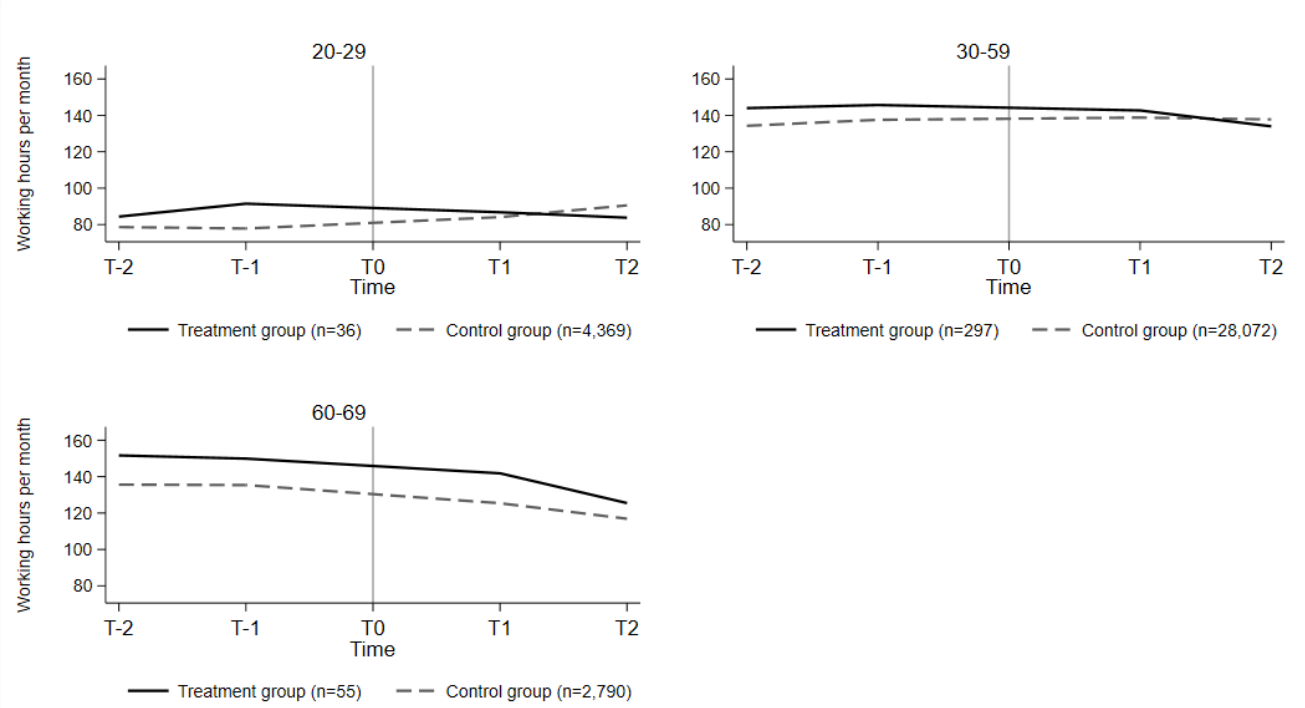
	T-1 to T1	T-1 to T2
Men	–2.2 (0.306)	–10.3 (0.000)
Women	–9.1 (0.001)	–17.2 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Finally, Figure 8 presents the results for employment moderated by age. In the short term, only the 30–59-year-olds experience a significant decline of 4.2 working hours (–2.9%). In the intermediate-term, however, the youngest workers are most severely affected with a decrease of

20.5 working hours (–21.3%) compared to 11.9 working hours for the 30–59-year-olds (–8.1%) and no statistically significant effect for the oldest workers. The results thus contradict our hypothesis on contracting out and age, as we find the most negative consequences for the youngest workers but no decline in employment among the oldest workers.

Figure 8. Contracting Out and Employment Moderated by Age



	T-1 to T1	T-1 to T2
Age 20–29	–11.0 (0.158)	–20.5 (0.017)
Age 30–59	–4.2 (0.025)	–11.9 (0.000)
Age 60–69	1.9 (0.661)	–6.0 (0.398)

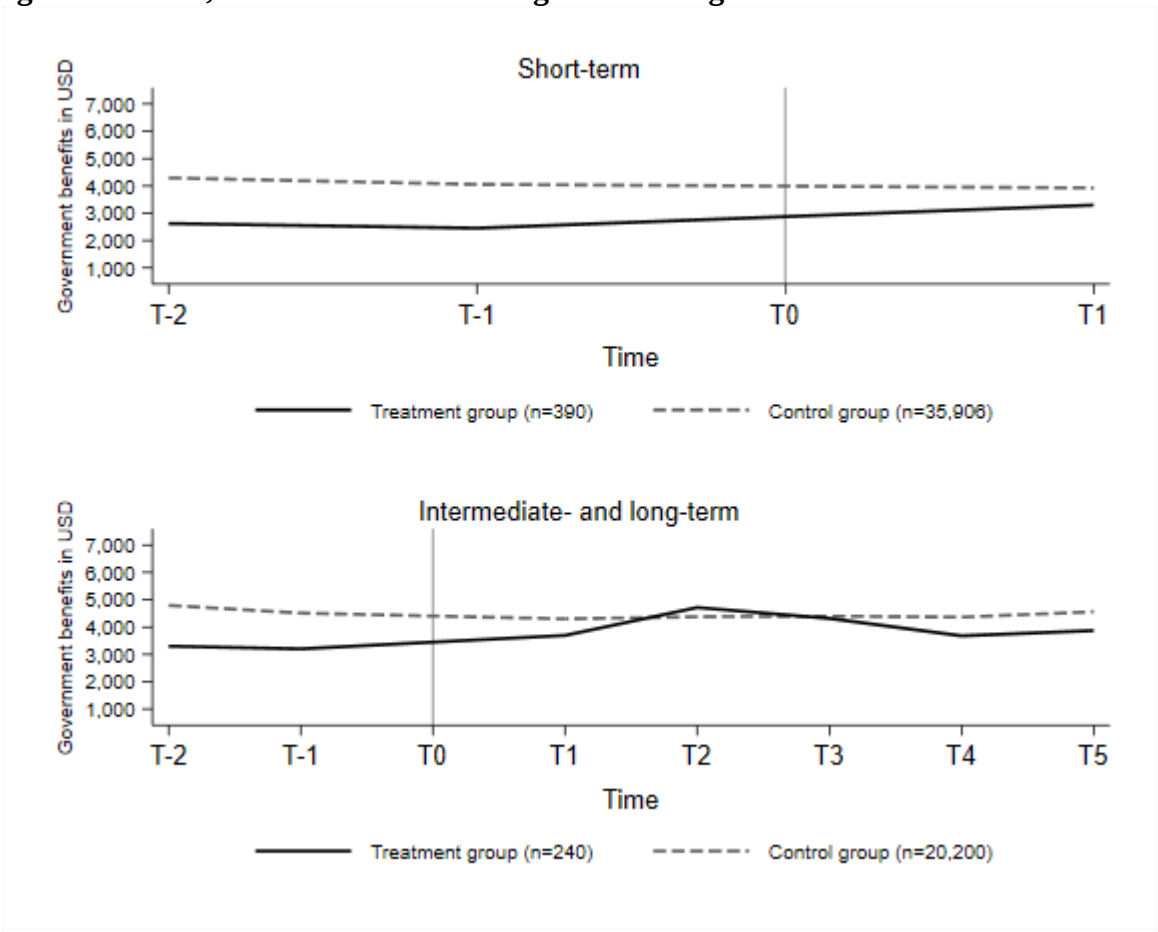
Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Contracting Out and Public Income Transfers

The decline in work income and employment may trigger additional costs for the public sector via increasing public income transfers. Figure 9 presents the short-, intermediate-, and long-term effects of contracting out on expenses for public income transfers. From Figure 9, we see that contracted-

out workers experienced a short-term increase of $976.3 (38.9%), indicating that workers grow more dependent on income transfers after contracting out. This transfer increases to $1,646.7 (51.7%) in the intermediate term before becoming insignificant in the longer (T5), which is plausible because the maximum unemployment benefit period in Denmark is two years for insured workers but longer for uninsured workers (although at a lower compensation level and subject to several eligibility criteria).

