RIETI Discussion Paper Series 12-E-079

Effect of Work-Life Balance Practices on Firm Productivity: Evidence from Japanese firm-level panel data

YAMAMOTO Isamu
Keio University

MATSUURA Toshiyuki
Keio University

RIETI
Research Institute of Economy, Trade & Industry, IAA

The Research Institute of Economy, Trade and Industry
http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 12-E-079
December 2012

Effect of Work-Life Balance Practices on Firm Productivity: Evidence from Japanese firm-level panel data

YAMAMOTO Isamu*
Keio University

MATSUURA Toshiyuki
Keio University

Abstract

This paper examines how firm practices that could contribute to worker attainment of work-life balance (WLB) affect the total factor productivity (TFP) of a firm, by using panel data of Japanese firms from the 1990s. We observed a positive correlation between the WLB practices and TFP among sampled firms. However, that correlation vanished when we controlled for unobserved firm heterogeneity, and we found no general causal relationship in which WLB practices increase firm TFP in the medium or long run. For firms with the following characteristics—large, manufacturing, and have exhibited labor hoarding during recessions—we found positive and sizable effects. Since these firms are likely to incur large fixed employment costs, we infer that firms investing in firm-specific human skills or having large hiring/firing costs can benefit from WLB practices through a decrease in turnover or an increase in recruiting effectiveness.

Keywords: Work-life balance, TFP, Fixed employment costs
JEL classification : D24, J24, J81

This study is based on microdata from the Basic Survey of Japanese Business Structure and Activities by the Ministry of Economy, Trade, and Industry, Japan, and an original survey co-sponsored by the Research Institute of Economy, Trade, and Industry (RIETI) and the Economic and Social Research Institute. We are grateful to the institutes for their support. We thank Fumio Ohtake, Hank Farber, Lisa Kahn, Takao Kato, Sachiko Kuroda, Masako Kurosawa, Masaaki Mizuochi, Emiko Takeishi, Yukiko Yokoyama, as well as the member of the RIETI project and the participants of the 14th Labor Economics conference as well as Trans-Pacific Labor Seminar 2012, for their valuable comments. Because the data used in this study were obtained only by signing a confidentiality agreement, the authors are unable to release them.

* Corresponding author: yamamoto@fbc.keio.ac.jp

1. Introduction

In response to the increasing need for work−life balance (WLB) of workers, an increasing number of firms are adopting practices that contribute to the attainment of worker WLB. These practices include child-care or family-care leave programs, flexible working arrangements, and the establishment of departments for promoting WLB practices. Do firms implement these WLB practices to attain firm benefits such as productivity increases or competitive advantages? Many studies in business and labor economics literature have investigated the relationship between WLB practices and firm performance measures, such as worker morale, turnover, stress, and absenteeism, as well as firm profit and productivity. However, their results have been rather inconclusive.[1] For example, Konrad and Mangel (2000) show that WLB practices have a positive impact on firm productivity. In contrast, in a study of 732 manufacturing firms in the United States, France, Germany, and the United Kingdom, Bloom et al. (2009, 2011) find no relationship between WLB practices and firm productivity when management practices are controlled.[2]

The literature suggests that WLB practices potentially improve firm performance by reducing worker turnover and absenteeism and by enhancing recruiting effectiveness. However, considering that the adoption rates of WLB practices are generally low, we determine the presence of certain firm characteristics that help WLB practices to significantly improve firm performance. For example, the larger the firm's fixed employment costs, the more they benefit from WLB practices. Specifically, for firms that invest intensively in firm-specific skills for their workers or those that incur large hiring costs, WLB practices are more cost effective because they can save on the adjustment cost of employment and earn returns on the firm's human investment as WLB practices decrease turnover and absenteeism. Thus, we conjecture that certain firm characteristics contribute to the positive effects of WLB practices on firm productivity making such firms more likely to adopt them.

By focusing on firm characteristics, such as fixed employment costs, we examine the effects of WLB practices on firm productivity using panel data of Japanese firms for the years1992, 1998, 2004, 2007, and 2008. As a direct measure of firm productivity, we use total factor productivity (TFP), which is consistently estimated by applying the methodology used in Levinsohn and Petrin (2003). Because TFP reflects a firm's technology level and growth potential over the medium and long run, we believe

[1] Freeman and Shaw (2009) suggest that there is considerable heterogeneity or variation in business practices and performances across countries, firms, and establishments, as well as among workers within establishments.

[2] Other studies include Milliken et al. (1998), Perry-Smith and Blum (2000), Batt (2002), and Gray and Tudball (2003).

that it is a reliable measure for identifying the effects of WLB practices on firm performance. An advantage of using Japanese firm data is that many firms in Japan incur large fixed employment costs. Japanese firms have long emphasized employee training in order to help workers accumulate firm-specific human skills (e.g., Mincer and Higuchi, 1988). Thus, by observing firm behavior, we identify the firms that incur large fixed employment costs and examine whether WLB practices have large effects on those firms.

One disadvantage would be that many large and/or high-performance Japanese firms might have adopted WLB practices as a part of corporate social responsibility (CSR) because of the increasing social pressure to promote WLB practices in the Japanese society.[3] If so, we need to consider the reverse causality that firms with higher productivity are more likely to implement WLB practices. In order to cope with the reverse causality or the endogeneity of WLB practices, we control for time-invariant firm characteristics using the fixed-effect estimation. Because, generally, large firms and high-performance firms have higher productivity potential, the fixed-effect estimation can consistently remove the reverse causality as long as this feature does not change over time. We also check for robustness of the estimation result to possible time-varying factors that could affect both the firm's adoption of WLB practices and productivity.

A few studies have employed firm panel data to examine the relationship between WLB practices and productivity. For example, after examining firm panel data in the US pharmaceutical industry, Shepard et al. (1996) find a positive effect of flexible work hours on firm productivity. Giardinia and Rüdiger (2008) use two-year panel data of 118 organizations to measure the effects of work–family practices on absenteeism and other firm performance measures. Our study differs from these studies. First, we focus not only on flexible work but also on many other WLB practices, such as child-care leave programs or the establishment of a department that promotes WLB practices. Second, as a direct measure of firm productivity, we use unbiased and consistent firm TFP estimates determined using the method proposed by Levinsohn and Petrin (2003). Third, our firm panel data has a relatively larger sample size (1,677 firms). Therefore, we believe that this study contributes to the causal relationship findings.

The main findings of this study are as follows. First, although we observe a positive correlation between firms' WLB practices and TFP, we find no causal relationship in which WLB practices increase firms' TFPs after controlling for unobserved firm heterogeneity. Similar findings have not been obtained in previous studies because the present study utilizes the longitudinal nature of firm data to identify the causal relationship. Second, we find positive and sizable effects for the following

[3] In Japan, the government, together with employers and labor union circles, formulated a *Charter for Work-Life Balance* and an *Action Policy for Promoting Work-Life Balance* in 2007 to promote the concept of WLB among employers and employees.

firm types: large firms, manufacturing firms, firms that exhibit labor hoarding during recessions, and firms that use electronic commerce. These results are robust against time-varying factors that could result in endogeneity in the adoption of WLB practices, the choice of firm productivity measure, and the estimation strategy. For the types of WLB practices, we conclude that the establishment of a department that promotes WLB practices and organizational efforts to reduce overtime as well as promotes child- and family-care leave over the legal minimum, tends to improve firms' productivity. In addition, we conclude that the generation of positive effects of WLB practices takes time. One of the interpretations of the results emphasized is that labor-hoarding firms are likely to incur large fixed employment costs, and therefore we conclude that firms investing in firm-specific human skills or those that have large hiring/firing costs could benefit from WLB practices by a decrease in turnover or increase in recruiting effectiveness.

This paper is divided as follows. Section II explains the potential channels for WLB practices to increase firm productivity and describes the empirical specification to identify the effects of WLB practices on TFP. Section III describes our data and the variables used in the estimation. Section IV shows the estimation results. Section V concludes.

2. Framework

2.1 Potential channels to increase firm productivity

According to Baughman et al. (2003), WLB practices can increase firm productivity through the following four channels: enhancing worker morale, reducing turnover rates, reducing absenteeism, and enhancing recruiting effectiveness. Previous studies conducted have focused on each of the channels (Dalton and Mesch 1990 and Giardinia and Rüdiger 2008), while other studies have focused on direct measures of productivity (for example, Shepard et al. 1996 and Bloom et al. 2009).

Although it is important to identify each of the channels, we differentiate the methods used in this study from those of previous studies by examining a direct measure of productivity, TFP, to ascertain whether WLB practices have an overall causal effect on firm productivity as a result of all four channels. If the adoption of WLB practices improves firm production efficiency through one of the channels, TFP would increase with other conditions being equal. In contrast, if a WLB practice results in large monetary and nonmonetary costs, including production inefficiency, TFP will decrease.

