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−Analysis on Effects of Partial Revision of Labour Standards Act in 2008—

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【Abstract】

To reduce long working hours, the revised Labour Standards Act of 2008 was executed on December 12, 2008, and went into effect on April 1, 2010. In this revision, the following amendments were implemented: (1) the legal overtime rate to be paid for 60 or more hours of overtime per month was increased from 25% to 50%; (2) once a labor-management agreement was executed, it was possible to provide paid leave for those employees who worked overtime more than 60 hours per month, in place of the standard 25% increase for overtime; and (3) instead of paid leave that was an alternative to the overtime rate referenced in Section (2), after the revision of the law, when a business executed a labor-management agreement, an employee could use any existing paid leave by the hour up to five days per year.

   In this study, to re-verify the effects of the revision, utilizing the existence of employees who are not covered by the revision, we perform Difference-in-Differences (DID) analysis by using the Keio Household Panel Survey. We estimate that a total of 55 working hours per week corresponds to 60 hours of overtime work per month, and then we perform the analysis. As a result, we confirm that the revision of the law reduced the overtime working hours of the employees who worked more than 55 hours per week on average before the revision (2004 to 2009). However, we confirm that there is no statistically significant impact on the provision and acquisition of annual paid leave of employees who worked more than 55 hours per week each period.

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—Analysis on Effects of Partial Revision of Labour Standards Act in 2008 [*]—

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To reduce long working hours, the revised Labour Standards Act of 2008 was executed on December 12, 2008, and went into effect on April 1, 2010. In this revision, the following amendments were implemented: (1) the legal overtime rate to be paid for 60 or more hours of overtime per month was increased from 25% to 50%; (2) once a labor-management agreement was executed, it was possible to provide paid leave for those employees who worked overtime more than 60 hours per month, in place of the standard 25% increase for overtime; and (3) instead of paid leave that was an alternative to the overtime rate referenced in Section (2), after the revision of the law, when a business executed a labor-management agreement, an employee could use any existing paid leave by the hour up to five days per year.

In this study, to re-verify the effects of the revision, utilizing the existence of employees who are not covered by the revision, we perform Difference-in-Differences (DID) analysis by using the Keio Household Panel Survey. We estimate that a total of 55 working hours per week corresponds to 60 hours of overtime work per month, and then we perform the analysis. As a result, we confirm that the revision of the law reduced the overtime working hours of the employees who worked more than 55 hours per week on average before the revision (2004 to 2009). However, we confirm that there is no statistically significant impact on the provision and acquisition of annual paid leave of employees who worked more than 55 hours per week each period.

Keywords

overtime work hours, annual paid leave, Labour Standards Act of 2008

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1. Introduction

In Japan, routinely working long hours is a serious problem. It has been pointed out that working long hours not only interferes with the work-life balance,[1] but also affects employees' physical and mental health, and in the worst case, can cause death from overwork.[2]

One of measures that may make working long hours reasonable is an increase in the overtime rate, as defined in the Labour Standards Act of 2008. Conventionally, the overtime rate in Japan was a standard 25% for hours worked over the legal limit. Compared to the rate in Europe and the United States, which was 50%,[3] the rate in Japan was half, and many argued that it was too low. However, on December 12, 2008, the Law for Partial Amendment to the Labour Standards Act of 2008 (Law No. 89, 2008) was executed, and became effective on April 1, 2010.

In that law, the following amendments were implemented: (1) the legal overtime rate[4] to be paid for 60 or more hours of overtime per month was increased from 25% to 50% (however, medium and small companies did not have to comply right away[5][6]); (2) once a

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[1] In order to support diverse work habits, the Work-life Balance Charter refers to working long hours and the utilization of annual paid holidays as follows: "In order to secure the health of workers and provide a working environment where they can work safely, it is important to promote the utilization of annual paid holidays to prevent working long hours and to make efforts to prevent mental health problems."

[2] Iwasaki (2008), Ma (2009), Yamaoka (2012), and Yamamoto & Kuroda (2014) pointed out that working long hours might increase the risk of cerebropathy and heart disease, and also might affect sleep, fatigue, and physical and mental disorders. Related to this, the Ministry of Health, Labour, and Welfare released the number of determined cases of compensation, and each number of determined cases of compensation by overtime work hour (monthly average) concerning cerebropathy, heart disease, and mental disorders in a report entitled "Compensation for Worker's Cerebropathy, Heart Disease, and Mental Diseases in 2013." The number of determined cases of compensation means the number of cases where the ministry determined job-related or not in the relevant year, and the number of cases of allowance determination means the number of job-related cases among them. The approval rate is a percentage of the number of cases of compensation from the total number of cases. We consider compensation determination for cerebropathy, heart disease, and mental diseases where the ministry finds a relationship between long workdays and these diseases. The number of determined cases regarding cerebropathy and heart diseases was 683 (he number of cases involving death among them: 290), and among them, the number of cases of 60 or more working hours was 285 (the number cased involving death among them: 123). The approval rate was 45% (The rate of death cases: 46%). Concerning mental diseases, the number of determined cases was 1193 (cases involving suicide and suicide attempts among them: 157), the number of cases of 60 or more working hours was 171 (cases involving suicide and suicide attempts among them: 37), and the approval rate was 23% (Suicide cases including suicide attempts: 29%). The approval rate indicates an upward trend. For more details, refer to "Compensation for Worker's Cerebropathy, Heart Disease, and Mental Diseases." However, the number of cases in this report show only the number of applications, and it is estimated that there are more potential cases.

[3] For more details on each company, refer to the Japan Institute for Labour Policy and Training (2014) and the Japan External Trade Organization (2013).

[4] Ordinance for Enforcement of the Labour Standards Act (Health and Welfare Ministry Ordinance No. 23, 1947) "Article 21: According to the definition in Clause 5, Article 37, in addition to family allowance and commuting allowance, the wages mentioned below shall not be calculated as the wage that is the base of the extra wages defined in Clause 1 and Clause 4 of Article 37: 1) family separation allowance; 2) child education allowance; 3) house allowance; 4) special wages; and 5) wages paid at regular intervals over a period exceeding one month."

[5] This is applied to companies of which amount of capital or total amount of investment is 50,000,000 yen or less in the case of a retail business, 50,000,000 yen or less in the case of a service business, 100,000,000 yen or less in the case of a wholesale trade, and 300,000,000 yen or less in the other cases, or the number of

labor-management agreement was executed, it was possible to provide paid leave for those employees who worked overtime more than 60 hours per month, in place of the standard 25% increase for overtime; and (3) instead of the paid leave that was an alternative to the overtime rate referenced in Section (2), after the revision of the law, when a business executed a labor-management agreement, an employee could use any existing paid leave by the hour up to five days per year (this applied to every company regardless of size[7]). Employees could freely select whether they would take paid leave by the day or by the hour.[8]

According to the amendments referenced above, in case of overtime of more than 60 hours per month, employees have the following three new options: (1) take the additional overtime rate in the form of a monetary bonus; (2) alternate part of the overtime rate with one-day leave or a half-day leave and take any remaining time with the overtime rate in the form of a monetary bonus; (3) alternate the total additional overtime for one-day leave or a half-day leave. Here, the unit for alternate leave is one-day or a half-day leave. This is because Item 2, Clause 1, Article 19-2 of the Law for Partial Amendment to the Labour Standards Act defines that a period of rest for employees shall be provided in a comprehensive time scale.[9]

Was the increase in the overtime rate and the alternatives for paid leave as defined in the 2008 revised law really effective for reducing long workdays? As will be explained in Chapter 3, if the Labour Demand Model[10] (Hamermesh, 1993) is applicable, the increase in the overtime rate is considered to be effective for reducing long working hours. On the other hand, as estimated in the Employment Contract Model[11] (Trejo, 1991), in cases where the total amount of wages and labor hours are part of a package contract, even if the overtime rate is increased, when an adjustment is performed due to a package contract by a reduction in the scheduled wages (possibly for an annual bonus or other allowances), the labor hours (and corresponding paid leave as a result of the law revision) may not change.[12] To analyze

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workers regularly employed is 50 or less in the case of a retail business, 100 or less in the case of a service business, 100 or less in a wholesale trade, and 300 or less in the other cases. Applicability is determined individually for companies (corporation or sole proprietor).

[6] The overtime rate for work on a scheduled day-off (35%) and late-night labor (25%) do not change. The overtime rate of medium and small companies will be discussed after three years of implementation.

[7] Even part-time workers with short, fixed working days can take paid leave after they conclude a labor-management agreement with employers. Employers decide how many hours equals one-day of annual paid leave based on the scheduled working hours of workers.

[8] For example, when workers want to take paid leave by the day, employers cannot change it to the paid leave by the hour.

[9] When a labor-management agreement approves that workers can bring fractional hours together with paid leave such as existing holidays and annual paid leave, it is permitted to alternate leave together with the existing paid leave and provide one-day or half-day leave. Please see the following URL for more details: http://www.mhlw.go.jp/topics/2008/12/dl/tp1216-11.pdf (accessed August 1, 2014).

[10] It is also called the Fixed-Wage Model as used by Trejo (1991).

[11] It is also called the Compensation Hypothesis or Fixed-Job Model, of which the latter name was used by Trejo (1991).

[12] Effectiveness of the overtime rate increase varies according to whether hours as defined in a package contract mean the total number of actual working hours or the hours including rest periods and paid leave.

the effectiveness of the revisions from the point of views of both models, it is desirable to control even observable properties and unobservable fixed effects (such as personal preference and company characteristics[13]), and also to focus precisely on any changes in wages. For that purpose, it was necessary to use data that allowed us to understand the working hours, wages, and other personal characteristics of a person who worked for the same company before and after the revision.

In this study, we verify how the revised Labour Standards Act of 2008 affected overtime work hours and the provision and acquisition of allowances for annual paid leave.[14] We used data from the Keio Household Panel Survey (KHPS), which contains follow-up surveys. The KHPS provides data for not only working hours and wages, but also the provision and acquisition of paid leave, concentration on work, and working styles such as discretionary work, de facto work, and flextime working without a set schedule. Therefore, we can analyze the impact on paid leave and the ability to concentrate on the job. Moreover, we can analyze impacts due to the overtime rate increase on each category such as working hours, wages, paid leave, and the ability to concentrate on the job, excluding categories where employees work under a system that includes discretionary work, de facto work, and flextime working without a set schedule, which may not allow overtime pay.