Figure 9. Short-, Intermediate- and Long-term Changes in Income Transfers

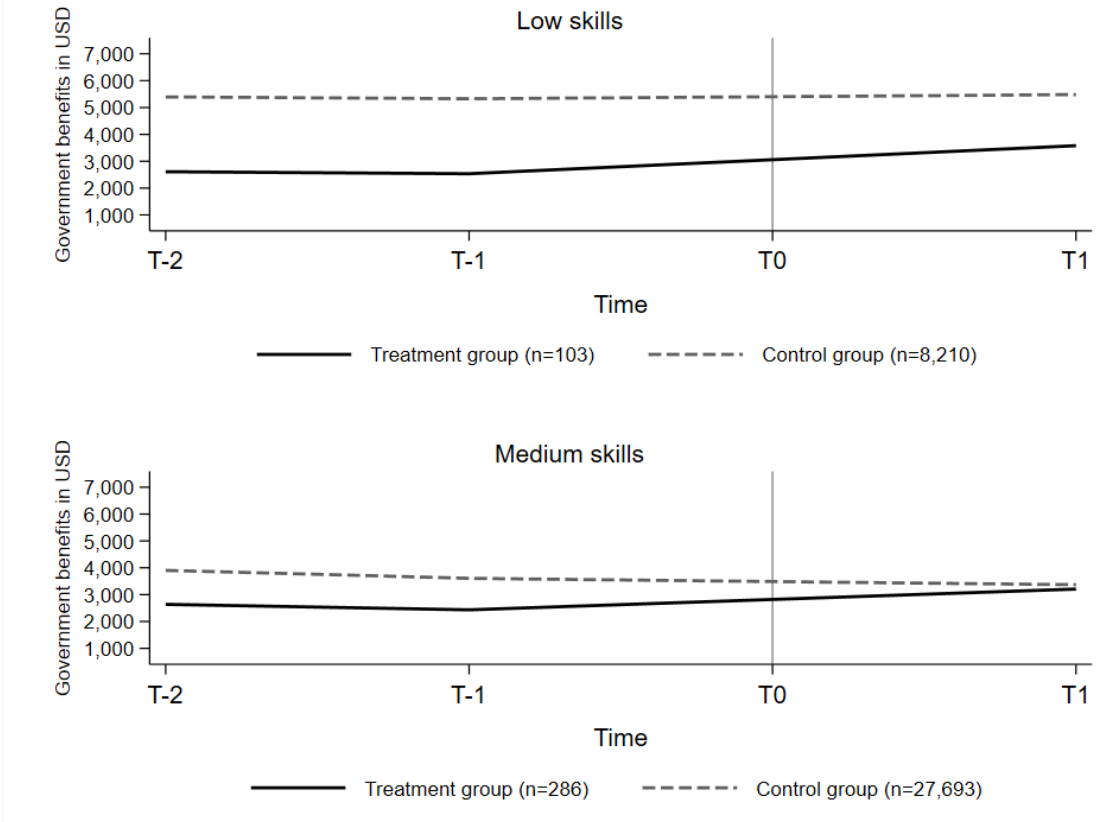


T-1 to T1	T-1 to T2	T-1 to T5
976.3 (0.000)	1,646.7 (0.006)	620.2 (0.314)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Turning to our moderation analyses, Figure 10 suggests no significant increase in public income transfers among low-skilled workers. In contrast, medium-skilled workers increase their use of income transfers by $1,013.1 (41.1%). The significant increase in income transfers for medium-skilled but not for low-skilled workers suggests that the former are better insured against unemployment. The latter argument is plausible when comparing with the results from the employment analysis in Figure 6, which shows that medium-skilled workers do not experience a larger decline in employment than low-skilled workers. These results suggest that medium-skilled workers are compensated more for declining work income and employment after contracting out.

Figure 10. Contracting Out and Income Transfers Moderated by Worker Skills



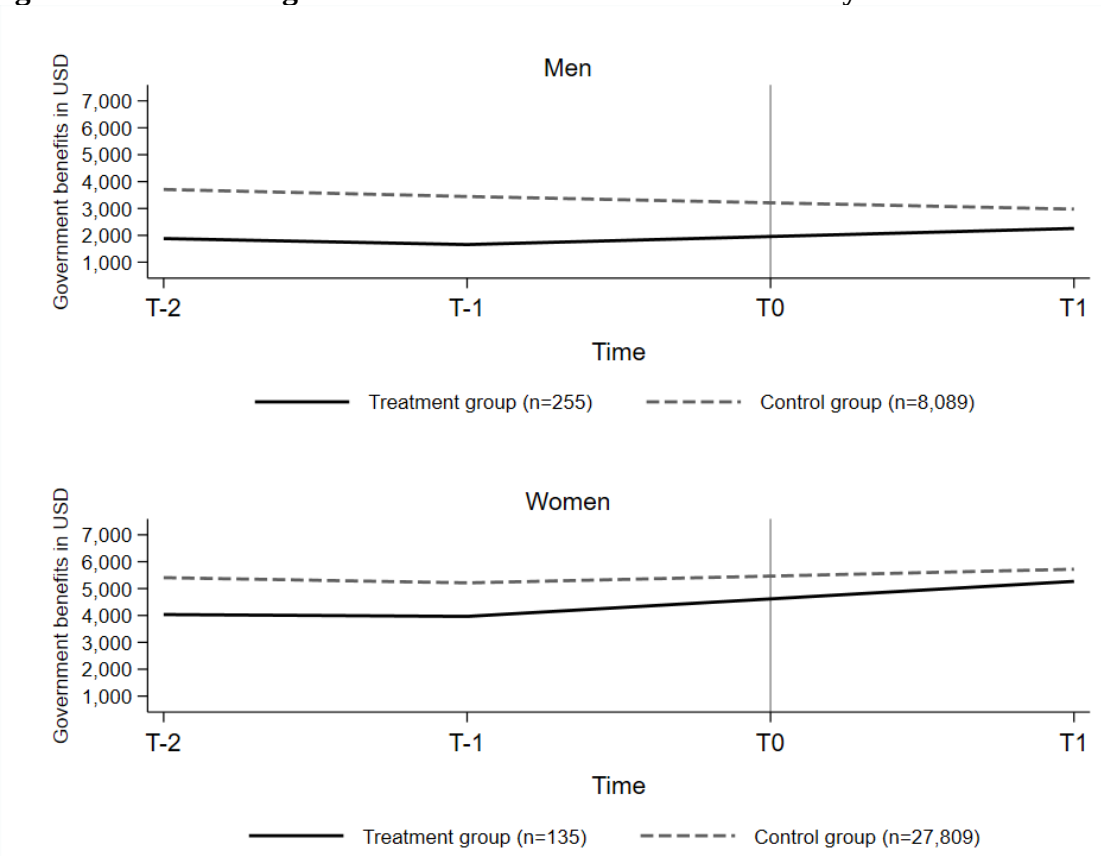
	T-1 to T1
Low skills	888.7 (0.175)
Medium skills	1,013.1 (0.001)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Moreover, Figure 11 suggests that contracting out significantly increases male workers use of income transfers by $1,070.3 (57.7%), whereas the coefficient for female workers is insignificant. So even though Figure 7 suggests that female workers work less after contracting out, our results show that male workers receive more benefits from the government, potentially signaling a gender gap in the economic compensation of workers after contracting out.

Once again, we examine women with different skill levels to examine if low-skilled women carry the negative consequences (see online appendix, Figure A8). Here, we find that low-skilled women do not experience an increase in their income transfer despite reducing their employment by 13.1 working hours per month (as presented in online appendix, Figure A7). Medium-skilled women, on the other hand, do experience a significant increase in income transfers, suggesting that low-skilled women experience more negative circumstances after contracting out: lower income, less employment, and no compensation.

Figure 11. Contracting Out and Income Transfer Moderated by Gender

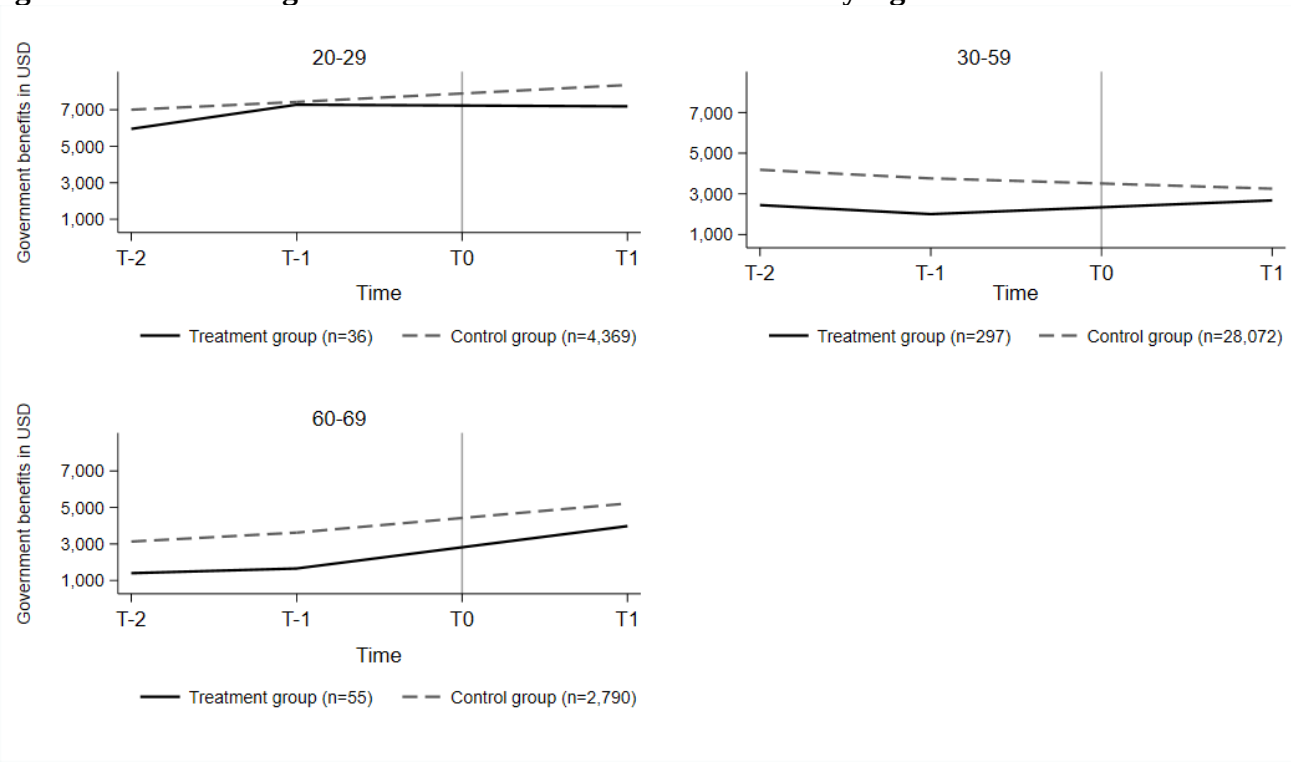


	T-1 to T1
Men	1,070.3 (0.001)
Women	797.7 (0.105)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Finally, we examine the influence of contracting out on income transfers across the three age groups. In Figure 12, we see how the 20–29-year-olds and oldest workers do not receive more income transfers after contracting out. In contrast, the 30–59-year-old workers significantly increased benefits by $1,180.3 (54.3%). The difference between the 20–29 and 30–59 age groups may suggest that middle-aged workers have had more time to earn the right to compensation from an unemployment insurance fund. We also see that the oldest workers did not experience any significant change to their level of income transfers.