In addition, we examine firm characteristics that contribute to the increasing effects of WLB practices on firm TFP. These include firm size, industry, information technology (IT) usage, and fixed costs of employment. Among them, we especially

focus on fixed employment costs such as training and investment costs in firm-specific skills and hiring/firing costs. Among the four channels for increasing firm productivity, the extent of benefits from reduced turnover and increased recruiting effectiveness should depend on the fixed employment costs. That is, for firms that incur low fixed employment costs, a decrease in turnover rate or an increase in recruiting effectiveness will not necessarily result in large benefits because they can replace new workers at a relatively small cost. However, these are expected to be very beneficial for firms with large fixed employment costs by reducing turnover and improving recruiting effectiveness because they can save more on fixed employment costs. Therefore, it is meaningful to conjecture that firms that incur larger fixed employment costs would benefit from adopting WLB practices through the channels of reduced turnover and improved recruiting effectiveness. As a simple measure of a firm's fixed employment costs, we use a firm's relative volatility of employment to output for the past decade, which is expected to vary depending on the extent of labor hoarding during recessions.

2.2 Empirical specifications

We use a two-step approach in the estimation. First, we estimate the production function using the method proposed by Levinsohn and Petrin (2003) to derive TFP on an hourly basis. Second, we estimate the effects of WLB practices on TFP by regressing the variables for WLB practices on the estimated TFP.

We first consider the following production function.

$$Y_{it} = f(A_{it}(WLB_{it}, \eta_i, trend), L_{it}, K_{it}), \quad (1)$$

where Y_{it} is value added, A_{it} is TFP, L_{it} is man-hour labor input, K_{it} is capital input, WLB_{it} is a variable indicating WLB practices adopted by firm i until year t, η_i is firm-specific characteristics, and *trend* is the time trend term.

A key issue in the estimation of the production function at the firm level is the correlation between unobservable productivity shocks and input level. Firms expand their input in response to a positive productivity shock. Unless controlling for an unobservable productivity shock, ordinary least square (OLS) estimates suffer an endogenous bias that stems from the correlation. Many alternatives to OLS have been developed; the Olley and Pakes (1996) methodology is one of the more popular alternatives. Their methodology uses investment as a proxy for these unobservable productivity shocks. However, investment is very lumpy, especially for small and medium firms that do not annually conduct fixed capital investments. Thus, the investment proxy is only valid for large firms that report non-zero investments. Levinsohn and Petrin (2003) show that intermediate inputs can solve the simultaneity problem. Thus, this approach should provide a better measure of unobservable shocks.

This paper uses the Levinsohn and Petrin technique for estimating TFP at the firm level because our sample includes small and medium firms that report zero investment.

When estimating firm-level TFP, we distinguish between regular and part-time workers and consider the number of working hours by these workers. It is usual for labor input to be measured by the number of employees because of data limitations. However, because some WLB practices are intended to encourage employees to reduce overtime hours, it is important to consider the changes in working hours. Because our data contains the average hours worked, we construct a man-hour base labor input indicator and use it when estimating firm-level TFP.

Instead of directly estimating equation (1), we first estimate the production function using the Levinsohn and Petrin methodology and define firm-level TFP as a residual according to equation (2).

$$A_{it} = f^{-1}(Y_{it}, L_{it}, K_{it}) \quad (2)$$

Then, we run the regression model represented by equation (3) and examine whether WLB practices affect TFP.

$$A_{it} = g(WLB_{it}, \eta_i, trend) \quad (3)$$

It is important to control for firm-specific characteristics in equation (3) because of the possibility that WLB practices have been adopted more by large and high-performance firms. High-performance firms may be able to afford the introduction of WLB practices. Alternatively, larger firms may face the social pressure to adopt WLB practices as a part of CSR. Therefore, if firms with potentially higher TFP adopt more WLB practices, the WLB practice variable (WLB_{it}) should be regarded as endogenous, that is, not independent of firm-specific characteristics (η_i). Using fixed-effect estimation, we control for firm-specific characteristics, such as time-invariant firm performance or firm size, and derive consistent estimates to identify the causal effects of WLB practices on TFP. It is also important to account for time-variant factors that could bring about reverse causality. For instance, a firm facing positive demand or productivity shocks may adopt more WLB practices in order to recruit more number of skilled workers. Therefore, as a robustness check, we control for intermediate inputs that can be proxy variables of demand or productivity shocks by using the method of Levinsohn and Petrin (2003). Specifically, we include the cost of information processing and communication in equation (3) as is done by Kawaguchi (2007).

3. Data and basic facts

3.1 Data

The data used in this paper is obtained from the *Basic Survey of Business and Activities* (BSBA) conducted by the Ministry of Economy, Trade and Industry (METI). The BSBA is an annual panel survey that began in 1991 and gathers representative statistics on Japanese firms with 50 or more regular employees, including those engaged in mining, manufacturing, electricity and gas, wholesale, retail, and several service industries. The survey captures a comprehensive picture of Japanese firms, including their basic financial information, business composition, R&D activities, IT usage, and foreign direct investments.[4] Note that the industry composition of the BSBA is more or less different from all industries conducting business in Japan. Because the BSBA is conducted by METI, the surveyed firms are concentrated in the manufacturing and wholesale/retail sectors. For example, the percentages of the manufacturing and wholesale/retail sectors in 2007 in the BSBA are 56.8% and 36.4%, respectively, while those in the Establishment and Enterprise Census, collected by the Statistics Bureau, are 29.4% and 23.2%, respectively. Therefore, it should be noted that the conclusions obtained in this study are derived from data that is concentrated in the two above-mentioned sectors.

Because the BSBA contains no information about firm WLB practices, we use the original survey of the firms, the *Work-Life Balance Survey in Japan and Europe* (WLB-JE), designed to survey the BSBA's respondent firms on their WLB practices. In the WLB-JE, the firms are asked when and what type of WLB practices they have introduced, as well as labor-related information, such as the average working hours in the past (1992, 1998, 2004, 2007, and 2008) and about human resource management attitudes.[5] Because we can perfectly match the WLB-JE with the BSBA using information on the names and addresses of the firms, it is possible to prepare long-run firm-level panel data from the late 1990s for TFP on an hourly basis and WLB practices. The questionnaire of the WLB-JE was sent to 9,628 firms in December 2010, of which 1,677 firms participated, which corresponded to a 17.4% response rate.

It should be noted that the WLB-JE contains no information on the eligibility for each WLB practice. Thus, the variables regarding WLB practices do not necessarily reflect the actual performance of these employees, and thus we cannot rule out the case that the practice is not applied to most of the employees, even if it is introduced.

An obvious drawback of the reliance on the WLB-JE is a potential selection bias due to the low response rate. Because the title of the survey includes the term

[4] For more details on the BSBA, see Morikawa (2010).

[5] The WLB-JE was conducted by the Research Institute for Economy, Trade, and Industry (RIETI) of METI.

"work-life balance," it is likely that those firms that employed increasing WLB practices tended to reply to the survey. However, the response rates do not vary according to firm size. Moreover, the sample means and standard deviations of the key variables used in the analysis below are not very different between the responding firms and others.[6] Furthermore, more than 30 questions were asked to each firm via mail, many of which were related to human resource management. Thus, we regard that a heavy response burden might have brought about a low response rate, in which case the selection bias might not have been sizable.

Another drawback is the potential retrospective bias for WLB practices' year of introduction. Because we extract information regarding the adoption of WLB practice in each year from retrospective questions (when each WLB practice was introduced), we cannot rule out a recall bias. However, it is likely that many WLB practices were introduced as a part of the personnel management system, such as the child-care leave system, the flextime system, and the establishment of a department to promote WLB practices. We suggest that reports involving such recall might suffer from relatively small retrospective bias. We therefore take advantage of retrospective recall to complement the lack of longitudinal information for the adoption of WLB practices.

3.2 TFP and WLB variables

Variables related to TFP, such as value added, labor input, and capital stock, are obtained mainly from the BSBA. We calculate value added by subtracting the costs for the intermediate inputs from a firm's total sales. As for intermediate input, we calculate it as follows: Cost of sales + Operating costs − Wage bills and Depreciation costs. Both sales and intermediate input costs are deflated by the output and input deflators of the Japan Industry Productivity (JIP) Database.[7] We use the deflated Tangible Asset as a proxy for capital stock. The capital stock deflator is calculated at the industry level as the ratio of capital stock to tangible assets based on *Financial Statements Statistics of Corporations by Industry* (Ministry of Finance).

As for labor input, we obtain detailed information from the BSBA, the WLB-JE, and the *Monthly Labor Survey* (Ministry of Health, Labour and Welfare). We use the BSBA to determine the number of regular and part-time workers. Data on

[6] Descriptive statistics for the key variables as of 2007 are as follows (standard deviations are in parenthesis): The number of workers is 613 (1,967) for respondents and 616 (2,269) for non-respondents, the ratio of manufacturing firms is 0.56 (0.50) and 0.45 (0.50), the value added is 6,528 (31,078) and 5,672 (31,823), and the relative volatility of employment to output × 100 is 0.013 (0.024) and 0.016 (0.027).

[7] The JIP Database is a semi-macro-level productivity database provided by the RIETI. It contains information on output, intermediate inputs, capital stock, and labor input for 108 industries for 1970 to 2008. For more details, see the RIETI website: http://www.rieti.go.jp/en/database/JIP2011/index.html

average working hours for regular workers are available at the firm level in WLB-JE. As for average working hours, we first calculate the ratio of working hours for part-time workers to those for regular workers by industry based on the *Monthly Labor Survey* and then multiply them by firm-level working hours for regular workers. We regard firm-level labor input as a sum of the total working hours for regular workers and part-time workers. Because WLB-JE collects information on working hours only for the past five years, we restrict our sample to 1992, 1998, 2004, 2007, and 2008 and estimate the TFP.

