Firm's demand for work hours:
Evidence from multi-country and matched firm-worker data

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Abstract

Using information on Japanese, UK, and German workers' work hour and matched firms' characteristics, this paper investigates whether the number of hours worked is determined by demand-side factors, and tries to introduce one possibility to explain why Japanese tend to work longer hours than workers in other countries. Based on an empirical framework that each firm sets a minimum boundary of work hours, and workers hired by the firm are not able to work less than the minimum requirement, we found that the minimum requirement depends on the fixed costs of labor that the firm bears. Specifically, firms that tend to conduct labor hoarding during recessions, presumably because of higher fixed costs, require incumbent workers to work longer hours. We also found that the greater the workers' firm-specific skills, the more firms placed demands on these workers to work longer hours, given other things are equal. Since Japanese firms have long been considered to bear large fixed costs to train workers, we interpret the long work hour requirement as a rational strategy for Japanese firms to protect those workers that have accumulated high skills from dismissal. In other words, the long work hours of Japanese workers reflect the practice of long-term employment, a typical feature of the Japanese labor market.

Keywords: labor demand, actual and desirable work hours, work hour constraints, fixed costs of labor, and work-life-balance.

JEL classification: J22; J23; J24; J32

I. Introduction

Japan has long being categorized as a nation working long hours. According to comparable statistics provided by OECD (2010), for example, 18% of Japanese male employees worked more than 60 hours per week in 2007, whereas the corresponding figures for British and German males were 7% and 4%, respectively. As such evidence shows, Japanese have been often considered workaholic by the international standard. However, do Japanese work long hours by their own choice, or are they forced to work longer from any constraints set by the firms in which they are employed? As described in more detail in the next section, many Japanese think that they are over-employed and want to reduce their work hours given the current wage rate. Using information on workers' work hour preferences and matched firm-worker characteristics, this paper examines how the number of hours worked is affected by demand-side factors, and tries to introduce one possibility to explain the large differences in the number of hours worked among countries.[1]

The canonical model of labor supply states that a worker can flexibly choose his/her own work hours to maximize the person's utility at any given wage. However, findings from several studies suggest that in reality workers cannot choose work hours freely. For example, in his survey on labor supply, Heckman (1993) concludes that most of the variability in labor supply can be explained by extensive margins (i.e., workers' flows into and from the labor market), whereas intensive margins (i.e., changes in hours worked) are extremely small. In fact, Kuroda and Yamamoto (2008) show that the intensive margin of Japanese workers is nearly zero, endorsing Heckman's conclusion. Using job-mover data, Altonji and Paxton (1986, 1988, 1992), Senesky (2004), and Martinez-Granado (2005) suggest that choices of wages and hours are only available as a "package"; therefore, a worker is not able to flexibly change work hours unless he/she changes jobs. Many studies, including Moffitt (1982), Stewart and Swaffield (1997), and Bryan (2004), confirm that some proportion of workers face work hour constraints and are unable to choose work hours freely. These studies suggest that the determination of work hours is heavily dependent on the demand side. Therefore, work hour constraints due to demand factors should be incorporated in estimations of the labor supply function.

While most of these studies concentrate on estimating the wage elasticity of work hours by incorporating such constraints, only a few focus on the determinants of

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[1] Regarding possible explanations for the differences in work hours among countries, see for example, Prescott (2004), Blanchard (2004), and Alesina et al. (2006).

the work hour constraints themselves—such as Stewart and Swaffield (1997), Doiron (2003), and Bryan (2004). They explicitly examine how demand factors affect the lower bound of work hours, although due to lack of detailed data, only limited information such as the local unemployment rate or firm size is used to specify the demand-side factors.[2] This paper provides further evidence that hours worked are affected by demand-related factors, using information from the employers' side not available in usual household surveys. Specifically, our advantage would be the rich information on workplaces and firms extracted from two surveys: an original multi-country workers' survey on Japan, the UK, and Germany and an original matched firm-worker data on Japan, designed to link with the annual official firm panel survey (Basic Survey of Business and Activities [BSBA], Ministry of Economy, Trade, and Industry). As explained in more detail in the next section, several previous studies have pointed out that demand for work hours is an increasing function of the user cost of labor. Because of the lack of firm-side information at the micro level, however, very few empirical studies have investigated this point. As a possible determinant of work hours, therefore, we focus on the factors that reflect the size of fixed costs of labor or the accumulation of firm-specific skills. Besides fixed costs, we also test the possibility that better workplace management would reduce the inefficiently long work hours. From the two data mentioned above, we extract information such as the firms' practices on employment adjustment during previous recessions, HRM and work-life-balance policies, and the degree of firm-specific skills of employees. We then utilize the information on workers' work hour preferences to investigate whether these firm-side factors are important determinants of work hours.

This paper is summarized as follows. First, a common feature is observed for all three countries (Japan, the UK, and Germany) regarding information from the workers side. That is, workers are required to work longer hours in workplaces where labor hoarding was observed during recessions compared to other workplaces. Second, we draw the same conclusion, focusing further on this feature using Japanese firm-worker matched data. Specifically, those firms that have largely adjusted the number of employees in previous recessions tend to demand significantly shorter work hours than those that have engaged in labor-hoarding practices, given the same negative shock. We interpret these results as follows: Labor-hoarding firms require incumbent workers to work long hours instead of hiring extra workers, and use such long overtime

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[2] Bryan (2007) also emphasizes the importance of firm-specific factors on work hours, indicating that nearly a third of the explained variation in work hours can be ascribed to firm-level characteristics based on the workplace survey.

work hours as a buffer to adjust personnel costs when a negative shock occurs. Thus, it may be argued that longer work hours by Japanese reflect the long-term employment system with high skill accumulation, which has been the typical feature of the Japanese labor market. Third, we also find that good HRM practices can serve as a device to reduce demand for work hours. This implies that there is still room for workplaces in Japan (where work hours are inefficiently long) to achieve a work-life-balance even under the traditional labor-hoarding environment.

