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# Who Bears the Cost? High-Frequency Evidence on Minimum Wage Effects and Amenity Pass-Through in Spot Labor Markets

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**Abstract**

This paper provides causal evidence on the short-run effects of minimum wage hikes in a spot labor market, using confidential contract-level data from Timee, a Japanese job-matching platform. Leveraging high-frequency variation and a bin-level difference-in-differences design, we find a 2 percentage point decline in employment within affected wage bins, with losses concentrated below the new threshold. Transportation reimbursement—a flexible non-wage amenity—remains largely unchanged, indicating limited pass-through. These findings suggest that spot labor markets adjust rapidly through wage compliance, with the cost burden borne by establishments rather than offset through reductions in job amenities.

**Keywords**: Minimum wage, Employment, Job amenity, Gig worker, Spot work, Difference-in-differences

**JEL code**: J21, J23, J38, J88

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# 1 Introduction

The gig economy, characterized by temporary, contract-based, and freelance online jobs rather than permanent positions, has witnessed rapid growth in recent years. An increasing share of freelance workers is now matched with customers through online platforms.[1] Despite the growing significance of the gig economy, research on the effects of minimum wage hikes within this context remains limited, with a few notable exceptions (Glasner 2023). In particular, there is a lack of studies examining alternative work arrangements (Mas and Pallais 2020), especially spot labor markets for jobs requiring minimal skills and the workers who take them.

In this paper, we use confidential, contract-level data from Timee, a Japanese spot labor market platform, to provide causal evidence on the effects of minimum wage hikes on short-term employment and transportation reimbursements. The former captures the immediate response of firms to minimum wage increases, while the latter, as an easily adjustable nonwage amenity, enables us to examine potential pass-through effects of minimum wage changes on broader compensation structures beyond base wages. Understanding these two outcomes is essential for capturing the impact of minimum wage hikes, as they reflect both the direct and indirect margins through which firms adjust labor conditions in response to wage floor policies.

To study minimum wage impact in the short-term, spot labor markets exhibit three ideal features: limited heterogeneity in labor, short-term employment contracts, and a wage-posting environment. First, limited job heterogeneity attracts workers seeking jobs that require minimal skills, who are particularly susceptible to minimum wage changes. These workers are matched to homogeneous spot jobs, making these markets closely resemble homogenous labor markets. Second, short-term employment contracts enable labor demand to adjust easily. Employers in the spot labor market are expected to be more elastic with respect to workers' wages than in the general labor market because they do not recruit for full-time jobs but for temporary jobs as needed. Our spot work data captures an extreme case of short-term labor demand adjustment, a phenomenon rarely observed in the empirical literature on the labor supply of taxi and Uber drivers (Angrist *et al.* 2021, Buchholz *et al.* 2023). Finally, the wage-posting environment precludes wage bargaining which is a common modelling assumption in the long-term employment contract, allowing us to focus on models grounded in monopsonistic or oligopsonistic labor market structures.

The advantage of our data lies in its ability to capture high-frequency and flexible dynamics in the spot labor market. First, the data are recorded at the daily level with associated click logs and user activity, allowing us to precisely track job posting activity immediately before and after the implementation of the new minimum wage. This granularity is substantially finer than the month-state level used in Sabia (2009a,b), Brochu *et al.* (2025), and Melo *et al.* (2025) or the quarter-state level in Addison *et al.* (2009) and Cengiz *et al.* (2019), enabling a more detailed view of temporal

[1] For instance, Kässi and Lehdonvirta (2018) report that the demand for online gig work grew by approximately 21% between 2016 and 2018, based on an analysis of open projects and tasks on various platforms.

labor market adjustments. Second, because establishments can easily modify job descriptions at the time of posting, we are able to observe short-term adjustments not only in wages but also in nonwage amenities, enabling a direct analysis of potential pass-through effects. While Dube and Lindner (2024) provides some examples of direct evidence on fringe benefits such as health insurance coverage and working conditions, such amenities are rarely observable in administrative data. In contrast, our setting allows us to track changes in transportation reimbursement—an easily adjustable amenity—with high temporal resolution, offering novel insight into short-run employer responses beyond wages. Third, since spot labor demand is not tied to long-term employment relationships, it is less affected by factors such as reputation concerns or switching costs, making it an ideal setting for identifying immediate behavioral responses to policy changes.

From a macroeconomic perspective, we first report a significant expansion of the private platform in the labor market for part-time spot employment between December 2019 and December 2023. The number of registered users, primarily unemployed individuals actively using the platform, increases gradually, while the number of vacancies grows sharply, particularly after 2022, leading to a rise in the labor market tightness ratio. Hiring counts show a substantial upward trend beginning in 2020, reflecting a substantial increase in successful job matches. The job-finding rate also steadily surpasses 1.0, indicating that each active worker matches with multiple spot vacancies per month. Meanwhile, the worker-finding rate remains stable at approximately 0.8, suggesting that 80% of spot jobs are successfully filled. These trends highlight the platform's growing role in facilitating part-time spot employment matching.

Using granular spot work platform data, as an illustrative example, we examine how Tokyo's minimum wage adjustment in 2023 reshaped employment patterns at the intensive margin of job characteristics. This uniquely detailed dataset allows us to track daily, weekly, and monthly shifts in employment distribution across wage levels, posted working hours, and transportation reimbursement. Descriptive evidence reveals a clear upward shift in wage distribution around the new minimum wage threshold, consistent with firms adjusting wages to comply with the new policy. In contrast, working hours and transportation reimbursement remained largely stable, suggesting limited pass-through of the policy to other job attributes. These fine-grained patterns highlight the value of high-frequency, contract-level data in capturing the immediate and heterogeneous responses of firms to labor market regulations, and they motivate a causal analysis to isolate the impact of the minimum wage change from broader trends.

Given the motivational data patterns, we employ a difference-in-differences (DID) framework inspired by Dustmann *et al.* (2022), which leverages variation in exposure to the minimum wage increase across wage bins. Rather than identifying treated workers based on demographic or job characteristics, we exploit the wage distribution itself, comparing employment outcomes in wage bins near the new minimum wage threshold with those in the upper tail of the distribution, which are assumed to be unaffected. We define treatment and control groups based on their relative

position to the minimum wage in each prefecture, enabling a consistent bin-level comparison over time. This granular approach is well suited to our setting, as it fully utilizes spot work platform data aggregated at the prefecture-month-wage-bin level. By estimating dynamic effects through interactions of relative time and exposure group indicators, we can trace the evolution of treatment effects before and after the policy change. To summarize these effects across the distribution, we implement the "excess-jobs-minus-missing-jobs" decomposition following Cengiz *et al.* (2019), and further compute employment elasticities and changes in the average wage for affected workers.

Our findings reveal that the impact of the minimum wage increase on employment in the lower end of the wage distribution. We find that the increase resulted in approximately 2 percentage point decline in total employment among wage bins directly affected by the policy, with a 3 percentage point reduction in jobs below the new minimum wage and a 1 percentage point increase just above it. Consistently, the employment elasticity with respect to minimum wages computed from Cengiz *et al.* (2019) is $-0.387$. These effects materialize immediately after the policy takes effect and remain stable throughout the post-reform period. Unlike evidence from broader labor markets where excess jobs offset missing jobs (Cengiz *et al.* 2019), our setting shows that missing jobs consistently exceed excess jobs, resulting in a net negative employment effect. These results support the view that the spot labor market adjusts quickly to minimum wage hikes, primarily through employment reallocation.

We next examine whether firms adjust non-wage job attributes, focusing on transportation reimbursement as an easily adjustable amenity. Our analysis shows that the average effect on the amount of transportation reimbursement as an intensive margin and the probability of providing the reimbursement as an extensive margin are statistically significant but economically negligible, peaking at just around 0.1 percentage points. The distributional impact across wage bins also remains small, with no systematic pattern of reallocation. This suggests that while firms comply with the new wage floors, they do not meaningfully reduce or alter ancillary benefits such as transportation reimbursement. Taken together, the findings imply that minimum wage increases in the spot labor market lead to compliance-driven wage adjustments with limited spillover into other margins such as nonwage amenity. Importantly, our analysis provides the first direct evidence that, in the short run, the cost burden of minimum wage hikes in this setting is absorbed by the demand side of the spot labor market—the establishments themselves—rather than being offset through reductions in job amenities.

From the platform's viewpoint, we show that total earnings on the platform remained stable before and after the minimum wage hike, with a modest increase afterward. This suggests that the policy did not reduce overall platform revenue. Instead, the composition of contracted payments shifted toward higher hourly wages, while working hours stayed constant and the number of matches declined slightly.

Finally, we use our approach to estimate the effect of minimum wage increases on specific

occupational subgroups. By leveraging high-frequency vacancy data across diverse job types, we detect meaningful variation in how employment adjusts within the wage distribution across occupations. The most noticeable reductions in low-wage employment are concentrated in sectors such as restaurants, retail, and event staffing, while other occupations—including logistics, customer service, and light work—exhibit more balanced patterns with offsetting gains. Importantly, in office work, we find evidence of upward shifts in job postings, suggesting that employers may be attempting to upgrade their workforce quality by attracting more capable workers — what appears to be a "quality jump" in response to rising labor costs. These patterns highlight how even modest policy changes can lead to occupational reallocation and qualitative shifts in job structure.

## 1.1 Related Literature

Our paper relates to three distinct literature: the employment effects of minimum wage increases on spot labor market, the relationships between minimum wage hikes and non-wage job amenities, and short-term employer responses to wage hikes.

First, our paper contributes to the nascent literature on alternative work arrangements (Mas and Pallais 2020), focusing on labor markets with greater frequency and flexibility than classical labor markets. A key distinction between spot work platforms and gig work platforms studied in Glasner (2023) is the skill requirement of workers: while gig work platforms often involve high-skill tasks such as programming or design, spot work typically requires minimal skills and can be accessed by a broader range of workers. This study is the first to estimate the effects of minimum wage increases on employment in spot labor markets.

Alternative work arrangements facilitated by online platforms have grown significantly in recent years (Katz and Krueger 2019). In spot labor markets, employers post job openings on online platforms specifying the dates and nature of the work, while workers apply for postings based on their availability. These jobs, often requiring minimal skill and training, are frequently compensated at minimum wage levels. As such, the majority of workers and establishments in spot labor markets are directly affected by minimum wage policies and spillover effects of minimum wage are limited.[2] We find clear negative employment effects and limited spillover effects compared by Lee (1999), Autor *et al.* (2016), and Cengiz *et al.* (2019).

Second, this paper contributes to the literature on the relationship between minimum wage hikes and non-wage job amenities (Mas 2025). While many studies of minimum wages explore their impact on employment, they do not explore their impact on non-wage amenities, which are wage offsets.[3] Even when the minimum wage increases, firms may adjust their labor costs by

[2]With similar contexts, Adams-Prassl *et al.* (2020), Melo *et al.* (2025) investigate the effect of minimum wage hikes on vacancy in online platforms.