We focus on the following WLB practices: 1) child-care leave above the legal minimum, 2) family-care leave above the legal minimum, 3) short-term working system (other than child-care and family-care leave), 4) flextime system, 5) limiting work location within the local area, 6) establishment of a department to promote WLB practices, and 7) organizational efforts to reduce overtime. Because the types of WLB practices vary, we first focus on the WLB practice index, which is the number of WLB practices that a firm adopted until the previous year. We also focus on each of the individual practices and examine how the effects of WLB practices evolved over the years after its adoption.

3.3 Basic facts

The summary statistics for a firm's TFP and for the seven WLB practices are summarized in Table 1. In addition, Figure 1 makes a yearly comparison to determine the relationship between TFP and each WLB practice.

In Figure 1, the bar graphs indicate the adoption rates of the WLB practice (right axis), while the line graphs indicate the average TFP levels in 1998, 2004, 2007, and 2008 for the following four firm groups (left axis):[8] 1) firms that adopted the WLB practice before 1997, 2) those that adopted it between 1998 and 2003, 3) those that adopted it between 2004 and 2008, and 4) those that have not adopted it. A white plot means that the WLB practice is not adopted at that time, whereas a colored plot means that it has been adopted.

When analyzing Table 1(1) for WLB practice 1 (child-care leave above the legal minimum), we observe that the adoption rates were generally low but increased from 1998 (less than 10%) to 2008 (about 20%). Moreover, the average TFPs for the firms that had not adopted the WLB practice were generally lower than those that adopted it. For example, the firms that adopted WLB practice 1 before 1997 (plotted in black triangles) experienced higher TFP levels as well as larger TFP growth than the firms that did not.

However, for firms that adopted the practice between 1998 and 2003 (plotted in

[8] Because the adoption rates of WLB practices were generally very low in 1992, we used the data from 1998 in Figure 1.

black squares) or between 2004 and 2006 (plotted in black circles), the increase in TFP after adoption was not necessarily evident compared with other firms. It is also interesting to note that the TFPs of these firms were already higher before they adopted WLB practice 1. This implies that WLB practice 1 does not markedly influence the increase in a firm's TFP. Instead, firms with higher productivity potential may have adopted it. This is regarded as evidence for the reverse causality that should be considered in the estimation. A similar feature is applied to the analyses of the other WLB practices in Figure 1 (2–7). That is, the adoption rates of the WLB practices were generally low, and the TFPs did not necessarily increase after their adoption.

However, Figure 1 illustrates several cases in which a WLB practice might have increased the TFP. For example, the average TFP for firms that adopted WLB practice 6 (establishment of a department to promote WLB practice) between 1998 to 2003 (plotted in black squares) or 2004 to 2006 (plotted in black circles) increased more after its adoption compared to those that did not adopt it. Likewise, firms that adopted WLB practice 7 (organizational efforts to reduce overtime hours) between 2004 and 2006 (plotted in black circles) experienced higher TFP growth in 2007 and 2008. Furthermore, for firms that adopted WLB practice 7 between 1998 and 2003, the TFP did not change immediately after the adoption in 2004, but increased considerably in 2007 and 2008. This observation indicates that it takes time for the WLB practices to increase TFP.

In summary, the following results are shown in Figure 1. First, the adoption rates of WLB practices were generally low but witnessed a gradual increase during the past decade. Second, the firms that adopted WLB practices tended to have higher TFPs, but their TFPs were already higher before the adoption of the WLB practices, indicating evidence of reverse causality. Third, several cases were observed in which WLB practices increased the firm TFP after the adoption, but the effects were delayed. Considering these findings, we examine the effects of WLB practices on firm TFP, as described below.

4. Estimation results

4.1 Effect of WLB practices on TFP

To examine the effects of WLB practices on TFP, we estimate equation (3) using Japanese firm panel data for 1998, 2004, 2007, and 2008. The main estimation results using an index for the number of adopted WLB practices as explanatory variables are shown in Table 2.

The first column in Table 2 shows the estimation results of the random-effect model in which time-invariant firm-fixed effects are not controlled. We find a significantly positive coefficient for the WLB practice index, indicating that more WLB

practices are associated with higher TFP. However, after controlling for the time-invariant firm-fixed effects in the second column, we find that the WLB practice index is insignificant. This result implies that there is no causal relationship in which the WLB practices increase firm TFP after controlling for the time-invariant endogeneity in adopting WLB practices. We infer that the positive correlation between WLB practices and TFP shown in the first column of Table 2 is most likely due to reverse causality, wherein firms with potentially higher productivity tend to adopt more WLB practices.

Considering the low adoption rates of WLB practices shown in Table 1, these estimation results seem sensible because more firms should have adopted these practices if there was a strong causal relationship in which WLB practices increased firm TFP. However, WLB practices might have had some positive effects on TFP depending on firm characteristics. In order to investigate this, we added cross terms of the WLB practice index with several firm characteristics to the fixed-effect estimations, the results of which are shown in the columns 3–6 in Table 2.

The third and fourth columns show the estimation results when we add the cross terms for large firm dummies (those with more than 300 employees) and manufacturing dummies, respectively. In either case, we observe positive significant coefficients for the cross terms, indicating that WLB practices have positive effects on firm productivity, given that the firm has more than 300 workers or it is part of the manufacturing industry. One of the features commonly observed for large and manufacturing Japanese firms is labor hoarding. Because the BSBA records annual information on total sales and the number of regular employees of each firm, we are able to calculate the volatility of regular (permanent) employees relative to output: the variance of the number of regular employees divided by that of total sales during the period 1998–2008. Using this variable as a proxy for the degree of employment adjustment (or the inverse of labor hoarding for regular employees), we are able to compare firm behavior for labor hoarding. It is shown that the relative volatility of regular employment to output for manufacturing firms with more than 300 workers is smaller than that for other firms.[9] This indicates the possibility that WLB practices have greater effects on TFP in labor-hoarding firms.

The fifth column of Table 2 shows the estimation results after we add a cross term with a dummy variable for labor hoarding, which takes the value of 1 if a firm has a relative volatility of regular employees less than the median and 0 otherwise. The table shows that the coefficient of the cross term is significantly positive. This result implies that the more the firms incur large fixed employment costs, the more they benefit from WLB practices because those practices decrease turnover and absenteeism. Therefore, firms can save on the adjustment costs of employment or earn returns on

[9] In particular, the median of relative variance was 0.0048 for manufacturing firms with more than 300 workers and 0.0056 for other firms.

human investment.

In the last column of Table 2, we include a cross term of an IT-usage variable that takes the value of 1 if the firm used electronic commerce and 0 otherwise. We find a significantly positive coefficient for the cross term, implying that higher IT concentration allows firms to take greater advantage of WLB practices.

In summary, Table 2 suggests the following results. First, we observe a positive correlation between WLB practices and firm productivity. Second, by controlling for time-invariant firm heterogeneity, we cannot confirm a causal effect of WLB practices. Third, for firms with certain characteristics, such as large size, manufacturing focus, labor hoarding, and IT use, WLB practices enhance firm productivity. We next check the robustness of these results, as described in the next section.

4.2 Robustness checks

(1) Time-varying controls

Although we controlled for time-invariant firm heterogeneity, such as higher productivity potential, it is also important to control for time-varying factors, such as demand or productivity shocks, which could affect both the firm's decision to adopt WLB practices and its productivity. To account for this, we use an approach similar to Kawaguchi (2007) who examines whether a higher proportion of female employees increased a firm's profit. Based on the idea of Levinsohn and Petrin (2003), Kawaguchi (2007) controls for an intermediate input and capital stock so that unobserved demand or productivity shocks do not produce endogeneity in the female proportion.

Following Kawaguchi (2007), we assume that the intermediate good's demand (M_{it}) is determined by fixed input, capital stock (K_{it}), and unobserved shock (v_{it}) as $M_{it} = m(v_{it}, K_{it})$. Then, the unobserved shocks, v_{it}, can be expressed as a monotonic function of M_{it} given K_{it} ($v_{it} = m^{-1}(M_{it}, K_{it})$). As a proxy for intermediate goods (M_{it}), we use a ratio of information processing and communication cost to total production cost (IC), the squared deviation from the sample mean of IC, and the deviation from the sample mean of IC multiplied by the asset-sales ratio, as suggested by Kawaguchi (2007). The key presumption is that information costs respond more rapidly to unobservable shocks than to total production costs.

According to this specification, equation (3) is estimated with time-varying controls, as shown in Table 3. Table 3 shows that many proxy variables for demand or productivity shocks are significant. Nonetheless, the estimated coefficients of the WLB practice index and its cross terms for firm characteristics are very similar to those in Table 2. This result implies a robustness of the main results to the possible endogeneity resulting from time-varying factors, such as demand or productivity shocks.

(2) Productivity measures

As a firm's productivity measure, we adopt the TFP that was estimated by the method of Levinsohn and Petrin (2003). To check for the robustness to the choice of productivity measure, we calculate the estimation results using labor productivity and TFP derived by the method of Wooldridge, Levinsohn, and Petrin (WLP) as dependent variables, respectively, as shown in Tables 4 and 5. Labor productivity is calculated as the value added divided by the man-hour labor input. The TFP based on the WLP method is a Wooldridge (2009) modification of the Levinsohn-Petrin TFP estimator. This estimator takes into account the simultaneity of inputs and productivity and is known to be robust to the critiques by Ackerberg et al. (2006).[10]

Tables 4 and 5 show similar coefficients for the variables related to WLB practices, and therefore confirm the robustness of productivity measures.