The structure of this paper is as follows. In Section II, we explain our data and observe some basic facts regarding the actual and desired work hours among Japanese, British, and German workers. In Section III, we briefly describe the theoretical background of why actual hours worked diverge from the desired hours, and introduce our empirical model to access the theory. Section IV shows the results using data from a cross-country survey on workers and Japanese firm-worker matched data. Section V concludes the paper.

II. Data and basic facts

(1) Data

The data used in this paper are mainly from the *Work-Life Balance Survey in Japan and Europe* (hereafter, WLB-JE), which was conducted in December 2010 by the Research Institute for Economy, Trade, and Industry (RIETI) of the Ministry of Economy, Trade, and Industry (METI). The WLB-JE consists of two strands: the matched firm-worker survey for Japanese firms and employees and the multi-country employee survey for Japanese, UK, and German employees.[3]

The matched firm-worker survey was conducted among firms that employ more than 100 employees to collect firm-side information on their human resource management (HRM) practices and policies to enhance worker's work-life balance (WLB) along with basic firm characteristics. The questionnaire was sent to the 9,628 firms that had responded to the BSBA conducted by METI. By matching the WLB-JE firm survey with the BSBA, the basic business-related information such as the past variation in the number of employees and sale amounts from their profit and loss statements becomes available. The respondent firms were also asked to choose more than five white-collar employees in their firm and hand out the questionnaire of the WLB-JE employee survey to them. Those employees were then asked to return the

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[3] As project members, we contributed to designing the questionnaires for these surveys.

questionnaire by mail after filling in the information on their actual and desired hours worked, wage, job tenure, job and HRM characteristics in their workplace, and other basic employee characteristics. As a result, information on 1,677 firms out of the 9,628 (which correspond to a 17.4% response rate) and 10,055 matched employees was available for the WLB-JE.

The cross-country employee survey, aimed to complement the above-mentioned Japanese matched firm-worker survey, was conducted via Internet so that the same questions were asked of white-collar employees working in the UK and Germany. The targeted employees worked for firms with more than 250 employees. The number of employees available was 979 in the UK and 1,012 in Germany.

From the WLB-JE, we use white-collar regular employees above 20 years old who usually work more than 20 hours a week. After removing outlier and missing values, our sample consists of 7,135 Japanese employees (4,958 males and 2,177 females) in 1,524 firms, 854 (392 males and 462 females) UK employees, and 875 (462 males and 413 females) German employees.

(2) Basic facts

Table 1 compares weekly hours worked and the ratio of long-hour workers among Japanese, UK, and German employees. The table indicates the average hours worked by Japanese males is much longer than others. Japanese males work 47 hours a week on average, and those working more than 50 hours (60 hours) a week amount to 40% (10%), which is much larger than for UK and German males. Although female employees also work longer in Japan, the differences in hours worked and ratio of long-hour workers are not so large as compared to UK and German females.

To check for the potential sampling bias in the WLB-JE data, we also calculated the average hours worked by adjusting the differences in individual characteristics among the three countries (see Table 1). Specifically, we first estimated the hours worked for each country, using individual characteristics such as age, tenure, tenure squared, manager dummy, occupation dummies, industry dummies, firm size dummies, marital status dummy, and child dummy. Then, applying Japanese data with the estimated coefficient for the UK or Germany, we derived the hours worked, adjusted for the potential differences in individual characteristics. Comparing the adjusted work hours with the original, we find no major changes in the differences of weekly hours worked and the ratio of long-hour workers among the three countries, suggesting that Japanese males work much longer than UK and German males.

We also compared hours worked in WLB-JE data with representative panel

data in each country. Table 2 summarizes weekly hours worked by white-collar employees and the ratio of those employees working more than 50 hours, using the Keio Panel Household Survey (KHPS), the British Panel Household Survey (BHPS), and the German Socio-Economic Panel (GSEOP). From Table 2, we find that the hours worked in each representative panel survey for 2004–2008 are longer than in our WLB-JE sample. This might be due to the difference in the survey year, since the WLB-JE was conducted after the financial crisis of 2008. However, even using 2010 data, only available for Japan, we find the average hours worked for both males and females are longer in the KHPS datasets. This implies that our WLB-JE samples might include a relatively larger proportion of workers who work shorter hours compared with the three countries' national averages.

Next, we considered worker's preferences for working hours to check the possible constraints on hours worked. In the WLB-JE, the respondents were asked to answer the following questions: If you could choose your working hours at your current hourly rate of pay, would you choose to increase or decrease the number of hours you work? If yes, by how much? The answers, summarized in Table 3, suggest the potential constraints for hours worked. Those who prefer to work more hours (or face the upper constraint), constitute about 10% in each country. On the other hand, the ratio of those who prefer to work less (or face the lower constraint) differs a lot across countries; more than a quarter of Japanese respondents declare that they want to decrease their work hours, whereas the proportion of such respondents is much smaller for both UK and Germany. As a result, the average number of hours worked that respondents want to change is about -1.6 hours for Japanese males, which is much larger compared with UK and German males. Furthermore, comparing the actual and preferred hours worked in Figure 1, we see that long-hours-working employees, especially Japanese males, tend to prefer shorter work hours.

These results imply that many Japanese employees face firms' work hour constraints that force them to work longer than workers' preferences. The evidence that a large proportion of workers face work hour constraints suggests that the demand-side factors have a great influence on Japanese workers who work long hours. In what follows, we estimate the firm's demand function for work hours and try to specify the demand factors that bring about long work hours.