Our results show that the incidence of more than 60 hours overtime work per month in employees was decreased after the revision, and accordingly, the wages for those employees decreased. But overall this impact was small because more than 60 hours overtime work was rare. We cannot determine if the provision and acquisition of paid leave were affected. Please note that this result contains some limitations.

This paper will proceed as follows. In the next chapter, we confirm whether the revision of the law was effective for matters concerning the number of working hours and annual paid leave using government statistics. In Chapter 3, we introduce research that verifies the effects of labor hour laws on matters regarding the number of working hours and annual paid leave, a theoretical model indicating the effects of the revisions of the Labour Standards Act of 2008 in Chapter 4, and the data and analysis method used for this research in Chapter 5. We interpret the estimated results in Chapter 6, explain additional limitations in Chapter 7, and then we present the conclusions of this research in the final chapter.

For this study, we assume the total number of actual working hours.

[13] The DID analysis used in this study cannot control differences in individual characteristics generated as a result of the revisions to the law. The analysis of this research is based on the assumption that the effects of the revision were fixed changes. For more details on the restrictions of the DID analysis, refer to Bertrand and Mullaitahan (2004) and Imbens and Wooldridge (2009).

[14] We focus on the heterogeneity of individuals for analysis. Thus, because the KHPS does not allow identification of companies, it is difficult to consider a mutually dependent relationship on labor demand actions such as the hiring of replacements. There is currently no ideal data, so we must address this theme at some point in the future.

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2. Confirmation of the effects of the revisions to the Labour Standards Act of 2008, according to government statistics

Before performing DID analysis with the information from the KHPS, we confirmed whether the revision of the law was effective for reducing the number of working hours and the acquisition and provision of annual paid leave using government statistics.

First, we confirmed the working hours. Table 1 shows the transition of the index of the total average actual working hours per month of a full-time worker who belongs to a company with five or more employees in the total industrial group, the index of scheduled working hours, and the index of non-scheduled working hours, according to Ministry of Health, Labor, and Welfare's Monthly Labour Survey. In the table, the index of the total actual working hours, the index of scheduled working hours, and the index of non-scheduled working hours dropped in 2009 (most notably was that the index of non-scheduled working hours dropped significantly). We consider the main cause of this to be the impact of the bankruptcy of Lehman Brothers in 2008. In 2010, the index of total actual working hours, the index of scheduled working hours, and the index of non-scheduled working hours all increased. After 2010, although the index of scheduled working hours increased and decreased frequently, the index of non-scheduled working hours was on the rise. However, the possibility cannot be denied that working hours could have increased more, if it were not for revisions to the Labour Standards Act.[15]

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[15] According to Ministry of Health, Labour, and Welfare's General Survey on Working Conditions, in 2013, the percentage of companies that applied a 50% or higher overtime rate for workers who worked more than 60 hours per month of overtime was 52.8%. Also, the report shows that individual percentages of the companies that applied a 50% or higher overtime rate by company size were as follows: 30 to 99 employees – 35.7%; 100 to 299 employees – 58.6%; 300 to 999 employees – 78.0%; 1,000 or more employees – 91.8%. Thus, there was a significant difference in the overtime rates according to company size. From the existing statistics, it is difficult to confirm the actual conditions where employees worked overtime for free, disregarding the rule. However, from what we gathered, unpaid overtime work does exist.

Table 1: Transition of the index of the total average actual working hours per month of a full-time worker who belongs to a company with 5 or more employees in the total industrial group, the index of scheduled working hours, and the index of non-scheduled working hours

Company size	Five or more employees		
Research items	Index of total actual working hours	Index of scheduled working hours	Index of non-scheduled working hours
2004	101.6	101.6	100.6
2005	101.0	101.0	101.2
2006	101.6	101.4	104.3
2007	101.7	101.2	106.6
2008	100.8	100.4	105.2
2009	98.2	98.9	89.9
2010	100.0	100.0	100.0
2011	100.0	99.9	101.2
2012	100.8	100.7	103.2
2013	100.2	99.8	106.1

Source: Monthly Labour Survey, Ministry of Health, Labour, and Welfare.
Note 1: The research target is "full-time employees." The scale is based on the number of employees per business.
Note 2: The basis of the indexes is from the 2010 data, defined as 100.

Table 2 shows the transition of the ratio of non-agricultural employees' total working hours of the last week of a month by the number of employees (by company size), as reported in the Labour Force Survey from the Statistics Bureau of the Ministry of Internal Affairs and Communications. On the assumption that the number of scheduled working hours is 8 hours per day and the number of working days per week is five, the working hours totaled 40 hours per week. The non-scheduled working hours to which the increased overtime rate applied according to the revised law was over 60 hours per month, and when converted to weekly hours, the total was over 15 hours per week (4 weeks in one month). As a result, employees who worked more than 55 hours per week qualify for the increased overtime rate. However, the released document did not separate the data for those who worked more than 55 hours per week or those who worked less than 55 hours per week. Therefore, we focused on the change in the ratio of people who were required to work more than 60 hours per week. Further, the Labour Force Survey shows working hours including hours for side businesses, work done from home, and temporary work, and does not always show whether the hours were worked in the same place. Since the data show the work hours of the last week of a month, there is a concern that in cases of companies where their busy season is concentrated at the end of the month, the data reported may be extremely different from the typical working hours. However, the Labour Force Survey organizes the statistics by company size precisely, and we also used the Labour Force Survey in this study to confirm changes in the ratio of people who worked for more than 60 hours per week. By looking at the information in Table 2, we can confirm that the data shows a downward trend. Concerning 2010, when the revised Labour Standards Act of 2008 was implemented, the application range focused on companies with 100 or more employees, thus we cannot confirm that the ratio of people who worked for more than 60 hours per week decreased significantly after 2010. To see the number employees who worked for more than 60 hours per week in each category, please refer to the

ratio of people who worked less than 35 hours per week as shown in Table 2. This data shows an increase.

Table 2: Transition of the ratio of non-agricultural employees' total working hours in the last week of a month by company size in the total industrial group

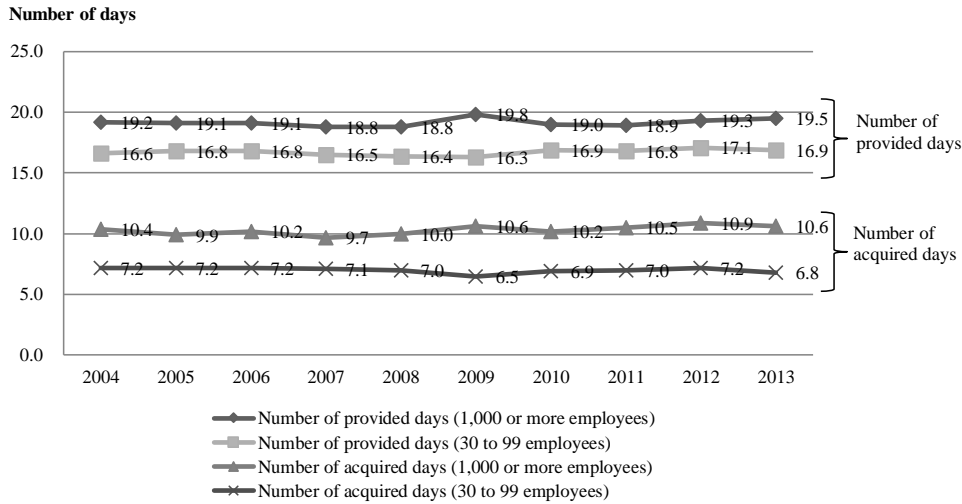| Total working hours of the last week of a month	Employees who work 60 hours or more per week					Employees who work less than 35 hours per week				
Company size	1 to 29 employees	30 to 99 employees	100 to 499 employees	500 to 999 employees	1000 or more employees	1 to 29 employees	30 to 99 employees	100 to 499 employees	500 to 999 employees	1000 or more employees
2004	12.5%	12.6%	13.0%	13.3%	12.8%	27.4%	22.9%	21.2%	20.8%	22.0%
2005	11.9%	11.9%	12.0%	12.8%	12.2%	28.1%	23.3%	21.8%	21.5%	22.1%
2006	11.0%	11.1%	11.2%	11.6%	11.2%	27.3%	22.2%	19.7%	19.3%	20.6%
2007	10.5%	10.6%	10.5%	10.2%	10.4%	29.4%	24.2%	22.2%	21.7%	23.2%
2008	10.6%	10.3%	9.9%	10.5%	9.5%	30.2%	25.1%	23.4%	23.9%	25.0%
2009	10.0%	9.5%	9.1%	9.2%	8.5%	31.1%	26.7%	24.6%	24.6%	25.7%
2010	10.2%	9.8%	9.4%	9.4%	8.5%	31.6%	26.3%	23.4%	23.8%	25.1%
2011	10.0%	9.7%	9.0%	9.8%	8.4%	31.9%	26.7%	24.3%	23.7%	25.7%
2012	9.6%	9.4%	8.8%	9.9%	8.6%	31.9%	26.6%	23.6%	23.7%	25.2%
2013	9.3%	9.3%	8.7%	8.9%	8.0%	33.6%	28.0%	25.8%	25.9%	28.1%

Source: Statistics Bureau, Ministry of Internal Affairs and Communications "Labour Force Survey" (data from 2011 does not contain information for Iwate, Miyagi, or Fukushima).

Note: Research target is limited to "non-agricultural employees." The scale is based on the number of employees per company.

To determine whether the revised law affected the acquisition and provision of annual paid leave, we indicated a transition of the number of provided and acquired days of annual paid leave according to the size of the company in total industrial group as reported in the Ministry of Health, Labour, and Welfare's General Survey on Working Conditions as shown in Figure 1. Because the data concerning annual paid leave in the General Survey on Working Conditions shows the average number of days per worker, a comparison of the time-series is difficult. Therefore, we compared the trends of the companies with 1000 or more employees, which are considered to be the most significantly affected companies, and companies with 30 to 99 employees, which are considered to be the least affected. Although in Figure 1, the number of provided days and the number of acquired days increased in cases of companies with more than 1000 employees in 2009, both numbers transitioned similarly from 2004 to 2008. From 2010, the number from companies with more than 1000 employees was slightly increased, but there was no significant shift.[16]

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[16] The number of days for paid leave shows the average number of days per worker. Because it is difficult to estimate how the statistics were interpreted, it is necessary to note this as a limitation of the study.