[3]Many studies analyzing the impact of minimum wages on employment focus on specific age groups (Card 1992, Neumark and Wascher 1992, Allegretto *et al.* 2011, Neumark *et al.* 2014, Allegretto *et al.* 2017), or specific industry sectors (Katz and Krueger 1992, Card and Krueger 1994, Dube *et al.* 2010). In recent years, a growing

reducing spending on non-wage amenities to offset higher wage expenses (Clemens 2021). Although research on minimum wages has advanced in the 21st century, empirical evidence on their influence over non-wage benefits (e.g., job amenities) remains limited (Dube and Lindner 2024). For instance, Harasztosi and Lindner (2019) find no clear effect of minimum wage hikes on fringe benefits in Hungary. By contrast, Marks (2011), Meiselbach and Abraham (2023), and Clemens *et al.* (2018) investigate minimum wage increases in relation to employer-provided health insurance and document modest negative effects on coverage among low-skilled workers. This paper investigates the causal impact of minimum wage increases on transportation reimbursement, as an easily adjustable non-wage amenity. Our analysis finds that such increases have limited effects on transportation reimbursement, consistent with previous studies such as Brown (1999), Simon and Kaestner (2004), and Harasztosi and Lindner (2019), suggesting that minimum wage policies may not significantly influence non-wage amenities.[4]

Third, this paper investigates "very" short-term effects of minimum wage increases by employing a novel difference-in-differences (DiD) framework inspired by Cengiz *et al.* (2019) and Dustmann *et al.* (2022), leveraging granular variation in the data.[5] Many studies estimate the impact of minimum wage policies on employment at annual or quarterly intervals, and some emphasize the importance of assessing medium- and long-term effects such as labor-capital substitution and firm exit (Neumark and Wascher 2008, Dube and Lindner 2024). However, with a few exceptions such as Brochu *et al.* (2025) and Melo *et al.* (2025), there remains limited literature examining firm responses at a more granular level—such as daily, weekly, or monthly frequencies.[6] By focusing

body of research has examined cases in which minimum wage policies appear to have limited or no measurable effects on employment (Clemens 2021, Manning 2021, Neumark and Shirley 2022). This literature also discusses methodological issues in estimating minimum wage effects (Neumark *et al.* 2014, Meer and West 2016, Allegretto *et al.* 2017, Dube and Lindner 2024, Jha *et al.* 2024), sectoral heterogeneity in labor market responses (Neumark and Wascher 2008, Cengiz *et al.* 2019), and challenges related to cohort definitions (Cengiz *et al.* 2019, Manning 2021). For a comprehensive overview, see Dube and Lindner (2024).

[4]Firm-provided training is often regarded as a form of non-wage compensation (Dube and Lindner 2024), but its relationship with minimum wage policies remains unclear. While early evidence suggests a negative effect (Hashimoto 1982), more recent studies offer mixed findings: some report no substantial impact (Grossberg and Sicilian 1999, Acemoglu and Pischke 2003, Arulampalam *et al.* 2004, Fairris and Pedace 2004, Bellmann *et al.* 2017), whereas others suggest that minimum wage hikes may reduce training opportunities (Neumark and Wascher 2001, Hara 2017). In our context, jobs are typically one-time and short-term, so firm-provided training is likely limited and not directly observable in the data. Investigating how wage regulations affect skill development, particularly in flexible or non-traditional labor markets, remains a promising avenue for future research.

[5]Our empirical strategy is based on the wage spillover from "missing jobs," which is a decrease in employment less than the new minimum wage, to "excess jobs," which is an increase in employment above the new minimum wage. Gopalan *et al.* (2021) and Brochu *et al.* (2025) also explore the impact of minimum wage employment in the same spirit as Cengiz *et al.* (2019).

[6]Sabia (2009a) and Sabia (2009b) use monthly Current Population Survey data and find negative employment effects based on specifications that regress employment on the logarithm of the minimum wage with state fixed effects and time fixed effects (often referred to as "TWFE-log(MW)"). As their approach leverages monthly variation, these estimates are essentially capturing the average monthly impact of a rising minimum wage on employment. However, these specifications are limited by the inability to test for pre-trends prior to the minimum wage increase, making it challenging to confirm that the parallel trends assumption holds. Indeed, Dube and Lindner (2024) shows that

on the exact timing of minimum wage hikes, we are able to assess whether firms comply with new wage and whether they adjust employment levels immediately. Our findings reveal that all firms comply with the new minimum wage when it increases. Furthermore, we find a steady decline in employment following these wage hikes. However, since total contracted payments remain stable, this suggests that minimum wage hikes led to a shift in the composition of employment—with fewer workers earning higher wages—without negatively affecting platform revenue.

The rest of the paper is structured as follows: Section 2 outlines the context of the spot labor market and the Japanese Minimum Wage Act with related studies. Section 3 introduces our data and illustrates motivating data patterns. Section 4 presents our identification strategy. Section 5 reports our empirical findings. Section 6 explores the heterogeneous effects across prefectures and occupations. Section 7 concludes the paper.

# 2 Background

## 2.1 Non-regular Work and Spot Work in Japan

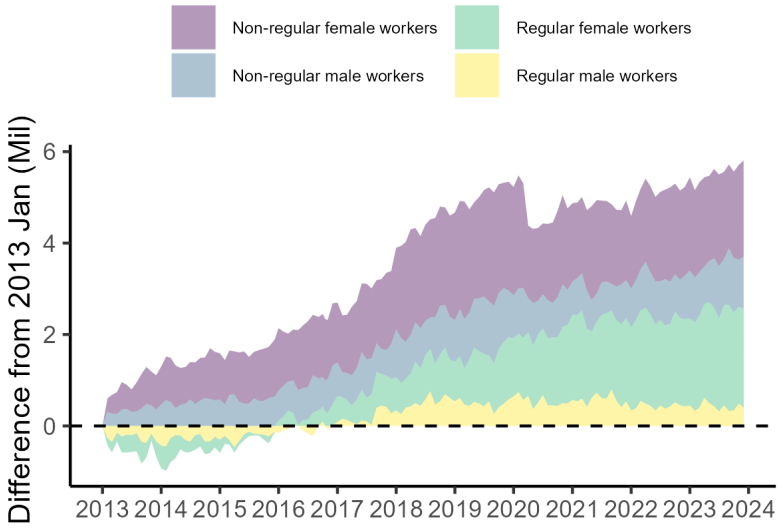
The number of non-regular workers and the significance of spot labor markets have grown considerably from 2013 to 2024 in Japan, as shown in Panels (a) and (b) of Figure 1. Panel (a) in Figure 1 shows an increasing popularity of non-regular workers. Using our spot work platform data, Panel (b) in Figure 1 shows a diverse range of job categories, with Entertainment, Food Industry, and Office Work occupying significant shares. Other categories like Event Staff, Light Work, and Professional roles also contribute to the platform's job distribution, albeit to a lesser extent. This surge suggests a growing reliance on the spot work platform for flexible employment opportunities, particularly in sectors like Entertainment and Food Industry. The steady rise across multiple categories implies an expanding spot labor market, reflecting a broadening acceptance and utilization of on-demand work arrangements in Japan.

## 2.2 Spot work platform

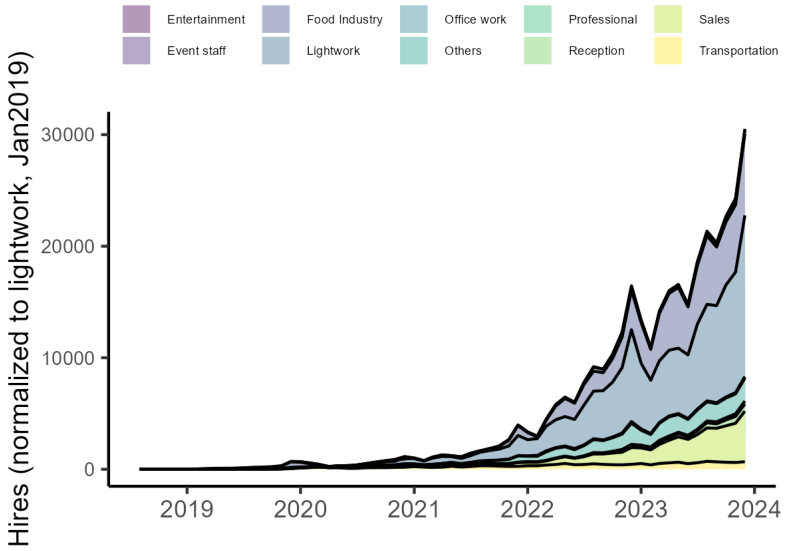
We use a term "spot work platform" to refer non-regular labor market provided by Timee, the huge online platform in Japan.[7] This platform operates as an on-demand staffing platform designed to

when the TWFE-log(MW) specification is applied to CPS data from the 1980s, the parallel trends assumption is violated, resulting in potentially biased estimates.

[7] According to the Japan Spot Work Association (JASWA), "spot work" refers to employment contracts for short-hour, one-off work engagements that are facilitated through digital platforms. These platforms serve as intermediaries that match job offers with available workers—often on a same-day or near-term basis—and rely on digital technologies to streamline the processes of matching, contracting, and compensation. JASWA plays a central role in promoting sound practices in the sector by issuing guidelines for legal compliance, offering interpretations of labor laws, and supporting proper labor management. In particular, it emphasizes the use of digital infrastructure to reduce the administrative burden traditionally associated with employment, including time tracking, wage calculation, and per-




(a) Hires, Labor force survey




(b) Hires, Spot work platform

Figure 1: Changes of Employment. National vs Spot Work Platform

Note: Panel (a) depicts the time series of job changes in Japan, standardized to January 2013. The colored areas indicate changes within specific worker groups. This graph is based on data from the Economic Survey by the Japanese Cabinet Office (see details at https://www5.cao.go.jp/keizai3/2024/0802wp-keizai/setsumei-e2024.pdf, accessed September 19, 2024). Panel (b) shows the time series of spot workers, standardized to April 2020. The vertical axis indicates the ratio relative to April 2020, and the horizontal axis shows the time (year-month). The filled areas illustrate the number of matched spot workers in each job category defined by the company. See the survey of Miyamoto (2025) for an overview of labor markets in Japan.

formance evaluation. This description draws on information provided by the association's official overview and published guidelines (https://www.jaswa.or.jp/about/; https://jaswa.or.jp/pdf/spotwork_gudeline_v2.pdf).

connect businesses with temporary workers for short-term jobs through the app. The primary users of the platform are individuals seeking flexible, task-based employment rather than long-term positions and establishments seeking for short-term workers. Workers can register on the platform for free and immediately gain access to job offers from various companies, with the platform streamlining the process of matching workers with available shifts across industries such as food, retail, and logistics.

