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### Reduced working hours and human capital investment: Evidence from the 40-hour workweek policy in South Korea

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### Abstract

This study analyzes the impact of working hours on vocational training, using South Korea's 40-hour workweek policy as an instrumental variable. Utilizing data from the Korean Labor and Income Panel Study (KLIPS), the results indicate that reduced working hours increase the likelihood of participating in vocational training participation and its duration, driven primarily by employer-provided training. These findings highlight how reducing working hours can influence human capital investment through vocational training.

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# 1. Introduction

Extended working hours can significantly increase worker fatigue and the probability of industrial accidents. Consequently, there is an increasing demand among employees for improved work-life balance. In response, policies designed to decrease working hours are increasingly being adopted to improve employee well-being and operational efficiency (Kossek and Lee, 2008; De Spiegelaere and Piasna, 2017).

However, from an employer's perspective, reduced working hours may reduce total production due to decreased labor input. Employers may seek to offset this by expanding their workforce; however, previous studies indicate that reduced working hours do not necessarily positively impact employment (Hunt, 1999; Kawaguchi et al., 2008; Kim and Lee, 2012). Consequently, employers are more inclined to emphasize enhancing labor productivity rather than augmenting employment. Moreover, pursuant to Article 4 of the Supplementary Provisions of the Labor Standards Act, firms must maintain existing wage levels despite reductions in working hours, thereby increasing the hourly labor cost. In this context, investing in vocational training serves as a viable strategy for firms to mitigate cost pressures by enhancing worker productivity (Becker, 1994).

Conversely, reduced working hours may restrict employers' investment in vocational training. Increased hourly labor costs due to wage maintenance may constrain firms' overall training budgets, potentially weakening their motivation to expand vocational training. Additionally, employees may allocate their discretionary time from reduced working hours to leisure or personal care instead of professional development. For instance, in Japan and Korea, where statutory working hours have been reduced, the duration allocated to market work, including schooling and studying, decreased, whereas the time devoted to personal care activities, including leisure and sleep, increased (Lee et al., 2012). If workers predominantly devote their additional discretionary time to personal pursuits, then voluntary participation in vocational training may not significantly change.

Thus, reduced working hours and vocational training may yield conflicting effects. However, to the best of our knowledge, limited empirical research has examined this relationship. This study seeks to empirically examine the impact of working hours on vocational training by leveraging exogenous changes in statutory working-hour reduction policies, thereby mitigating endogeneity.

Following this introduction, Section 2 delineates the empirical framework used for analysis, while Section 3 describes the data and estimation results. Finally, Section 4 elucidates the implications derived from analyzing the relationship between working hours and vocational training.

## 2. Empirical Framework

Vocational training in Korea is classified into individual choice and employer-provided training. This study analyzes the effect of working hours on vocational training participation. Further, it examines the relationship by distinguishing between types of training. It specifically seeks to ascertain the impact of reduced working hours on the probability of participating in each type. In addition, considering the cost burden on employers, the study distinguishes between employer-provided training conducted during work hours and that conducted during leisure hours. Employers typically offer enhanced financial support for training conducted during work hours, thus increasing such training may impose a heightened cost burden on employers (Pischke, 2001). Furthermore, we estimate the impact of reduced working hours on

vocational training duration to assess whether changes in working hours impact training intensity.

However, examining the causal relationship between working hours and vocational training necessitates addressing unobserved endogenous changes in working hours. Thus, this study employs an instrumental variable (IV) approach, leveraging the exogenous implementation of the 40-hour workweek policy. The validity of the IV is supported by the legislative intent and implementation design of the 40-hour workweek policy. Official government documents indicate that the policy's primary objectives were to enhance workers' quality of life and alleviate unemployment via work sharing, rather than to promote vocational training or implement supplementary training subsidy programs. Moreover, the timing of the policy implementation was predetermined by firm size via a legislative amendment in 2003. It was implemented in a staggered manner, requiring mandatory compliance from firms at the assigned time.<sup>1</sup> These institutional features generate exogenous variation in working hours that is independent of firms' training demand or economic conditions, thereby justifying the use of the 40-hour workweek policy as a valid instrument for working hours (Ahn, 2016). The model incorporates time and firm size dummies to account for potential effects arising from the policy's staggered implementation across different years and firm sizes.