Figure 1: Transition of the number of days of provided and acquired annual paid leave by company size in total industrial group

Number of days

As previously mentioned, when comparing the working hours and annual paid leave with the government statistics, we could not confirm that the working hours and the number of acquired and provided days for annual paid leave changed drastically from 2010. However, the working hours and the progression of the acquisition and provision of annual paid leave that we have reviewed thus far did not allow us to identify the effects of the revisions to the law, but it did include other effects. Therefore, in this study, to control these "other effects" and then to verify the effects of the revision of the law, we used the KHPS and verified the information using DID analysis.

3. Research precedents on the effects of working-hour laws

Effects of the revised Labour Standards Act of 2008 vary according to what mechanism is working in the background. In this section, we introduce the Labour Demand Model (Hamermesh, 1993) and the Employment Contract Model (Trejo, 1991), to consider what

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mechanism works in each case where the revision of the law proves to be either effective or ineffective. Then, we confirm the verified research results on the effects of the working-hour laws.

First, if the Labour Demand Model is at play, companies supposedly reduce the working hours to respond to the increase of expenses when the overtime rate is increased. In other words, in the Labour Demand Model, the scheduled wages are constant, and only when there are costs for the adjustment[17] of the number of employees, do the companies respond to the increased overtime rate by changing the working hours. This explanation is primarily derived from the reports of Trejo (1991). For more details, refer to the research of Trejo (2003) and Bell and Hart (2003).

Hamermesh and Trejo (2000) analyzed the effects of an increase in the overtime rate in California, USA, with the Current Population Survey from 1973, 1985, and 1991. In California, people could ask for payment of overtime when they worked more than 40 hours per week, as defined by the Fair Labor Standards Act. After the revision, they could also ask for payment of overtime when they worked for more than 8 hours per day. This provision applied to women only at first, and beginning in 1980, it also applied to men. In the study, they compared the working hours of male employees and female employees in California and employees in other states to see if the working hours of male employees decreased. As a result of the analysis, they confirmed that the number of male employees who worked more than 8 hours in a day was lower in California than in other states, and accordingly considered that the Labour Demand Model was applied.

On the other hand, if the Employment Contract Model is established in Japan, even when the overtime rate is increased, other employment costs are reduced and working hours do not change, and accordingly, the effects of the revised Labour Standards Act of 2008 disappear. In the Employment Contract Model, employment contracts include both wages and working hours in a package contract. Under the hypotheses, even if the overtime rate is increased, that amount is set off by a reduction in fixed wages (or in bonuses or other allowances), and the wage is adjusted in the package contract. Therefore, working hours and the acquisition and provision of annual paid leave supposedly do not change. Trejo (1991) analyzed the effects of the overtime rate with the results of the Current Population Survey from May 1974, 1976, and 1978, in order to verify the Employment Contract Model. The results demonstrated that scheduled wages were reduced to set off the increased overtime rate, but the effects were not significant enough to completely set off the increase. However, there are some issues with this analysis, as there was no differentiation in the application of the overtime

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[17] Trejo (2003) explained the costs for the adjustment of quasi-labor fixed costs as required for human resources and training, fringe benefits, insurance premiums, and so on.

rate, and the industries and job types were largely different, so it was not clear whether the effects were brought on by the increase in the overtime rate or were due to the different industries and job types. With that, Trejo (2003) used the panel data of 11 industries from 1970 to 1989, and again verified the effects of the increase in the overtime rate derived from the revised Fair Labor Standards Act and a Supreme Court ruling. As a result, it was confirmed that overtime hours did not change in response to the increase in the overtime rate during the sampling period.

The other research precedent on the Employment Contract Model and the Labour Demand Model had different conclusions about which model was consistent. Bhattacharya, DeLeire, and MaCurdy (2000) verified the effects of restoring provisions of the above-referenced law from allowing employees who worked for more than 8 hours per day to ask for payment of overtime to the former working-hour restriction where employees could ask for payment of overtime for working more than 40 hours per week. Mitchell (2005) verified the effects of the white-collar exemption conducted in 1999 in California. Results from both studies were consistent with the conclusions of the Labour Demand Model. On the other hand, Bell and Hart (2003), and Kalwij and Gregory (2005) who used data from England, concluded that the Employment Contract Model was more consistent.

Although there were other verifications of the impacts of reduced legal hours, these verifications of clearly the same results were not generally accepted. Friesen (2002) confirmed that the impact on working hours was limited and also that wages for legal hours increased. Skuterud (2007) verified the effects of the policy in the province of Quebec in Canada to reduce weekly working hours from 44 hours to 40 hours and demonstrated that the number of full-time employees who worked more than 40 hours per week decreased by 20%. It was further confirmed that the decrease in the number of working hours did not lead to more job opportunities. Kawaguchi, Naito, and Yokoyama (2008) analyzed the effects of reduced legal hours from 48 hours to 40 hours in Japan from 1987 to 1997, from the perspectives of the number of working hours, wage rate, and employment opportunities. As a result of the analysis using the Basic Survey on Wage Structure, they demonstrated that even when legal hours were reduced by almost one hour, reduction in the actual time worked was just 0.14 hour. On the other hand, it was confirmed that the monthly earnings increased, even though the working hours were slightly reduced.

Research on the overtime rate in Japan has demonstrated that the increase in the overtime rate generally contributed to the reduction of working hours. Hayami (1995) used the KEO Model II developed by the Keio Economic Observatory at Keio University for simulation of the impacts of the increase in the overtime rate, and reported the results. According to the report, when the overtime rate was increased from 25% to 35%, the total actual working

hours decreased by 2 to 2.3%, and the number of employees went up by 1.2 to 1.3%. Moreover, Kuroda and Yamamoto (2012) studied the impacts of the system that provided no overtime, such as the system for white-collar exemptions and nominal managers (to which no working-hour restriction was applied). According to their analysis, compared to the employees who were covered by working-hour restrictions, the employees who were not covered by such restrictions tended to work longer especially in difficult economic times, and they stated that the Labour Demand Model was more consistent.

Was the revision of the overtime rate in 2008 really effective for reducing long workdays? In order to confirm whether it changed as indicated by the Labour Demand Model, or whether it did not change the working hours and paid leave as indicated by the Employment Contract Model, we must use the data that provides for a distinction of the effects derived from the increase in the overtime rate and the effects of demand derived from the different industries and job types, similar to the research that Trejo (2003) performed. We should also control the properties of individual preferences and types of companies. For that purpose, analysis with the panel data is necessary. Before our research, Asai (2014) utilized the panel data from the Japanese Life Course Panel Survey (JLPS), from the Institute of Social Science at the University of Tokyo and performed a DID analysis concerning the effects of the revised Labour Standards Act of 2008. In that analysis, she compared the data from January 2010, immediately before the revision, and the data from every January after the revision. She also analyzed requests of employees regarding whether they wanted to increase or decrease their working hours, considering their preferences. As a result, she clarified that the increase in the overtime rate had no impact on working hours and overtime of more than 60 hours per month, which was valuable information. However, we should discuss an additional issue regarding her research. To be more precise, the research did not clarify the effects of alternating overtime premiums with paid leave, brought by the revisions in 2008, as well as the shift from the normal business hours system to the discretionary working hours system, de facto work, or flextime working without a set schedule. In addition, the oldest employee in the JLPS respondents at this time was in his/her mid-40s at most, and if older employees are included in the analysis, the results may be different from the results of Asai's research (2014).[18] In this study, we consider these issues and re-verify how the companies responded to the effects of the revised Labour Standards Act of 2008.

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[18] Based on the data of the number of workers (non-agricultural industries) in the Labour Force Survey by the Statistics Bureau of the Ministry of Internal Affairs and Communications, we calculated the ratios of workers who worked for more than 60 hours per week out of all workers in 2009 and 2012 (the data of 2011 did not include continuous data due to the Great East Japan Earthquake) and compared them. Employees aged 45 to 49, aged 50 to 54, and aged 55 to 59 changed by -0.49 to -0.15%, and employees aged 20 to 24, aged 25 to 29, aged 30 to 34, aged 35 to 39, and aged 40 to 44 changed by -0.18 to 0.04%. Therefore, there is a possibility that the working hours of employees that are older than mid-40s are reduced. To confirm what factor may be affected most by the revision, we should increase variation in ages and job tenure years

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4. Theoretical model

In this study, we verify the effects of the revised Labour Standards Act of 2008 using examples from the theoretical model introduced by Trejo (2003).[19] First, a profit is indicated as Π. Turnover and expenses that make up the profit are indicated as follows: turnover $f(N,H)$ is indicated as a production function consisting of the number of employees (N) and working hours per person (H), for simplification. Expenses include one factor vN that is required for the employment adjustment and another part that varies according to number of hours worked. The latter part is divided further into three parts, including one part where the overtime rate is 0% and the working hours are within the legal hours (this is represented by $H \leq \overline{H}^{p25}$, requiring the expense ratio wNH where w is the rate of scheduled wages), a part of where the overtime rate is 25% and the working hours are over the legal hours (this is represented by $\overline{H}^{p25} < H \leq \overline{H}^{p50}$, that requires $(1 + \theta^{p25})wN(H - \overline{H}^{p25})$ $1 + \theta^{p25} = 1.25$ times the overtime rate. Note $\theta^{p25} = 0.25$.), and a part where the overtime rate is 50% and the working hours are over the legal hours (this is represented by $\overline{H}^{p50} < H$, indicating where overtime hours are more than 60 hours per month. The expense is $(1 + \theta^{p25} + \theta^{p50})wN(H - \overline{H}^{p50})$, in other words, the expense of $1 + \theta^{p25} + \theta^{p50} = 1.5$ times overtime rate. Note $\theta^{p50} = 0.25$.). Therefore, the profit is indicated as follows according to the pattern of working hours:

In case of $H \leq \overline{H}^{p25}$:
$$\Pi^1(w,v) = max\ f(N,H) - (wNH + vN)$$

In case of $\overline{H}^{p25} < H \leq \overline{H}^{p50}$:
$$\Pi^2(w,v,\theta^{p25},\overline{H}^{p25}) = max\ f(N,H) - [wN\overline{H}^{p25} + (1 + \theta^{p25})wN(H - \overline{H}^{p25}) + vN]$$

In case of $\overline{H}^{p50} < H$:
$$\Pi^3(w,v,\theta^{p25},\theta^{p50},\overline{H}^{p25},\overline{H}^{p50})$$
$$= max\ f(N,H) - [wN\overline{H}^{p25} + (1 + \theta^{p25})wN(\overline{H}^{p50} - \overline{H}^{p25}) + (1 + \theta^{p25} + \theta^{p50})wN(H - \overline{H}^{p50}) + vN]$$