Figure 12. Contracting Out and Income Transfer Moderated by Age



	T-1 to T1
Age 20–29	–1,021.9 (0.242)
Age 30–59	1,180.3 (0.000)
Age 60–69	725.0 (0.340)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

To summarize, we have found a significant decline in work income in the intermediate and long term (Hypothesis 1) and in employment in the short, intermediate, and long term (Hypothesis 2). Concerning the moderators, we see that medium-skilled workers experience a smaller negative effect on work income and employment than do low-skilled workers (Hypothesis 3). For gender, our findings show that male workers are better off than female workers, both regarding work income and employment (Hypothesis 4). For age, the findings suggest that the youngest workers experience more adverse effects than older workers on work income and employment (opposite direction of Hypothesis 5). Finally, the findings suggest that contracted-out workers receive significantly more government income transfers in the short and intermediate term, whereas the

moderation analysis indicates that medium-skilled, male, and middle-aged workers receive the greatest income compensation. The main findings are summarized in Table 1.

Table 1. Summary of Empirical Findings

Outcome	Findings
Work Income	• Lower salaries in the intermediate and long term • Low-skilled workers more negatively affected in the intermediate term • Female workers more negatively affected in the short and intermediate term • Younger workers more negatively affected in the short and intermediate term
Employment	• Lower employment in the short, intermediate, and long term • Low-skilled workers more negatively affected in the short and intermediate term • Female workers more negatively affected in the short and intermediate term • Younger workers more negatively affected in the intermediate term
Income Transfers	• Higher income transfer in the short and intermediate term • Medium-skilled, male, and middle-aged workers received the highest compensation from government income transfers in the short term

Discussion

The results support the theoretical expectations of a wage gap between the public and private sectors for contracted out services. This finding corresponds with previous studies on the wage and employment consequences of asset privatization (e.g., Brown et al. 2006; Melly and Puhani 2013; Arnold 2019) and contracting out (Petersen et al. 2022). Our study extends these insights by examining whether individual characteristics moderate the influence of contracting out on work income and employment, thereby combining an economic and human resource perspective on contracting out. The findings are noteworthy, indicating that the wage and employment gap is largest for female, low-skilled, and younger workers, who pay the greatest price for contracting out

and are moreover compensated less by government income transfers than their male, medium-skilled, and older colleagues.

The findings raise important questions about the balance between economic and human values in government contracting. While the economic rationale has long dominated the academic debate on contracting out (Bel, Fageda, and Warner 2010; Domberger and Jensen 1997; Hodge 2000; Savas 1987), this study emphasizes the need to better link the economic and human dimensions. If cost reductions – either for the contracting company, government, or both – are realized by reducing work income and employment, contracting out can have additional costs for society. Indeed, our findings suggest increased expenses for public income transfers in the first two years, which need to be accounted for when evaluating the net economic effect of contracting out (Petersen et al. 2022). In the long-term, our findings indicate that workers may either have returned to the labor market in another job or have lost the right to government income transfers. The latter is plausible because the right to insurance-based government income transfers in Denmark has recently been reduced from four to two years, and our findings indicate that workers lose employment but do not receive more income transfers in the long term. These findings provide initial evidence that contracting out has both short-, medium-, and long-term societal and human costs that need to be accounted for when evaluating government contracting performance.

Our study also talks to questions of equity between workers of different genders, skill levels, and ages in the public and private labor markets. Female workers are consistently worse off than male workers in our empirical results. Economic theory of wage gaps predicts that private employers will penalize women more for the greater proportion of domestic and family-related work than public employers, who have a more egalitarian approach to wage formation (Melly and Puhany 2013; Campos et al. 2017). Our findings are consistent with these theoretical expectations by indicating that female workers are both subject to a larger wage and employment penalty than male workers. Contracting agencies can utilize these insights to increase equality by setting salary

and employment obligations in third-party contracts. This potentially involves a more explicit incorporation of human resource aspects (e.g., collective agreements, paid maternity leave) in the contract design and subsequent contract monitoring and enforcement, which is essential to ensure compliance during the contract period (Anguelov 2020).

Relatedly, the finding that younger employees experience greater declines in income and employment than older employees is contrary to our theoretical expectations (Göbel and Zwick 2013; Olson and Tåg 2021). There are at least two potential explanations for this finding. First, younger employees are likely to have earned shorter notice periods than their older colleagues and are therefore easier (and cheaper) to dismiss for the receiving private employer. This points to the employer cost of dismissing workers as a supplement to productivity and skill obsolescence (Skirbekk 2008; Lallemand and Rycx 2009) as explanations for age differentials in worker outcomes. This is possibly because outsourcing contracts are relatively shorter and employment termination costs therefore weigh relatively heavier than in asset privatization. Another possible explanation is that some Danish employers apply a last-in, first-out approach to layoffs, meaning that newly hired workers (which is often correlated with age) are dismissed first regardless of their skills and productivity. This offers initial evidence that worker outcomes in contracting out may have a different age distribution than the existing literature anticipates. Additional research could examine whether these findings apply to other countries and service areas or are particular to the empirical setting scrutinized here.

Further theory development on wage formation and employment in public and private organizations could integrate economic theory of wage setting with a human resource perspective on contract monitoring and enforcement. The conventional approach to contract monitoring in the public administration literature is to anticipate more detailed monitoring arrangements for complex products where service quality is hard to specify and monitor (Anguelov 2020). While making sense from an economic perspective, this approach may have unintended consequences from a

human resource perspective. If government agencies relax on oversight arrangements for simpler products, this potentially gives suppliers leeway to reduce salary costs by paying employees less and/or reducing employment. Weak contract monitoring arrangements for relatively simple services can therefore result in the greatest deterioration in working conditions. The finding that declining work income and employment is worse for workers in low-skilled jobs provides initial evidence that this may be happening. From a human resource perspective, this suggests a need for combining economic theory of public–private wage gaps with a public administration perspective on contract design and monitoring to develop improved ― and possibly more equitable ― conditions for workers when governments contract out.

Lastly, from a practice-oriented perspective, the reduced worker salaries raise important questions about whether private suppliers can deliver the same service quality with fewer human resources (Jensen and Stonecash 2005; Warner and Hefetz 2020). If contracting out incentivizes private suppliers to introduce new technologies and/or innovative work practices, some service types (e.g., cleaning, street maintenance) may in fact be delivered with the same quality by fewer workers. However, human services, such as childcare, care for the elderly, and social and health services, are more about the direct contact between frontline workers and citizens (Chuang et al. 2020), making it more challenging to raise technical efficiency through technological improvements. Fewer workers may therefore be linked more directly to declining service quality, which does not make contracting out an improvement in efficiency but simply a reduction in costs and service quality, in line with theoretical insights in Hart, Shleifer, and Vishny (1997) and Levin and Tadelis (2010). This highlights the fundamental tradeoff public organizations are facing between focusing on the productive cost side of service delivery or the more aggregate economic and non-economic costs and benefits of contracting out. Extending research on contracting out to include a perspective on costs, service quality, and worker outcomes offers possibilities for improving government contracting practices.

Conclusion

This study was designed to examine the consequences of government contracting out for wage setting, employment, and income transfers for different sub-groups of workers. Our DiD-analyses with CEM weights suggested a significant decrease in work income and employment for workers overall, albeit with major inter-group differences: i) for work income, female workers experienced a 14.6% decline two years after contracting out (three times their male counterparts), low-skilled workers experienced a 9.6% decline (30% higher than medium-skilled workers), while young workers experienced a 29.2% decline (largest among all groups); ii) for employment, female workers lost 13.3% of their working hours (almost twice as much as male workers), low-skilled workers lost 11.0% of their working hours (31% higher than medium-skilled workers), while young workers lost 21.3% of their working hours; iii) further sub-group analyses showed that the decline in income and employment was especially severe for low-skilled female workers. Together, these results provide strong empirical evidence that female, low-skilled, and younger workers pay the highest price for contracting out.

Our study contributes a critical perspective on the rarely studied worker consequences of government contracting practices. The findings suggest that the cost savings for the contracting public organizations found in previous research (Domberger and Jensen 2005; Hodge 2000; Petersen, Hjelmar, and Vrangbæk 2018) are at least partly due to reduced labor costs. Research in government contracting has hitherto focused on aggregate worker effects (Fernandez et al. 2006; Petersen et al. 2022) and therefore been unable to test the significance of important human factors (e.g., skills, gender, age) on how workers fare after contracting out. From a theoretical perspective, these results are important because they contribute to understanding fundamental wage and employment gaps across the public and private sectors for workers with different characteristics. The theory on wage formation utilized in this study differentiates between various individual

characteristics, thus contributing to a deeper theoretical and empirical understanding of the human traits and resources that moderate the relationship between contracting out and worker outcomes.