III. Theoretical and empirical framework

(1) Theoretical background

As briefly mentioned in the Introduction, a strand of literature on labor supply has long suggested that because of firms' fixed costs to employ workers and individual costs to move between jobs or firms, hours worked are considerably influenced and determined by the firm; workers cannot freely choose the number of hours they work, at least in the short run. To mention an early example, Rosen (1969) pointed out that due to factors such as hiring or specific training costs, firms' demand for work hours is an increasing function of the user cost of labor.[4] More recently, Kahn and Lang (1991, 1992) tested whether long-term contracts suggested by either the agency model (Lazear, 1981) or the firm-specific human capital model (Mincer,1974; Becker, 1964) may specify hours of work that deviate from the spot market level. They obtain favorable (but weak) results for the firm-specific human capital model to explain the workers' work hour constraints. Specifically, they suggest that firm-specific human capital makes long-term employment relationships desirable for workers and firms, and by sharing in the investment in human capital both parties ensure against a withdrawal by either. In this setting, the investment is shared by setting the wages in the early years above the value of the marginal product, but below the alternative wages. The implications of this model for work hour restrictions is that a firm will restrict low-tenure workers from working more hours, while making long-tenured (thus, highly skilled) employees to work longer. In other words, these studies suggest that the larger the fixed costs of hiring and training a worker, the longer the firm requires the invested workers to work, indicating the positive correlation between fixed costs and work hours.

While the above authors focus on the cross-sectional variation of work hours among individuals, some studies emphasize the business cycle variation of work hours when firms incur fixed costs. In general, if firms incur large fixed costs of labor, it is likely that they adjust labor costs by using work hours in recessions to prevent those costs from being sunk. For example, Nickell (1978) shows theoretically that if fixed costs increase, the period of work hour adjustment and labor hoarding would become longer. If this is true, higher fixed costs would require a firm to make work hours more flexible. Therefore, such firms would keep work hours longer during a normal period in order to save for future negative shocks. In a similar context, Hunt (2000) empirically

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[4] See also Barzel (1973) and Deardroff and Stafford (1976) who provide reasons other than fixed costs to explain why some workers' actual work hours diverge from the desired.

shows that more flexible use of short hours slows the adjustment of the number of workers based on the German experience. In Germany, the use of short time (reduction below the standard hours) by union-firm negotiation was widespread during the 1980s, and this flexibility in work hours served as a buffer to protect workers from dismissal. The German experience shows that if hours can be reduced far below the standard workweek, long work hours during a normal period may not be necessary. However, we assume such type of adjustment is not common, since there is a downward rigidity in the nominal standard wage.[5] For example, in Japan, Kuroda and Yamamoto (2003a, 2003b) show that downward nominal wage rigidity was observed in the severe deflationary recession of the 1990s. If reducing hours below the standard workweek is difficult, firms need to set demand for hours above the standard to make room for adjustment when a negative shock occurs.

All these studies suggest that high training costs, or accumulated firm-specific human capital, may be an important factor determining the length of work hours. Japanese firms have long been considered to emphasize employee training in order to accumulate firm-specific human skills. We presume that this may be one of the reasons why Japanese work longer hours than people in other countries. For example, Mincer and Higuchi (1988) find that the wage profile of Japanese firms is much steeper than that of US firms. Some empirical findings indicate that many Japanese firms practice long-term employment, by comparing the adjustment speed of employment and work hours when a negative shock occurs (e.g., Shinozuka and Ishihara, 1977; Tachibanaki, 1987; Abraham and Houseman, 1989). Many of them suggest that the adjustment of employment is significantly greater in other countries than in Japan while that of work hours is greater in Japan, suggesting strong labor-hoarding practices by Japanese firms. Such behavior has been interpreted as a consequence of protecting regular workers who have accumulated high human skills at heavy training costs against dismissal.[6] Although much research has focused on the differences in the speed of employment

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[5] According to Hunt (2000), in Germany, workers put on short time receive short-time benefits, which replace the same proportion of their lost earnings as unemployment insurance would if they were fully unemployed, and such benefits may last up to two years during recessions. This policy indicates such nationwide insurance system to compensate wage cuts is necessary to make standard hours flexible.

[6] Even after the prolonged recession since the early 1990s (the so-called lost decade of Japan), Kato (2001) finds that Japan's long-term employment system still endures. Kambayashi and Kato (2011) also find that the job stability of regular employees was not affected much, especially during the first five years of Japan's Great Recession following the bubble. However, they also suggest that the job stability of regular employees eventually declined somewhat during the final years of the Great Recession. Further data accumulation is needed to test whether the Japanese traditional employment system has changed completely in response to Japan's prolonged recession.

adjustment, very few studies have looked into the adjustment cost or fixed-cost differences to explain the work hour differences among countries. In the following analysis, we investigate, by employing several variables as proxies for high fixed costs, whether these factors can explain why Japanese workers' long work hours.

(2) Empirical framework

Following the method developed by Stewart and Swaffield (1997), we use work hour constraints to identify and estimate the firm's demand function for work hours. We consider the following friction model in which working hours are observed depending on the constraints set by firms.

$$
h_i = \begin{cases} x_i'\beta + m_i'\gamma + \varepsilon_i & if & x_i'\beta + \varepsilon_i < h_i^* - m_i\gamma \\ indetermin\,ate & if & h_i^* - m_i\gamma \le x_i'\beta + \varepsilon_i \le h_i^* \\ x_i'\beta + \varepsilon_i & if & x_i'\beta_i + \varepsilon_i > h_i^* \end{cases}, \qquad (1)
$$

where h_i represents the observed log work hours of employee i; h_i^* indicates the preferred log work hours of employee i; x_i is a vector of demand factors that determine the lower bound of work hours; β is its coefficient vector; m_i is a vector of demand and supply factors that affect the upper bound of work hours; γ is its coefficient vector; and ε_i is an error component.