The Labour Standards Act that was revised in 2008 defined a new pattern of working hours, of which the overtime rate was 50% (as represented by $\overline{H}^{p50} < H$). As a result,

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[19] Asai (2014) also presented a theoretical model that was similar to this study concerning the impact on working hours.

companies that permitted their employees to work overtime of more than 60 hours per month were under the obligation to pay additional expenses calculated by $(1 + \theta^{p25} + \theta^{p50})wN(H - \bar{H}^{p50})$. The part of the equation represented by θ^{p50}, θ^{p50} depends on the scheduled wage rate (w), the number of employees (N), and the number of working hours per person (H). We assume that companies change H when w and N are fixed (the Labour Demand Model), or change w when N and H are fixed (the Employment Contract Model), in order to pursue profit.[20]

The revised Labour Standards Act of 2008 allowed companies to provide paid leave to their employees who worked overtime of more than 60 hours per month if they executed a labor-management agreement. The part of the equation that can be alternated with paid leave is expressed as $\theta^{p50}wN(H - \bar{H}^{p50})$, and the profit function is indicated as follows:

In case of $\bar{H}^{p50} < H$, alternated with paid leave:
$$\Pi^4(w, v, \theta^{p25}, \theta^{p50}, \bar{H}^{p25}, \bar{H}^{p50})$$
$$= max\ f(N, H) - [wN\bar{H}^{p25} + (1 + \theta^{p25})wN(\bar{H}^{p50} - \bar{H}^{p25}) + (1 + \theta^{p25})wN(H - \bar{H}^{p50})$$
$$+ \theta^{p50}wN(H - \bar{H}^{p50}) + vN]$$

When the profit function is as shown above, the sum totals of the profit function and expenses in the case of $\bar{H}^{p50} < H$ are the same. Therefore, the total expense the company bears does not change if the paid leave is acquired by the day or by the hour or if overtime premiums are paid. In any case, when employees work overtime more than 60 hours per month, companies shall bear additional expenses.

In this section, we consider a case where a cost represented by $\emptyset(\emptyset \geq 1)$ is required for alternating overtime payments with paid leave. When a worker takes paid leave, it is necessary to assign a person to take the place of that worker in some cases. We assume the cost for this exchange. The symbols below indicate the case where one of the variables that can be alternated with paid leave is changed to $\emptyset\theta^{p50}wN(H - \bar{H}^{p50})$:

$$\Pi^4(w, v, \theta^{p25}, \theta^{p50}, \bar{H}^{p25}, \bar{H}^{p50})$$
$$= max\ f(N, H) - [wN\bar{H}^{p25} + (1 + \theta^{p25})wN(\bar{H}^{p50} - \bar{H}^{p25}) + (1 + \theta^{p25})wN(H - \bar{H}^{p50})$$
$$+ \emptyset\theta^{p50}wN(H - \bar{H}^{p50}) + vN]$$

In the case where $\emptyset = 1$, the impact on the profit of a company does not change even when overtime premiums are paid or alternated with paid leave. However, in the case where $\emptyset > 1$,

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[20] In this study, it is difficult to strictly identify both hypotheses with specific parameters. The precedent research tends to have this problem. Also, the Labour Demand Model ignores actions of the labor suppler. This point should be considered in future research.

since the cost is necessary when the overtime premiums are alternated with paid leaves, there is no incentive for the company. We consider that $\emptyset$ varies according to whether employees acquire their paid leave by the day or by the hour. We assume that the first case incurs a higher cost because a substitute employee is necessary. Although $\emptyset$ cannot be observed directly in this study, we perform positive analysis on how the provision and acquisition of paid leave changes due to the increase in the overtime rate to confirm the impacts of the increase of the overtime rate on the provision and acquisition of paid leave. Due to special circumstances in Japan, people actually hesitate to take paid leave even though the system of paid leave is available. If paid leave is not fully utilized, the provisions for paid leave may be even more cost effective that the payment of overtime. This is also why we analyze the two aspects of paid leave—provision and acquisition.

5.   Data and analysis methods

The individual data used in this research was derived from the KHPS of the Panel Data Research Center at Keio University. The KHPS is given every year to respondents to follow-up on the initial survey and has been conducted every January since 2004, and includes several questions concerning occupation, earnings, and family structure. The research target includes 4000 respondents from 20 years old to 69 years old at the time of the initial survey (the end of January) including men and women (the number of respondents in the data provided to us was 4005 including extra respondents). In addition, the center similarly sampled and added 1400 respondents in 2007 (1419 including the extra respondents), and 1000 responders in 2012 (1012 including the extra respondents). We were able to utilize data collected for 10 years from 2004 to 2013. This data allowed us to understand the variation in working hours of individuals of the overall working generations around 2010, when the revised Labour Standards Act of 2008 went into effect. In this study, we analyzed initial respondents and additional respondents in 2007.

Our research target was regular employees under 60 years of age. We only analyzed employees who worked for the same companies before and after the implementation of the revised law (Survey in 2010 and Survey in 2011). With these KHPS respondents, we made histograms showing distributions of working hours before and after the revision as shown in Figure 2. They showed not only distributions before and after the revision, but also whether or not each employee's working hours were averaging over 55 hours per week before the

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revision.[21] The reason why we focused on 55 hours per week, is that the overtime rate went up to 50% when overtime hours were more than 60 hours per month, and cases where employees worked 55 hours per week corresponded to cases of overtime of 60 hours per month, on the assumption that the scheduled working hours were eight hours per day and the number of workdays per week was five. We continuously focused on the number 55 hours per week in the later estimates. However, the KHPS Survey in January 2010 was conducted immediately before the revision, and it was difficult to determine whether the revised law affected the working hours system to be discussed later in this study, except for overtime and paid leave systems. Therefore, we excluded the data from this period.

In the overall respondents, the data is concentrated near 40 hours per week prior to the revision, and most subparts (81.55%) are found within the area of 55 hours per week or less. Therefore, it can be stated that a limited number of employees were affected by the revised law. The overall figure after the revision also showed no significant change. Therefore, we selected a respondent of employees whose average working hours were over 55 hours per week before the revision (2004 to 2009) and compared their data both before and after the revision. Although there were concentrations around 60 hours per week before the revision, it was mitigated after the revision, and working hours tended to be reduced. On the other hand, when the average before the revision was less than 55 hours, no significant change appeared, similar to the overall data. In the following sections, we make estimations regarding additional factors and analyze the impact on working hours, wages, and the provision and acquisition of paid leave.

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[21] Also in the following sections, we focus on whether the average working hours before the revision were 55 hours or more. This is an average value, calculated by dividing the total observed working hours of each period before the revision by the number of times of observations. In our calculations, we only used the period in which the workers belonged to the same companies both before and after the revision.

Figure 2: Distributions of working hours before and after the revision of the law (concentrating on employees who worked less than 55 hours per week and who worked over 55 hours per week, before and after the revision)
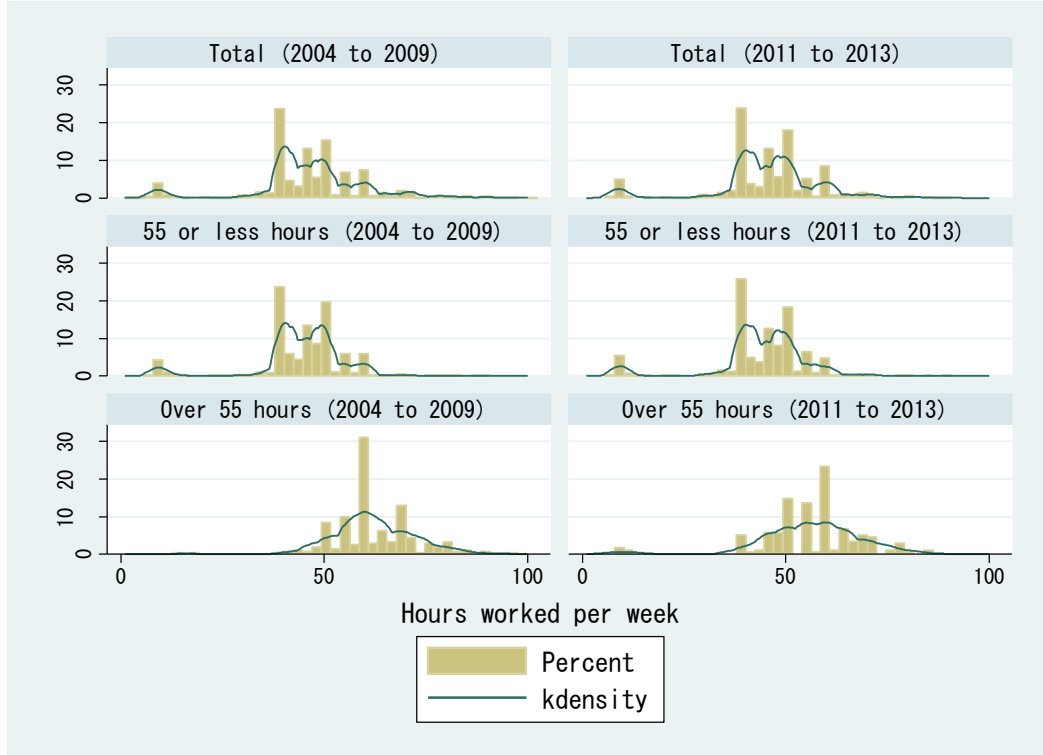
In this study, we perform Difference in Difference (DID) analysis, by comparison between a treatment group of employees whose legal overtime rate was increased, and a control group of employees whose rate was not increased. In particular, concerning working hours, real wage rates, the number of days of provided and acquired annual paid leave, and working hours systems, we prepared the following nine formulas:

$$H1_{it} = \beta_1^{H1} + \beta_2^{H1} Y_{it}^{H1} + \beta_3^{H1} A_{it}^{H1} + \beta_4^{H1} \left(Y_{it}^{H1} \times A_{it}^{H1} \right) + X_{it}^{H1'} \beta_5^{H1} + \alpha_i^{H1} + \varepsilon_{it}^{H1} \tag{1}$$

$$H2_{it} = \beta_1^{H2} + \beta_2^{H2} Y_{it}^{H2} + \beta_3^{H2} A_{it}^{H2} + \beta_4^{H2} (Y_{it}^{H2} \times A_{it}^{H2}) + X_{it}^{H2'} \beta_5^{H2} + \alpha_i^{H2} + \varepsilon_{it}^{H2} \tag{2}$$