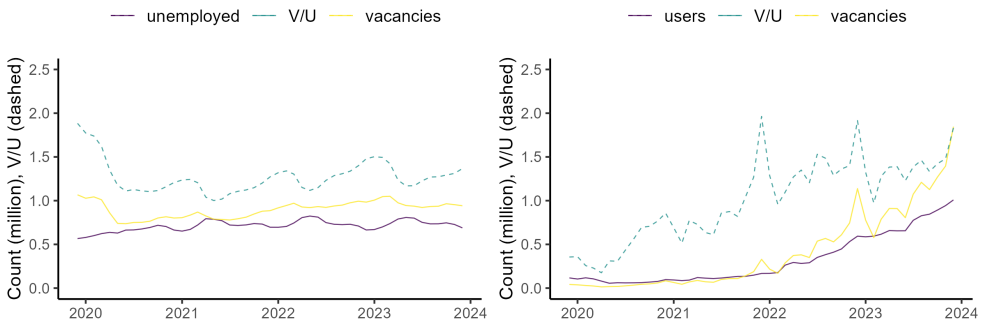
The platform's business model allows workers to browse and accept jobs without the need for a traditional hiring process. Instead of charging a subscription fee, the platform earns revenue through fees paid by the businesses utilizing the service. 30% of contracted payments are paid by businesses to the platform as revenue. This arrangement benefits both companies and workers by offering flexible, short-term employment opportunities while avoiding the formalities and commitments of long-term contracts. The platform's simplicity and immediacy are attractive particularly for workers looking to fit employment around their schedules.

Certain qualifications (nurses, caregivers, childcare workers, etc.) are required for some jobs, but these jobs are a minority of the total, and most are jobs that any worker can do. Workers in this market can apply for jobs and perform their duties without having any special human capital. Therefore, we treat this labor market as a labor market requiring minimal skills.

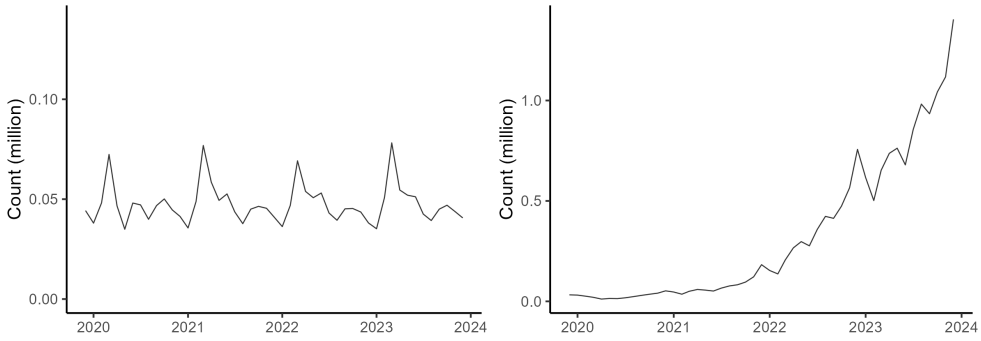
On this platform, workers may receive not only a total income from employment based on hourly wages but also transportation reimbursement. This reimbursement is intended to cover the cost of traveling to and from the workplace. However, firms are not legally required to provide such transportation reimbursement, and the decision to do so is solely at the discretion of each firm. In addition, because this reimbursement must be determined at the time of posting a job on the platform, firms often lack accurate information about the actual commuting costs incurred by workers. Moreover, workers are not required to report or return any discrepancies between their actual travel costs and the reimbursement they receive. As a result, if an increase in the minimum wage leads to higher employment costs, there is a possibility that firms may choose to offset some of these additional costs by reducing transportation reimbursement, thereby mitigating the overall negative impact of increased labor costs from minimum wage increases.

## 2.3 Institutional vs. Platform-Based Matching: Hello Work and Spot Work

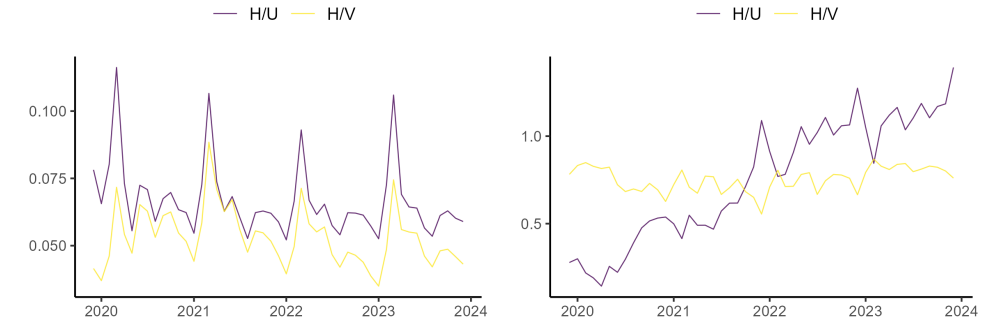
Figure 2 from Kanayama and Otani (2024) provides a comparative analysis of labor market dynamics between the Hello Work public employment platform (left panel) and a private spot work platform (right panel) from December 2019 to December 2023. Hello Work is a government-operated institution in Japan as a conventional platform that provides job seekers with part-time and full-time employment counseling, job placement services, and vocational training, playing a




(a) User $U$, vacancy $V$, and tightness $(\frac{V}{U})$




(b) Hire $H$




(c) Job and worker finding rate $(\frac{H}{U}, \frac{H}{V})$

Figure 2: Trends of Macro Variables: Hello Work Part-time (left) vs Platform (right) 2019-2023

Note: Details are in Kanayama and Otani (2024). For the left panels, we use the Report on Employment Service (*Shokugyo Antei Gyomu Tokei*) for the month-level aggregate data from December 2019 to December 2023 to capture the trends of matchings between unemployed workers and vacancies via a conventional platform. These datasets include the number of job openings, job seekers, and successful job placements, primarily sourced from the Ministry of Health, Labour and Welfare (MHLW) of Japan, which publishes monthly reports and statistical data on the Public Employment Security Office, commonly known as Hello Work. Hello Work is a government-operated institution in Japan as a conventional platform that provides job seekers with employment counseling, job placement services, and vocational training, playing a critical role in Japan's labor market.

critical role in Japan's labor market (Otani 2024b).

First, I discuss the left panel of Hello Work for part-time workers and jobs.[8] In Panel (a), the number of unemployed individuals remains stable over the observed period, hovering around 0.8 million. Vacancies and tightness ($V/U$) show stable trends. Panel (b) shows that the hiring count through Hello Work remains low, with a small oscillating pattern throughout the period. This stable but limited hiring activity suggests that the platform may face constraints or inefficiencies in increasing the job match rate for part-time workers. In Panel (c), the job and worker finding rates ($H/U$ and $H/V$) exhibit a gradual decline over time, suggesting reduced effectiveness in matching job seekers with available vacancies via Hello Work. This decline might reflect a growing preference for alternative job search methods such as the spot-work platform.

In contrast, the right panels reflect the dynamics of the private platform, where a distinctive pattern emerges. Unlike Hello Work's part-time flow from unemployed to employed, workers on this platform do not automatically leave after securing a match, which retains a larger pool of active users. The number of registered users increases gradually, while the number of vacancies rises sharply, especially post-2022, leading to a notable rise in labor market tightness ($V/U$). This reflects an expanding demand for spot employment opportunities. The hiring count in Panel (b) shows a rapid upward trajectory starting around 2022, underscoring a marked increase in successful matches.

Panel (c) illustrates the job and worker finding rates ($H/U$ and $H/V$), highlighting significant differences compared to Hello Work. The job finding rate ($H/U$) continues to rise, reaching values close to 1.3, indicating that each worker matches with multiple vacancies per month. On the other hand, the worker finding rate ($H/V$) remains stable around 0.8, suggesting that 80% of the available jobs are successfully filled. This pattern demonstrates the platform's increasing efficiency in matching workers to vacancies. It indicates a maturing spot labor market that still exhibits strong growth.

## 2.4 Minimum Wages in Japan

This section introduces the regional minimum wages set for each of the 47 prefectures in Japan, which we define as "regional minimum wages." The introduction of regional minimum wages follows the framework described by Tamada (2009) and Kawaguchi and Mori (2021). The Ministry of Health, Labor and Welfare established the Central Minimum Wage Council, which operates under the tripartite principle and consists of representatives from labor, management, and public interest groups.

The Council divides the 47 prefectures into four regional blocks based on regional welfare

[8] For full-time jobs on the public and private job matching platforms, Otani (2024a) estimates trends of matching efficiency and elasticity between 2014 and 2024. Otani (2024b) also provides the long-term trends of full-time and part-time job matchings in Hello Work between 1972 and 2024.

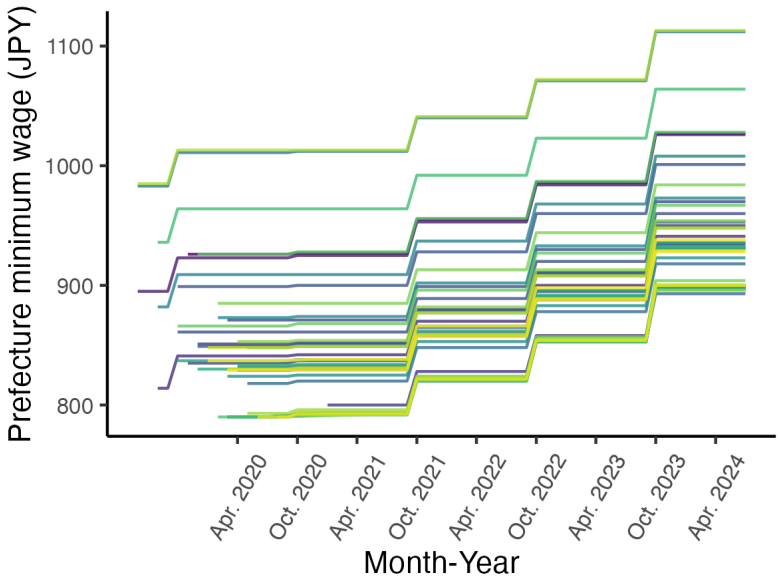



Figure 3: The Dynamics of Regional Minimum Wages Changes

Note: This describes the monthly changes of the regional minimum wages each prefectures. Until 2022, each prefecture was divided into four categories based on the average income level of its workers, and a minimum wage was assigned to each category as a guideline. Many prefectures set a wage close to this guideline as the regional minimum wage for that prefecture.

levels. It sets guidelines ("Meyasu") for the recommended increase in the hourly minimum wage for each group. These recommendations primarily reference the average annual wage increase rate for workers at workplaces with fewer than 30 regular employees, as reported in the Minimum Wage Survey. The Council typically holds its first meeting in June and finalizes the guidelines by the end of July. Based on these guidelines, the Local Minimum Wage Councils in each prefecture determine the specific minimum wage increases in August, with the revised wages coming into effect during the first week of October. This two-stage process has been implemented annually since 1978, with a few exceptions, ensuring regular increases in the local minimum wage.