(3) Differences in difference estimation

Lastly, as a similar estimation strategy, we use a difference-in-differences estimation to compare year-to-year changes in TFPs between the firms with WLB practices and others. In order to conduct a difference-in-differences estimation, we focus on WLB practice 6 (Establishment of a department to promote WLB practices) and examine the differences from year 2004 to 2008. WLB practice 6 is chosen because this practice is regarded as the most advanced and aggressive in the attainment of WLB by employees.[11] We then derive the average treatment effect of this WLB practice on TFP by estimating the following equation:

$$A_{it} = (\alpha + \alpha' C_i) W_{it} \times T + \beta W_{it}, + \gamma T, \qquad (4)$$

where W_{it} is a dummy variable that takes the value of 1 if the firm adopts WLB practice 6 until the previous year, C_i is the firm characteristics examined above (large firm dummy, manufacturing dummy, labor-hoarding dummy, or IT-usage dummy), and T is a year dummy for 2008. We interpret the estimated coefficient ($\alpha + \alpha' C_i$) as the average treatment effect.

In estimating equation (4), we use the propensity score for adopting the WLB practice. That is, we derive the propensity score weighted least-square (WLS) estimates based on Hirano and Imbens (2001). We define propensity score e_i as the probit

[10] For details of TFP on WLP, see Petrin and Levinsohn (2012). We use the stata code provided by Amil Petrin's web site.

[11] WLB practice 6 may include unobserved WLB practices or it could be a proxy of the actual adoption of the practice.

estimate of the probability to adopt the WLB practice using average hours worked, capital-labor ratio, firm size and industry dummies, and firm age as explanatory variables. Then, we calculate the weight λ_i from propensity score e_i as $\lambda_i = \sqrt{W_i / e_i + (1 - W_i)/(1 - e_i)}$ and use this weight in the estimation. The underlying concept is to compare the TFP growth of the firms with those of similar firms by assigning heavier weights to those firms that adopt the practice but have similar characteristics to the firms that did not adopt the practice (firms with a low propensity score) and vice versa.

The estimation results of equation (4) are summarized in Table 6.[12] Although the cross term with the IT-usage dummy is insignificant, the table indicates that most of the results did not greatly differ from those obtained in Table 2, that is, the WLB practice itself did not have an effect on the TFP, but for large, manufacturing, or labor-hoarding firms, the practice could significantly increase the firm's TFP after adoption.

4.3 The effect of each WLB practice and its lag structure

We compare the effects of each of the seven WLB practices on firm TFP. We estimate equation (3) for each WLB practice; Table 7 summarizes the estimated coefficients and standard errors of each practice along with its cross term of firm characteristics. Table 7 shows that no WLB practice by itself has significantly positive effects on firm TFP. However, if combined with particular firm characteristics, such as large size, manufacturing, labor hoarding, or IT usage, positive effects are observed, especially for WLB practices 1 (child-care leave above legal minimum), 2 (family-care leave above legal minimum), 6 (establishment of a department to promote WLB practice), and 7 (organizational efforts to reduce overtime).

In addition, we consider the possibility that the effect could vary depending on the number of years since the adoption of the practice. Specifically, we use dummy variables to indicate whether a firm adopts each practice *S* years ago (*S* = 1, 2, 3, 4, 5, or more, then 6) in equation (3).[13] The estimation results are shown in Table 8(1) for the random-effects model and Table 8(2) for the fixed-effects model. The average effects listed at the bottom of the tables indicate the three-year or all-year averages of the

[12] We confirmed that the balancing property was satisfied. In addition, we obtained similar results when we simply estimated equation (4) by ordinary least squares.

[13] The year of the introduction of each WLB practice was surveyed only for the firms that had adopted the practice at the time of the survey. Thus, cases in which the practice was introduced but removed until the survey year were excluded.

coefficients for the lags of WLB practice dummies. These figures indicate medium- or long-term effects of WLB practices on TFP.

Table 8(1) shows several significantly positive coefficients for the random-effects model. For example, WLB practices 1 (child-care leave above legal minimum), 2 (family-care leave above legal minimum), 3 (short-term working system), and 4 (flextime system) have positive coefficients for the five-year and/or more than six-year lags. Likewise, WLB practices 6 (establishment of a department to promote WLB practice) and 7 (organizational efforts to reduce overtime) have a one-year or two-year lag. Therefore, the average effects for WLB practices 1, 2, 6, and 7 are significantly positive, which indicates a positive correlation between these WLB practices and firm TFP in the medium and long run, as shown in Table 2.

After controlling for the time-invariant firm-fixed effects in Table 8(2), we find that most of the coefficients for the WLB practice dummies are insignificant and the average effects of WLB practices for the three-year and all-year results are insignificant. These results imply that each WLB practice has no causal relationship with firm TFP. However, it is worth noting that we find significant and positive coefficients for longer lags of the WLB practice adoption dummies such as WLB practices 2, 6, and 7. From these results, we interpret that it would take some time for the WLB practice to have an effect on firm productivity, which seems consistent with the observations in Figure 1.

The effects of each WLB practice differ depending on firm characteristics, as shown in Table 2. For example, Table 7(3) summarizes the estimation results with only labor-hoarding firms used as the sample. Although we see significantly negative coefficients in several cases, significantly positive effects of WLB practices are also found, especially for WLB practice 6 (establishment of a department to promote WLB practice) and 7 (organizational efforts to reduce overtime). Moreover, the effects of these WLB practices in the medium and long run are sizable: a 19–23% increase in the TFP for three years after the adoption of the WLB practice and a 16–19% increase for all periods.[14]

5. Concluding remarks

This paper examines how firm practices contributing to worker attainment of WLB affect TFP using panel data of Japanese firms from the 1990s. We observe a positive correlation between firm WLB practices and TFP. However, it is likely that this positive correlation results from the reverse causality in which firms with higher productivity

[14] Results similar to those in Table 2 are obtained when we focus on other firm characteristics such as firm size and industry.

tend to implement WLB practices because these firms can afford to introduce WLB practices and/or they face social pressure to fulfill CSR. In fact, when unobserved firm heterogeneity is controlled, we find no causal relationship in which WLB practices increase a firm's TFP. Therefore, the WLB practices by themselves that were examined in this paper do not increase a firm's productivity.

We also find significantly positive effects for firms with the following characteristics: large size, manufacturing focus, those that exhibit labor hoarding during recessions, and those using electronic commerce. Among these characteristics, we emphasize labor hoarding because labor-hoarding firms are likely to incur large fixed employment costs. Thus, we infer that firms investing in firm-specific human skills or having large hiring/firing costs could benefit from WLB practices through decreases in turnover or increases in recruiting effectiveness. Therefore, we conclude that firms exhibiting characteristics, such as those having large fixed employment costs, which contribute to WLB practices, have positive effects on productivity.

This paper's results are robust against time-varying factors that could bring about endogeneity in adopting WLB practices, the choice of firm productivity measure, and estimation strategy. As for the type of WLB practices, we determine that the establishment of a department to promote WLB practices and organizational efforts to reduce overtime as well as child- and family-care leave above the legal minimum tend to improve firm productivity. Furthermore, we find that it took some time for WLB practices to have a positive effect.

Our conclusion that firms with large fixed costs of employment could benefit from WLB practices is consistent with the findings in previous studies, especially those of Yanadori and Kato (2009). Using cross-sectional data of Japanese firms, Yanadori and Kato (2009) find that work–family practices could decrease female turnover rates. Furthermore, it is interesting to compare the results of this study with those of Bloom et al. (2009). Based on the cross-sectional data of firms in four counties, Bloom et al. (2009) show that it is not WLB but management practices that affect firm productivity; hence, the effects of WLB practices on firm productivity disappears once management practices are controlled. This suggests that the firm-fixed effects that we control for in the estimation should include firm management practices that are emphasized by Bloom et al. (2009). That is, the firms implementing more WLB practices are likely to have better management practices, and therefore the estimations that control for firm-fixed effects or management practices may have suggested no causal effects of WLB practices on firm productivity. However, even when controlling for firm-fixed effects, we confirm the existence of causal effects for firms with certain characteristics, such as those having large fixed employment costs.

One of the implications from this finding is that firms with such characteristics can benefit from the implementation of WLB practices. For example, among firms that hoard labor, WLB practices that retain personnel, such as dedicated WLB departments

or reduced overtime policies, preserve the firm's ability to generate future productivity growth. However, it is surprising that labor-hoarding firms do not necessarily exhibit higher adoption of WLB practices. For example, the adoption rate of the practice "an establishment of department to promote WLB practice" is 14% for labor-hoarding firms and 11% for others; the adoption rate of the practice "organizational efforts to reduce overtime" is 31% for labor-hoarding firms and 29% for others. Even though labor-hoarding firms can benefit from these WLB practices, the differences in the adoption rates are marginal. If this is related to a lack of information on the effect of WLB practices, as suggested by Bryson et al. (2007) or Bloom et al. (2011), we derive the argument that the government may be able to promote the implementation of firm WLB practices by announcing the positive effects on firm productivity to those firms.

References

Ackerberg, Daniel, Kevin, Caves, and Garth Frazer (2006) "Structural Identification of Production functions," *MPRA Paper*, 38349.