$$V1_{it} = \beta_1^{V1} + \beta_2^{V1} Y_{it}^{V1} + \beta_3^{V1} A_{it}^{V1} + \beta_4^{V1} (Y_{it}^{V1} \times A_{it}^{V1}) + X_{it}^{V1'} \beta_5^{V1} + \alpha_i^{V1} + \varepsilon_{it}^{V1} \tag{3}$$

$$V2_{it} = \beta_1^{V2} + \beta_2^{V2} Y_{it}^{V2} + \beta_3^{V2} A_{it}^{V2} + \beta_4^{V2} (Y_{it}^{V2} \times A_{it}^{V2}) + X_{it}^{V2'} \beta_5^{V2} + \alpha_i^{V2} + \varepsilon_{it}^{V2} \tag{4}$$

$$W1_{it} = \beta_1^{W1} + \beta_2^{W1} Y_{it}^{W1} + \beta_3^{W1} A_{it}^{W1} + \beta_4^{W1} (Y_{it}^{W1} \times A_{it}^{W1}) + X_{it}^{W1'} \beta_5^{W1} + \alpha_i^{W1} + \varepsilon_{it}^{W1} \tag{5}$$

$$W2_{it} = \beta_1^{W2} + \beta_2^{W2} Y_{it}^{W2} + \beta_3^{W2} A_{it}^{W2} + \beta_4^{W2} (Y_{it}^{W2} \times A_{it}^{W2}) + X_{it}^{W2'} \beta_5^{W2} + \alpha_i^{W2} + \varepsilon_{it}^{W2} \tag{6}$$

$$C_{it} = \beta_1^{C} + \beta_2^{C} Y_{it}^{C} + \beta_3^{C} A_{it}^{C} + \beta_4^{C} (Y_{it}^{C} \times A_{it}^{C}) + X_{it}^{C'} \beta_5^{C} + \alpha_i^{C} + \varepsilon_{it}^{C} \tag{7}$$

$$N1_{it} = \beta_1^{N1} + \beta_2^{N1} Y_{it}^{N1} + \beta_3^{N1} A_{it}^{N1} + \beta_4^{N1} (Y_{it}^{N1} \times A_{it}^{N1}) + X_{it}^{N1'} \beta_5^{N1} + \alpha_i^{N1} + \varepsilon_{it}^{N1} \tag{8}$$

$$N2_{it} = \beta_1^{N2} + \beta_2^{N2} Y_{it}^{N2} + \beta_3^{N2} A_{it}^{N2} + \beta_4^{N2} (Y_{it}^{N2} \times A_{it}^{N2}) + X_{it}^{N2'} \beta_5^{N2} + \alpha_i^{N2} + \varepsilon_{it}^{N2} \tag{9}$$

Here, the subscript i indicates a person, and t indicates a year. $H1_{it}$ is a dummy variable indicating whether or not weekly working hours go over 55 hours. $H2_{it}$ is a continuous variable regarding the surplus of hours over 55 in a week. This variable is 1 when the weekly working hours are 56 hours, and cases where the weekly working hours are less than 56 are not included in the variable. $V1_{it}$ indicates the number of days of provided annual paid leave, and $V2_{it}$ indicates the number of days of acquired annual paid leave. $W1_{it}$ indicates annual earnings from primary work (log in real term), and $W2_{it}$ indicates the wage rate per hour (log in real term).[22] C_{it} is a dummy variable for the ability to concentrate on the job.[23] $N1_{it}$ is a dummy variable, which indicates 1 when the working hour system includes discretionary or de facto work, and indicates 0 when the working hour system is a general or flexible schedule system. $N2_{it}$ too is a dummy variable, which indicates 1 when the working hour system includes flextime working without a set schedule (managers and others who do not receive overtime premiums), and indicates 0 when the working hour system is a general or flexible schedule system. Y_{it} is a dummy variable, which indicates 1 when the period is 2011 to 2014, and indicates 0 when the period is 2005 to 2009. However,

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[22] It was adjusted using the "Consumer Price Index" (sum total excluding imputed rents of owned houses) by the Statistics Bureau, Ministry of Internal Affairs and Communications.
[23] Dummy variable for the ability to concentrate on the job: Question "Have you ever lost your concentration on the job?" Answer: "Frequently/Sometimes/Almost never/Never." The variable is 1 when a responder selects "Never."

concerning formulas (3), (4), (8), and (9), we only analyze data after 2008. This is because the surveys contain no questions regarding the number of days of provided and acquired annual paid leave and the working hours systems, which are explained variables, until 2007. Therefore, in these cases, Y_{it} indicates 0 only for the year 2008 and the year 2009. The reason why the year 2004 is excluded is that the control variables were not available, as will be discussed later. The reason why the year 2010 is excluded, is that the year 2010 was immediately before the implementation of the revised law, and it was difficult to estimate the clear impact on the working hours system in this year. A_{it} is a dummy variable for the revision that was applied. In this study, we divided the treatment group and the control group by type of industry and number of employees and prepared a variable that used 1 for the treatment group for which the revision was considered to be applied. To be more specific, the employees of wholesale trades, retail businesses, and service businesses[24] with 100 or more employees, the employees of other types of industries with 500 or more employees,[25] and people involved in public affairs[26] are represented by a 1, and the employees of wholesale trades and retail businesses with 5 to 29 employees, the employees of service businesses and other types of industries with 5 to 99 employees are represented by a 0.[27] In this study, we confirm whether or not the coefficient β_4 of the cross-term was significant after the implementation of the revised law, and verify whether or not the revision had an impact. The coefficient β_4 is defined as a difference between the treatment group and the control group before and after the revision, as shown below:

$$\beta_4^Z = \left(Z_{treatment\ group}^{after} - Z_{treatment\ group}^{before}\right) - \left(Z_{control\ group}^{after} - Z_{control\ group}^{before}\right) \tag{10}$$
$$Z \in (H1, H2, V1, V2, W1, W2, C, N1, N2)$$

We introduce a rate of change of the production index[28] of the relevant industry for the

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[24] Definition of service businesses according to the KHPS: "information services and research services," "telecommunication services excluding information services," "medical and welfare services," "education and learning support services," and "other services."

[25] Concerning the number of employees, the KHPS asks a question regarding the number of employees in the overall company for which a respondent works on a routine basis. In the KHPS survey, the definition of "overall company" depends on the respondent. Therefore, there is a possibility that unsuitable respondents are included.

[26] As a result of the recommendation by the National Personnel Authority in August 2009, an increase in the overtime rate and settlement of alternative systems for paid leave were introduced along with the revision. Therefore, we included civil services in the treatment group. However, there is a possibility that some local authorities receive slightly different treatment from the recommended content.

[27] Because the KHPS gives options such as "wholesale trade or retail business," we cannot determine which one a respondent belongs to.

[28] We use the Indices of Mining and Industrial Output for the mining and manufacturing industry, the values of the relevant industry of the Indices of Tertiary Industry Activity for the tertiary industry, and the Indices of Government Services, etc. in the Indices of All Industry Activity for the civil services. However, for "education and learning support services" of the KHPS, we use the values of "learning support" from the Indices of Tertiary Industry Activity.

control variable X_{it} in order to control variation in the demand of products. In addition, we use dummy variables regarding age, job tenure, job type, existence of a labor union at the worksite,[29] job title status, gender, partner status, academic record, and type of industry. Note that β in each formula including β_4 is a parameter, α_i is an individual effect, and ε_{it} is an error term. We excluded the rate of change of the production index in 2004, as we could not calculate a value used for analysis in 2004 due changes in the industrial classifications. We confirmed the impact on working hours with formulas (1) and (2), the impact on provision and acquisition of annual paid leave with formulas (3) and (4), the impact on the total amount of wages with formula (5) and the wage rate with formula (6) at the same time, and the ability to concentrate on the job with formula (7). Companies may increase the number of employees who work under the working hours systems allowing no overtime premium to reduce the labor costs derived from the increase in the overtime rate. Therefore, we confirmed whether or not the application of the working hours system changed after the revision with formulas (8) and (9). Note that formulas (1), (7), (8), and (9) are estimated with a linear probability model (LPM). Concerning which model is theoretically valid, the simplest assumption is that when formulas (1), (2), (5), and (6) show significantly negative DID estimation values, the Labour Demand Model is relevant. On the other hand, when formulas (1) and (2) are not significant, in some cases, not only the Employment Contract Model, but also the Labour Demand Model are relevant. Those cases, for example, are where the sample size was too small to be significant, alternating with paid leave or when change in the working hours system was performed and the optimal working hours before the revision were less than 55 hours and did not become negative values. Therefore, we prepare sub-samples and analyze the paid leave and the working hours systems for more precise analysis.

Concerning formulas (1) through (7), we used the data of respondents working under the typical working hours systems or flexible working hours systems and focused on employees who received overtime premiums.[30]

Table 3 shows descriptive statistics of the variables introduced above. The mean value of

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[29] Concerning labor union, the KHPS gives options as follows and allows a respondent to select one: "1. Our worksite has no labor union; 2. Our worksite has a labor union, but I am not a member; 3. I am a member of the labor union of our worksite; 4. I am a member of the labor union that is not an union of our worksite; and 5. I am inapplicable (self-employed worker, freelance professional)." In this study, when the respondent selected answer 2 or 3, we set the labor union dummy variable as 1, and when the respondent selected another answer, we set the dummy variable as 0. In Japan, more than half of the labor unions have union-shop contracts (the Ministry of Health, Labor, and Welfare's General Survey on Labour Relations in 2011 (Survey on Collective Agreements) indicated that 64.3% of the companies had union-shop contracts and provisions of some kind), and generally, almost all regular employees of companies that have labor unions, except managers, are members of unions. Therefore, instead asking whether or not a respondent is a member, the question to ask is whether or not a respondent's worksite has a labor union for a more suitable analysis of Japanese workers. Ohtake (2001) and Ogura (2003) also pointed this out.

[30] Research on the working hours systems began in 2008. For values prior to 2008, we used the results of 2008 for a follow-up study.

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the revision application dummy variable was 0.504 to 0.613, and the ratio of the treatment group to the control group was small; the percentage of employees whose overtime working hours were over 55 hours was 18.1%.