This study also has several limitations. An important limitation is that our treatment group identification method only enabled us to examine outcomes for public workers who changed employment to a private employer. Remaining workers in the contracting agencies may also experience changes in their work income, productivity requirements, and employment when parts of the organization's portfolio of tasks is subjected to contracting out. Another limitation of our study is the empirical focus on a single country, which limits the generalizability of our findings to other national contexts with different labor market regulations and role of collective labor agreements. Finally, while the strength of our study is the use of individual-level register data to measure changes in work income, employment, and income transfers, an important limitation is the lack of perceptual measures of worker job satisfaction, motivation, and perceived stress, which could potentially moderate the relationship between contracting out and worker outcomes.

Further research on the human perspective could examine how contracting out influences public organizations as workplaces. Here, we can theoretically expect both efficiency improvements due to the external competitive pressure introduced via the tendering of contracts (Brunjes 2020), and declining productivity due to a poorer person–environment fit after contracting out (Petersen et al. 2022). Another important task for future research lies in linking contracting out, changing working conditions, and efficiency in service delivery. Such measures should include both production costs and the transaction costs of preparing, negotiating, and monitoring third-party contracts (Brown, Potoski, and Van Slyke 2016). Extending our study, future research should also attempt to link potential cost savings in the contracting organization with increasing expenditures for government income transfers for workers who become unemployed. Such a perspective has potential to combine economic rationales of contracting out with a human resource perspective and

thereby provide a more nuanced understanding of the aggregate societal and human consequences of contracting practices in public organizations.

Data Availability

The data is stored on Statistics Denmark servers and cannot be made publicly available for privacy and legal reasons. Employees at Danish Universities can apply for access to Statistics Denmark's microdata.

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[1] Other alternatives have been tried for our matching exercise. CEM with only job type yielded equivalent results, but the parallel-trend assumption was better met in the primary model as pre-trend levels were more similar in our preferred model. The main results with the alternative matching procedure are available in the online appendix, figure A9-A11. We also tried exact matching on all variables, but this matching procedure heavily reduced our sample size.

[2] Our sample size does not allow us to conduct the analysis for each industry that underwent contracting out. When using matching procedures, we have taken care of potential distortion caused by the multiorganizational character of our study.

[3] We do not show T0 (the year of transfer), because it is a mixture of public and private effects and due to rules of anonymity set by our data provider.

[4] The income and employment data have been corrected for a one-time payment that some treated employees received due to specific terms in their working contracts. We identified this one-time payment by applying the following rules: Income had to be twice the size of the previous month, with working hours being the same or lower than 1.5 times the previous month. When these one-time payments occurred, we used the income and work hours from the previous month.

[5] This variable could also be called skills/qualification, given the way in which we operationalize it. We keep the term 'skills' for simplicity, as often done in the literature.

[6] To avoid losing observations, we merged and inserted these cases in the medium skill group, which we denote medium skilled workers because practically all workers in the group have that level of skills.

[7] Since the data on benefits was not provided for 2020, the analysis of benefits uses the full treatment group to calculate the change from T-1 to T1 and the reduced treatment group in the analysis from T-1 to T2 and to T5.

[8] In the long-term analysis, we note that the trend from T-2 to T1 is different from the short- and medium-term analysis. As noted in the method and data section, this difference is due to the reduced sample size in the long-term analysis.

Online Appendix

Table A1. Treatment and Control Group Characteristics with and without CEM-weights

Variable	Category	Control	Treatment	Control	Treatment
		Without weights		With weights	
Job Type	Property inspectors	5.116 (14%)	142 (36%)	13.073 (36%)	142 (36%)
	Social and health assistants	6.867 (19%)	44 (11%)	4.050 (11%)	44 (11%)
	Office work	10.423 (29%)	22 (6%)	2.025 (6%)	22 (6%)
	Canteen work	812 (2%)	16 (4%)	1.473 (4%)	16 (4%)
Gender	Men	8.090 (23%)	255 (65%)	23.477 (65%)	255 (65%)
	Women	27.816 (77%)	135 (35%)	12.429 (35%)	135 (35%)
Education	Elementary school	5.075 (14%)	80 (21%)	7.365 (21%)	80 (21%)
	High school	3.135 (9%)	23 (6%)	2.118 (6%)	23 (6%)
	Vocational training	22.112 (62%)	252 (65%)	23.201 (65%)	252 (65%)
	Qualifying exam	3 (0%)	1 (0%)	92 (0%)	1 (0%)
	Short higher education	488 (1%)	10 (3%)	921 (3%)	10 (3%)
	Medium higher education	4.472 (12%)	13 (3%)	1.197 (3%)	13 (3%)
	Bachelor’s degree	25 (0%)	4 (1%)	368 (1%)	4 (1%)
	Master’s degree	596 (2%)	7 (2%)	644 (2%)	7 (2%)
	Ph.D.	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Age	Average	45.06	47.6	47.3	47.6
	Standard deviation	12.08	11.73	11.39	11.73
	Total	35.906 (100%)	390 (100%)	35.906 (100%)	390 (100%)

Note: The treatment and control groups contain 55 different job types. However, in this table we only show the four most common job types.

Table A2. Work Income in Percentages

	T-1 to T1	T-1 to T2
Overall	0.5 (0.706)	-7.9 (0.000)
Low skills	-2.6 (0.407)	-9.6 (0.004)
Medium skills	1.5 (0.328)	-7.4 (0.000)
Men	3.4 (0.053)	-4.8 (0.022)
Women	-5.7 (0.007)	-14.6 (0.000)
Men with low skills	2.2 (0.543)	-6.9 (0.107)
Women with low skills	-11.9 (0.030)	-15.1 (0.005)
Men with medium skills	3.8 (0.058)	-4.1 (0.085)
Women with medium skills	-3.6 (0.078)	-14.5 (0.000)
Age 20-29	-18.3 (0.042)	-29.2 (0.001)
Age 30-59	0.9 (0.555)	-6.2 (0.002)
Age 60-69	8.2 (0.000)	-4.9 (0.295)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Table A3. Employment in Percentages

	T-1 to T1	T-1 to T2
Overall	-3.3 (0.005)	-9.0 (0.000)
Low skills	-5.3 (0.021)	-11.0 (0.001)
Medium skills	-2.7 (0.048)	-8.4 (0.000)
Men	-1.5 (0.281)	-7.0 (0.000)
Women	-7.1 (0.000)	-13.3 (0.000)
Men with low skills	-1.8 (0.498)	-8.8 (0.023)
Women with low skills	-11.7 (0.005)	-15.0 (0.007)
Men with medium skills	-1.4 (0.390)	-6.5 (0.005)
Women with medium skills	-5.5 (0.016)	-12.9 (0.001)
Age 20-29	-12.2 (0.106)	-21.3 (0.008)
Age 30-59	-2.9 (0.020)	-8.1 (0.000)
Age 60-69	2.1 (0.426)	-3.1 (0.553)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Table A4. Income Transfers in Percentages

	T-1 to T1
Overall	38.9 (0.000)
Low skills	37.2 (0.122)
Medium skills	41.1 (0.001)
Men	57.7 (0.006)
Women	21.1 (0.060)
Men with low skills	63.8 (0.296)
Women with low skills	14.9 (0.395)
Men with medium skills	55.8 (0.006)
Women with medium skills	26.4 (0.066)
Age 20-29	-12.3 (0.242)
Age 30-59	54.3 (0.001)
Age 60-69	66.5 (0.084)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Table A5. Parallel Trends in Work Income

	T-2 to T-1
Overall	-390.8 (0.397)
Low skills	1,272.5 (0.148)
Medium skills	-983.3 (0.067)
Men	-509.1 (0.314)
Women	-176.0 (0.849)
Men with low skills	-430.2 (0.669)
Women with low skills	3,842.3 (0.013)
Men with medium skills	-525.7 (0.370)
Women with medium skills	-1,927.4 (0.084)
Age 20-29	1,623.7 (0.450)
Age 30-59	-548.3 (0.291)
Age 60-69	-238.1 (0.789)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Table A6. Parallel Trends in Employment

	T-2 to T-1
Overall	-1.05 (0.451)
Low skills	1.11 (0.718)
Medium skills	-1.83 (0.236)
Men	-2.54 (0.094)
Women	1.77 (0.530)
Men with low skills	-4.00 (0.258)
Women with low skills	8.76 (0.110)
Men with medium skills	-2.10 (0.207)
Women with medium skills	-1.28 (0.695)
Age 20-29	7.93 (0.333)
Age 30-59	-1.64 (0.266)
Age 60-69	-1.49 (0.499)