$$\begin{aligned} Y_{it}^* &= \beta_0 + \beta_1 h_{it} + \beta_2 X_{it} + u_{it} \\ h_{it} &= \pi_1 WR_{it} + \pi_2 X_{it} + v_{it} \end{aligned} \quad (1) \quad (2)$$

Using Equations (1) and (2) as the foundation, this study applies an IV-Probit model based on Rivers and Vuong's (1988) two-step approach to analyze the effect of working hours on the probability of vocational training participation. In Equation (1), the dependent variable is a dummy variable representing participation in vocational training, and  $h_{it}$  denotes the actual weekly working hours of individual  $i$  at time  $t$ . In addition,  $WR_{it}$  in Equation (2) denotes a dummy variable indicating whether the establishment at which individual  $i$  is currently employed is subject to the statutory reduction in working hours in year  $t$ . The coefficient  $\pi_1$  in Equation (2) represents the effect of introducing the 40-hour workweek policy on working hours  $h_{it}$ . The error terms in these equations are expressed as  $u_{it} = \theta_1 v_{it} + e_{it}$ . Here, the error term  $v_{it}$  can be estimated as the residual ( $\hat{v}_{it}$ ) from Equation (2), which is subsequently included as an additional regressor in Equation (1), yielding Equation (3). In this setup,  $\hat{v}_{it}$  serves as a proxy variable capturing the variability of the unobserved variable  $v$ , which induces endogeneity (Etilé and Sharma, 2015). By substituting  $v_{it}$  in Equation (3) with the residual ( $\hat{v}_{it}$ ) estimated in Equation (2), the endogeneity of  $h_{it}$  can be effectively controlled.

$$Y_{it}^* = \beta_0 + \beta_1 h_{it} + \beta_2 X_{it} + \theta_1 v_{it} + e_{it}, \quad e_{it}|h, X, v \sim N(0, \sigma_e^2) \quad (3)$$

Additionally, the impact of working hours on training duration is estimated using Equation (3). However, because a significant proportion of the sample's workers do not participate in training, Smith and Blundell's (1986) two-step approach is applied to an IV-Tobit model. With valid IV, the IV-Tobit model—like the IV-Probit model—can control for endogeneity in

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<sup>1</sup> In Korea, statutory working hours were initially set at 44 per week. However, they were gradually reduced based on workplace size between 2004 and 2011. This reduction was implemented first for workplaces with 1,000 or more employees, as well as businesses in the finance, insurance, and public sectors. Subsequently, the 40-hour workweek was extended to workplaces with 300 or more employees in 2005, 100 or more in 2006, 50 or more in 2007, 20 or more in 2008, and finally to workplaces with five or more employees in 2011.

working hours in Equation (3). Moreover, because the Tobit model may produce biased estimates under non-normality or heteroskedasticity, the training duration is log-transformed (Melenberg and Van Soest, 1996). Consequently,  $Y_{it}$  in the IV-Tobit model represents the logarithmic form of the total vocational training duration initiated at time  $t$ .

### 3. Data and Results

We construct the analysis sample using data from the Korean Labor and Income Panel Study (KLIPS), a nationally representative panel survey of Korean households. KLIPS is conducted annually, and this study specifically utilizes data gathered between 2003 and 2012. The analysis is restricted to wage workers and excludes part-time employees, based on the assumption that part-time workers are less likely to be significantly affected by the 40-hour workweek policy and are less likely to be targeted for vocational training.<sup>2</sup> Consequently, approximately 5.9% of the initial sample was excluded from the analysis.

Table I presents the descriptive statistics for the analysis sample. Panel A compares worker groups before and after the implementation of the 40-hour workweek policy. The average weekly working hours before the policy were 51.12 hours, which decreased to 47.49 hours post-implementation. Additionally, workers observed after the policy implementation exhibited increased participation rates in vocational training, longer training durations, higher unionization rates, and higher wages compared to those observed before the policy.<sup>3</sup> However, because the 40-hour workweek policy was introduced in a staggered manner, commencing with large firms, the post-reform sample comprises a relatively higher proportion of employees at large establishments. Because large-firm workers tend to have higher unionization rates, wages and access to training resources, it remains ambiguous whether the observed differences in sample characteristics before and after the reform indicate differences in firm size composition or causal effects attributable to the reduction in working hours.