We assume that a firm sets a lower bound of work hours, $x_i\beta$, and an upper bound, $x_i\beta+m_i\gamma$, for each employee. The lower bound is determined by the firm and employee characteristics x_i, which include hourly wage[7], age, tenure, tenure squared, university graduates dummy, manager dummy, occupation dummies, firm size dummies, and the proxies for the fixed labor costs, which we explain in detail below. We especially expect that larger fixed labor costs would increase the firm's demand for work hours. The upper bound is assumed to be higher than the lower bound by $m_i\gamma$, which consists of a constant term plus other factors. We assume the upper bound is affected by the exemption from overtime regulations, which reflects the firms' cost for overtime pay. Since we do not have exact information on exemption, we instead incorporate manager dummy as a proxy. We also consider the case where the upper

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[7] Hourly wage is calculated by dividing annual wage income by annual hours worked (=weekly hours worked times 52). Since each respondent was asked annual wage income in local currency, we converted wages of UK and German workers into yen using OECD's Purchasing Power Parity Index (private consumption, year 2009 average). The conversion rates are £1=¥189.3554 for UK workers, and €1=¥146.9663 for German workers.

bound varies due to supply factors where some workers are forced to work shorter hours because of other responsibilities such as childbearing.

The first line of equation (1) expresses that the status where the work hour constraint is below a worker's desired level (when a worker answers that he/she wants to work more given the current hourly wage). In this status, the actual hours worked is determined at the upper bound. The second line represents the status where the worker's actual and desired work hours coincide. In this status, hours worked are determined by both firm and worker factors. The third line is the status where the work hour constraint is above the worker's desired level (when the worker answers that he/she wants to work less). In this status, the actual hours worked are determined at the lower bound. Since only labor demand behavior is reflected in the first and third statuses where hour constraints are binding, we suppose that Stewart and Swaffield's (1997) framework consistently identifies the firm's labor demand function for hours worked.

As is often pointed out, it is important to note that when taking hours worked as an independent variable in the regression, the hourly wage taken as a dependent variable could be endogenous when there are measurement errors in the reported work hours. We therefore instrument hourly wage using industry dummies and job experience (total period engaged in the current job) for the cross-country estimations.[8] When using Japanese firm-worker matched data for estimation, we also use the firm's establishment year and return on sales in fiscal year 2008 as instruments.

The likelihood function of equation (1) is as follows.

$$
L = \prod_{h_i^* - m_i'\gamma \leq x_i'\beta + \varepsilon_i \leq h_i^*} \frac{1}{\sigma} \phi\left(\frac{h_i - x_i'\beta - m_i'\gamma}{\sigma} \right)
$$
$$
\times \prod_{x_i'\beta + \varepsilon_i < h_i^* - m_i'\gamma} \frac{1}{\sigma} \left[\phi\left(\frac{h_i - x_i'\beta}{\sigma} \right) - \Phi\left(\frac{h_i - x_i'\beta - m_i'\gamma}{\sigma} \right) \right] \prod_{x_i'\beta_i + \varepsilon_i > h_i^*} \frac{1}{\sigma} \phi\left(\frac{h_i - x_i'\beta}{\sigma} \right) \quad , (2)
$$

where φ and Φ are the normal density and cumulative distribution functions, respectively, and σ is the standard deviation of the error term. We derive maximum likelihood estimates for (1) using the likelihood function (2).

(3) Proxy variables for firm's fixed costs of employment

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[8] As robustness checks, we confirmed that the estimation results do not significantly change when we use variables other than industry dummies or job experience as instruments, such as occupation dummies as instruments, or when we exclude hourly wage but include industry dummies and job experience.

In the following estimation, we focus on the proxy variables for the firm's fixed costs of employment. As discussed above, the firm would demand longer work hours if its fixed costs of employment are larger. As proxies for the fixed labor costs to firms, we consider the following variables. The first group includes job tenure at the current firm, university graduate dummy, and manager dummy, which takes a value of 1 for those with a management title. If Becker's human capital theory holds, the job tenure in the firm should reflect the firm-specific skills, which would indicate larger fixed labor costs. Likewise, since it is usual for university graduates or managers to take larger hiring costs, university graduate and manager dummies may also reflect large fixed costs for firms. We employ the first group of variables to grasp how fixed-cost differences among individuals affect the variation in work hours among them.

The second group we consider is the type of adjustment in the workplace. In the WLB-JE, the respondents are asked to answer whether each of the following practices applies to their workplace when long-term demand variations are projected:

(a) labor hoarding of permanent employees (adjusting working hours of existing permanent employees or transferring permanent employees between departments),

(b) labor hoarding of temporary employees (adjusting working hours of existing temporary employees or transferring temporary employees between departments),

(c) adjustment of the number of permanent and temporary employees or outsourcing work).

We assume the practice of labor hoarding of permanent employees is associated with longer work hours because some overtime hours are necessary as a buffer stock in case the firm has to decrease labor cost in recessions. Similarly, we believe that the more a firm practices labor hoarding of temporary employees and adjusts the number of employees, the less likely it is that the firm will save overtime hours as a buffer; therefore, the required lower bound for the permanent employees becomes shorter. The second-group variables are employed to grasp how fixed-cost differences among firms affect business cycle variation in work hours.

In the matched firm-worker estimation, we also consider the proxy variables for fixed labor costs extracted from firm-side information. These include the volatility of permanent employees relative to output, the ratio of the seniority element in wage setting, the ratio of permanent employees, and the HR practices to train employees. The volatility of permanent employees relative to output is calculated using the variation of the number of permanent employees per year divided by the variation of total sales from BSBA during the period 1998 to 2008. This variable should stand for the degree of employment adjustment (or the inverse of labor hoarding for permanent employees) of

each firm; therefore, we expect negative signs for the determinants of the lower bound in equation (1). The other three variables are expected to increase work hours since they indicate the firm's fixed costs of employment; thus, we expect positive signs for the determinants of the lower bound. The above proxy variables for fixed labor costs and other variables used in the estimations are summarized in Table 4.

IV. Estimation results using cross-country data

(1) Basic characteristics and fixed-cost variables

The estimation results using cross-country data for males and females are summarized in Tables 5(1) and (2), respectively. From Table 5(1) for males, we find the hourly wage is negatively and age positively correlated with firms' demand for work hours in Japan. As for the proxy variables of fixed labor costs, tenure and tenure squared are significant for Japan. Although the coefficient of tenure squared is negative, it is shown that the marginal effect of job tenure on firms' demand for work hours is positive until about 16 years of tenure in Japan. Similarly, the manager dummy (the one incorporated in the lower bound) is significantly positive in all countries.