The Regional Minimum Wage Act applies to nearly all workers in Japan, regardless of industry, age, or gender. However, exceptions exist where the director of the labor bureau in each prefecture deems it appropriate to pay less than the regional minimum wage.[9]

Figure 3 illustrates the changes in regional minimum wages over time. This analysis uses minimum wage variations across prefectures from 2020 to 2023. In October 2020, due to the negative employment shock caused by COVID-19, the minimum wage increased only slightly, by an average of 0.2%. However, from 2021 onwards, the minimum wage increased consistently each year, with an average increase of 4.7% in 2023. Notably, except for the period of economic

[9]Examples where it is considered appropriate to pay less than the minimum wage include: 1) individuals with significant mental or physical disabilities, 2) employees on trial periods, 3) participants in certified basic vocational training programs, 4) workers engaged in light work, and 5) those performing intermittent work.

stagnation during the COVID-19 pandemic, substantial minimum wage increases have occurred in October across all prefectures.

The minimum wage hikes in Japan are effective as a tool to increase wages (Aoyagi *et al.* 2016). However, these minimum wage increases in Japan are likely to have a negative influence on the labor market. Numerous studies have examined the impact of minimum wage policies on employment in Japan (Tachibanaki and Urakawa 2006, Yugami 2005, Kawaguchi and Mori 2009, Higuchi 2013, Kambayashi *et al.* 2013, Akesaka *et al.* 2017, Okudaira *et al.* 2019, Izumi *et al.* 2020, Kawaguchi and Mori 2021, Izumi *et al.* 2022). Many of these studies report negative employment effects for certain demographic groups (Kawaguchi and Yamada 2007, Kawaguchi and Mori 2009, Kambayashi *et al.* 2013, Akesaka *et al.* 2017, Okudaira *et al.* 2019, Kawaguchi and Mori 2021, Izumi *et al.* 2022). For example, Kawaguchi and Mori (2021) examine the employment effects of minimum wages by leveraging the 2007 reform of Japan's Minimum Wage Act.[10] They find that the employment elasticity of the minimum wage for less-educated young men is -1.2. This implies that although the minimum wage in Japan affects only certain demographic groups, the magnitude of its impact can be larger than what is observed in other countries.

# 3 Data

## 3.1 Data source and data construction

We base our analysis on spot work-level records from a Japanese platform operated by a private company that facilitates the matching of spot workers and employers. This dataset allows us to analyze the short-term effects of minimum wage changes on the employment of workers with minimal skills.

We aggregate the contract-level data to calculate key metrics at the prefecture-month-wage-bin and prefecture-month level, including the number of job postings (vacancies), the number of matches (employment), and transportation reimbursements as an amenity. Unlike Dustmann *et al.* (2022), there is no difference between actual and contractual working hours, which is an advantageous point in our data. The dataset also includes detailed characteristics of employers, such as their industry, occupation, and geographic information (prefecture, municipality, longitude, and latitude). This rich dataset enables a comprehensive and heterogeneity analysis of how minimum wage changes impact the short-term dynamics of spot labor markets.

[10]This reform mandated that monthly minimum wage earnings must meet or exceed monthly public assistance levels. Prefectures where minimum wages fell below public assistance thresholds experienced substantial increases. Using the difference between public assistance levels and monthly minimum wage earnings in 2006 as an instrumental variable, they estimate the local average causal effect of the minimum wage on employment during the years following the reform. This approach has since been applied in several studies (Okudaira *et al.* 2019, Mizushima and Noguchi 2021, Yamagishi 2021, Izumi *et al.* 2022).

## 3.2 Summary statistics

Table 1: Summary Statistics

(a) Contract Level

| | N | mean | median | sd | min | max |
|---|---|---|---|---|---|---|
| Hourly wage | 8676859 | 1086.00 | 1100.00 | 123.12 | 853.00 | 2000.00 |
| Working hour | 8676859 | 4.79 | 4.50 | 1.84 | 1.00 | 16.00 |
| Transportation reimbursement (JPY) | 8676859 | 404.66 | 500.00 | 255.20 | 0.00 | 1500.00 |

(b) Prefecture-month-wage-bin Level

| | N | mean | median | sd | min | max |
|---|---|---|---|---|---|---|
| Employment | 61584 | 191.50 | 0.00 | 1789.66 | 0.00 | 83132.00 |
| Vacancy | 61584 | 235.06 | 0.00 | 2171.97 | 0.00 | 111897.00 |
| Transportation reimbursement (1000 JPY) | 61584 | 57.01 | 0.00 | 662.52 | 0.00 | 40443.18 |

(c) Prefecture-month Level

| | N | mean | median | sd | min | max |
|---|---|---|---|---|---|---|
| Employment | 564 | 20909.74 | 7150.00 | 34828.00 | 505.00 | 262946.00 |
| Vacancy | 564 | 25666.38 | 9244.00 | 42709.43 | 633.00 | 350733.00 |
| Transportation reimbursement (1000 JPY) | 564 | 6225.54 | 1608.10 | 13945.51 | 132.40 | 120488.85 |

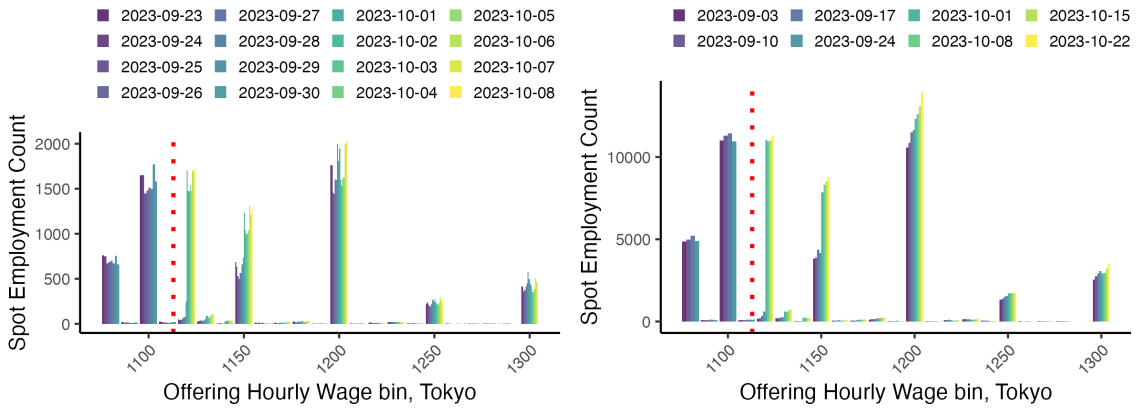
*Note*: This table reports the mean, median, standard deviation, and median of each of our outcome variables during the period of analysis, April 2023 through March 2024. 150 JPY is about 1 USD in the current exchange rate.

Table 1 presents the summary statistics for key labor market variables at different levels of aggregation. At the contract level, the average hourly wage is 1,086.00 JPY, with a median of 1,100 JPY, indicating that most contracts offer wages within a similar range and are somewhat affected by minimum wage changes. Employers also provide transportation reimbursement, averaging 404.66 JPY per contract, with a median of 500 JPY. The substantial difference between the minimum and maximum values suggests that transportation support varies significantly depending on job location and employer policies. At the prefecture-month level, employment and vacancy figures reveal substantial fluctuations across regions and time periods. The average number of spot employments per prefecture-month is 20,909.74, while vacancies are slightly higher at 25,666.38, indicating the presence of unfilled positions.

## 3.3 Preliminary Evidence before and after the Change of the Minimum Wage

Leveraging the strengths of granular spot work platform data, we focus on Tokyo to illustrate how the minimum wage adjustment reshaped employment patterns, allowing for a detailed examination of wage shifts while revealing the stability of working hours and transportation reimbursement.

**The Hourly Wage Distribution** Figure 4 illustrates the transition in employment distribution across hourly wage bins at both the daily and weekly levels before and after the minimum wage adjustment. The ability to observe such granular, high-frequency adjustments is a unique strength of our spot labor platform data, enabling us to capture firms' real-time responses to policy changes with day-to-day resolution. Panel (a) shows the daily evolution of employment distribution in Tokyo, revealing a sharp and immediate decline in employment below the new minimum wage threshold (1,113 JPY) just one day after the policy took effect. Jobs previously offered at lower wages either disappeared or were adjusted upward, with a clear clustering of employment around the new minimum wage floor. Panel (b) aggregates these patterns at the weekly level, confirming the persistence of this shift over the course of a month. Complementarily, Panel (a) in Figure 5 shows that the effect persists over a six-month period.




(a) Daily (b) Weekly

Figure 4: Transition of Employment Distribution by Week and Day Before and After the Minimum Wage Change

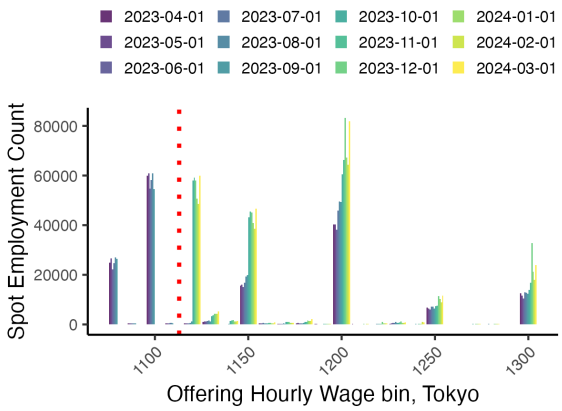
Note: The x-axis represents the target element bins, while the y-axis indicates the total count of spot employment. The colored bars represent different months, allowing for a clear comparison of employment pattern shifts over time. The red dashed line denotes Tokyo's 2023 October minimum wage, i.e., 1,113 JPY.

**Adjustments in Working Hours and Transportation Reimbursement** Panel (b) in Figure 5 reveals that employment distribution across working hour bins remains relatively stable, though

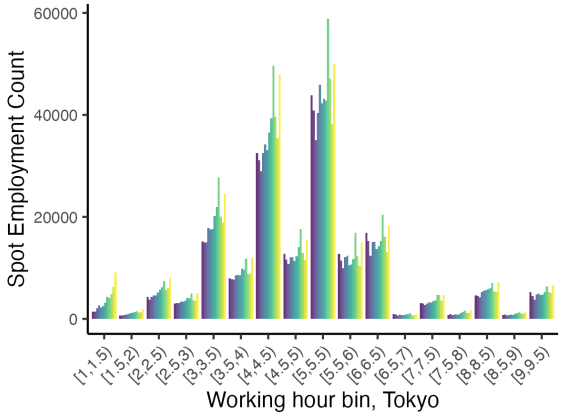
some shifts suggest firms' strategic adjustments to optimize labor costs. Employment at common working hour intervals, such as four and eight hours, remains prominent, while shorter-hour categories show slight declines, possibly due to increased hourly labor costs. Panel (c) examines transportation reimbursement, showing a stable yet slightly shifting distribution, with a concentration in the 500 JPY reimbursement bin, indicating standardized employer practices. While wage structures have adapted, transportation reimbursements largely remain unchanged, though some redistribution in higher reimbursement categories suggests firms may be adjusting overall compensation structures in response to rising labor costs. These patterns underscore the interconnected nature of wage adjustments and broader employer strategies in response to policy changes.