To assess this concern more directly, Panel B compares wages and unionization rates before and after the policy across different firm size categories. When firm size remains constant, the sharp changes observed in Panel A largely diminish. For example, unionization rates have remained relatively stable in firms with 50–99 employees (0.25 to 0.24), whereas they have decreased in firms with 100–299 employees (0.47 to 0.38) and 300–999 employees (0.64 to 0.56). Similarly, changes in wages are modest when analyzed based on firm size groups. These patterns indicate that the pronounced differences in wages and unionization in Panel A appear to be primarily influenced by compositional changes induced by the staggered implementation of the policy, rather than by the policy itself.<sup>4</sup> To mitigate potential

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<sup>2</sup> Incorporating part-time workers in the analysis of vocational training participation and duration yielded analogous results, which are available upon request.

<sup>3</sup> The KLIPS surveys up to three most recent training programs attended by each worker. Accordingly, participation in vocational training is defined as having participated in at least one training program during the past year. The total training duration is calculated by summing the durations of all training programs in which the worker participated during that year. In addition, individual choice training and employer-provided training are distinguished based on the respondent's answers.

<sup>4</sup> An apparent exception arises for establishments with fewer than five employees, where both wages and unionization rates increase significantly. However, these establishments were not covered by the 40-hour workweek during the sample period. This pattern is influenced by the inclusion of finance, insurance, and public-sector workers—who were covered from 2004

confounding due to differences in sample composition before and after the introduction of the 40-hour workweek policy, this study controls for firm size, along with individual and occupation-level characteristics.

According to the first-stage estimation results presented in Table II, the estimated coefficient  $\hat{\pi}_1$  is -0.1, statistically significant at the 1% level, indicating that implementing the policy reduced working hours by one hour on average. The unit of working hours was converted to ten hours for clarity in displaying estimated coefficients to three decimal places, where a one-hour reduction corresponds to a 0.1-unit decrease in  $h_{it}$ . Furthermore, the F-statistic for the IV is 29.75, exceeding the conventional threshold of ten for weak instruments, suggesting that weak instrument concerns are not present (Staiger and Stock, 1997).

Despite a statutory reduction of four hours in working hours, the actual decrease is significantly less owing to two main reasons. First, a non-negligible proportion of workers were already employed for fewer than 40 hours per week before the reform. In 2003, they accounted for approximately 8.2% of the sample. Because the policy was non-binding for these workers, their inclusion diminishes the average treatment effect. Second, as indicated by Ahn (2016), the prevailing institutional framework at that time excluded weekend work from the computation of statutory weekly working hours. Consequently, certain firms may reduce weekday hours while redistributing labor to Saturdays, thereby limiting the reduction in total hours worked.

The second-stage estimates reported in Table II illustrate the impact of exogenous changes in working hours—driven by the implementation of the working-hour reduction policy—on the overall likelihood of engaging in vocational training and its duration. Columns 1 and 3 provide estimates that do not account for the endogeneity of working hours. In this case, reduced working hours seem to adversely impact the probability of engaging in job training, yet do not significantly influence the total number of participation days. However, the IV estimation results indicate an upward bias in the estimates presented in Columns 1 and 3.

The IV estimation coefficient for the overall probability of vocational training participation, alongside the average marginal effect (in brackets), is negative and statistically significant at the 5% level. This result indicates that a one-hour reduction in working hours attributable to the policy enhances the probability of participating in vocational training by approximately 1.3 percentage points, signifying a 13% increase in participation probability compared to the average training participation rate of 10% in the total sample. Additionally, the IV estimation results in Column 4 indicate that a one-hour reduction in working hours increases vocational training duration by approximately 2.6%. Given the total sample's average vocational training duration of 38 days, this corresponds to an increase of approximately 0.98 days.

These findings indicate that firms may have increased their investments in vocational training to enhance worker productivity, seeking to offset declines in overall production caused by reduced working hours. A one-hour reduction in weekly working hours may seem insignificant for individuals, yet it can represent a substantial decline in labor input at the firm level. For example, in a firm with 100 employees, this reduction equates to approximately 5,200 fewer labor hours annually. This substantial reduction in total labor input generates compelling incentives for firms to enhance worker productivity, and increased investment in vocational training can be perceived as a direct and feasible adjustment margin.