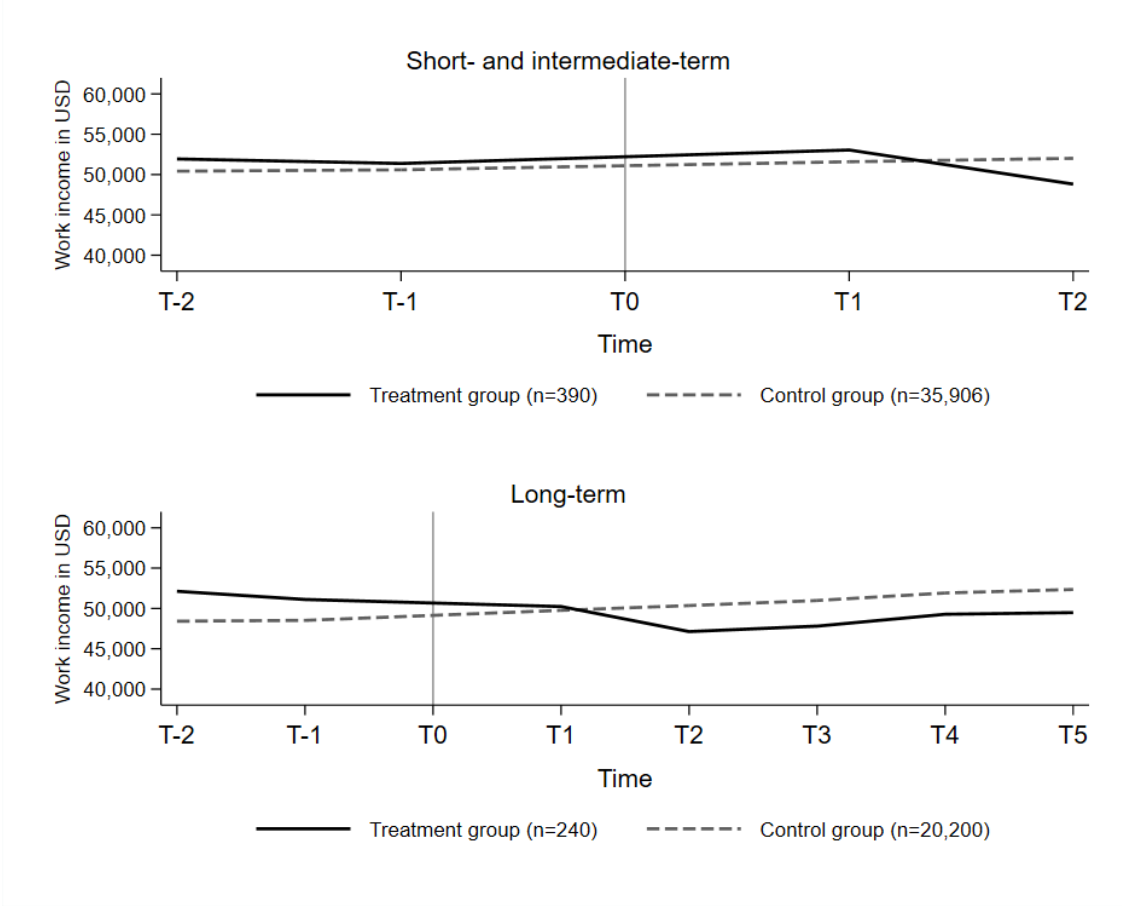
Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

Table A7. Parallel Trends in Income Transfer

	T-2 to T-1
Overall	66.1 (0.751)
Low skills	-5.9 (0.986)
Medium skills	91.1 (0.721)
Men	38.9 (0.878)
Women	122.8 (0.734)
Men with low skills	357.5 (0.312)
Women with low skills	-552.7 (0.413)
Men with medium skills	-65.6 (0.836)
Women with medium skills	417.4 (0.330)
Age 20-29	900.3 (0.312)
Age 30-59	-20.3 (0.934)
Age 60-69	-235.7 (0.405)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

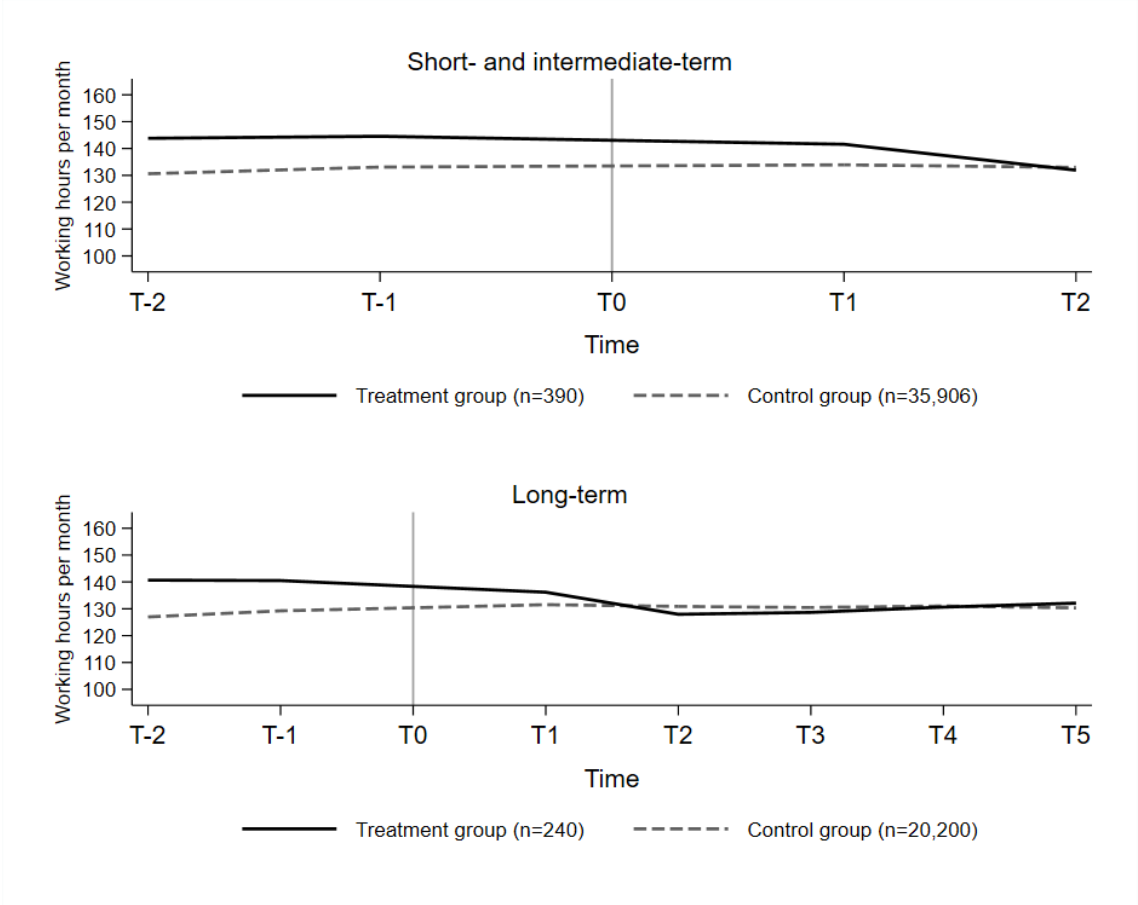
Figure A1. Short-, Intermediate-, and Long-Term Changes in All Work Income



T-1 to T1	T-1 to T2	T-1 to T5
-672.1 (0.378)	-3985.0 (0.000)	-5464.4 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

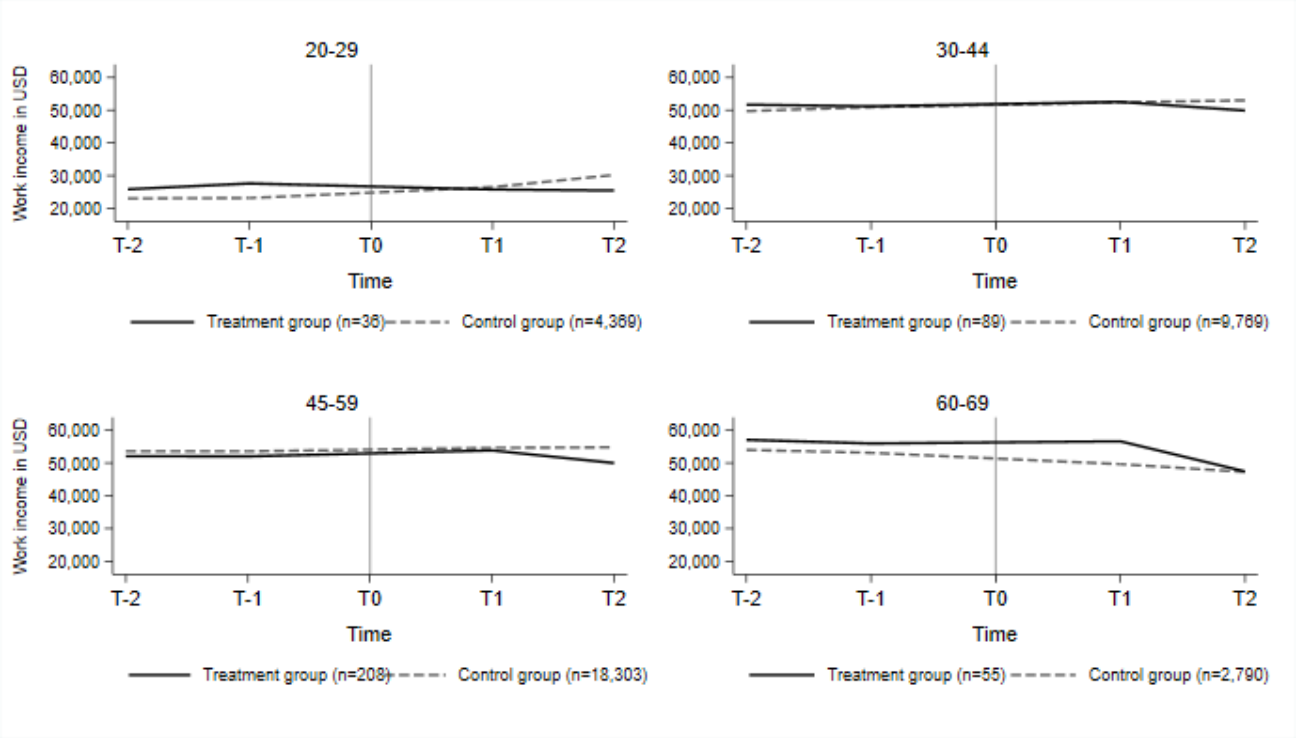
Figure A2. Short-, Intermediate-, and Long-Term Changes in All Employment