As expected, the positive effects of tenure and manager dummy on hours worked imply that the larger fixed costs of employment induce firms to demand longer work hours. It is inferred that firm-specific skills accumulate as the tenure increases and/or the management position rises since worker's mobility among firms is very low, especially in Japan. It seems that the job tenure and the manager dummy are appropriate proxies of firms' fixed costs in Japan. However, the job tenure might not necessarily be proper proxies for fixed costs in the UK and Germany, where labor mobility is higher.

In this regard, when we look at a dummy variable for labor hoarding of regular workers in Table 5(1), we find significantly positive effects on work hours in all countries. That is, those firms that cope with long-term demand variations by labor hoarding of permanent employees tend to set the lower bound of work hours higher. This is a direct evidence for the existence of overtime work as a buffer against unexpected demand variations.

The upper bound of work hours is considerably higher than the lower bound. In Table 5(1), the estimated upper bounds are 46% to 67% above the lower bounds and additionally 10% higher for Japanese managers. This result is consistent with the fact that a relatively smaller proportion of workers offer to work longer as shown in Table 1. It is also consistent with Stewart and Swaffield's (1997) results.

Next, looking at Table 5(2) for females, we find that the estimated coefficients for job tenure and its squared are not significant for Japan and Germany, and the estimated signs were contrary to what we expected for the UK. The different results for the effects of job tenure between male and female employees in Japan might imply that the firm's demand for work hours of females would differ from those of males since the proportion of those who work as assistants (therefore, the necessary skills are limited) is much larger for female employees. On the other hand, manager dummies (the one incorporated in lower bound) are significant for Japan and the UK and university graduate dummy is significant for the UK and Germany. These results presumably imply that manager and university graduate dummies would be proper proxies to reflect large fixed costs for females. The results indicated in the types of adjustment are partially consistent with what we expected. That is, the dummy variable for labor hoarding of temporary workers are significantly positive for the UK and Germany, indicating the possibility for the practice of longer work hours as a buffer of employment adjustment.

In sum, we can confirm from Table 5 that firms who bear large fixed costs for employees are more likely to require incumbent employees to work long hours. This feature is particularly evident in Japanese males, indicating that one of the possible factors for Japanese males to work long hours could be the large fixed costs of employment for accumulated human skills. In fact, as Table 4 shows, most of the proxy variables for fixed labor costs are larger in Japan than in the UK or Germany. For example, the job tenure is 6 to 7 years longer and the proportion of firms which practice labor hoarding of permanent employees is more than 20% larger in Japan. Therefore, both the larger fixed cost of employment and the larger effects of the fixed costs on work hours would bring about considerably longer hours worked by Japanese male employees.

(2) HRM practices at workplace

Even though the required work hours are determined by worker and firm characteristics such as human capital accumulations, HRM practices might increase or decrease the hours worked through a change in efficiency or productivity at the workplace. It is possible for us to examine this since the WLB-JE contains information on HRM practices at the workplace in the workers' survey.

Specifically, the WLB-JE asks the respondent workers to answer whether their job description is clearly defined, they have a lot of discretionary powers, the job is carried out in a team, and they are often faced with uncertainty. We compile job

characteristics dummy variables that take 1 if the respondents answer "true" or "basically true" to each question and 0 otherwise. The WLB-JE also asks whether their manager evaluates those who work overtime or on holidays, is careful to allocate jobs efficiently, keeps good communications with the subordinates, and considers the subordinate's work-life balance. We then make dummy variables to indicate manager's types based on these questions.

Adding a set of these dummy variables of job characteristics and manager type to the variables used in Table 5, we estimate the above friction models. The estimation results are listed in Table 6. As for job characteristics, we see that a clearer job description is associated with shorter work hours for German males and Japanese females, which indicates that hours worked could be reduced through efficient management at the workplace. It is also shown that uncertainty would increase work hours in Japan and the UK. This result is consistent with the findings in the previous section: as the fixed costs of employment induce firms to demand longer work hours against future demand variations, longer work hours are needed in a workplace where uncertainty is large.

The manager type also affects the hours worked. For example, if managers tend to evaluate overtime work, work hours become longer for Japanese and UK workers. In addition, at workplaces where managers assign jobs efficiently, keep good communications with his/her workers, and consider the work-life balance of employees, work hours tend to become shorter for Japanese and UK males. These results imply that even if high fixed costs of employment may increase the demand for work hours, there is still room for reducing work hours by employing efficient managerial practices at workplaces.

(3) Demand-side factors from matched firm-worker data

The results obtained above are derived from information in the workers' survey. Although we have utilized workplace information from the workers' survey, it is more important and straightforward to use the information from the matched-firm survey when examining the effect of firm-side variables such as fixed cost of labor on work hours. Therefore, we use the matched firm-worker data, which are available only for Japanese workers in the WLB-JE, to further examine firms' work hour demand by adding the firm-side information to equation (1).

As described in Section III, we use the volatility of permanent employees relative to output, seniority in wage setting, ratio of regular employees, and HR practices to train employees. The estimation results are summarized in Table 7. The

table shows that the coefficient of volatility of permanent employees relative to output is significantly negative for males. That is, for those firms that have exhibited lower employment adjustment (or larger labor hoarding) in the past decade, the lower bound of work hours tend to become higher. This is consistent with previous findings; possibly due to larger fixed costs of employment, those firms that practiced less employment adjustment in the previous recession tend to require the incumbent workers to work longer, to keep overtime work as a buffer to prepare for future demand variations. In Table 7, for female employees, however, the relative volatility is significantly positive, which contradicts our conjecture.

In Table 7, it is also found that the ratio of seniority element in wage setting is significantly positive for male employees, and that the ratio of regular workers is significantly positive for female employees. These results are consistent with the findings in Table 5 that the proxies for labor fixed cost are associated with longer work hours required by firms.