Batt, Rosemary (2002) "Managing customer services: human resource practices, quit rates, and sales growth," *Academy of Management Journal*, Vol.45, No.3, pp. 587-597.

Baughman, Reagan, Daniela DiNardi, and Douglas Holtz-Eakin (2003) "Productivity and wage effects of "family-friendly" fringe benefits," *International Journal of Manpower*, Vol.24, No.3, pp. 247-259.

Bloom, Nick, Tobias Kretschmer, and John Van Reenan (2009) "Work-life balance, management practices and productivity," Freeman, Richard B. and Kathryn L. Shaw eds. *International Differences in the Business Practices and Productivity of Firms*, The University of Chicago Press. Chapter 1, pp. 15-54.

Bloom, Nick, Tobias Kretschmer, and John Van Reenan (2011) "Are Family-friendly Workplace Practices a Valuable Firm Resource?" *Strategic Management Journal*, Vol.32, No.4, pp. 343-367.

Bryson, Alex, Rafael Gomez, Tobias Kretschmer, and Paul Willman (2007) "The diffusion of workplace voice and high-commitment human resource management practices in Britain, 1984–1998," *Industrial and Corporate Change*, Vol.16, No.3, pp. 395-426.

Dalton, Dan R. and Debra J. Mesch (1990) "The impact of flexible scheduling on employee attendance and turnover," *Administrative Science Quarterly*, Vol.35, No.2, pp. 370-387.

Freeman, Richard B. and Kathryn L. Shaw eds. (2009) *International Differences in the Business Practices and Productivity of Firms*, The University of Chicago Press.

Giardinia, Angelo and Rüdiger Kabsta (2008) "Effects of work-family human resource practices: a longitudinal perspective," *The International Journal of Human Resource Management*, Vol.19, No.11, pp. 2079-2094.

Gray, Matthew and Jacqueline Tudball (2003) "Family-friendly work practices: differences within and between workplaces," *Journal of Industrial Relations*, Vol.45, No.3, pp. 269-291.

Hirano, Keisuke, and Imbens, Guido (2001) "Estimation of Causal Effects using Propensity Score Weighting: An Application to Data on Right Heart Catheterization." Health Services and Outcomes Research Methodology. 2(3-4), pp. 259-278.

Kawaguchi, Daiji (2007) "A Market Test for Sex Discrimination: Evidence from Japanese Firm-Level Data," *International Journal of Industrial Organization*,

Vol.25, No.3, pp.441-460.
Konrad, Alison and Robert Mangel (2000) “The impact of work-life programs on firm productivity,” *Strategic Management Journal*, Vol.21, pp.1225-1237.
Levinsohn, James and Amil Petrin (2003) “Estimating production functions using inputs to control for unobservables,” *Review of Economic Studies*, Vol.70, No.2, pp.317-342.
Milliken, Frances, Luis Martins, and Hal Morgan (1998) “Explaining organizational responsiveness to work-family issues: the role of human resource executives as issue interpreters,” *Academy of Management Journal*, Vol.41, No.5, pp. 580-592.
Mincer, Jacob and Yoshio Higuchi (1988) “Wage structures and labor turnover in the United States and Japan,” *Journal of the Japanese and International Economies*, Vol.2, No.2, pp. 97-133.
Morikawa, Masayuki (2010) “Labor unions and productivity: an empirical analysis using Japanese firm-level data,” *Labour Economics*, Vol.17, No.6, pp. 1030-1103.
Olley, Steven G. and Ariel Pakes (1996) “The dynamics of productivity in the telecommunications equipment industry,” *Econometrica*, Vol.64, No.6, pp. 1263-1297.
Perry-Smith, Jil, and Terry Blum (2000) “Work-Family Human Resource Bundles and Perceived Organizational Performance,” *Academy of Management Journal*, Vol.43, No.3, pp. 1107-1117.
Petrin, Amil and Levinsohn James (2012) “Measuring aggregate productivity growth using plant-level data,” forthcoming in *Rand Journal of Economics*.
Shepard, Edward M. III, Thomas J. Clifton, and Douglas Kruse (1996) “Flexible work hours and productivity: some evidence from the pharmaceutical industry,” *Industrial Relations*, Vol.35, No.1, pp. 123-139.
Yanadori, Yoshio and Takao Kato (2009) “Work and family practices in Japanese firms: their scope, nature and impact on employee turnover,” *The International Journal of Human Resource Management*, Vol.20, No.2, pp. 439-456.
Wooldridge, Jeffrey (2009) “On estimating firm-level production functions using proxy variables to control for unobservable,” *Economic Letters*, Vol.104, pp. 112-114.

Table 1 Summary statistics

	All sample	Firm size	Industry
		more than 300 workers	Manufacturing
TFP	0.32	0.34	0.34
	(0.17)	(0.18)	(0.16)
WLB practices			
Child-care leave above legal minimum			
Adoption dummy	0.18	0.23	0.20
	(0.38)	(0.42)	(0.40)
Years of the adoption	2000	2000	2001
	(6.99)	(6.98)	(7.47)
Family-care leave above legal minimum			
Adoption dummy	0.15	0.19	0.17
	(0.36)	(0.40)	(0.38)
Years of the adoption	2000	1999	2000
	(5.72)	(5.90)	(5.81)
Short-time working system			
Adoption dummy	0.10	0.09	0.09
	(0.30)	(0.28)	(0.29)
Years of the adoption	2002	2002	2002
	(5.90)	(5.18)	(5.73)
Flextime system			
Adoption dummy	0.15	0.20	0.18
	(0.36)	(0.40)	(0.38)
Years of the adoption	1999	1997	1998
	(7.28)	(7.79)	(7.53)
Practice to limit work location within local area			
Adoption dummy	0.06	0.10	0.04
	(0.24)	(0.30)	(0.19)
Years of the adoption	1996	1998	1994
	(13.32)	(8.49)	(16.80)
Establishment of department to promote WLB practice			
Adoption dummy	0.12	0.17	0.15
	(0.33)	(0.37)	(0.35)
Years of the adoption	2006	2006	2006
	(2.74)	(2.83)	(2.70)
Organizational efforts to reduce overtime hours			
Adoption dummy	0.30	0.30	0.31
	(0.46)	(0.46)	(0.46)
Years of the adoption	2004	2004	2004
	(5.96)	(5.65)	(6.49)
Number of firms	1,292	527	581

Notes: 1. umbers in parentheses are standard deviations.

2. WLB practice adoption dummy is the index variable, which takes the value of 1 if the firm adopts WLB practices until 2008 and 0 otherwise.

Table 2 Main estimation results

	Dependent variable = *ln* (TFP)					
	(1) RE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
WLB practice index	0.042**	0.013	-0.015	-0.090**	-0.022	-0.022
	(0.012)	(0.017)	(0.023)	(0.020)	(0.022)	(0.020)
Cross terms						
Large firm dummy			0.055+			
			(0.030)			
Manufacturing dummy				0.189**		
				(0.026)		
Labor hoarding dummy					0.068*	
					(0.030)	
IT usage dummy						0.040+
						(0.021)
Trend	0.018**	0.020**	0.020**	0.020**	0.020**	0.040**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Constant	-37.426**	-41.516**	-41.892**	-41.299**	-41.623**	-81.369**
	(3.744)	(4.024)	(4.029)	(3.987)	(4.025)	(7.328)
Sample size	5,169	5,169	5,169	5,169	5,169	3,949

Notes: 1. Dependent variables are log TFPs on value-added basis.
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
4. WLB practice index is the sum of the number of adopted WLB practices until the previous year. The large-firm dummy takes the value of 1 for a firm with more than 300 workers. The labor-hoarding dummy takes the value of 1 for the firm with relative volatility of regular employees to output for a decade less than the median. The IT-usage dummy, available only after 1998, takes the value of 1 if a firm uses electronic commerce.

Table 3 Robustness checks: time-varying controls

	Dependent variable = *ln* (TFP)					
	(1) RE	(2) FE	(3) FE	(4) FE	(5) FE	(6) FE
WLB practice index	0.042**	0.006	-0.025	-0.095**	-0.025	-0.024
	(0.012)	(0.017)	(0.022)	(0.019)	(0.021)	(0.020)
Cross terms						
Large firm dummy			0.061*			
			(0.029)			
Manufacturing dummy				0.187**		
				(0.026)		
Labor hoarding dummy					0.060*	
					(0.030)	
IT usage dummy						0.041*
						(0.020)
Information cost ratio (I.C.)	3.744+	-3.969	-4.093+	-3.483	-3.986	-5.263+
	(2.108)	(2.468)	(2.472)	(2.409)	(2.453)	(2.695)
(I.C.-mean(I.C.))2	-21.646*	7.672	7.549	4.271	7.532	9.562
	(8.788)	(11.195)	(11.355)	(10.565)	(11.262)	(9.986)
Asset ratio x (I.C.-mean(I.C.)	3.886	9.539*	9.866*	8.030+	9.316*	10.431*
	(3.310)	(4.205)	(4.214)	(4.281)	(4.198)	(4.083)
Fix asset ratio	-0.333**	-0.564**	-0.567**	-0.560**	-0.560**	-0.718**
	(0.039)	(0.057)	(0.057)	(0.057)	(0.057)	(0.099)
Trend	0.019**	0.022**	0.022**	0.021**	0.022**	0.033**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Constant	-39.975**	-44.191**	-44.590**	-44.071**	-44.258**	-66.463**
	(3.760)	(4.039)	(4.041)	(4.009)	(4.042)	(7.549)
Sample size	5,169	5,169	5,169	5,169	5,169	3,949