Table 3: Descriptive statistics

	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
"Over 55 weekly working hours" dummy variable	0.181	0.386	0.687	0.464										
Hours worked per week	46.39	12.96												
Hours exceeding 55 hours per week					9.221	7.084								
Real wage (log)	6.219	0.467	6.26	0.438										
Real wage rate (log)	−1.51	0.593	−1.77	0.501										
Number of days of provided paid leave (excl. the number of carry-over days)							14.48	7.296						
Number of days of acquired paid leave							5.467	5.881						
"Ability to concentrate on the job" dummy									0.211	0.408				
"Discretionary/de facto work" dummy variable											0.04	0.195		
"Flextime working without a set schedule" dummy variable													0.081	0.274
"Revision application" dummy variable	0.606	0.489	0.537	0.499	0.504	0.501	0.545	0.499	0.586	0.493	0.613	0.487	0.606	0.489
"After-revision (2011 or later)" dummy variable	0.407	0.491	0.434	0.496	0.349	0.477	0.503	0.502	0.466	0.499	0.559	0.497	0.557	0.497
"Revision application" dummy variable × "After-revision (2011 or later)" dummy variable	0.249	0.433	0.206	0.405	0.158	0.365	0.261	0.44	0.278	0.448	0.347	0.476	0.34	0.474
"20s" dummy variable	0.083	0.275	0.068	0.252	0.079	0.27	0.061	0.239	0.076	0.265	0.064	0.246	0.061	0.24
"30s" dummy variable	0.299	0.458	0.339	0.474	0.333	0.472	0.303	0.461	0.298	0.457	0.295	0.456	0.282	0.45
"40s" dummy variable	0.367	0.482	0.425	0.495	0.405	0.491	0.461	0.5	0.357	0.479	0.365	0.482	0.377	0.485
"50s" dummy variable	0.251	0.434	0.168	0.375	0.183	0.387	0.176	0.382	0.27	0.444	0.275	0.447	0.28	0.449
"5 or less years of job tenure" dummy variable	0.163	0.369	0.177	0.382	0.198	0.399	0.139	0.347			0.138	0.345	0.135	0.341
"6 to 10 years of job tenure" dummy variable	0.195	0.396	0.271	0.445	0.237	0.426	0.2	0.401			0.197	0.398	0.186	0.389
"11 to 15 years of job tenure" dummy variable	0.155	0.362	0.171	0.377	0.158	0.365	0.212	0.41			0.165	0.371	0.163	0.369
"16 to 20 years of job tenure" dummy variable	0.155	0.362	0.1	0.301	0.14	0.347	0.109	0.313			0.143	0.35	0.148	0.355
"21 or more years of job tenure" dummy variable	0.332	0.471	0.28	0.45	0.267	0.443	0.339	0.475			0.357	0.479	0.369	0.483
"Junior high graduate" dummy variable	0.058	0.233	0.062	0.241	0.059	0.235	0.079	0.27			0.062	0.241	0.062	0.241
"High-school graduate" dummy variable	0.419	0.493	0.478	0.5	0.486	0.5	0.394	0.49			0.4	0.49	0.396	0.489
"Junior college/technical college graduate" dummy variable	0.108	0.31	0.094	0.293	0.104	0.306	0.127	0.334			0.103	0.305	0.107	0.31
"University graduate/master's degree" dummy variable	0.353	0.478	0.354	0.479	0.333	0.472	0.382	0.487			0.372	0.483	0.373	0.484
"Other" dummy variable	0.063	0.243	0.012	0.108	0.018	0.132	0.018	0.134			0.062	0.241	0.062	0.241
"Clerical job" dummy variable	0.241	0.428	0.097	0.297	0.153	0.36	0.176	0.382	0.24	0.427				
"Sales/service job" dummy variable	0.131	0.337	0.206	0.405	0.178	0.383	0.152	0.36	0.132	0.339				
"Managerial job" dummy variable	0.065	0.247	0.029	0.169	0.046	0.209	0.042	0.202	0.064	0.244				
"Other" dummy variable	0.563	0.496	0.667	0.472	0.623	0.485	0.63	0.484	0.564	0.496				
"Existence of labor union at worksite" dummy variable	0.48	0.5	0.481	0.5	0.44	0.497	0.461	0.5			0.484	0.5	0.472	0.499
"Female" dummy variable	0.221	0.415	0.041	0.199	0.066	0.249	0.067	0.25	0.232	0.423	0.224	0.417	0.217	0.412
"Construction industry" dummy variable	0.093	0.291	0.162	0.369	0.178	0.383			0.096	0.294	0.09	0.286	0.092	0.289
"Manufacturing industry" dummy variable	0.253	0.435	0.145	0.352	0.196	0.397			0.248	0.432	0.243	0.429	0.242	0.428
"Wholesale/retail/catering/hotel industry" dummy variable	0.091	0.287	0.159	0.366	0.142	0.35			0.093	0.29	0.102	0.303	0.099	0.299
"Finance/insurance" dummy variable	0.053	0.225	0.065	0.247	0.043	0.204			0.053	0.224	0.057	0.231	0.056	0.23
"Transportation industry" dummy variable	0.061	0.239	0.139	0.346	0.127	0.334			0.06	0.237	0.057	0.231	0.057	0.232
"Medical/welfare" dummy variable	0.112	0.315	0.038	0.192	0.053	0.225			0.107	0.309	0.109	0.312	0.109	0.312
"Education/learning support industry" dummy variable	0.051	0.219	0.103	0.305	0.064	0.244			0.051	0.221	0.054	0.227	0.055	0.228
"Other" dummy variable	0.287	0.452	0.189	0.392	0.196	0.397			0.292	0.455	0.287	0.453	0.29	0.454
"Holding a managerial post" dummy variable	0.364	0.481	0.389	0.488	0.412	0.493	0.503	0.502			0.508	4.693	0.496	4.75
Production index change rate (%)	0.974	4.269	−0.04	4.021	0.355	4.485								
Total unemployment rate	4.373	0.408	4.369	0.405	4.331	0.396								
"Married" dummy variable							0.824	0.382						
Number of children							1.539	1.118	1.412	1.128				
	N=2116		N=339		N=393		N=165		N=2069		N=1691		N=1768	
	Estimation formula (1)A, (5)A, (6)A		Estimation formula (1)B, (5)B, (6)B		Estimation formula (2)		Estimation formula (3),(4)		Estimation formula (7)		Estimation formula (8)		Estimation formula (9)	

Source: Calculations made by the authors using data from the KHPS.

Note: We excluded the respondents that gave no reply or selected "Inapplicable." We also excluded the values outside of the range between the mean +/- standard deviation ×3 as outliers.

6. Estimation results

Table 4 shows the estimation results of formulas (1) through (9).[31] As a result of the Hausman Test, formulas (2), (5)A, and (6)A supported the Fixed-Effects Model, and the other results supported the Random-Effects Model (or Random-Effects LPM). Because formulas (3) and (4) had no variation in the revision application dummy variable of one identical person, and the Fixed-Effects Model could not estimate the parameters of β_3^{V1} and β_3^{V2}, we used only the Random-Effects Model for estimation.

To conserve space in this article, we did not include the results of the model not supported by the Hausman Test.[32] The values in the top column of the explanatory variables are cross-term coefficients.

In this section, we will review the following five points in this order: (1) working hours, (2) provision and acquisition of paid leave, (3) wages and wage rates, (4) the ability to concentrate on the job, and (5) working hours systems.

First, we confirmed the impact on working hours. Formula (1)A showed no significant cross-term coefficient and did not show that the revision was effective. As confirmed in the previous section, the working hours of approximately 80% of the regular employees were less than 55 hours before the revision, and the impact of the change in the overtime rate was considered to be small. However, what was the result of the data of employees who had already worked long hours on a daily basis before the revision? Formula (1)B showed only the data of employees who had already worked more than 55 hours per week on average for the same companies for the period before the revision from 2004 to 2009. By using this formula, we confirmed that the working hours were reduced significantly after the revision (marginal effect -0.200).[33] On the other hand, were employees' hours that exceeded more than 55 working hours per week reduced? The results of formula (2) showed no significant cross-term coefficient, and did not show that those employees' hours exceeding more than 55

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[31] The results do not use robust standard errors because the robust standard errors do not allow operation of the Hausman Test. Although there are several test methods with the robust standard errors to determine whether the Fixed-Effects Model or the Random-Effects Model is appropriate, we could not find a test method that was applicable to a case where the explanation variables of both models did not match.

[32] In the Fixed-Effects Model (or Fixed-Effects LPM), we excluded from the estimates the "female" dummy variable, "academic record" dummy variable, and "industry type" dummy variable as shown in Table 3.

[33] There is concern that a sample selection bias appeared depending on whether or not the average working hours before the revision were over 55. To confirm this point, we used Heckman's two-step method, and found that β_4^{H1} was negative and significant, and the inverse Mills' ratio was not significant. For the first-step estimation at this time, we used the following variables from the survey in 2009 (when there was no reply in 2009, we used information from before and after 2009) such as the "age" dummy variable, "job tenure" dummy variable, "academic record" dummy variable, "job type" dummy variable, "industry type" dummy variable, "number of employees" dummy variable, "labor union" dummy variable, "female" dummy variable, " "holding a managerial post" dummy variable " dummy variable, "region" dummy variable, and "municipal size" dummy variable. The dummy variable for "number of employees" was not used in past estimations, but what we used to evaluate the size of the company within the five stages.

hours per week were reduced.[34]

Secondly, we confirmed the impact on the provision and acquisition of paid leave. Formulas (3) and (4) showed results concerning the number of days of provided paid leave, and also the number of days of acquired paid leave, but the cross-term was not significant. The employees who were supposedly impacted by the revision were those who worked more than 55 hours per week. However, it should be noted that the sample size was reduced to 165 when we limited the data in this way.

Thirdly, we confirmed the impact on wages and wage rates. Formula (5)B showed the impact on wages and formula (6)B showed the impact on wage rates by using the sample from formula (1)B. Formula (5)B showed a reduction in wages after the revision, as the cross-term was negative and significant (10% level).[35] However, formula (5)A, used to estimate the whole sample, showed no significant cross-term, and therefore, we consider there was almost no overall impact. On the other hand, formula (6)B showed no significant cross-term, and did not show an impact on wage rates.[36] Note that formula (6)A did not have a significant cross-term, similar to (5)A. With the results mentioned above, we consider the employees' working hours that exceeded more than 55 hours per week were reduced, and wages were also reduced at the same time, but the wage rate showed no significant reduction, and there is still a possibility that the companies maintained the same hourly wage rates as before the revision. We suspect that the reasons for the reduction in the amount of wages were the reduction in the overtime premiums along with reduction in the opportunities for long overtime hours. However, we cannot verify this further because the KHPS does not have questions regarding overtime premiums.