We also include the firm's attitude to the work-life balance of their employees to see how these variables affect work hours. In the WLB-JE firm survey, firms are asked to answer how much they deal proactively with their workers' work-life balance, using a scale of 0 to 10. The estimation results in Table 7 show that for females work hours get shorter as the firm deals more proactively with employees' work-life balance. However, other variables such as a dummy for making efforts to reduce hours worked are not significant.

V. Conclusion

Using information on workers' preferences for work hours and a rich collection of matched firm-worker data, this paper investigated whether the number of hours worked is (partially) determined by demand-side factors, and tried to introduce one possibility to explain why Japanese tend to work longer than workers in other countries.

Our results show that work hours are indeed determined by the demand-side factors; that is, each firm sets a minimum boundary of work hours, and workers hired in the firm cannot work less than the minimum requirement. The minimum requirement depends on the degree of labor-hoarding practices by the firm and the amount of fixed costs of labor that the firm bears. Specifically, firms that tend to conduct labor hoarding during recessions, presumably because of large fixed costs, require incumbent workers to work longer hours in normal times compared to firms that do not engage in such

practices. We also found that the higher the firm-specific skills, the longer the firm's requirement of work hours, given other things are equal. Since Japanese firms have long been considered to bear large costs to train workers, our findings are consistent with Rosen (1969), who points out that firms' demand for hours worked is an increasing function of the user cost of labor, such as hiring and training costs. Given these results, we interpret the long work hour requirement as a rational strategy for Japanese firms to protect high-skill-accumulated workers from dismissal. To sum up, long work hours by Japanese workers reflect the long-term employment practice, a typical feature of the Japanese labor market.

Even though each firm sets a certain lower bound of work hours and Japanese firms are more likely to set such a boundary higher relative to other countries due to large fixed costs, it would be reasonable to think that a worker who wants to work less can be sorted and matched with firms that offer short working hours. Therefore, in the long run, there would be no divergence between actual and desired work hours. However, a possible implication suggested from the findings in this paper is that such sorting and matching are less likely to occur under an environment where mobility costs are very high, such as in the Japanese labor market. This does not mean that there is no room for the Japanese to achieve a work-life-balance even under such a traditional labor-hoarding environment. For example, our findings suggest that good HRM practices can serve as a device to lower firms' demand of work hours where hours worked are inefficiently long. Introducing German-type short-hour policies supported by unemployment insurance may also be worth considering to make firms' work hour adjustment more flexible under recessions.

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Table 1 Weekly hours worked

	Male			Female		
	Japan	UK	Germany	Japan	UK	Germany
Original						
Weekly hours worked	46.91	42.01	43.31	42.06	38.19	39.08
	(8.09)	(8.51)	(7.11)	(5.55)	(8.93)	(7.92)
Ratio of long-hour workers						
More than 50 hours	0.38	0.16	0.20	0.11	0.08	0.09
	(0.49)	(0.37)	(0.40)	(0.32)	(0.28)	(0.28)
More than 60 hours	0.10	0.05	0.05	0.02	0.04	0.02
	(0.30)	(0.21)	(0.21)	(0.13)	(0.19)	(0.13)
Adjusted						
Weekly hours worked	46.91	41.09	43.52	42.06	38.13	38.95
	(2.08)	(3.93)	(2.63)	(1.41)	(4.08)	(2.55)
Ratio of long-hour workers						
More than 50 hours	0.38	0.23	0.24	0.11	0.06	0.03
	(0.11)	(0.18)	(0.14)	(0.08)	(0.08)	(0.05)
More than 60 hours	0.10	0.12	0.06	0.02	0.03	0.02
	(0.06)	(0.14)	(0.08)	(0.03)	(0.07)	(0.08)

Note: Numbers in parentheses are robust standard errors.

Table 2 Weekly hours worked in representative panel data

	Male			Female		
	Japan (KHPS)	UK (BHPS)	Germany (GSEOP)	Japan (KHPS)	UK (BHPS)	Germany (GSEOP)
2004-2008						
Weekly hours worked	51.65	42.47	45.10	44.98	36.78	36.67
	(10.88)	(9.30)	(7.84)	(8.96)	(9.55)	(9.44)
Ratio of workers working more than 50 hours	0.59	0.21	0.29	0.27	0.09	0.08
	(0.49)	(0.40)	(0.45)	(0.44)	(0.28)	(0.28)
Observations	4012	1982	8317	1635	2993	8662
2010						
Weekly hours worked	50.68			44.41		
	(10.49)			(8.86)		
Ratio of workers working more than 50 hours	0.54			0.23		
	(0.50)			(0.42)		
Observations	715			271		

Note: Numbers in parentheses are robust standard errors.

Table 3 Preferences for hours worked

	Male			Female		
	Japan	UK	Germany	Japan	UK	Germany
Preferences to change work hours						
Increase	0.09	0.10	0.09	0.07	0.10	0.10
	(0.28)	(0.31)	(0.29)	(0.25)	(0.30)	(0.30)
Not change	0.68	0.76	0.85	0.67	0.70	0.84
	(0.47)	(0.43)	(0.36)	(0.47)	(0.46)	(0.37)
Decrease	0.24	0.14	0.07	0.26	0.20	0.07
	(0.43)	(0.34)	(0.25)	(0.44)	(0.40)	(0.25)
Number of work hours that	-1.58	-0.83	-0.07	-1.59	-1.65	-0.08
workers prefer to change	(6.34)	(7.66)	(3.72)	(4.74)	(7.69)	(5.42)
Observations	5053	395	461	2262	431	419

Note: Numbers in parentheses are robust standard errors.