Notes: 1. Dependent variables are log TFPs on a value-added basis.
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4 Robustness checks: Labor productivity

	Dependent variable = *ln* (Labor productivity)					
	(1)	(2)	(3)	(4)	(5)	(6)
	RE	FE	FE	FE	FE	FE
WLB practice index	0.041**	0.010	-0.016	-0.093**	-0.033	-0.019
	(0.013)	(0.016)	(0.020)	(0.017)	(0.021)	(0.019)
Cross terms						
Large firm dummy			0.049+			
			(0.028)			
Manufacturing dummy				0.188**		
				(0.025)		
Labor hoarding dummy					0.081**	
					(0.028)	
IT usage dummy						0.036+
						(0.020)
Trend	0.027**	0.029**	0.029**	0.029**	0.029**	0.045**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Constant	-56.264**	-60.267**	-60.600**	-60.051**	-60.395**	-92.070**
	(3.778)	(4.022)	(4.023)	(3.998)	(4.022)	(7.362)
Sample size	5,169	5,169	5,169	5,169	5,169	3,949

Notes: 1. Dependent variables are log labor productivity (value-added divided by man-hour labor input).
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 5 Robustness checks: TFP from WLP method

	Dependent variable = *ln* (TFP)					
	(1)	(2)	(3)	(4)	(5)	(6)
	RE	FE	FE	FE	FE	FE
WLB practice index	0.053**	0.013	-0.019	-0.088**	-0.029	-0.019
	(0.013)	(0.017)	(0.020)	(0.017)	(0.021)	(0.018)
Cross terms						
Large firm dummy			0.063*			
			(0.028)			
Manufacturing dummy				0.185**		
				(0.025)		
Labor hoarding dummy					0.081**	
					(0.028)	
IT usage dummy						0.035+
						(0.020)
Trend	0.024**	0.020**	0.027**	0.026**	0.027**	0.044**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
Constant	-48.814**	-41.516**	-54.296**	-53.741**	-54.043**	-89.526**
	(3.753)	(4.024)	(3.973)	(3.946)	(3.974)	(7.250)
Sample size	5,169	5,169	5,169	5,169	5,169	3,949

Notes: 1. Dependent variables are log TFPs on value-added basis derived from WLP method.
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6 Difference-in-differences estimation with propensity score weighting

	Dependent variable = *ln* (TFP)				
	(1) FE	(2) FE	(3) FE	(4) FE	(5) FE
WLB practice adoption dummy x Year dummy	0.155				
	(0.119)				
Cross terms					
Large firm dummy		0.166+			
		(0.095)			
Manufacturing dummy			0.310**		
			(0.096)		
Labor hoarding dummy				0.262*	
				(0.102)	
IT usage dummy					0.134
					(0.119)
WLB practice adoption dummy	-0.208	-0.125	-0.196*	-0.212*	-0.146
	(0.136)	(0.085)	(0.094)	(0.095)	(0.104)
Year dummy	0.151**	0.165**	0.138**	0.149**	0.171**
	(0.015)	(0.026)	(0.020)	(0.020)	(0.025)
Constant	-1.378**	-1.386**	-1.380**	-1.378**	-1.384**
	(0.021)	(0.021)	(0.022)	(0.020)	(0.022)
Sample size	2,278	2,278	2,278	2,278	2,278

Notes: 1. Dependent variables are log TFP on value-added basis.
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
4. Year dummy takes the value of 1 for the year 2008.
5. Sample consists of the firms in 2004 and 2008. The WLB practice is the establishment of a department to promote WLB practice.

Table 7 Effects of each WLB practice on firm's TFP

	Dependent variable = *ln* (TFP)						
	(1) Child-care leave above legal minimum	(2) Family-care leave above legal minimum	(3) Short-time working system	(4) Flextime system	(5) Practice to limit work location in local area	(6) Establishment of dept. to promote WLB practice	(7) Organizational efforts to reduce overtime
WLB practice adoption dummy	-0.056	-0.002	-0.026	-0.037	-0.327+	-0.025	-0.006
	(0.060)	(0.067)	(0.056)	(0.079)	(0.193)	(0.095)	(0.038)
Cross terms with Large firm dummy	0.143+	0.127	-0.030	0.022	0.359+	0.193+	0.093
	(0.084)	(0.112)	(0.094)	(0.113)	(0.200)	(0.117)	(0.067)
WLB practice adoption dummy	-0.143*	-0.181*	-0.161*	-0.194**	-0.150	-0.171+	-0.172**
	(0.058)	(0.074)	(0.070)	(0.073)	(0.091)	(0.089)	(0.041)
Cross terms with Manufacturing dummy	0.280**	0.401**	0.249**	0.309**	0.258*	0.402**	0.360**
	(0.082)	(0.102)	(0.087)	(0.108)	(0.120)	(0.110)	(0.058)
WLB practice adoption dummy	0.004	0.049	-0.057	0.013	-0.080	-0.045	-0.116**
	(0.065)	(0.075)	(0.063)	(0.114)	(0.073)	(0.068)	(0.041)
Cross terms with Labor hoarding dummy	0.012	-0.001	0.037	-0.066	0.052	0.287**	0.284**
	(0.085)	(0.108)	(0.091)	(0.127)	(0.150)	(0.108)	(0.060)
WLB practice adoption dummy	-0.062	-0.165*	-0.026	-0.083	-0.175	-0.041	0.041
	(0.057)	(0.067)	(0.064)	(0.081)	(0.152)	(0.061)	(0.040)
Cross terms with IT usage dummy	0.140*	0.219**	-0.050	-0.028	0.109	0.141+	-0.024
	(0.062)	(0.065)	(0.061)	(0.063)	(0.096)	(0.080)	(0.045)

Notes: 1. Dependent variables are log TFP on value-added basis.
2. Numbers in parentheses are robust standard errors.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
4. WLB practice adoption dummy takes the value of 1 if a firm adopted the practice until the previous year and 0 otherwise.

Table 8 Effects of WLB practices on firm TFP

(1) Random-effects model

	WLB practices						
	(1) Child-care leave above legal minimum	(2) Family-care leave above legal minimum	(3) Short-time working system	(4) Flextime system	(5) Practice to limit work location in local area	(6) Establishment of dept. to promote WLB practice	(7) Organizational efforts to reduce overtime
WLB practice adoption dummies							
1 year earlier	0.070	−0.007	−0.114	−0.092	0.028	0.203**	0.007
	(0.084)	(0.093)	(0.074)	(0.120)	(0.065)	(0.062)	(0.039)
2 year earlier	0.069	0.065	−0.010	−0.052	−0.016	0.138+	0.090+
	(0.043)	(0.049)	(0.063)	(0.066)	(0.083)	(0.083)	(0.048)
3 year earlier	0.028	0.023	0.041	0.001	−0.230	0.096	0.067
	(0.060)	(0.071)	(0.070)	(0.066)	(0.149)	(0.100)	(0.056)
4 year earlier	−0.001	0.061	−0.012	0.062	0.013	−0.075	−0.044
	(0.069)	(0.083)	(0.084)	(0.069)	(0.075)	(0.129)	(0.049)
5 year earlier	0.117*	0.217**	0.123	0.140*	0.114	0.135	0.054
	(0.047)	(0.047)	(0.081)	(0.068)	(0.077)	(0.084)	(0.059)
more than 6 year earlier	0.160**	0.242**	0.078+	0.188**	0.021	0.084	0.005
	(0.035)	(0.036)	(0.047)	(0.037)	(0.048)	(0.115)	(0.037)
Trend	0.018**	0.017**	0.020**	0.018**	0.020**	0.019**	0.019**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	−37.390**	−36.027**	−40.914**	−37.563**	−40.766**	−40.204**	−38.853**
	(2.864)	(2.829)	(2.827)	(2.813)	(2.729)	(2.843)	(3.009)
Sample size	4,757	4,775	4,774	4,760	4,870	4,782	4,358
Average effects for 3 years	0.055	0.027	-0.028	-0.048	-0.073	0.146**	0.055+
	[1.91]	[0.35]	[0.41]	[0.80]	[1.25]	[7.51]	[3.14]
Average effects for all years	0.074*	0.100**	0.017	0.041	-0.012	0.097+	0.030
	[6.41]	[9.15]	[0.25]	[1.28]	[0.07]	[3.59]	[1.46]

Notes: 1. Dependent variables are log TFPs on value-added basis.
2. Numbers in parentheses are robust standard errors. Numbers in block parentheses are F-statistics for the sum of the effects on TFP.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