T-1 to T1	T-1 to T2	T-1 to T5
-3.8 (0.031)	-12.5 (0.000)	-9.5 (0.016)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

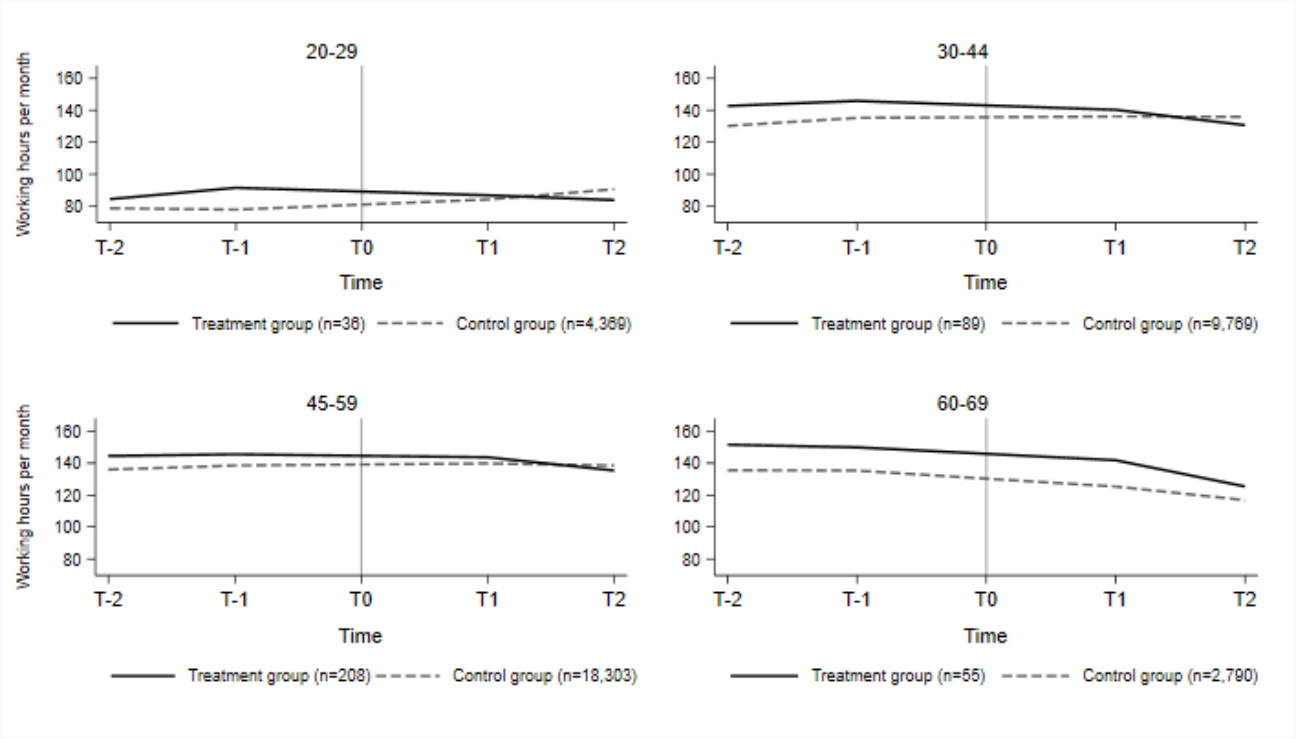
Figure A3. Contracting Out and Work Income Moderated by Age (four groups)



	T-1 to T1	T-1 to T2
Age 20–29	–5,166.5 (0.067)	–9,208.7 (0.002)
Age 30–44	–127.3 (0.942)	–3,366,62 (0.122)
Age 45–59	730.1 (0.447)	–3,291.5 (0.005)
Age 60–69	4,128.7 (0.006)	–2,730.5 (0.265)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

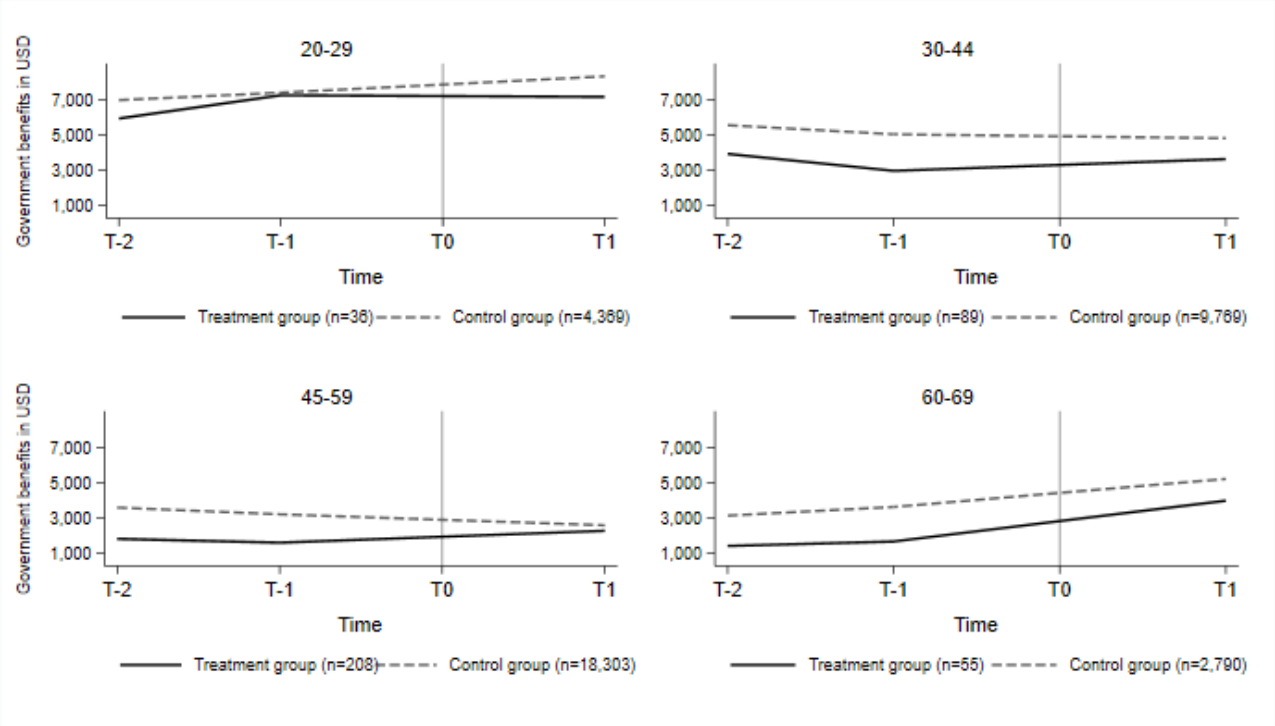
Figure A4. Contracting Out and Employment Moderated by Age (four groups)



	T-1 to T1	T-1 to T2
Age 20–29	–11.0 (0.158)	–20.5 (0.017)
Age 30–44	–6.5 (0.103)	–15.8 (0.002)
Age 45–59	–3.2 (0.116)	–10.2 (0.001)
Age 60–69	1.9 (0.661)	–6.0 (0.398)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