A natural question is whether the wage increase resulting from the minimum wage adjustment led to a pass-through effect on working hours and transportation reimbursement, or if firms primarily confined their response to wage adjustments. Figure 6 demonstrates that the minimum wage adjustment primarily impacted the distribution of employment across wage bins, while working hours and transportation reimbursement remained largely unaffected. In panel (a), employment previously concentrated in wage bins below the new minimum wage threshold shifted upwards, clustering around the new minimum wage level, indicating compliance-driven wage adjustments. However, panel (b) shows minimal changes in the distribution of working hours, suggesting that firms maintained their established job structures despite increased labor costs. Similarly, transportation reimbursement patterns in panel (c) exhibit stability, with no significant redistribution, reinforcing the notion that firms adjusted wages in response to the policy change without altering other compensation components. This pattern highlights that the primary response to the minimum wage hike was wage compliance, rather than broader changes in job design or additional benefits.

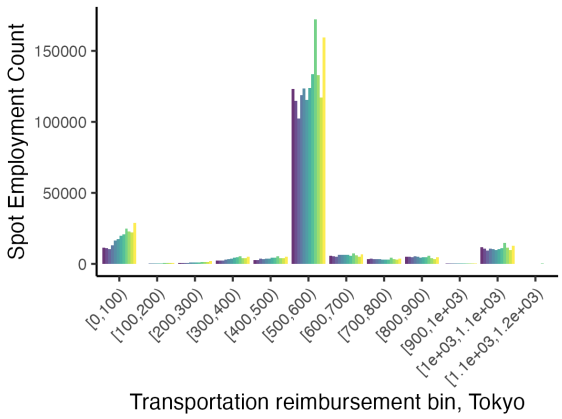
These illustrative data patterns motivate us to move beyond descriptive analysis and investigate the causal impact of the minimum wage adjustment on employment outcomes. While the observed shifts in wage distribution suggest strong compliance effects and limited pass-through to other job attributes, such as working hours and transportation reimbursement, these patterns alone do not establish causality. In particular, they cannot account for concurrent platform growth or heterogeneous trends across prefectures, which may confound observed changes. To rigorously evaluate whether and to what extent the policy change affected employment dynamics—particularly in terms of hiring behavior, job retention, or adjustments in job design—we turn to a difference-in-differences (DID) framework. This approach allows us to isolate the effect of the minimum wage hike by comparing changes in outcomes between treated and control groups over time, accounting for underlying trends and potential confounders.




(a) Hourly Wage



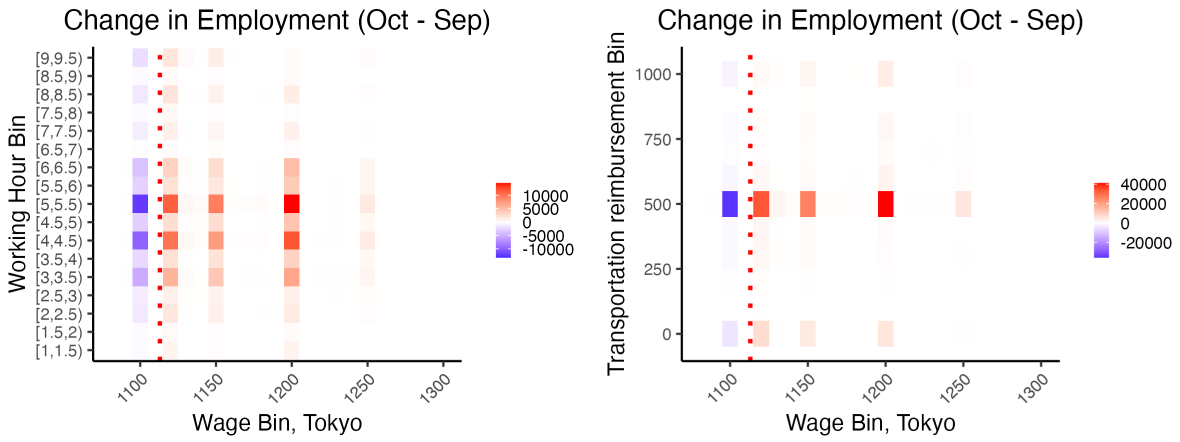

(b) Posted Working Hour




(c) Transportation Reimbursement

Figure 5: Transition of employment distribution before and after the change of minimum wage

Note: The x-axis represents the target element bins, while the y-axis indicates the total count of spot employment. The colored bars represent different months, allowing for a clear comparison of employment pattern shifts over time. The red dashed line denotes Tokyo's 2023 October minimum wage, i.e., 1,113 JPY.




(a) Working Hour and Wage (b) Transportation Reimbursement and Wage

Figure 6: Change in Employment Distribution Before and After the Minimum Wage Change

Note: The x-axis represents the wage bins, while the y-axis indicates either the working hour bins (panel a) or the transportation reimbursement bins (panel b). The color intensity reflects the change in spot employment between September and October, with red indicating an increase and blue indicating a decrease. The red dashed line denotes Tokyo's 2023 October minimum wage, i.e., 1,113 JPY.

# 4 Empirical Strategy

## 4.1 Prefecture-month-wage-bin level DID estimate

The key challenge to estimate the effect of minimum wage increase on the outcome is that we can not observe the counterfactual wage distribution in the absence of the policy shock. To address this issue, following Dustmann *et al.* (2022), we employ a difference-in-differences identification strategy, comparing the outcome before and after the minimum wage increase between observations near the minimum wage threshold and those in the upper part of the wage distribution, which is unlikely to be affected by the policy change.

Specifically, we first decompose the wage distribution in each prefecture into wage bins, where each bin $j$ has a width of 10 yen. We then partition each wage bin $j$ in prefecture $p$ into a mutually exclusive group $E_j(p) = e$ for $e \in \{-1, \ldots, 3, \infty\}$, based on its relative distance from the increased minimum wage $MW_p$. Specifically, if wage bin $j$ in prefecture $p$ falls within the interval $[MW_p + e \times 100, MW_p + e \times 100 + 99]$, it is assigned to group $e$. We define the threshold $\bar{W}_p = MW_p + 400$, and assign $E_{j(p)} = \infty$ if wage bin $j$ falls within $[\bar{W}_p, \infty]$. We assume that wage bins in group $\infty$ are unaffected by the minimum wage increase, an assumption we refer to as the limited spillover effect assumption. Under this assumption, we call the group $\infty$ as the control group. Finally, for each group $e$, we compare the evolution of the outcome between group $e$ and group $\infty$ before and after the minimum wage increase.

We implement this DID identification strategy by running the following regression:

$$\frac{Y_{j(p),t}}{N_{p,t}} = \sum_{l \neq -1} \sum_{e \neq \infty} \mu_{l,e} \mathbf{1}\{t - 7 = l\} \mathbf{1}\{E_{j(p)} = e\} + \alpha_e + \lambda_t + \epsilon_{j,t}, \tag{1}$$

where $t \in \{1, \ldots, 12\}$ denotes the calendar month, and $l \in \{-6, \ldots, 5\}$ denotes the relative time period before or after the minimum wage increase at time $t = 7$.[11] $Y_{j(p),t}$ is the employment for each bin $j$ in prefecture $p$ at time $t$, $N_{p,t}$ is the number of job posting in prefecture $p$ at time $t$, $\alpha_e$ is the group fixed effect, and $\lambda_t$ is the time fixed effect.[12] Note that this regression is saturated and each coefficient $\mu_{l,e}$ is the difference-in-differences estimand:

$$\mu_{l,e} = E\left[\frac{Y_{j(p),7+l}}{N_{p,7+l}} - \frac{Y_{j(p),6}}{N_{p,6}} | E_{j(p)} = e\right] - E\left[\frac{Y_{j(p),7+l}}{N_{p,7+l}} - \frac{Y_{j(p),6}}{N_{p,6}} | E_{j(p)} = \infty\right],$$

where the pre-treatment period is $t = 6$ and the control group is group $\infty$.

Under the DID identification strategy, each coefficient $\mu_{l,e}$ captures the dynamic effect of the minimum wage increase on the outcome in group $e$ at a given relative period $l$. Formally, we assume the three identifying assumptions below.

**Limited Spillover Effect Assumption** This assumption requires that the effect of the minimum wage increase on the outcome vanishes at a certain point $\bar{W}_p$ in the wage distribution in each prefecture $p$. It ensures that group $\infty$ (the upper part of the wage distribution) serves as a valid control group. We will assess the validity of this assumption by examining the impact of the minimum wage increase on groups near $\bar{W}_p$ such as $e = 2, 3$.

**No Anticipation Assumption** This assumption rules out the anticipation effect of the minimum wage increase on the outcome at a give period $l = -1$, i.e., before exposure to the policy shock. While this assumption is not directly testable, we will conduct a robustness check by using the pre-treatment period that is further from the policy shock, such as $l = -2$ or $l = -3$.

**Parallel Trends Assumption** This assumption requires that for each group $e$, the outcome evolves similarly over time between group $e$ and control group $\infty$. This assumption is also not directly testable, but we assess the plausibility of this assumption, checking the pre-trends differences for the outcome.

[11] $t = 1$ corresponds to April 2023, and $t = 12$ corresponds to March 2024.

[12] The notation $j(p)$ indicates that the wage bin $j$ belongs to prefecture $p$. We adopt this notation because the regression in (1) exploits variation only at the group $e$ and time $t$ levels.