(2) Fixed-effects model

	WLB practices						
	(1) Child-care leave above legal minimum	(2) Family-care leave above legal minimum	(3) Short-time working system	(4) Flextime system	(5) Practice to limit work location in local area	(6) Establishment of dept. to promote WLB practice	(7) Organizational efforts to reduce overtime
WLB practice adoption dummies							
1 year earlier	0.016	−0.048	−0.156*	−0.170	−0.033	0.164**	0.017
	(0.085)	(0.102)	(0.074)	(0.128)	(0.072)	(0.055)	(0.036)
2 year earlier	0.034	0.039	−0.034	−0.092	0.017	0.046	0.092+
	(0.050)	(0.058)	(0.066)	(0.079)	(0.099)	(0.093)	(0.051)
3 year earlier	0.001	−0.007	0.035	−0.034	−0.226	0.081	0.073
	(0.065)	(0.077)	(0.056)	(0.081)	(0.182)	(0.106)	(0.060)
4 year earlier	−0.050	0.026	−0.056	0.012	−0.028	−0.043	−0.020
	(0.074)	(0.091)	(0.110)	(0.073)	(0.085)	(0.137)	(0.051)
5 year earlier	0.034	0.167**	0.075	0.055	0.055	0.193+	0.093+
	(0.062)	(0.064)	(0.086)	(0.095)	(0.074)	(0.117)	(0.056)
more than 6 year earlier	0.068	0.189*	0.004	0.091	−0.060	0.097	0.050
	(0.068)	(0.082)	(0.074)	(0.077)	(0.078)	(0.145)	(0.062)
Trend	0.019**	0.018**	0.020**	0.019**	0.020**	0.020**	0.018**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	−39.177**	−37.254**	−42.080**	−39.663**	−41.556**	−41.214**	−38.363**
	(3.959)	(3.842)	(3.899)	(3.842)	(3.792)	(3.826)	(4.092)
Sample size	4,757	4,775	4,774	4,760	4,870	4,782	4,358
Average effects for 3 years	0.017	-0.005	-0.052	-0.099	-0.081	0.097	0.060
	[0.12]	[0.01]	[1.14]	[2.16]	[0.74]	[2.16]	[2.27]
Average effects for all years	0.017	0.061	-0.022	-0.023	-0.046	0.090	0.051
	[0.14]	[1.24]	[0.21]	[0.16]	[0.43]	[1.39]	[2.05]

Notes: 1. Dependent variables are log TFP on value-added basis.
2. Numbers in parentheses are robust standard errors. Numbers in block parentheses are F-statistics for the sum of the effects on TFP.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

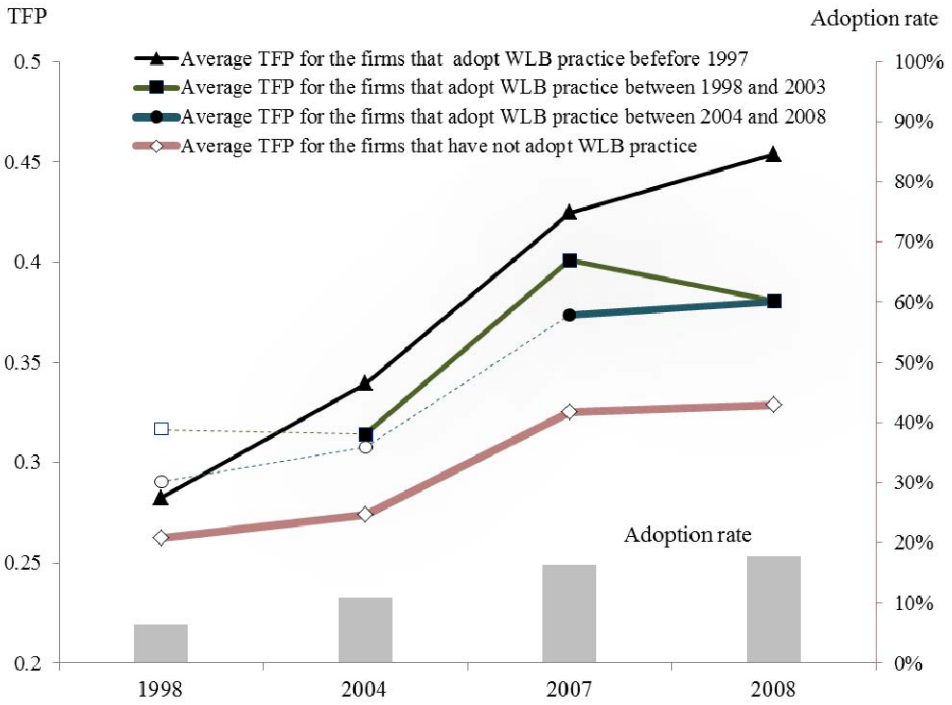
(3) Labor-hoarding firms

	WLB practices						
	(1) Child-care leave above legal minimum	(2) Family-care leave above legal minimum	(3) Short-time working system	(4) Flextime system	(5) Practice to limit work location in local area	(6) Establishment of dept. to promote WLB practice	(7) Organizational efforts to reduce overtime
WLB practice adoption dummies							
1 year earlier	0.074	−0.027	−0.162	−0.211	0.035	0.210*	0.067
	(0.078)	(0.103)	(0.108)	(0.137)	(0.121)	(0.085)	(0.047)
2 year earlier	−0.029	−0.067	−0.115	−0.156	−0.337	0.326**	0.254**
	(0.071)	(0.084)	(0.090)	(0.102)	(0.206)	(0.121)	(0.067)
3 year earlier	−0.143	−0.209+	−0.020	−0.184*	−0.282	0.151	0.241**
	(0.096)	(0.121)	(0.087)	(0.091)	(0.231)	(0.178)	(0.086)
4 year earlier	−0.203*	−0.115	−0.082	−0.083	−0.044	−0.081	0.035
	(0.097)	(0.113)	(0.108)	(0.090)	(0.199)	(0.190)	(0.082)
5 year earlier	0.002	0.105	0.102	−0.100	0.173	0.413**	0.193*
	(0.082)	(0.089)	(0.113)	(0.103)	(0.133)	(0.143)	(0.075)
more than 6 year earlier	0.089	0.222+	−0.034	0.033	−0.047	0.127	0.158+
	(0.091)	(0.121)	(0.108)	(0.084)	(0.138)	(0.144)	(0.084)
Sample size	2,365	2,359	2,369	2,394	2,475	2,399	2,184
Average effects for 3 years	-0.033	-0.101	-0.099	-0.183*	-0.195	0.229*	0.187**
	[0.27]	[1.63]	[1.96]	[5.61]	[1.59]	[4.71]	[11.50]
Average effects for all years	-0.035	-0.015	-0.052	-0.117+	-0.084	0.191*	0.158**
	[0.35]	[0.04]	[0.60]	[3.67]	[0.49]	[3.88]	[10.02]

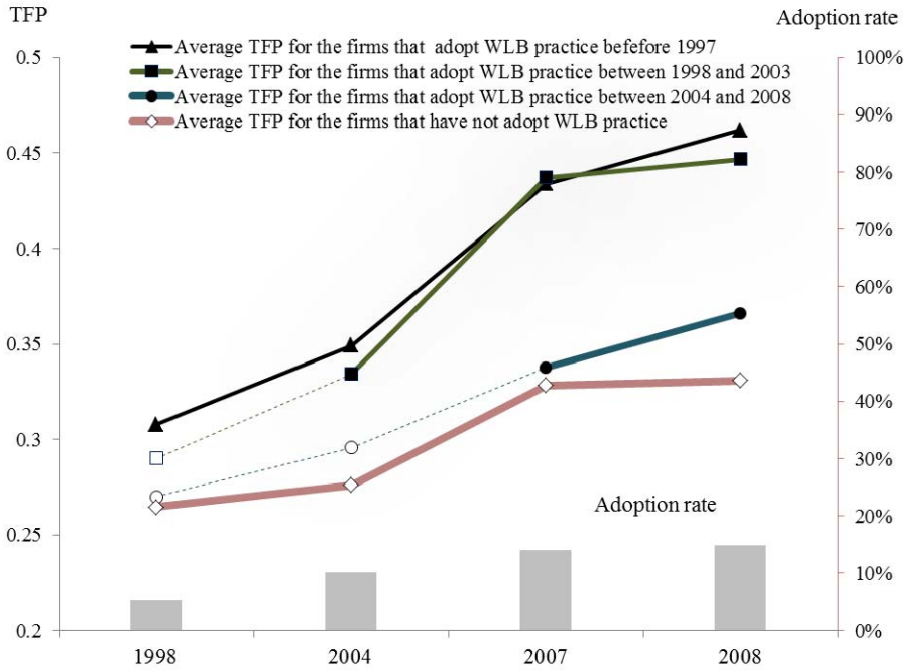
Notes: 1. Dependent variables are log TFP on value-added basis.
2. Numbers in parentheses are robust standard errors. Numbers in block parentheses are F-statistics for the sum of the effects on TFP.
3. **, *, and + indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
4. Trend and constant terms are included.