Table 4 Descriptive statistics for explanatory variables

	Male			Female		
	Japan	UK	Germany	Japan	UK	Germany
Hourly wage	0.22	0.27	0.33	0.16	0.22	0.26
	(0.09)	(0.13)	(0.15)	(0.06)	(0.10)	(0.11)
Age	40.75	41.39	38.90	35.26	37.39	36.93
	(9.25)	(10.18)	(9.71)	(9.25)	(10.68)	(9.83)
Tenure	14.72	8.11	7.79	11.04	6.64	7.59
	(9.92)	(6.11)	(5.87)	(8.80)	(5.52)	(6.25)
Manager dummy	0.69	0.44	0.37	0.22	0.34	0.24
	(0.46)	(0.50)	(0.48)	(0.41)	(0.47)	(0.43)
University graduate dummy	0.64	0.12	0.09	0.34	0.11	0.06
	(0.48)	(0.32)	(0.29)	(0.47)	(0.31)	(0.23)
Type of adjustment in workplace						
Labor hoarding of permanent workers	0.73	0.47	0.50	0.69	0.47	0.45
	(0.64)	(0.66)	(0.67)	(0.63)	(0.64)	(0.63)
Labor hoarding of temporary workers	0.16	0.42	0.40	0.16	0.31	0.35
	(0.43)	(0.67)	(0.63)	(0.43)	(0.57)	(0.60)
Adjustment using permanent and	0.57	0.74	0.96	0.47	0.72	0.82
temporary workers	(0.81)	(1.06)	(1.07)	(0.76)	(1.01)	(1.07)
Spouse dummy	0.72	0.27	0.34	0.40	0.38	0.36
	(0.45)	(0.44)	(0.47)	(0.49)	(0.48)	(0.48)
Child dummy	0.12	0.15	0.11	0.05	0.19	0.15
	(0.33)	(0.35)	(0.32)	(0.22)	(0.39)	(0.35)
Job experience	11.37	9.60	9.50	10.38	7.68	9.08
	(9.09)	(6.26)	(6.19)	(8.12)	(5.69)	(6.65)
Firm matched variables						
Relative volatility of employment	0.01			0.01		
to output	(0.02)			(0.02)		
Seniority in wage setting	0.23			0.23		
	(0.27)			(0.27)		
Ratio of regular employees	0.76			0.76		
	(0.26)			(0.26)		
Employee training dummy	0.86			0.82		
	(0.35)			(0.38)		
Extent how much firms deal proactively	5.74			5.77		
with their workers' WLB (0 to 10)	(1.87)			(1.93)		
Work hour reduction policy	0.27			0.25		
	(0.44)			(0.43)		
Establishment year	1957.1			1957.3		
	(20.02)			(20.61)		
Return on sales (fiscal year 2008)	0.02			0.02		
	(0.06)			(0.06)		
Observations	5,053	395	461	2,262	431	419

Note: 1. Numbers in parentheses are robust standard errors.

    2. For the firm matched data, the number of observations is 3,735 for males and 1,457 for females.

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Table 5 Cross-country estimations: The effects of fixed costs on hours worked

(1) Male

	Japan		UK		Germany	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	2.77**	2.74**	3.61**	3.59**	3.86**	3.87**
	(0.20)	(0.20)	(0.24)	(0.23)	(0.23)	(0.23)
Log wage rate	-0.42**	-0.43**	0.05	0.04	0.12	0.14
	(0.08)	(0.08)	(0.14)	(0.13)	(0.12)	(0.12)
Age	0.01**	0.01**	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tenure	0.01**	0.01**	0.01	0.01	-0.00	0.00
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Tenure squared /100	-0.02**	-0.02**	-0.06	-0.05	-0.01	-0.02
	(0.00)	(0.00)	(0.05)	(0.05)	(0.05)	(0.05)
University graduate dummy	0.02+	0.02+	0.02	0.04	0.01	0.02
	(0.01)	(0.01)	(0.07)	(0.07)	(0.06)	(0.06)
Manager dummy	0.05**	0.05**	0.10+	0.10+	0.13*	0.12*
	(0.01)	(0.01)	(0.05)	(0.05)	(0.05)	(0.05)
Type of adjustment in workplace						
Labor hoarding of		0.01*		0.06*		0.06*
permanent workers		(0.01)		(0.03)		(0.03)
Labor hoarding of		0.00		-0.05		0.01
temporary workers		(0.01)		(0.03)		(0.03)
Adjustment using		-0.00		0.00		-0.02
permanent and temporary		(0.01)		(0.02)		(0.02)
Gamma	0.46**	0.46**	0.65**	0.65**	0.67**	0.66**
	(0.02)	(0.02)	(0.08)	(0.08)	(0.09)	(0.09)
Manager dummy	0.10**	0.10**	-0.05	-0.04	-0.04	-0.03
	(0.02)	(0.02)	(0.07)	(0.07)	(0.07)	(0.07)
Spouse dummy	-0.01	-0.01	-0.09	-0.08	0.02	0.02
	(0.02)	(0.02)	(0.06)	(0.06)	(0.07)	(0.07)
Child dummy	-0.03+	-0.03+	-0.02	-0.02	0.02	0.01
	(0.02)	(0.02)	(0.08)	(0.07)	(0.10)	(0.10)
Theta	0.28**	0.28**	0.31**	0.31**	0.33**	0.33**
	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)
Log likelihood	-3254	-3251	-272.9	-270.3	-330.0	-327.5
Observations	5,053	5,053	395	395	461	461

Notes: 1. Numbers in parentheses are robust standard errors.