Table III presents the findings from the analysis of the impact of working hours on vocational training, categorized into individual choice and employer-provided training. In Panel A, the IV estimation demonstrates that working hours do not significantly influence the

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regardless of establishment size—and who typically exhibit higher wages and unionization rates. Appendix Table AI reports additional firm-size-specific results.

probability of participation or the duration of individual choice vocational training. This finding may suggest that employees utilized the time gained from the transition to a 40-hour workweek for leisure activities rather than training aimed at improving job skills or career development (Lee et al., 2012).

In contrast, the IV estimation results in Panel B indicate that a one-hour decrease in working hours increases the probability of participating in employer-provided vocational training by approximately 1.3 percentage points, representing a 14% increase relative to the average employer-provided training participation rate of 9%. Furthermore, the impact on the duration of employer-provided job training is statistically significant at the 10% level, with a one-hour reduction in working hours estimated to increase the number of training days by approximately 2.26%, on average. This finding indicates that the observed rise in participation probability and duration of overall vocational training, attributable to reduced working hours, primarily stems from employer-provided training.

Furthermore, Panel C indicates that the probability of participating in employer-provided training during working hours surpasses that during leisure hours. Although labor costs may increase due to higher hourly wages from reduced working hours, the rise in both the probability of participating in job training during working hours—which imposes a greater financial burden on firms—and the duration of training indicates that firms are highly motivated to improve worker productivity through such training.

To further assess the robustness of the main results, we examine whether the estimated effects represent a pure hours effect, rather than being confounded by income effects. We specifically re-estimate the baseline specification by incorporating real monthly wages as an additional control variable. The estimates, as indicated in Appendix Table AII, are both qualitatively and quantitatively consistent with the baseline results. This finding indicates that the IV strategy effectively isolates the causal effect of changes in working hours, while adequately accounting for potential income-related confounders.

Large firms, with more developed HR systems and enhanced training resources, may respond differently to reductions in work hours compared to smaller firms. To examine this possibility, we estimate a specification that incorporates an interaction term between weekly working hours and an indicator for large firms (defined as those with 300 or more employees). The interaction term, as indicated in Appendix Table AIII, is not statistically significant across all specifications, implying insufficient evidence of heterogeneous effects based on firm size. A potential explanation pertains to the institutional characteristics of Korea's training system. Government support for vocational training is more substantial for small and medium-sized firms, potentially alleviating disparities in training capacity across different firm sizes. This policy framework may mitigate disparities in firms' reactions to decreases in working hours.

## **4. Conclusion**

Empirical analysis utilizing KLIPS data demonstrates that reduced working hours enhance the probability of participation in vocational training and extend its duration. Notably, these effects were predominantly influenced by employer-provided training, with significant increases observed in training conducted during working hours as opposed to leisure time. This finding indicates that employers increased both participation in and the duration of vocational training to enhance worker productivity and offset declines in total production due to reduced working hours. Policymakers frequently prioritize conventional outcomes such as employment, wages, and job satisfaction; thus, these findings underscore the necessity of considering the

potential benefits of vocational training when evaluating the implications of working-hour reduction policies.

## Declaration of Funding

No funding was received.

## Data Availability Statement

This study utilizes data from the **Korean Labor & Income Panel Study (KLIPS)**, which is publicly available through the Korea Labor Institute (KLI) website (<https://www.kli.re.kr/klips>). Access to the data requires registration and approval from the Korea Labor Institute. The authors do not have the authority to share the dataset directly, but researchers can obtain access by following the guidelines provided by KLI.