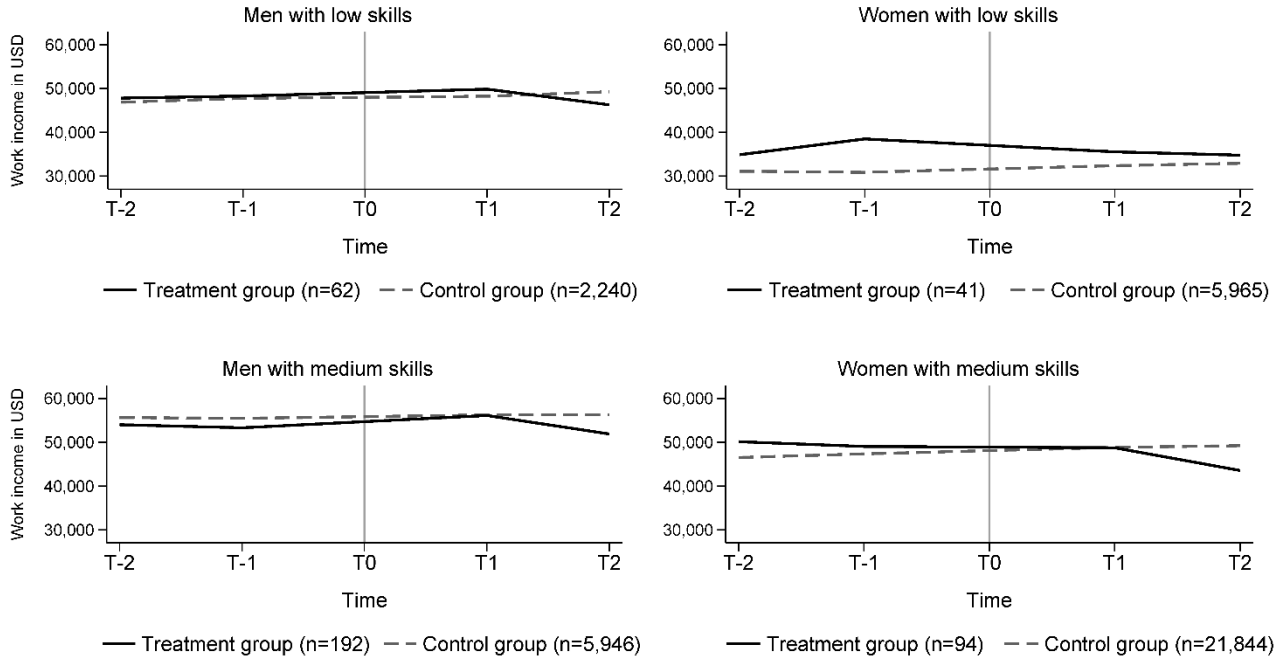
Figure A5. Contracting Out and Income Transfer Moderated by Age (four groups)



	T-1 to T1
Age 20–29	–1,021.9 (0.242)
Age 30–44	897.9 (0.173)
Age 45–59	1301.3 (0.000)
Age 60–69	725.0 (0.340)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

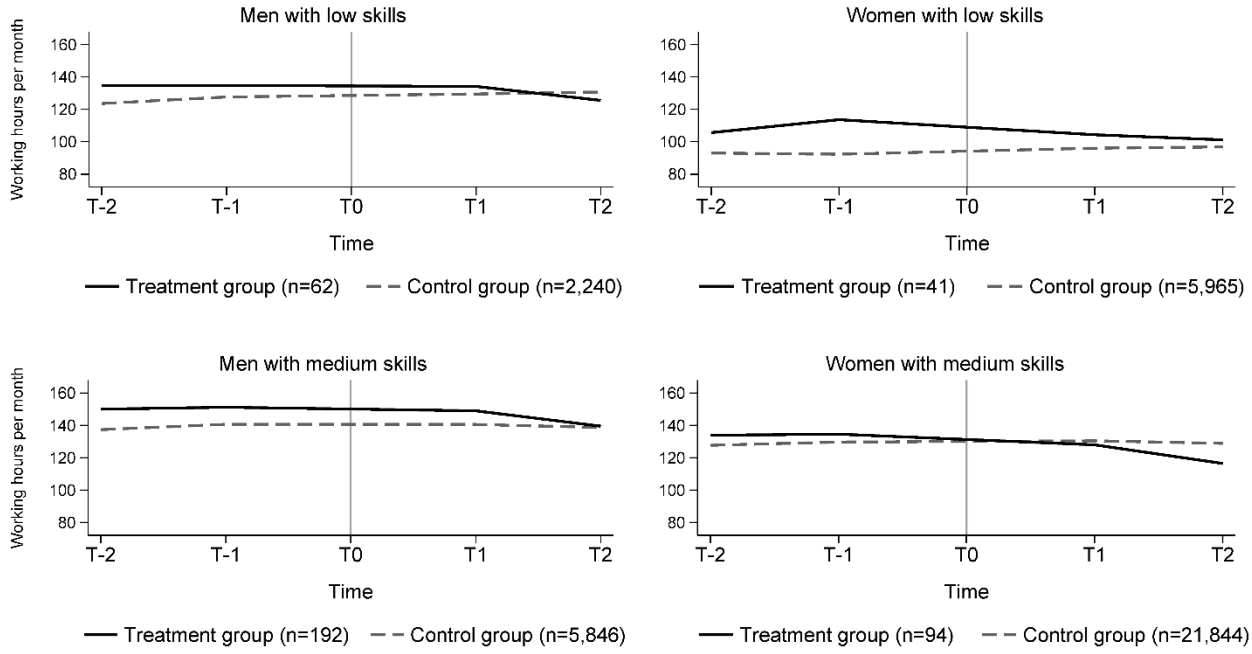
Figure A6. Contracting Out and Work Income Moderated by Employee Skills and Gender



	T-1 to T1	T-1 to T2
Men with low skills	1,101.4 (0.547)	-3,506.6 (0.098)
Women with low skills	-4,473.5 (0.044)	-5,756.4 (0.017)
Men with medium skills	2,030.7 (0.075)	-2,245.4 (0.087)
Women with medium skills	-1,775.4 (0.095)	-7,351.8 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

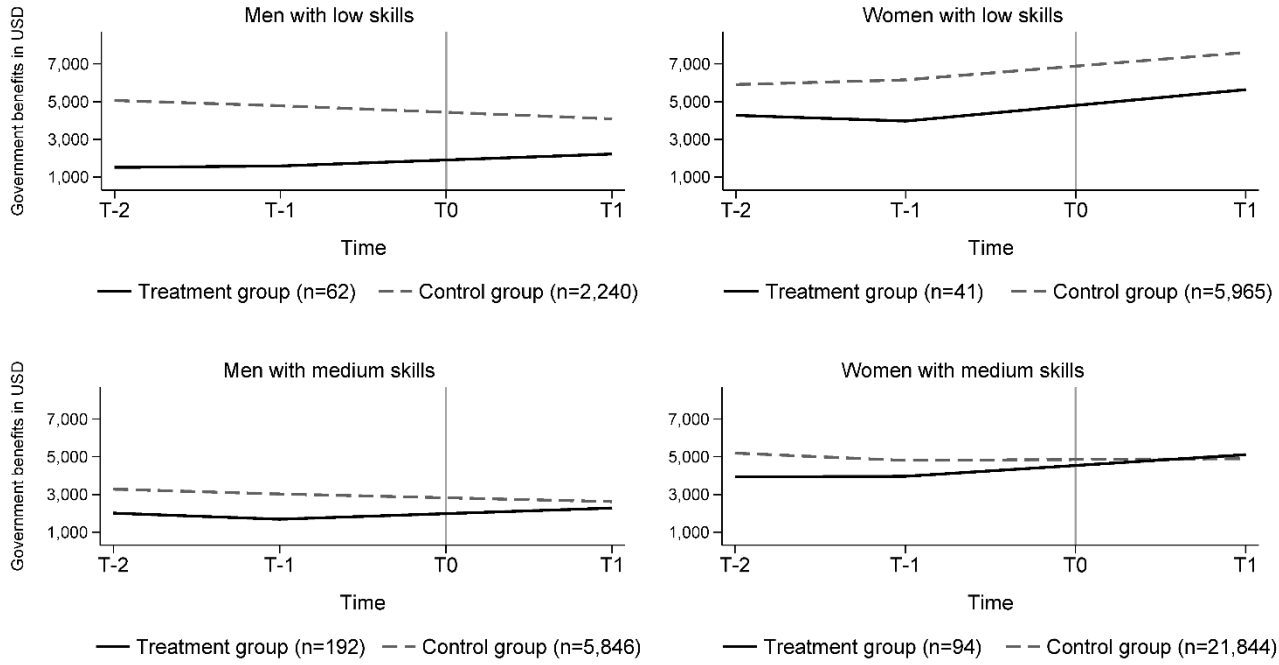
Figure A7. Contracting Out and Employment Moderated by Employee Skills and Gender



	T-1 to T1	T-1 to T2
Men with low skills	-2.4 (0.535)	-12.2 (0.021)
Women with low skills	-13.1 (0.011)	-17.0 (0.013)
Men with medium skills	-2.1 (0.405)	-9.8 (0.004)
Women with medium skills	-7.4 (0.020)	-17.3 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