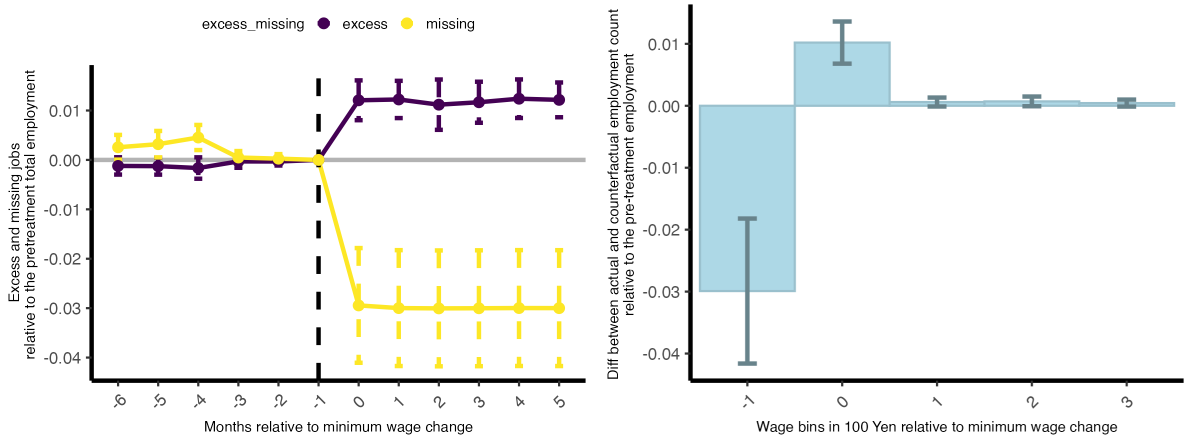
### 4.2 Excess-jobs-Missing-jobs Approach

Next, following Cengiz *et al.* (2019), we estimate the effect of minimum wage increase on the outcome throughout the wage distribution by aggregating each $\mu_{l,e}$, given by the prefecture-month-wage-bin level DID estimates. Let $\Delta a_l = \sum_{e=0}^{3} \mu_{l,e}$ and $\Delta b_l = \mu_{l,-1}$ denote the excess jobs and the missing jobs at a give relative period $l$, respectively. Let $\Delta a = \frac{1}{6}\sum_{l=0}^{5} \Delta a_l$ and $\Delta b = \frac{1}{6}\sum_{l=0}^{5} \Delta b_l$ denote the total excess jobs and missing jobs after the increase of minimum wage, respectively. Also, let $\Delta a_e = \frac{1}{6}\sum_{l=0}^{5} \mu_{e,l}$ and $\Delta b_{-1} = \frac{1}{6}\sum_{l=0}^{5} \mu_{-1,l}$ define the excess jobs and the missing jobs at a give relative exclusive group $e$, respectively. We compute the overall employment effect at a give relative period $l$, denoted as $\Delta e_l$, by summing the excess and missing jobs at that period: $\Delta e_l = \Delta a_l + \Delta b_l$. Furthermore, we calculate the total employment effect after the minimum wage increase, denoted as $\Delta e$, by summing $\Delta e$ over all relevant periods: $\Delta e = \sum_{l=0}^{5} e_l$.

## 5 Results

### 5.1 Prefecture-month-wage-bin Level DID Estimate on Employment

We begin by presenting the impact of minimum wage increases on wage bins below and above the minimum wage in the wage distribution. Panel (a) in Figure 7 presents the estimated excess jobs and missing jobs for each month before and after the minimum wage increase. Panel (b) in Figure 7 presents the estimated impact of minimum wage increases on the employment of each group $e$ in the wage distribution, reflecting the cumulative effect across all months following the increase.




(a) Missing and Excess Jobs over Time

(b) Wage Distribution

Figure 7: Impact of Minimum Wages on Employment

Note: Panel (a) of Figure 7 shows the estimated excess jobs and missing jobs for each month before and after the minimum wage increase. Panel (b) of Figure 7 shows the estimated impact of the minimum wage increase on employment for each group $e$ in the wage distribution.

Three key findings emerge from Panel (a) and Panel (b). First, immediately after the minimum wage increase, there is a clear occurrence of job losses (missing jobs) below the minimum wage and job creation (excess jobs) above the minimum wage in the wage distribution. Second, the estimated excess jobs and missing jobs remain stable across months following the minimum wage increase. This suggests that in a spot labor market, there are no significant dynamic effects of the minimum wage increase, and the labor market adjusts immediately to the change. Finally, while Cengiz *et al.* (2019), which examines the U.S. labor market, finds that the estimated number of excess jobs and missing jobs are approximately equal, our analysis of the spot labor market reveals that the number of missing jobs ($-3.0\%$) exceeds that of excess jobs ($1.2\%$).[13]

Note that Panel (a) and Panel (b) also confirm the validity of the assumptions underlying our identification strategy. From Panel (a), we observe that the estimated excess jobs and missing jobs are close to zero in the period before the minimum wage increase. This supports the plausibility of the parallel trends assumption. From Panel (b), we observe that excess jobs are hardly generated in the upper distribution, far from the minimum wage. This supports the plausibility of the limited spillover effect assumption.

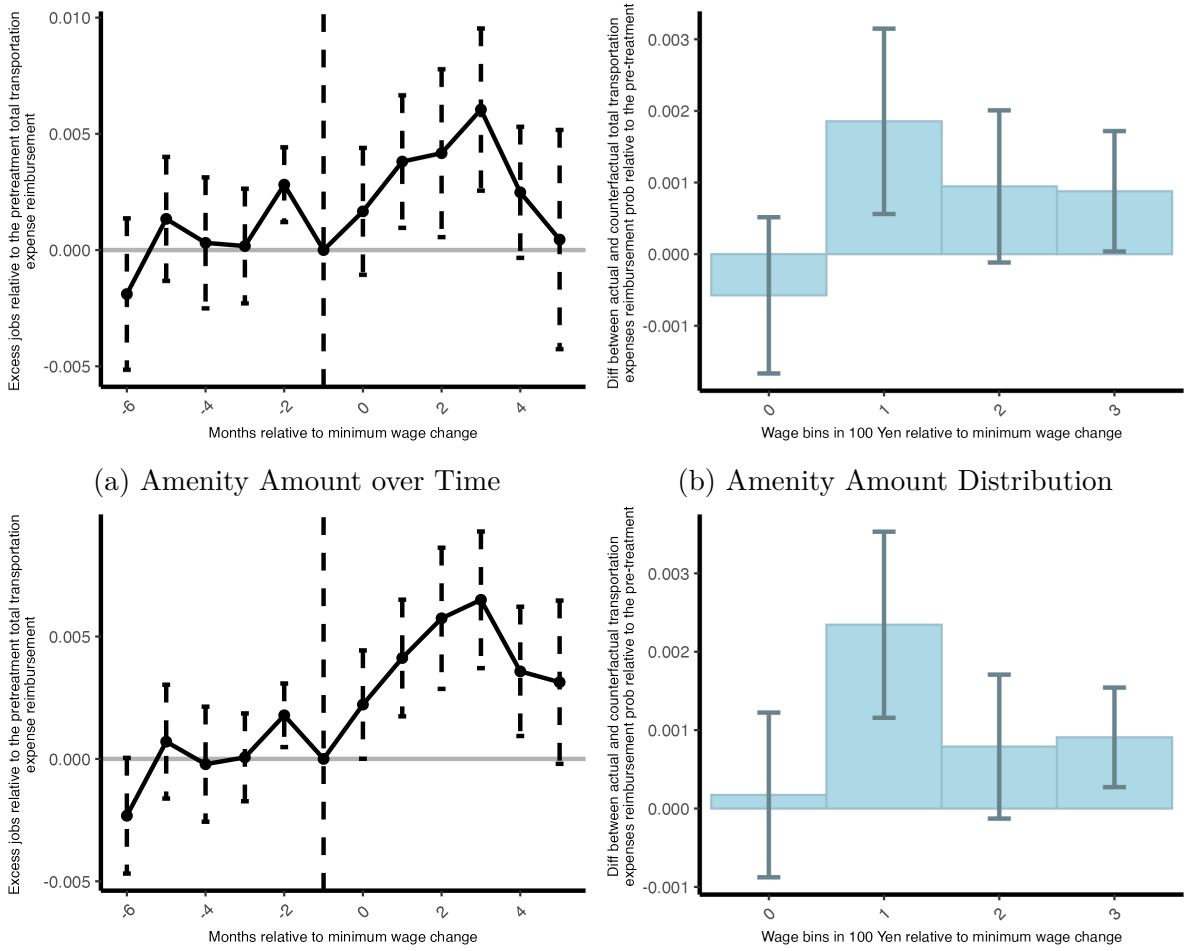
## 5.2 Margins of Adjustment

So far, we have estimated the impact of minimum wage increases on employment in the spot labor market and found that the effect is negative. However, are there other margins of adjustment—such as amenities—that also respond to minimum wage increases? In this section, given the detailed nature of our spot labor market data, we examine how minimum wage increases affect transportation expenses—one of the representative amenities offered by firms. We also analyze how minimum wage hikes influence employment across different time slots.

**Pass-through to Transportation Reimbursement as Amenity** We begin by estimating the impact of minimum wage increases on transportation reimbursement offered by firms. The estimation method follows that of Section 4, with the outcome variable being transportation reimbursement linked to employment (set to zero if no allowance is provided) and probability of providing any transportation allowance. Since employment in group $e = -1$ disappears after the minimum wage revision, we focus on estimating and aggregating the effects on transportation reimbursement for groups with $e \geq 0$.

Panel (a) in Figure 8 displays the estimated changes in transportation reimbursement, measured relative to the timing of the minimum wage increase. The estimates fluctuate around zero in the pre-treatment period and show no systematic trend following the policy change, suggesting that transportation reimbursement as an amenity remained largely stable over time. While Some

[13] The elasticity with respect to minimum wages computed from the formula of Cengiz *et al.* (2019) is $-0.387(0.132)$ where the bracket number is the standard error. See the detail in Appendix A.




(a) Amenity Amount over Time

(b) Amenity Amount Distribution

(c) Amenity Provision Probability over Time

(d) Amenity Provision Probability Distribution

Figure 8: Impact of Minimum Wages on Transportation Reimbursement as Amenity

Note: Panel (a) of Figure 8 plots the changes in transportation reimbursement before and after the minimum wage increase. Panel (b) plots the estimated effects of minimum wage increases on transportation reimbursement for each group $e \in \{0, \ldots, 3\}$. Panels (c) and (d) provides the version of probabilities of providing transportation reimbursement.

estimates are statistically significant at at conventional levels—peaking around 0.6 % increasing-they are economically negligible in the post-treatment period. Panel (b) presents the estimated impact of the minimum wage on transportation reimbursement across wage bins. However estimates in the wage bin of $e = 1$ are statistically significant at conventional levels—peaking around 0.2%—this is also ignorable, indicating that minimum wage pass-through via intensive margin did not meaningfully extend to changes in transportation reimbursement practices.

Panel (c) in Figure 8 presents the dynamic effects of the minimum wage increase on the provision probability of transportation reimbursement. The estimates gradually increase in the post-treatment period, peaking around 0.7%, suggesting a statistically significant but economically modest increase in the likelihood that firms offer this amenity. Panel (d) shows the estimated

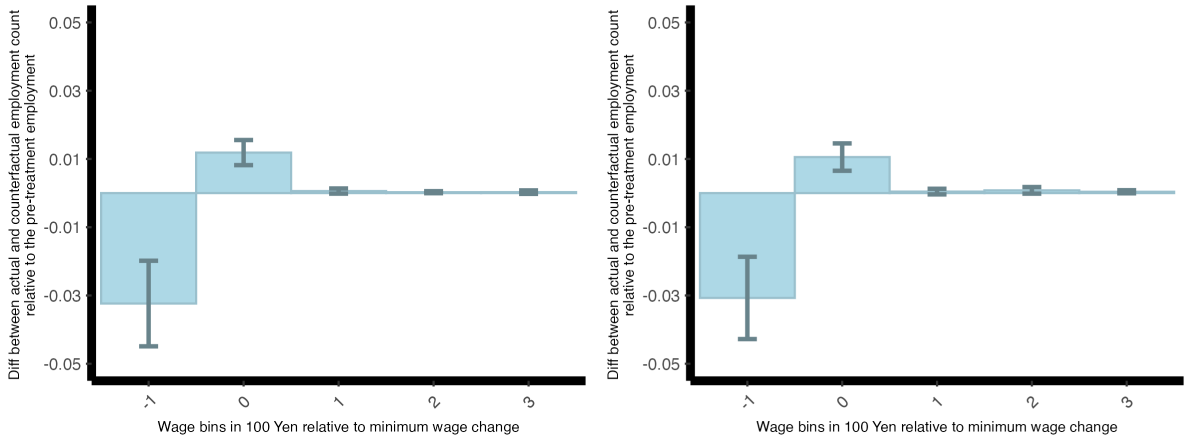
impact across wage bins, revealing a similar pattern: while the provision probability rises in the lower part of the wage distribution, the overall magnitude remains small. These patterns suggest that although there is some statistically detectable response at the extensive margin—whether or not the amenity is offered—the degree of adjustment remains limited. Thus, even when considering the amenity provision decision itself, the minimum wage pass-through effect appears minimal.