Fourthly, we confirmed the impact on the ability to concentrate on the job. In cases of employees who worked for more than 55 hours per week on average before the revision, we suspect they had received extra wages in many years. However, it cannot be said that the wage rates decreased while the opportunities for long-term work of over 55 hours per week decreased. One of the reasons for this was improvement in the productivity of employees. It was difficult to measure the productivity itself, so we focused on the ability to concentrate on the job in this section, instead. Formula (7) showed a 10% level, but the cross-term was positive and significant (marginal effect 0.05). This result was derived from research among

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[34] We estimated using the Random-Effects Tobit Model that was based on the assumption that the working hours of 55 hours or less per week were reduced, but found that β_4^{H2} was not significant.

[35] Similar to formula (1)B, we used Heckman's two-step method. The inverse Mills' ratio was not significant, and β_4^{W1} was negative and significant at the 10% level.

[36] Similar to formulas (1)B and (6)B, we used Heckman's two-step method. The inverse Mills' ratio was not significant. However, β_4^{W2} was negative and significant at the 10% level. Because the inverse Mills' ratio was not significant, we decided that the sample selection problem was so small that we did not need to address it and that we could interpret according to the panel estimation results. However, for confirmation, we discussed this point in the section on limitations.

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whole sample. One of our interpretations regarding this effect is that the companies to which the revision was applied immediately began efforts to improve labor efficiency.

Finally, we confirmed the impact on the working hours systems. Formulas (8) and (9) analyzed the working hours systems and similarly showed no significant cross-term. Therefore, the research has not shown that the companies to which the revision was applied responded to the increase in the overtime rate by adjusting their working hours systems.[37]

As mentioned above, according to the results, although the system changed as a result of the revisions to the Labour Standards Act of 2008, only a small impact could be confirmed statistically on all employees in the companies to which the revision was applied; however, there were statistically significant results in the reduction of working hours[38] and in the reduction in wages[39] for the employees who worked long hours before the revision. It was also clarified that all employees in the companies to which the revision was applied had improved their concentration on their jobs.[40] However, it should be reiterated that the number of employees who worked for more than 55 hours before the revision was small, and if the research target was limited to those employees, the sample size for this analysis would also be very small. In particular, where β_4 was not significant, we cannot determine that it had no impact of the revision.

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[37] On the other hand, we could assume that the workers who worked under the systems that included flextime working without a set schedule, discretionary work, and de facto work took a toll on the working hours. On this point, we selected those workers and analyzed their working hours using the Random-Effects Tobit Model on the assumption that 40 working hours or less per week were reduced. However, the DID estimation value was not significant.

[38] The workers whose working hours were significantly reduced were supposedly those with many years of job tenure. When we estimated the "job tenure" dummy variable, the "after-revision" dummy variable, and the "revision application" dummy variable as a Triple Difference, the cross-term of these three variables tended to be significantly negative in cases of longer job tenure. The same trend appeared when we made the job tenure a continuous variable. The reason for such a difference should be the focus of a future study.

[39] Concerning formulas (1)B and (5)B, we divided the "after-revision (2011 or later)" dummy variable into three dummies "2011," "2012," and "2013," and confirmed a cross-term between them and the "revision application company" dummy variable to check the trend of reduction. As a result, the working hours were reduced over time after the revision, and the amount of wages decreased in 2012. It is difficult to discuss aspects of this difference and the temporal trend between the working hours and the amount of wages because the sample size was too small.

[40] The estimation samples included respondents of the companies whose size changed after the revision. To check whether or not it affected the results, we estimated with the additional dummy variables such as (1) transferred to the control group after 2009 and (2) transferred to the treatment group after 2009, and made additional estimates based on formulas (1) through (9) after excluding those respondents. As a result, we found that the significance of the cross-term did not change and the cross-term did not increase in significance. Therefore, we feel that there was no bias that could change the conclusions of this report.

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Table 4: Results of formulas (1) through (9)

Estimation formula name:	(1)A	(1)B	(2)	(3)	(4)	(5)A	(5)B	(6)A	(6)B	(7)	(8)	(9)
Explained variable:	"Over 55 weekly working hours" dummy variable		Hours exceeding 55 weekly working hours	Number of days of provided paid leave (excl. the number of carry-over days)	Number of days of acquired paid leave	Real wage (log)		Real wage rate(log)		"Ability to concentrate on the job" dummy variable	"Discretionary/de facto work" dummy variable	"Flextime working without a set schedule" dummy variable
Sample condition (weekly working hours):	Whole sample	Over 55 hours on average before revision	Whole sample	Over 55 hours currently		Whole sample	Over 55 hours on average before revision	Whole sample	Over 55 hours on average before revision	Whole sample	Whole sample	
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
"Revision application" dummy variable × "After-revision (2011 or later)" dummy variable (β_4)	-0.028	-0.200**	0.021	0.277	-0.968	0.017	-0.076*	0.046	-0.110	0.050*	0.007	0.020
	(0.029)	(0.094)	(2.095)	(2.019)	(1.627)	(0.015)	(0.044)	(0.040)	(0.068)	(0.030)	(0.013)	(0.020)
"Revision application" dummy variable (β_3)	-0.020	-0.089	-1.498	4.457***	1.783	0.008	0.212***	-0.068	0.270***	-0.051*	0.005	-0.017
	(0.031)	(0.085)	(1.534)	(1.387)	(1.216)	(0.030)	(0.069)	(0.078)	(0.085)	(0.031)	(0.017)	(0.025)
"After-revision (2011 or later)" dummy variable (β_2)	-0.019	-0.217***	1.400	3.173**	-0.971	0.122***	0.129***	0.100**	0.215***	-0.073***	-0.004	-0.028*
	(0.024)	(0.074)	(1.782)	(1.518)	(1.226)	(0.019)	(0.047)	(0.050)	(0.070)	(0.023)	(0.011)	(0.016)
Age (ref = 20s)												
"30s" dummy variable	0.043	0.251**	-3.898	-3.505	1.280	0.110***	0.267***	0.054	0.294***	-0.024	0.003	-0.021
	(0.036)	(0.117)	(2.698)	(2.467)	(2.073)	(0.022)	(0.061)	(0.057)	(0.092)	(0.038)	(0.021)	(0.031)
"40s" dummy variable	0.059	0.282**	-7.609**	-4.607*	0.691	0.152***	0.385***	0.109	0.496***	-0.078*	-0.011	0.014
	(0.041)	(0.128)	(3.583)	(2.441)	(2.194)	(0.029)	(0.079)	(0.077)	(0.112)	(0.043)	(0.024)	(0.035)
"50s" dummy variable	0.009	0.366***	-13.235***	-3.693	1.013	0.096***	0.297***	0.066	0.437***	-0.117**	0.002	0.022
	(0.045)	(0.140)	(4.812)	(2.804)	(2.518)	(0.037)	(0.096)	(0.096)	(0.130)	(0.047)	(0.026)	(0.038)
Job tenure (ref = 5 or less years)												
"6-10 years" dummy variable	-0.028	0.047	-2.010	3.079*	1.460	0.034**	0.049	0.115**	0.040		0.006	-0.013
	(0.027)	(0.079)	(2.304)	(1.851)	(1.604)	(0.017)	(0.045)	(0.045)	(0.065)		(0.015)	(0.023)
"11-15 years" dummy variable	-0.059*	0.043	-4.839	5.955***	3.432*	0.049*	0.055	0.164**	0.046		0.016	0.048*
	(0.033)	(0.097)	(3.245)	(1.951)	(1.839)	(0.027)	(0.061)	(0.069)	(0.086)		(0.019)	(0.028)
"16-20 years" dummy variable	-0.086**	0.062	-3.103	4.464**	1.680	0.014	0.086	0.151	0.124		-0.004	0.026
	(0.036)	(0.107)	(4.674)	(2.185)	(2.019)	(0.036)	(0.079)	(0.093)	(0.101)		(0.021)	(0.030)
"21 or more years" dummy variable	-0.103***	-0.076	-1.543	6.618***	1.359	-0.009	0.122	0.187	0.173		-0.004	0.027
	(0.039)	(0.100)	(5.930)	(1.871)	(1.822)	(0.045)	(0.092)	(0.117)	(0.109)		(0.022)	(0.031)
Job type (ref = Clerical job)												
"Sales/service job" dummy variable	0.057	0.017	-3.364	-2.074	-4.939***	-0.018	-0.004	-0.156**	-0.055	-0.045		
	(0.038)	(0.105)	(2.998)	(1.767)	(1.644)	(0.025)	(0.065)	(0.067)	(0.094)	(0.040)		
"Managerial job" dummy variable	-0.002	0.245	2.658	0.097	-1.483	-0.005	0.110	-0.069	-0.059	0.002		
	(0.042)	(0.182)	(3.925)	(2.700)	(2.344)	(0.026)	(0.127)	(0.069)	(0.171)	(0.045)		
"Other" dummy variable	0.004	-0.017	0.128	-3.912***	-1.817	0.005	-0.003	-0.070	-0.067	-0.011		
	(0.028)	(0.106)	(3.005)	(1.412)	(1.330)	(0.020)	(0.075)	(0.053)	(0.101)	(0.030)		
"Existence of labor union at worksite" dummy variable	0.002	0.122*	0.076	0.460	0.425	0.015	-0.018	0.038	-0.032		0.011	-0.034*
	(0.026)	(0.070)	(2.081)	(1.175)	(1.056)	(0.021)	(0.045)	(0.054)	(0.064)		(0.014)	(0.020)
"Holding a managerial post" dummy variable	0.020	-0.020	-3.310**	-3.538***	-0.878	0.034**	0.060	0.031	0.114**			
	(0.021)	(0.063)	(1.573)	(1.180)	(1.059)	(0.013)	(0.037)	(0.035)	(0.054)			
Production index change rate	0.001	-0.004	-0.171								0.000	0.002*
	(0.002)	(0.007)	(0.127)								(0.001)	(0.001)
Total unemployment rate						-0.086***	-0.038	-0.060*	0.012			
						(0.014)	(0.039)	(0.036)	(0.059)			
"Female" dummy variable	-0.160***	-0.090		0.391	1.255		-0.339		-0.320	-0.109***	-0.033	-0.076***
	(0.036)	(0.199)		(2.023)	(1.960)		(0.255)		(0.255)	(0.037)	(0.021)	(0.028)
"Married" dummy variable				0.638						-0.032		
				(1.782)						(0.037)		
Number of children				-0.528						0.029**		
				(0.583)						(0.014)		
"Academic record" dummy variable	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
"Industry type" dummy variable	Yes	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes
Constant term	0.318***	0.735***	20.162***	15.017***	1.542	6.389***	5.740***	-1.430***	-2.608***	0.282***	0.017	0.080
	(0.071)	(0.188)	(4.604)	(2.649)	(2.521)	(0.079)	(0.242)	(0.207)	(0.319)	(0.063)	(0.040)	(0.063)
Sample size (the number of individuals)	2116(513)	339(84)	393(193)	165(111)	165(111)	2116(513)	339(84)	2116(513)	339(84)	2069(540)	1691(515)	1768(527)
Estimation method	Random-Effects LPM	Random-Effects LPM	Fixed-Effects Model	Random-Effects Model	Random-Effects Model	Fixed-Effects Model	Random-Effects Model	Fixed-Effects Model	Random-Effects Model	Random-Effects LPM	Random-Effects LPM	Random-Effects LPM
Hausman Test	19.67	15.82	26.72	–	–	142.04	14.19	40.07	6.73	10.00	10.56	12.42
Prob>chi2	0.235	0.465	0.045	–	–	0.000	0.585	0.0008	0.9782	0.531	0.567	0.413

Source: Estimated by the authors using data from the KHPS.