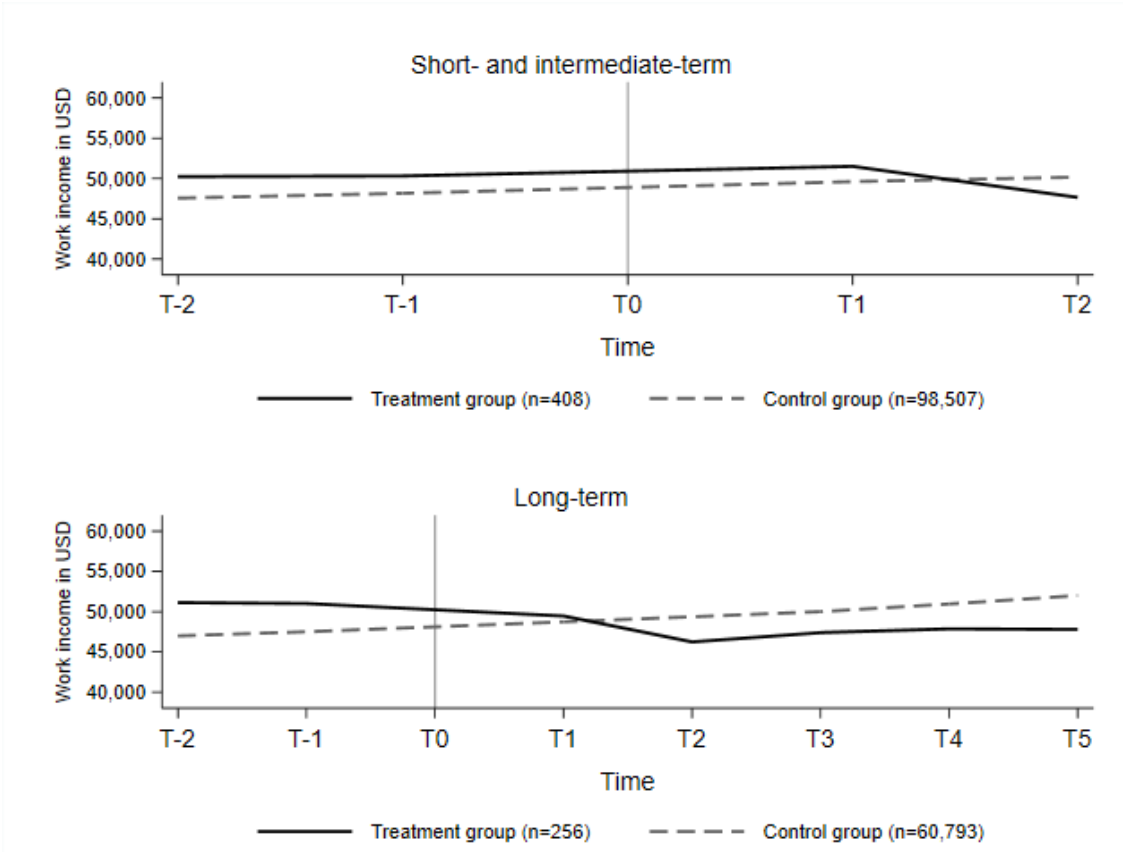
Figure A8. Contracting Out and Income Transfer Moderated by Employee Skills and Gender



	T-1 to T1
Men with low skills	1,330.1 (0.137)
Women with low skills	213.2 (0.816)
Men with medium skills	994.1 (0.003)
Women with medium skills	1,051.7 (0.070)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type, gender, education, and age.

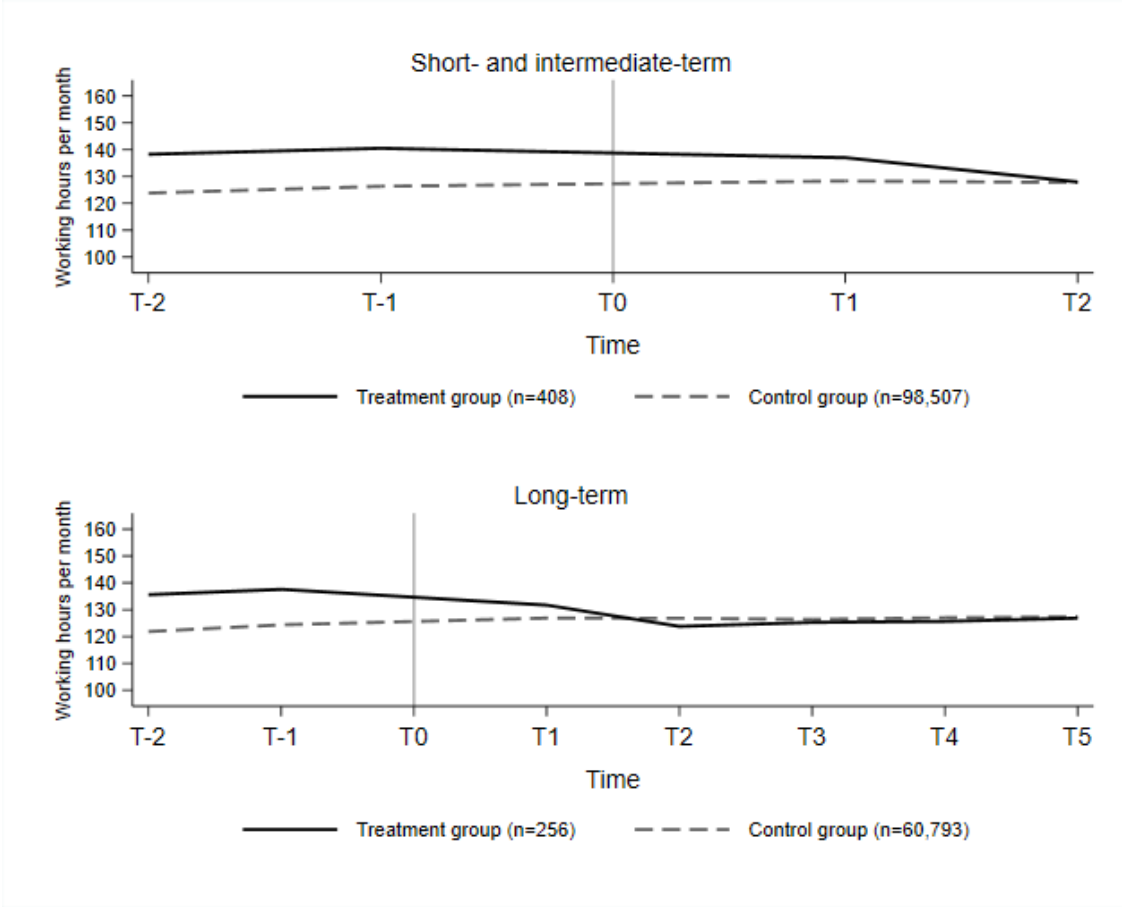
Figure A9. Changes in Work Income but Only Matched on Job Type



T-1 to T1	T-1 to T2	T-1 to T5
-256.9 (0.710)	-4667.2 (0.000)	- 7721.7 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type.

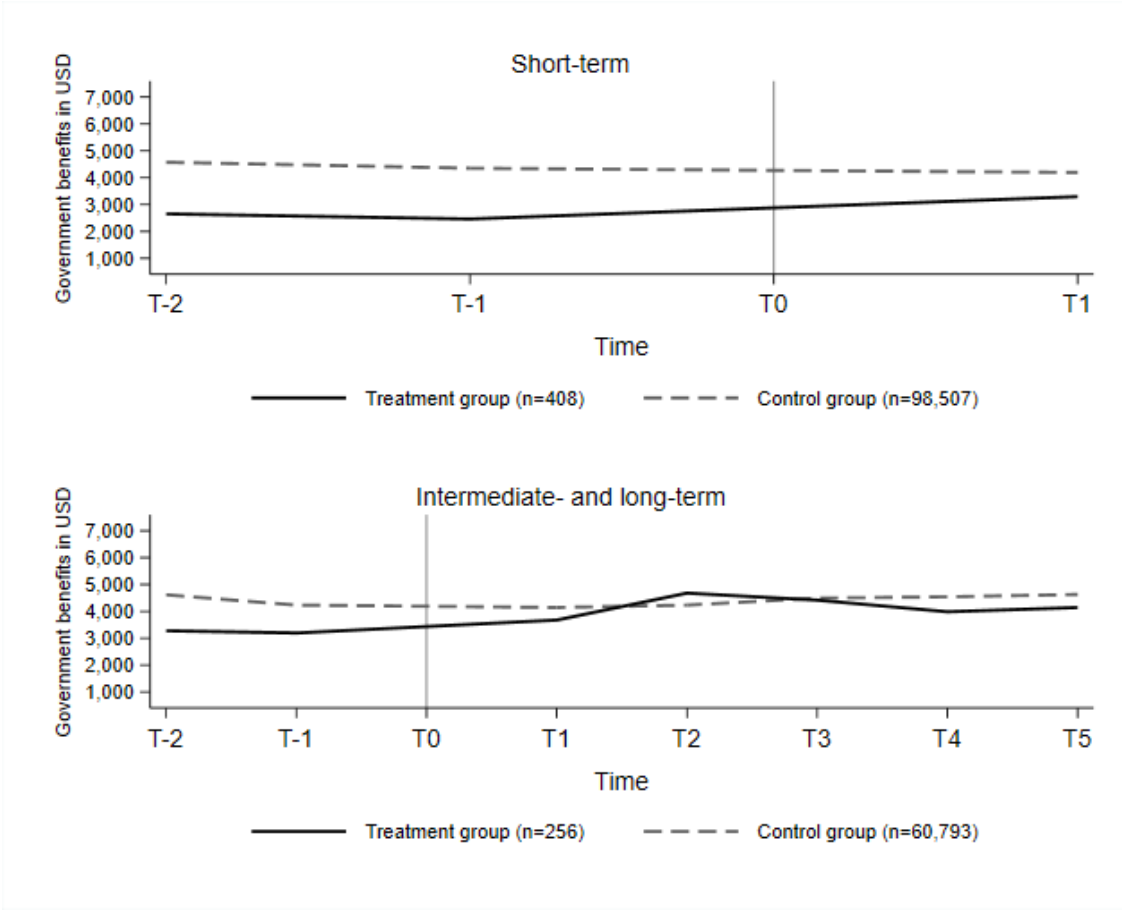
Figure A10. Changes in Employment but Only Matched on Job Type



T-1 to T1	T-1 to T2	T-1 to T5
-5.5 (0.001)	-14.0 (0.000)	-13.7 (0.000)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type.

Figure A11. Changes in Income Transfers but Only Matched on Job Type



T-1 to T1	T-1 to T2	T-1 to T5
-990.6 (0.000)	-1486.5 (0.006)	-554.0 (0.353)

Note: Cells contain DiD coefficients (p-values in parentheses). Treatment and control groups matched on job type.