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**Table I. Summary Statistics*****Panel A. Full Sample Comparison (Before vs. After Implementation)***

|                                              | Before | After  | Total  |
|----------------------------------------------|--------|--------|--------|
| Weekly working hours                         | 51.12  | 47.49  | 49.62  |
| <b>Overall vocational training</b>           |        |        |        |
| Participation rate                           | 0.08   | 0.14   | 0.10   |
| Participation duration (days)                | 34.30  | 40.75  | 37.85  |
| <b>Individual choice vocational training</b> |        |        |        |
| Participation rate                           | 0.01   | 0.01   | 0.01   |
| Participation duration (days)                | 95.91  | 112.55 | 103.25 |
| <b>Employer-provided vocational training</b> |        |        |        |
| Participation rate                           | 0.07   | 0.13   | 0.09   |
| Participation duration (days)                | 25.51  | 34.76  | 30.75  |
| <b>During work hours</b>                     |        |        |        |
| Participation rate                           | 0.05   | 0.09   | 0.07   |
| Participation duration (days)                | 21.33  | 21.23  | 21.27  |
| <b>During leisure hours</b>                  |        |        |        |
| Participation rate                           | 0.02   | 0.04   | 0.03   |
| Participation duration (days)                | 35.21  | 62.08  | 50.97  |
| Age                                          | 38.90  | 39.35  | 39.09  |
| Female                                       | 0.40   | 0.33   | 0.37   |
| Married                                      | 0.64   | 0.70   | 0.66   |
| Regular worker                               | 0.73   | 0.80   | 0.76   |
| Unionization rate                            | 0.10   | 0.31   | 0.19   |
| Real monthly wage (KRW 10,000)               | 144.76 | 206.09 | 170.17 |
| Education                                    |        |        |        |
| Less than high school                        | 0.20   | 0.11   | 0.16   |
| High school                                  | 0.42   | 0.36   | 0.40   |
| College                                      | 0.35   | 0.48   | 0.40   |
| Above college                                | 0.02   | 0.06   | 0.04   |
| Number of observations                       | 19,642 | 13,896 | 33,538 |

***Panel B. Within-Firm-Size Unionization Rate and Wage***

| Firm Size                | Unionization Rate |       | Wage   |        | N      |       |
|--------------------------|-------------------|-------|--------|--------|--------|-------|
|                          | Before            | After | Before | After  | Before | After |
| Less than 5 employees    | 0.01              | 0.23  | 118.48 | 193.51 | 5,747  | 82    |
| 5-19 employees           | 0.05              | 0.12  | 143.62 | 166.86 | 8,705  | 3,588 |
| 20-49 employees          | 0.14              | 0.17  | 161.80 | 189.60 | 2,253  | 2,412 |
| 50-99 employees          | 0.25              | 0.24  | 175.27 | 199.29 | 1,372  | 2,205 |
| 100-299 employees        | 0.47              | 0.38  | 185.97 | 211.88 | 1,014  | 2,487 |
| 300-999 employees        | 0.64              | 0.56  | 209.31 | 240.27 | 390    | 1,583 |
| More than 1000 employees | 0.73              | 0.70  | 230.95 | 289.28 | 161    | 1,539 |

**Table II. The Impact of Working Hours on Overall Vocational Training Participation and Duration**

|                              | Participation                   |                                   | Duration                    |                                 |
|------------------------------|---------------------------------|-----------------------------------|-----------------------------|---------------------------------|
|                              | Probit<br>(1)                   | IV-Probit<br>(2)                  | Tobit<br>(3)                | IV-Tobit<br>(4)                 |
| <b>Panel A. First Stage</b>  |                                 |                                   |                             |                                 |
| 40-hour workweek policy      |                                 | -0.101***<br>(0.019)              |                             | -0.102***<br>(0.019)            |
| F-statistic                  |                                 | 29.75                             |                             | 30.26                           |
| <b>Panel B. Second Stage</b> |                                 |                                   |                             |                                 |
| Weekly working hours         | 0.020**<br>(0.010)<br>[0.003]** | -0.835**<br>(0.389)<br>[-0.130]** | 0.052<br>(0.035)<br>[0.005] | -2.604*<br>(1.408)<br>[-0.263]* |
| Female                       | -0.031<br>(0.025)               | -0.319**<br>(0.135)               | -0.101<br>(0.086)           | -0.995**<br>(0.489)             |
| Age                          | 0.001<br>(0.009)                | -0.001<br>(0.010)                 | 0.004<br>(0.031)            | -0.000<br>(0.035)               |
| Age <sup>2</sup>             | -0.000<br>(0.000)               | -0.000<br>(0.000)                 | -0.000<br>(0.000)           | -0.000<br>(0.000)               |
| Experience                   | 0.009***<br>(0.002)             | -0.003<br>(0.006)                 | 0.032***<br>(0.007)         | -0.006<br>(0.021)               |
| Married                      | 0.188***<br>(0.028)             | 0.206***<br>(0.030)               | 0.579***<br>(0.094)         | 0.634***<br>(0.110)             |
| Regular worker               | 0.200***<br>(0.031)             | 0.445***<br>(0.117)               | 0.675***<br>(0.106)         | 1.435***<br>(0.416)             |
| Labor union member           | 0.347***<br>(0.027)             | 0.293***<br>(0.040)               | 1.120***<br>(0.092)         | 0.952***<br>(0.134)             |
| High school                  | 0.068*<br>(0.040)               | 0.031<br>(0.049)                  | 0.274*<br>(0.142)           | 0.159<br>(0.173)                |
| College                      | 0.210***<br>(0.045)             | 0.029<br>(0.100)                  | 0.847***<br>(0.157)         | 0.285<br>(0.352)                |
| Above college                | 0.176***<br>(0.066)             | -0.061<br>(0.137)                 | 0.782***<br>(0.221)         | 0.047<br>(0.468)                |
| Constant                     | -2.257***<br>(0.232)            | 1.745<br>(1.849)                  | -7.470***<br>(0.787)        | 4.958<br>(6.665)                |
| Number of observations       | 33,538                          |                                   | 33,518                      |                                 |