Figure 1 Work–life balance (WLB) practices and total factor productivity (TFP)

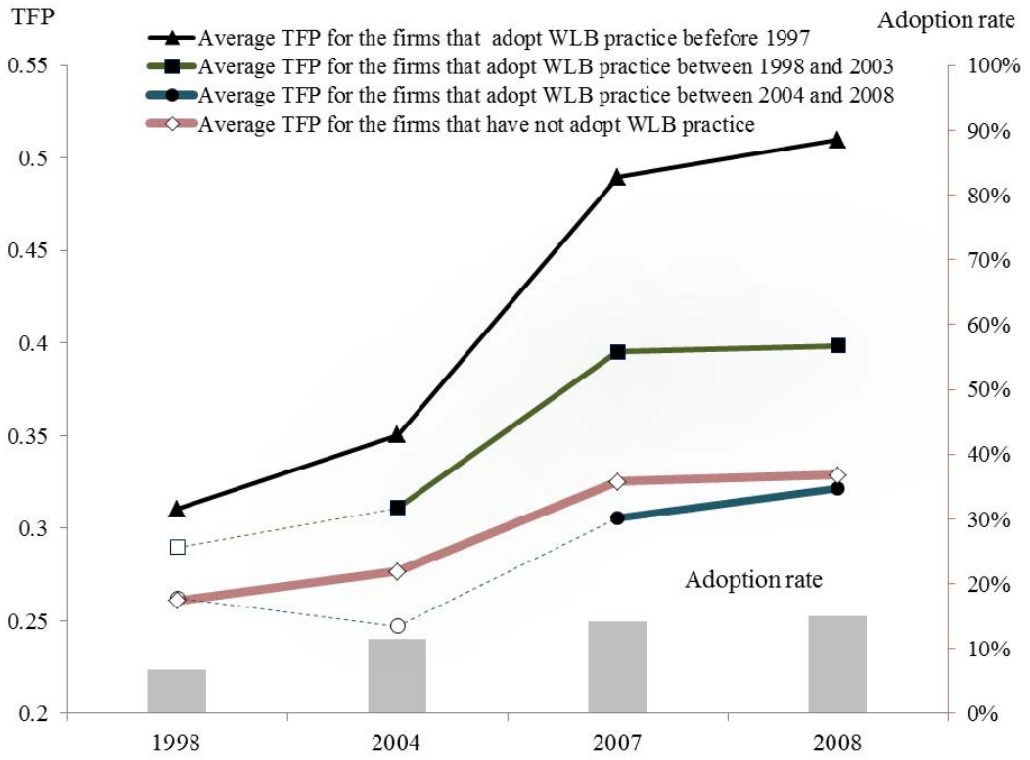
(1) Child-care leave above legal minimum



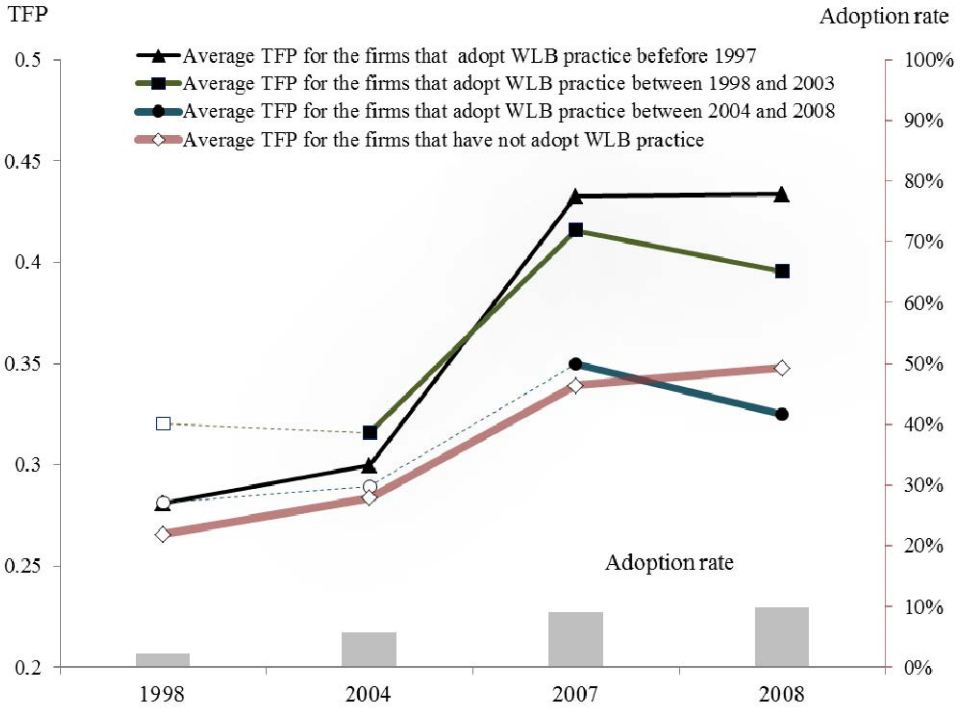
(2) Family-care leave above legal minimum



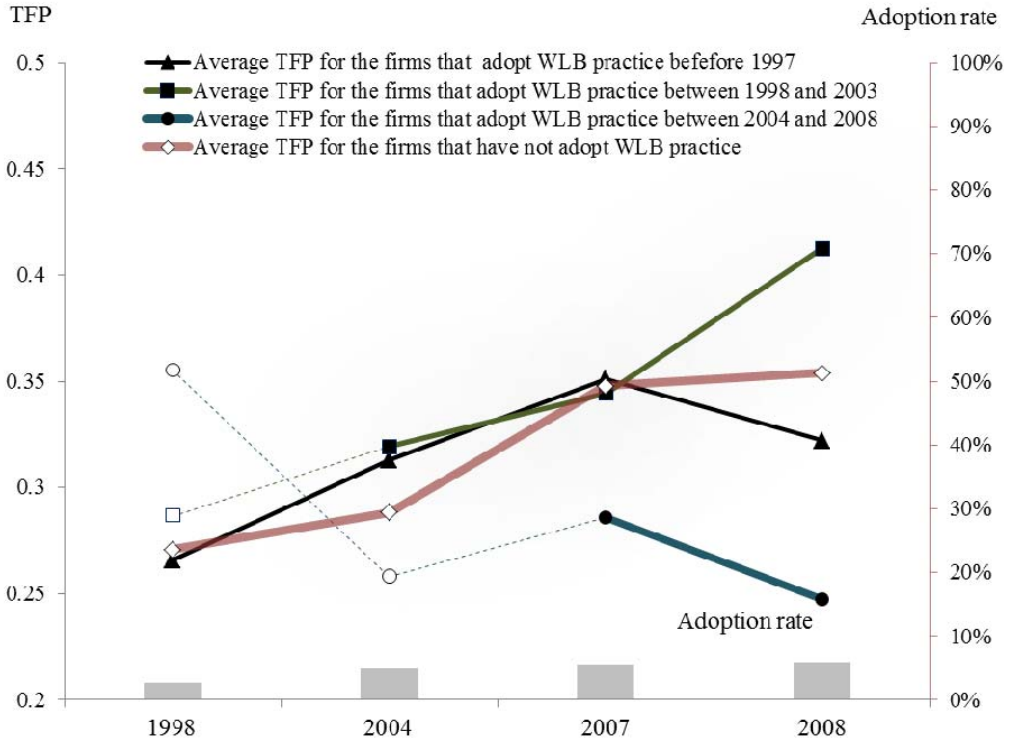
(3) Short-term working system



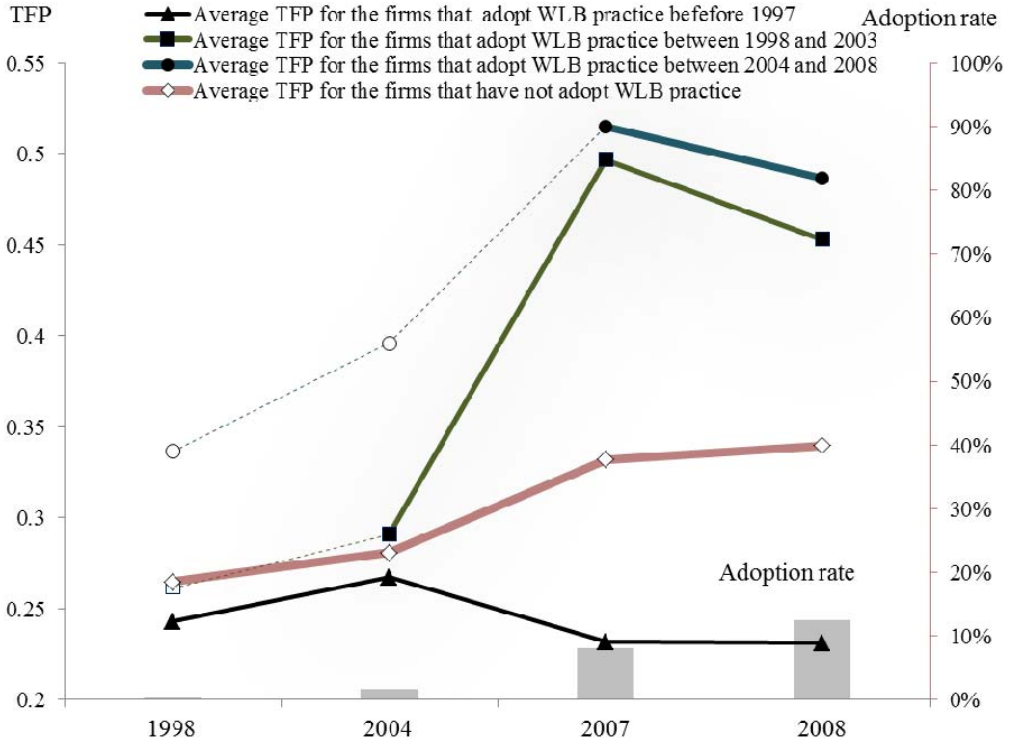
(4) Flextime system



(5) Practice to limit work location within local area



(6) Establishment of a department for promoting WLB practices



(7) Organizational efforts to reduce overtime hours