**The impact on employment across different time slots** Next, we estimate the impact of minimum wage increases on employment across different time slots. Specifically, we divide the 24-hour day into four periods—morning (6:00–12:00), afternoon (12:00–18:00), evening/night (18:00–24:00), and late night (24:00–6:00)—and estimate the effect of minimum wage increases on employment within each time slot. This time-of-day granularity allows us to observe potential reallocation of spot labor within a day—for example, whether firms shift demand toward late-night hours in response to higher wage costs. Figure 9 presents the estimated effects of minimum wage increases on employment across different time periods. The figure shows that the impact of minimum wage hikes on employment is largely uniform across time slots, suggesting that there is no meaningful substitution of employment across time periods.

## 5.3 Platform Revenue

A key advantage of using platform data is the ability to observe not only posted wages but also actual matching outcomes—namely, the contracted payments—on a daily basis. Even if employment volume declined as shown in the above, rising wages due to the minimum wage hike would still raise total earnings. Since 30% of contracted payments are paid by businesses to the platform as revenue, this indicator is directly linked to platform earnings.

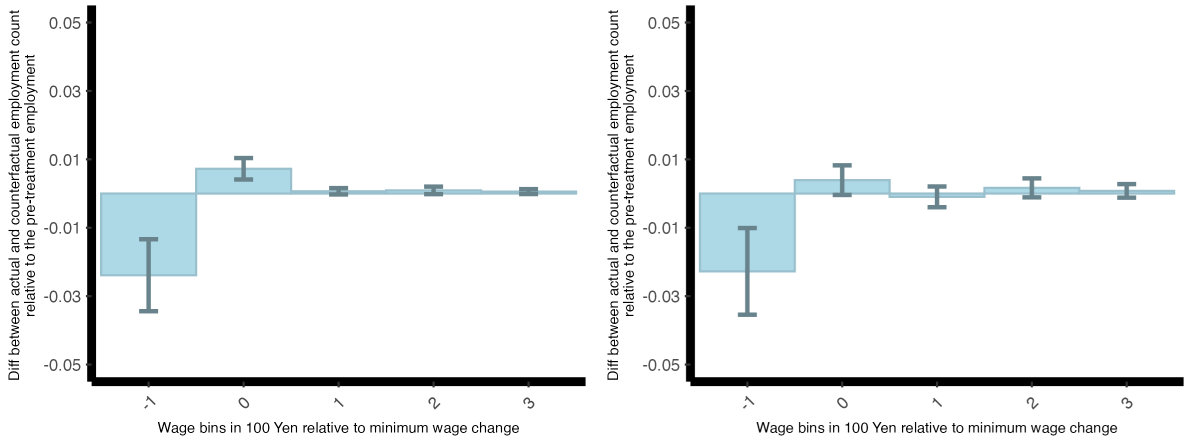
Figure 10 illustrates the temporal dynamics of weekly fixed effects from a regression of total earnings at the prefecture-week level on prefecture and week dummy variables. The observed post-October increase in total earnings indicates that the minimum wage revision had a limited impact on platform revenue. The stability in total earnings before and after the revision suggests that the policy primarily altered the composition of contracted payments, reflecting a shift in the composition of contracted payments due to the minimum wage hike toward higher hourly wages, with working hours remaining stable and a slight decline in the number of matched workers, rather than a change in total transaction volume.




(a) Morning




(b) Evening




(c) Night




(d) Midnight

Figure 9: Impact of Minimum Wages on Employment per Working Hour Category

Note: We divide the 24-hour day into four periods—morning (6:00–12:00), afternoon (12:00–18:00), evening/night (18:00–24:00), and late night (24:00–6:00).

# 6 Heterogeneous Job-Posting Responses to the Minimum Wage

## 6.1 Prefecture-month and Occupation-month level DID estimate

In section 5.1, we estimate the effect of the minimum wage increase on the outcome by aggregating the events of the minimum wage increase across prefectures. However, the minimum wage bite varies across prefectures, and the relationship between the employment effect and the Kaitz index (the ratio between the median wage and the minimum wage) is intrinsically interesting. We implement the DID identification strategy separately for each prefecture $p$, and show that the estimated employment effects are more negative in prefectures with a higher Kaitz index.

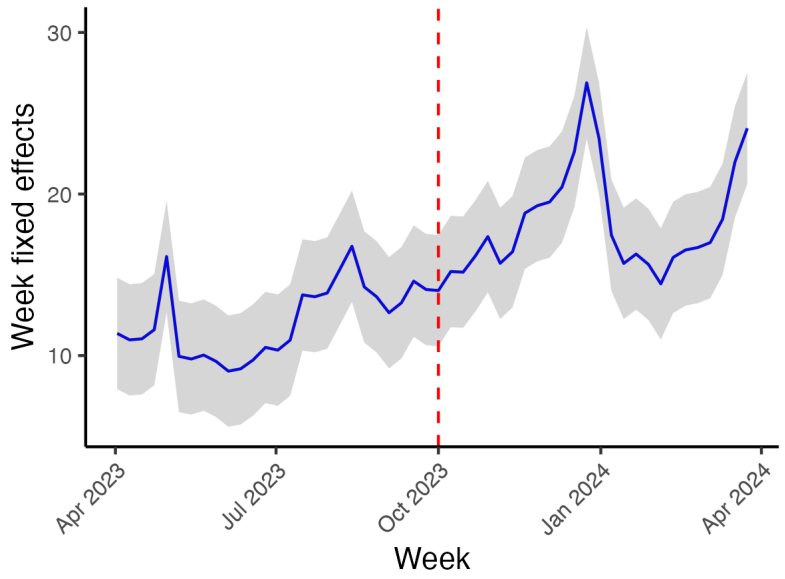



Figure 10: Estimated Week Fixed Effects in Contracted Total Earnings

Note: This describes the week fixed effects with confidence intervals from a regression of total earnings at the prefecture-week level on prefecture and week dummy variables. Total earnings is calculated as hourly wages multiplied by working hours.

Specifically, we first construct a separate data set for each prefecture $p$ and run the following regression within each data set:

$$Y_{j,t}^{p} = \sum_{l \neq -1} \sum_{e \neq \infty} \mu_{l,e}^{p} \mathbf{1}\{t - 7 = l\} \mathbf{1}\{E_j^p = e\} + \alpha_e^p + \lambda_t^p + \epsilon_{j,t}^p. \tag{2}$$

Here, the superscript $p$ indicates that this regression is estimated separately for each prefecture $p$. As in (1), each coefficient $\mu_{l,e}^{p}$ is the DID estimand, capturing the dynamic effect of the minimum wage increase on the outcome at a given period $l$ in prefecture $p$ under the DID identifying assumptions:

$$\mu_{l,e}^{p} = E[Y_{j,7+l}^{p} - Y_{j,6}^{p} | E_j^p = e] - E[Y_{j,7+l}^{p} - Y_{j,6}^{p} | E_j^p = \infty],$$

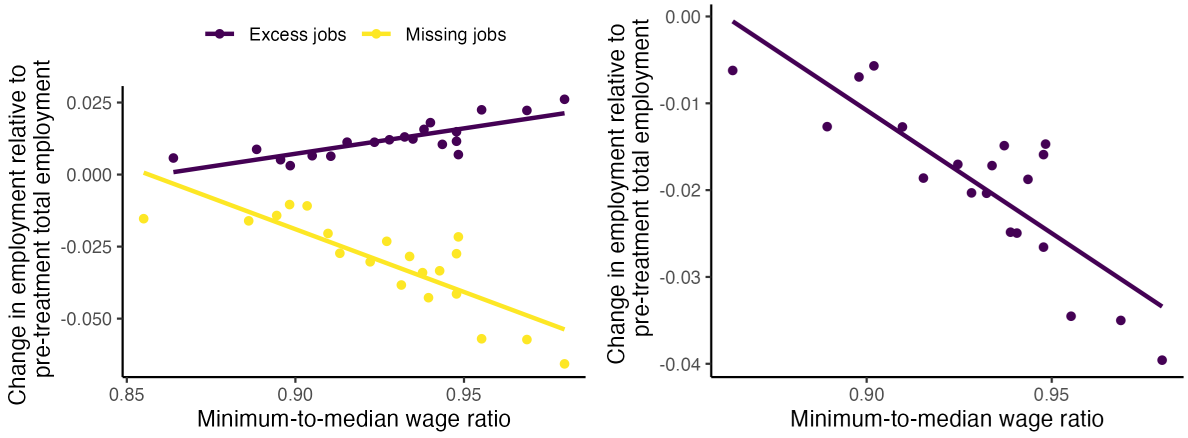
where the pre-treatment period is $l = -1$ and the control group is group $\infty$ in prefecture $p$.

Next, as in Section 4.2, we compute the missing jobs, excess jobs, and the overall employment effect for each prefecture $p$ by aggregating $\mu_{l,e}^{p}$ in the fist step:

$$\Delta a^p = \sum_{l=0}^{5} \Delta a_l^p, \quad \Delta b^p = \sum_{l=0}^{5} \Delta b_l^p, \quad \Delta e^p = \sum_{l=0}^{5} e_l^p,$$

where the superscript $p$ indicates that each quantity is defined within prefecture $p$.

**Prefecture-month level** Figure 11 illustrates the relationship between the Kaitz index and employment outcomes across prefectures. The Kaitz index is calculated for each prefecture as the ratio of the October 2023 median wage to the increased minimum wage. Panel (a) plots the estimated numbers of missing and excess jobs against the Kaitz index. It shows a positive association between the Kaitz index and excess jobs, and a negative association with missing jobs. When the minimum wage is high relative to the median wage, minimum wage hikes tend to have a stronger impact. Panel (b) presents the relationship between the Kaitz index and the overall employment effect, revealing a negative correlation. These findings suggest that, in Japan's spot work market, minimum wage increases have already begun to produce modest negative employment effects, in contrast to the United States, where such effects remain limited (Cengiz *et al.* 2019).