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Standard errors for estimated coefficients are in parentheses, and AMEs are in brackets. For the nonlinear models, the AME standard errors were obtained from 1,000 bootstrap samplings. All regression models include control variables for individual characteristics such as gender, age, age squared, marital status, and education level, as well as job-related characteristics such as work experience, employment type (regular or non-regular), labor union membership, occupational dummies, and industrial dummies. Additionally, firm-size dummies are included to account for firm-specific effects. Finally, the models control for time and regional fixed effects.

**Table III. The Impact of Working Hours on Individual Choice and Employer-Provided Training**

|                               | Participation                     |                                   | Duration                          |                                 |
|-------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|---------------------------------|
|                               | Probit                            | IV-Probit                         | Tobit                             | IV-Tobit                        |
|                               | coef (se)                         | coef (se)                         | coef (se)                         | coef (se)                       |
|                               | [margin]                          | [margin]                          | [margin]                          | [margin]                        |
| <b>Panel A</b>                |                                   |                                   |                                   |                                 |
| Individual choice (=1 if yes) | 0.001<br>(0.026)<br>[0.000]       | 0.019<br>(0.801)<br>[0.000]       | -0.015<br>(0.199)<br>[-0.000]     | -1.923<br>(6.897)<br>[-0.017]   |
| Number of observations        | 33,538                            |                                   | 33,518                            |                                 |
| <b>Panel B</b>                |                                   |                                   |                                   |                                 |
| Employer-provided (=1 if yes) | 0.021*<br>(0.011)<br>[0.003]*     | -0.936**<br>(0.441)<br>[-0.134]** | 0.060*<br>(0.035)<br>[0.005]*     | -2.487*<br>(1.274)<br>[-0.226]* |
| Number of observations        | 33,538                            |                                   | 33,518                            |                                 |
| <b>Panel C</b>                |                                   |                                   |                                   |                                 |
| During work hours             | -0.004<br>(0.012)<br>[-0.000]     | -0.911*<br>(0.475)<br>[-0.103]*   | -0.013<br>(0.036)<br>[-0.001]     | -2.230*<br>(1.336)<br>[-0.145]* |
| During leisure hours          | 0.059***<br>(0.016)<br>[0.003]*** | -0.736<br>(0.591)<br>[-0.043]     | 0.261***<br>(0.077)<br>[0.008]*** | -3.353<br>(2.924)<br>[-0.096]   |
| Number of observations        | 33,499                            |                                   | 33,482                            |                                 |

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Standard errors for estimated coefficients are in parentheses, and AMEs are in brackets. For the nonlinear models, the AME standard errors were obtained from 1,000 bootstrap samplings. All regression models include control variables for individual characteristics such as gender, age, age squared, marital status, and education level, as well as job-related characteristics such as work experience, employment type (regular or non-regular), labor union membership, occupational dummies, and industrial dummies. Additionally, firm-size dummies are included to account for firm-specific effects. Finally, the models control for time and regional fixed effects.