Note: ***, **, and * individually refer to the 1% level, 5% level, and 10% level and that they are significant. The numbers in ( ) show standard errors.

7.   Limitations of this study

In this section, we will discuss the additional limitations of the results of our study.

First, we discussed the possibility that a variation in significance could depend on the respondents that have large disparities when various personal properties were controlled, if the sample size was small. Table 5 shows the results after excluding personal characteristics. The cross-term coefficients in the table show that wages and the ability to concentrate on the job, which were significant in the previous section, were not significant. Although regarding the ability to concentrate on the job, the sample size of 2069 was limiting, the sample size concerning wage analysis was only 339, and there may be limitations regarding these coefficients. On the other hand, concerning working hours, (1)B' results shows that it was significant even though the level was 10%, and this is considered to be consistent with the results discussed in the previous section.

Secondly, we discussed how the difference in the properties of the limited respondents such as formulas (1)B, (5)B, and (6)B affected the results as a whole. Table 6 shows an LMP estimation of the probability where the average weekly working hours before the revision were over 55 hours (84 respondents), among the people belonging to sample 1A, (5)A, and (6)A (513 respondents).[41] We used the explanatory variable for the research in 2009, but a few of them included missing values due to no-answer responses. In that case, we used past values, and for missing values otherwise, we used values from the next year or from the year after the next. The results show that the age group of which average weekly working hours were over 55 hours before the revision consisted primarily of employees in their 30s and 40s, compared to those in their 50s of which probability was lowest. Concerning job tenure, compared to the group with 11–15 years that had the lowest probability, the group of employees with 6–10 years had higher probability. Concerning the industry type, compared to the manufacturing industry, the construction industry, the wholesale/retail/catering/hotel industry, the finance industry, and the education/learning support industry indicated a higher tendency. In addition, there were more male respondents than female. Other factors such as the job type and academic record were not significant. Therefore, we should reiterate that the results regarding working hours and wages as discussed in the previous section include variations according to age, job tenure, industry type, and gender. However, we consider that the sample selection bias was small enough to have no effect on our results (see footnotes 33, 35, and 36).

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[41] As a result of the uneven dispersion test of Breusch-Pagan/Cook-Weisberg, there was a possibility of uneven dispersion. Therefore, we used the White robust standard errors.

Table 5: Results excluding personal characteristics

Estimation formula name:	(1)A'	(1)B'	(2)'	(3)'	(4)'	(5)A'	(5)B'	(6)A'	(6)B'	(7)'	(8)'	(9)'
Explained variable:	"Over 55 weekly working hours" dummy variable		Hours exceeding 55 weekly working hours	Number of days of provided paid leave (excl. the number of carry-over days)	Number of days of acquired paid leave	Real wage (log)		Real wage rate(log)		"Ability to concentrate on the job" dummy variable	"Discretionary/de facto work" dummy variable	"Flextime working without a set schedule" dummy variable
Sample condition (weekly working hours):	Whole sample	Over 55 hours on average before revision	Whole sample	Over 55 hours currently		Whole sample	Over 55 hours on average before revision	Whole sample	Over 55 hours on average before revision	Whole sample	Whole sample	
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
"Revision application" dummy variable × "After-revision (2011 or later)" dummy variable (β_4)	0.007	−0.177*	−0.314	0.721	−2.081	0.017	−0.064	0.041	−0.104	0.048	0.005	0.015
	(0.030)	(0.094)	(1.482)	(2.071)	(1.526)	(0.016)	(0.044)	(0.039)	(0.068)	(0.030)	(0.013)	(0.019)
"Revision application" dummy variable (β_3)	0.032	−0.036	0.518	4.852***	3.615***	0.010	0.093	−0.061	−0.122	−0.030	0.023	−0.005
	(0.061)	(0.071)	(0.914)	(1.476)	(1.284)	(0.031)	(0.095)	(0.078)	(0.149)	(0.029)	(0.015)	(0.022)
"After-revision (2011 or later)" dummy variable (β_2)	−0.060**	−0.197***	−0.544	3.621**	−0.082	0.076***	0.143***	0.101***	0.295***	−0.084***	−0.002	−0.013
	(0.024)	(0.068)	(1.024)	(1.531)	(1.112)	(0.012)	(0.032)	(0.031)	(0.049)	(0.023)	(0.010)	(0.015)
Constant term	0.185***	0.830***	9.011***	9.829***	4.197***	6.178***	6.161***	−1.524***	−1.814***	0.256***	0.028**	0.093***
	(0.038)	(0.054)	(0.665)	(1.118)	(0.957)	(0.019)	(0.054)	(0.049)	(0.084)	(0.023)	(0.013)	(0.017)
Sample size (the number of individuals)	2116(513)	339(84)	393(193)	165(111)	165(111)	2116(513)	339(84)	2116(513)	339(84)	2069(540)	1691(515)	1768(527)
Estimation method	Fixed-Effects LPM	Random-Effects LPM	Random-Effects Model	Random-Effects Model	Random-Effects Model	Fixed-Effects Model	Fixed-Effects Model	Fixed-Effects Model	Fixed-Effects Model	Random-Effects LPM	Random-Effects LPM	Random-Effects LPM
Hausman Test	10.98	2.92	2.88	–	–	44.96	25.18	33.6	12.34	2.06	1.86	2.45
Prob>chi2	0.012	0.403	0.411			0.000	0.000	0.000	0.0063	0.560	0.602	0.484

Source: Estimated by the authors using data from the KHPS.

Note: ***, **, and * individually refer to the 1% level, 5% level, and 10% level and they are significant. The numbers in ( ) show standard errors.

Table 6: LPM estimation regarding workers who worked for more than 55 hours per week on average before the revision

	Coef.	(Std. error)
Age (ref = over 50)		
"20s" dummy variable	0.007	(0.071)
"30s" dummy variable	0.084*	(0.047)
"40s" dummy variable	0.119***	(0.040)
Job tenure (ref=11-15 years)		
"5 or less years" dummy variable	0.066	(0.057)
"6-10 years" dummy variable	0.144**	(0.059)
"16-20 years" dummy variable	0.000	(0.058)
"21 or more years" dummy variable	0.011	(0.055)
Job type (ref = Clerical job)		
"Sales/service job" dummy variable	0.049	(0.071)
"Managerial job" dummy variable	0.012	(0.064)
"Other" dummy variable	0.039	(0.038)
Industry type (ref = Manufacturing industry)		
"Construction industry" dummy variable	0.127*	(0.067)
"Wholesale/retail/catering/hotel industry" dummy variable	0.162**	(0.081)
"Finance/insurance" dummy variable	0.175*	(0.093)
"Transportation industry" dummy variable	0.128	(0.085)
"Medical/Welfare" dummy	0.006	(0.049)
"Education/learning support industry" dummy	0.263***	(0.093)
"Other industry type" dummy	0.048	(0.039)
Academic record (ref = Junior high graduate)		
"High-school graduate" dummy variable	−0.032	(0.078)
"Junior college/technical college graduate" dummy variable	−0.018	(0.087)
"University graduate/master's degree" dummy variable	−0.075	(0.080)
"Other" dummy variable	−0.124	(0.093)
"Existence of labor union at worksite" dummy variable	−0.006	(0.035)
"Holding a managerial post" dummy variable	0.007	(0.040)
"Female" dummy variable	−0.182***	(0.038)
Constant term	0.105	(0.086)
Sample size	513	

Source: Estimated by the authors using data from the KHPS.
Note: ***, **, and * individually refer to the 1% level, 5% level, and 10% level and they are significant. "Std. error" means robust standard error.

8. Conclusion

In this study, with performed a DID analysis and verified whether the revisions to the Labour Standards Act of 2008 contributed to a reduction in long working hours, by using the the KHPS. As a result, although we could not confirm impacts on all of the employees, we confirmed it was effective in reducing the number of overtime hours of employees who had been conventionally working long hours prior to the revision and should be a target of the increased overtime rate. The wages for those employees were decreased. The ability to

concentrate on the job was improved in all employees in companies to which the revision was applied. We could not determine if the provisions allowing employees to alternate overtime premiums with annual paid leave was effective. However, as previously mentioned, there are limitations to these results.

To show that the Employment Contract Model is established, we must confirm that the working hours and wages do not change. Although Trejo (1991) referred to the possibility of annual adjustments, the KHPS asked about "the average" weekly working hours, and the DID results of this study included data from three years after the revision. Even with some limitations, even if we deny the possibility of a reduction in working hours and wages in the working hours and the wages, we think that we cannot dismiss the use of the Labour Demand Model.

A significant limitation of this study, is that because the KHPS provides no information regarding the capital stock of each company, it is difficult to strictly differentiate the treatment group from the control group. Due to the unavailability of information regarding production activities and the number of employees, the analysis extracts such information. Furthermore, concerning this, this puts a limitation on the essential part of the DID analysis. During the time period of this analysis, there was an economic downturn precipitated by the Lehman Brothers bankruptcy. The production condition of the companies represented by the sample employees was not known, and we could not establish controls for the production activities in this analysis. Therefore, even if the treatment group and the control group can be strictly differentiated, the DID analysis basis itself is unstable when the impact of the economy on production activities is uneven in either group. Consequentially, it would be beneficial to take a structural estimation approach, taking the companies' production activities and employment adjustments into consideration using Employer-Employee data for conducting a simulation in order to discuss the potential impacts. However, at present, we do not know of any available or appropriate data. We would like to conduct this analysis in the future without these limitations.

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