(a) Missing and Excess Jobs (b) Employment Change

Figure 11: Relationship between Excess Jobs, Missing Jobs, Employment Change, and the Kaitz Index (Minimum-to-Median Wage Ratio) across Prefectures

Note: Figure 11 shows the binned scatter plots for missing and excess jobs in Panel (a), and total employment changes in Panel (b) by the value of the minimum-to-median wage ratio (Kaitz index) for the 47 prefecture-specific estimates. The Kaitz index is calculated for each prefecture as the ratio of the October 2023 median wage to the increased minimum wage.

**Occupation-month level** While prior studies have often concentrated on sectors like restaurants—where the minimum wage is most binding and effects are more easily detected—we adopt a distributional approach that captures wage and employment responses even in industries with limited direct exposure. This enables a more comprehensive evaluation of the policy's impact across a broader range of occupations.[14]

[14] Lordan and Neumark (2018) and Aaronson and Phelan (2019) find that the minimum wage reduces the employment of the lowest-wage workers in routine automatable occupations. Dustmann *et al.* (2022) find that minimum wages could also affect productivity by improving the composition of jobs in the economy and in response to minimum wage increases, small, inefficient firms exited the market, and workers at these firms found employment at more productive firms. Also, Forsythe (2023) finds that there is no heterogeneity across occupation.

Figure 12 illustrates heterogeneous occupation-level responses to minimum wage hikes, revealing distinct patterns across job categories. The most pronounced employment losses below the new minimum wage occur in Restaurant, Retail, and Event Staff, where a substantial number of low-wage jobs disappear. In contrast, occupations such as Logistics, Customer Service, and Light Work exhibit relatively balanced patterns, with moderate excess job creation at or just above the new minimum that partially offsets missing jobs. Professional and Entertainment roles show smaller overall impacts, suggesting limited exposure to the minimum wage threshold. Notably, Office Work stands out as the only occupation with significant employment gains concentrated in the higher wage bins, implying that employers may be attempting to upgrade their workforce quality by attracting more capable workers—what appears to be a "quality jump" in response to rising labor costs. Overall, these findings suggest that minimum wage increases lead not only to occupational reallocation but also to qualitative adjustments in hiring, especially in tasks related to office work.

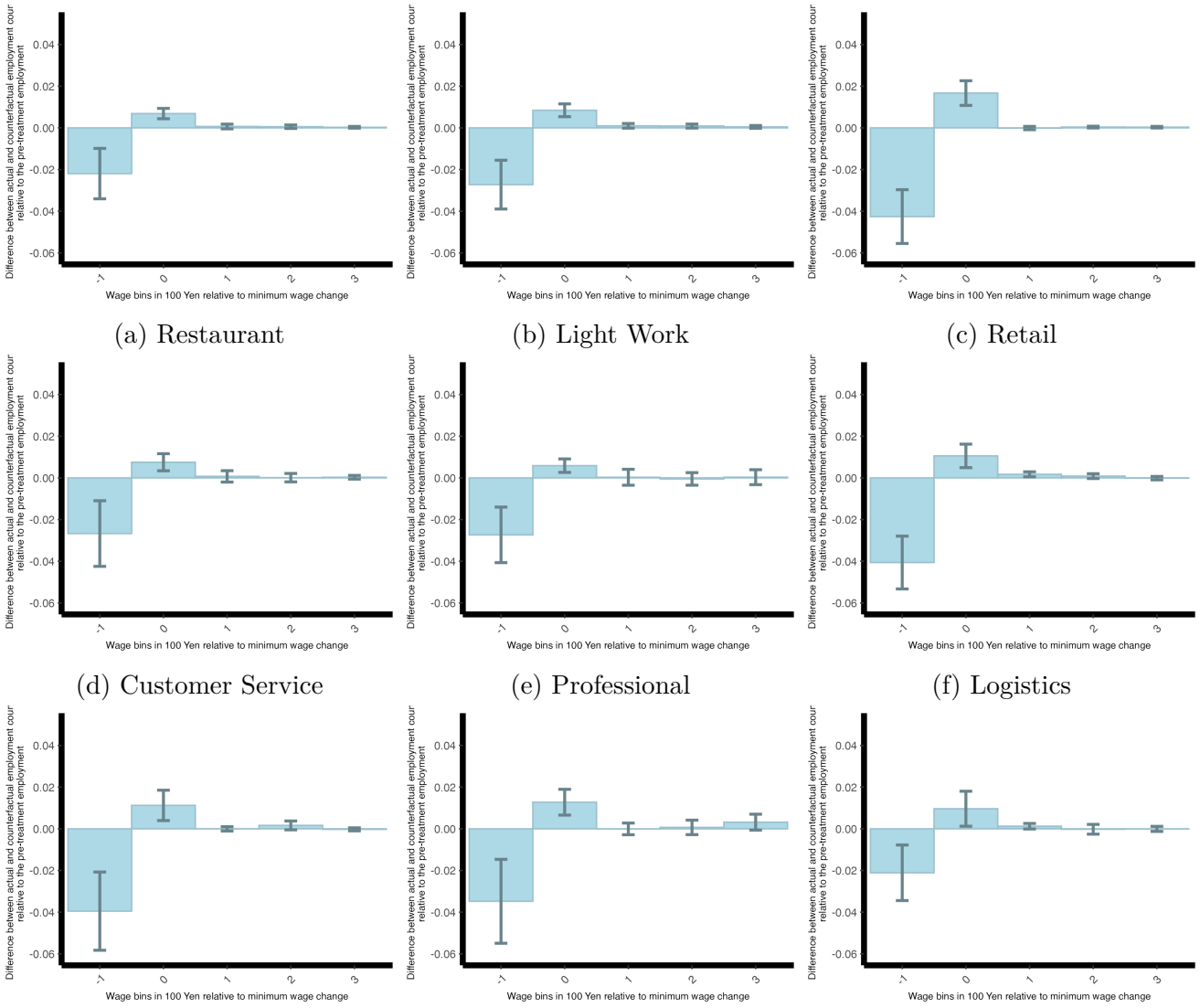
## 6.2 Limitations

While our contract-level data allow us to examine the immediate responses of employers to minimum wage hikes in spot labor markets, several limitations remain. First, our data are limited to labor demand and supply within a single job-matching platform, which restricts the external validity of our findings. This limitation is shared by many studies relying on platform data (Horton 2025, Melo *et al.* 2025, Stanton and Thomas 2021).

Second, although we observe high-frequency adjustments in wages and transportation reimbursement, we cannot analyze employer responses along other production margins. In particular, we are unable to examine substitution between spot workers and other inputs, such as capital or long-term contract workers. For instance, Harasztosi and Lindner (2019) find that firms exposed to minimum wage increases raise capital investment relative to unexposed firms. However, such capital-labor substitution is likely to be limited in the short run, as investment decisions typically unfold over longer horizons.

Labor-labor substitution, by contrast, may operate on shorter time scales. Establishments may stop posting on the platform or reallocate tasks to existing long-term workers. Clemens *et al.* (2021) show that skill requirements increased in low-wage jobs after minimum wage hikes, suggesting one channel through which employers adjust labor composition. As Dube and Lindner (2024) discuss, reallocating existing long-term workers may act as a form of wage retrenchment. Unfortunately, our data do not allow us to observe establishment-level staffing decisions that include both spot and non-spot workers.

Third, our analysis of non-wage amenities focuses on transportation reimbursement, an amenity that is easily adjustable and measurable in the short term. While this is an important dimension of compensation in spot labor markets, it does not capture other fringe benefits or working conditions,




(a) Restaurant (b) Light Work (c) Retail

(d) Customer Service (e) Professional (f) Logistics

(g) Entertainment (h) Office Work (i) Event Staff

Figure 12: Impact of Minimum Wages on Employment and Wages by Occupations

Note: Figure 12 shows the estimated impact of the minimum wage increase on employment for each group $e$ in the wage distribution for each occupation in the platform.

such as insurance coverage, training opportunities, workplace safety, or scheduling flexibility. These aspects may also respond to wage regulation over longer horizons but are not observable in our data.

Taken together, our findings provide valuable insights into short-term wage and amenity adjustments in response to minimum wage hikes, but a fuller understanding of firm behavior would require richer data linking spot and long-term employment as well as broader measures of job quality.

# 7 Conclusion

In this paper, we investigate the impact of a minimum wage increase on employment in the spot labor market, leveraging unique data from that market. Employing a difference-in-differences identification strategy, we find that the minimum wage increase in 2023 in Japan had a negative effect by 2% on spot market employment. Leveraging the richness of the spot labor market data, we further explore whether the minimum wage increase affected other margins of adjustment beyond employment, such as job amenities. Specifically, we analyze its impact on transportation reimbursement—one of the representative amenities—and find that the minimum wage increase had little effect on the transportation reimbursement offered by firms. Additionally, we estimate the impact of the minimum wage increase on employment across different time slots and find a uniformly negative effect across all time periods. This research contributes to our understanding of how minimum wage policies influence a labor market characterized by short-term employment arrangements.

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# A Appendix

## A.1 Elasticities Related to the Minimum Wages

Following the method of Cengiz *et al.* (2019), we estimate (i) the elasticity of employment with respect to minimum wages and (ii) the employment elasticity with respect to the affected wages.

Table 2: Impact of Minimum Wages on Employment and Wages

| | Estimate (SE) |
|---|---|
| Missing jobs below new MW | -0.03 |
| | (0.006) |
| Excess jobs above new MW | 0.012 |
| | (0.002) |
| Affected wages | 0.366 |
| | (0.171) |
| Affected employment | -0.268 |
| | (0.091) |
| Employment elasticity w.r.t MW | -0.387 |
| | (0.132) |
| Emp. elasticity w.r.t affected wage | -0.732 |
| | (0.091) |
| Job below new MW | 0.068 |
| % MW changes | 0.047 |

*Note*: The table reports the effects of a minimum wage increase based on the event study analysis exploiting 47 prefecture-level minimum wage changes in 2023 (i.e., about 4% minimum wage increase). The table reports six-months averaged post-treatment estimates on missing jobs up to 100JPY below the new minimum wage, excess jobs at and up to 300JPY above it, employment, and wages. Robust standard errors in parentheses are clustered by wage-bin separated by 10 JPY.

Table 2 reports six-month–averaged post-treatment effects for the baseline specification depicted in the Figure 7. The magnitude of missing jobs below new minimum wages exceeds the magnitude of excess jobs above new minimum wages in the six-month window. The estimated employment elasticity with respect to the minimum wage is -0.387, which is consistent with the Figure 7. Unlike the findings of Cengiz *et al.* (2019) and Dube and Zipperer (2024), our own wage elasticity is -0.732, indicating that wages are relatively elastic to wage adjustment related to the minimum wages compared by the median one (-0.13) shown by Dube and Lindner (2024).