    2. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

(2) Female

	Japan		UK		Germany	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	3.45**	3.45**	3.18**	3.18**	3.31**	3.25**
	(0.29)	(0.29)	(0.32)	(0.33)	(0.22)	(0.23)
Log wage rate	-0.10	-0.10	-0.24	-0.23	0.04	0.04
	(0.12)	(0.12)	(0.21)	(0.22)	(0.16)	(0.16)
Age	0.00	0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Tenure	0.00	0.00	-0.02+	-0.02+	-0.01	-0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Tenure squared /100	0.00	0.00	0.09	0.09+	-0.01	-0.01
	(0.01)	(0.01)	(0.05)	(0.05)	(0.06)	(0.06)
University graduate dummy	0.03	0.03	0.16*	0.16*	0.22+	0.20+
	(0.02)	(0.02)	(0.07)	(0.07)	(0.11)	(0.11)
Manager dummy	0.05*	0.05*	0.14*	0.14*	-0.02	-0.03
	(0.02)	(0.02)	(0.07)	(0.07)	(0.08)	(0.08)
Type of adjustment in workplace						
Labor hoarding of		0.01		-0.02		0.03
permanent workers		(0.01)		(0.03)		(0.04)
Labor hoarding of		-0.00		0.07+		0.09+
temporary workers		(0.01)		(0.04)		(0.05)
Adjustment using		-0.00		0.01		0.01
permanent and temporary		(0.01)		(0.02)		(0.03)
Gamma	0.42**	0.42**	0.65**	0.65**	0.86**	0.86**
	(0.02)	(0.02)	(0.07)	(0.07)	(0.10)	(0.10)
Manager dummy	0.00	0.00	-0.00	-0.01	0.11	0.11
	(0.03)	(0.03)	(0.07)	(0.07)	(0.12)	(0.12)
Spouse dummy	-0.00	-0.00	-0.05	-0.04	-0.05	-0.04
	(0.02)	(0.02)	(0.06)	(0.06)	(0.08)	(0.08)
Child dummy	-0.02	-0.02	0.13	0.14	-0.21*	-0.23*
	(0.05)	(0.05)	(0.09)	(0.09)	(0.10)	(0.09)
Theta	0.22**	0.22**	0.36**	0.35**	0.41**	0.40**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.04)	(0.04)
Log likelihood	-1164	-1163	-321.0	-318.0	-307.2	-302.3
Observations	2,262	2,262	431	431	419	419

Notes: 1. Numbers in parentheses are robust standard errors.

2. **, *, and + indicate statistical significance at the 1 %, 5%, and 10% levels, respectively.

Table 6 Cross-country estimations: The effects of job and HRM characteristics

	Male			Female		
	Japan	UK	Germany	Japan	UK	Germany
Job characteristics dummies (true or basically true = 1)						
Job description is clearly defined	-0.00	0.01	-0.09+	-0.04**	0.01	0.04
	(0.01)	(0.06)	(0.05)	(0.01)	(0.06)	(0.08)
Having a lot of discretionary powe	-0.01	-0.03	-0.00	0.01	-0.01	-0.03
	(0.01)	(0.04)	(0.04)	(0.01)	(0.04)	(0.06)
Carried out in a team	0.01	0.03	0.03	0.01	-0.06	0.05
	(0.01)	(0.05)	(0.04)	(0.01)	(0.05)	(0.05)
Facing a lot of uncertainty	0.07**	0.11**	0.06	0.02*	0.12**	0.01
	(0.01)	(0.04)	(0.04)	(0.01)	(0.04)	(0.05)
Manager's type dummies (true or basically true = 1)						
Evaluate overtime	0.04**	0.11*	0.03	0.02+	0.11*	-0.04
	(0.01)	(0.05)	(0.06)	(0.01)	(0.05)	(0.06)
Assign job equally	-0.03**	-0.10*	-0.04	-0.02	-0.06	-0.10+
	(0.01)	(0.04)	(0.05)	(0.01)	(0.05)	(0.06)
Keep good communication	-0.03**	0.12**	0.04	0.01	-0.03	0.07
	(0.01)	(0.05)	(0.05)	(0.01)	(0.05)	(0.07)
Consider work-life-balance	-0.02*	-0.12**	0.02	-0.02	-0.03	-0.01
	(0.01)	(0.04)	(0.04)	(0.01)	(0.04)	(0.06)
Log likelihood	-3156	-256.3	-323.3	-1124	-306.9	-299.9
Observations	5,016	395	461	2,229	431	419

Notes: 1. Numbers in parentheses are robust standard errors.

2. **, *, and + indicate statistical significance at the 1%, 5%, and 10 % levels, respectively.

3. All explanatory variables in Table 5 are also included.

Table 7 Firm-worker matched estimations

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Firm matched variables						
Relative volatility of employment to output	-0.49*		-0.51*	0.56**		0.52*
	(0.21)		(0.21)	(0.21)		(0.21)
Seniority in wage setting	0.05**		0.05**	-0.01		-0.01
	(0.02)		(0.02)	(0.02)		(0.02)
Ratio of regular employees	-0.00		-0.00	0.03		0.04+
	(0.02)		(0.02)	(0.02)		(0.02)
Employee training dummy	0.02		0.02	0.02		0.02+
	(0.01)		(0.01)	(0.01)		(0.01)
Extent how much firms deal proactively		-0.00	-0.01+		-0.01**	-0.01**
with their workers' WLB (0 to 10)		(0.00)	(0.00)		(0.00)	(0.00)
Making efforts to reduce work hour		-0.00	-0.01		0.01	0.00
		(0.01)	(0.01)		(0.01)	(0.01)
Log likelihood	-2403	-2408	-2401	-656.0	-655.9	-650.7
Observations	3,735	3,735	3,735	1,457	1,457	1,457

Notes: 1. Numbers in parentheses are robust standard errors.

2. **, *, and + indicate statistical significance at the 1 %, 5%, and 10% levels, respectively.
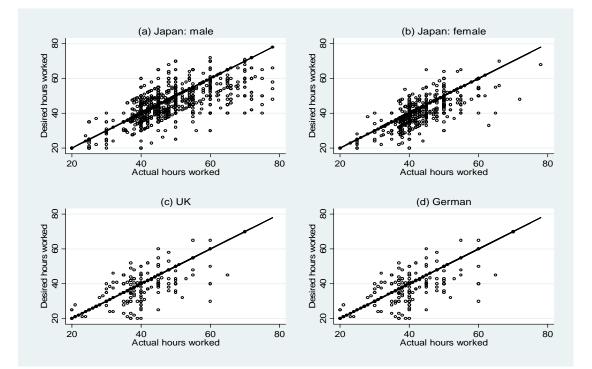
3. All explanatory variables in Table 5 are also included.

Figure 1 Actual and preferred hours worked