Would Legislation for Mandatory Retirement Affect Actual Employment?

Jaeryang Nam[*]

This study analyzes the employment effect of retirement age legislation using a theoretical model and seeks empirical evidence through empirical analysis of Korean experience. When a deferred wage contract is made to induce workers' sincere work, an agreement on the compulsory termination of employment contracts between companies and workers, that is, retirement age, is required. If the retirement age model under these deferred wage contracts is expanded to analyze the effect of legal coercion of retirement age on employment, the legalization of retirement age induces early retirement that terminates employment before retirement age through voluntary transactions between companies and workers. Accordingly, despite the extension of the retirement age, the number of retirement age retirees decreases and the number of early retirees increases.

In 2013, through the revision of the Elderly Employment Act, Korea mandated the retirement age to be 60 years or older. Since the retirement age was set at 55 years old in many cases at the time, this legalization of the retirement age was the same as increasing the retirement age by 5 years or more at once. This is a shock that greatly increases corporate labor costs. This paper combines data from the business panel survey before and after the revision of the law with each other, and also combines them with the employment insurance DB for analysis. In addition, an empirical analysis was conducted using a method of applying the double difference method to the labor demand function, which is the result of a company's optimization behavior.

As a result, although the law was revised but has not yet been implemented, early retirement was taking place much larger than after the enforcement of the law. This is an important result indicating that adjustments based on expectations are being made more in response to the impact of the introduction of laws or systems than after the actual enforcement of the law. In addition, there has been a rapid spread of the wage peak system since the enforcement of the law, which is likely to have played a role in reducing early retirement of workers close to retirement age.

Keywords: Enactment of mandatory retirement, employment effect, mandatory retirement, early retirement, difference in difference, wage peak system

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* Senior Research Fellow, Korea Labor Institute (KLI)

Ⅰ. Introduction

People are currently enjoying an extended longevity that humanity has never previously experienced. While longevity is a blessing on the one hand, on the other, it has resulted in many never-before-seen changes. A major change is population aging. Most developed countries have been experiencing the aging phenomenon. This phenomenon has been gradually proceeding in the United States and countries in Europe over a relatively long period of time, while Japan has experienced highly rapid aging. South Korea has recently experienced more rapid aging due to the long-lasting low birth rate following the rapid decline in fertility. South Korea's aging speed is far exceeding that of Japan.

Aging is mostly accompanied by an increasing healthy life expectancy. Thus, aged people have commonly shown strong work ability and motivation despite their high agedness. In countries where the pension system is well-established and can financially support retirement life, the aged prefer to undertake economic activities through pensions rather than work. However, in the case where the pension system is not well-established or where the pension is not sufficient to leading an economic life due to a low income replacement ratio, aged workers are more actively engaged in the labor market.

In response to this situation, some countries that have already experienced aging and have established a relatively strong pension system are exerting efforts to alleviate the financial burden associated with aging by lowering the normal retirement age. Although these efforts by the government have not been successful due to opposition from (future) pensioners, this process has resulted in the gradual raising of the normal retirement age. In other words, the mandatory retirement age is constantly being raised. The United States and the United Kingdom have repealed the mandatory retirement age. Japan has been raising the mandatory retirement age, and recently, the post-retirement employment system has been expanding.

South Korea, which does not have a well-established a pension system with a low-income replacement ratio, is in a significantly different situation compared to other countries. Nevertheless, South Korea recently raised the mandatory retirement age. South Korea revised the Elderly Employment Act (in May 2013) [1] to enact a mandatory retirement age or implement the "mandatory quota system for employing those aged 60 or older." The previous Elderly Employment Act provided only a recommended retirement age, which was not mandatory. This mandatory retirement age was enacted "to ensure job opportunities for

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1) Officially titled as "Act on Prohibition of Age Discrimination in Employment and Elderly Employment Promotion"(Abbreviated as : Elderly Employment Act)

workers with the ability to work." [2]

The revised law changed the provision regarding the mandatory retirement age from recommended to mandatory and set the retirement age to be 60 or higher, providing that the mandatory retirement age is otherwise deemed to be 60 years or higher. The provisions related to the mandatory retirement age in the revised Elderly Employment Act have been effective for workplaces with 300 or more employees since January 2016 and for those with less than 300 e mployees since January 2017. Before the revision of this law, the average age for retirement set by companies and employees at large companies was 57, and the mandatory retirement age was commonly set as 55. Thus, this revised law provides workers the opportunity to work until they are at least 60 years of age, and for this reason, this revised Elderly Employment Act is also called the "Retirement Extension Act."

Countries that experienced aging earlier in time are raising their mandatory retirement ages, and other countries that have recently experienced rapid aging are raising or enacting a mandatory retirement age. For the mandatory retirement age set by law to be meaningful, the newly set mandatory retirement age must be higher than the existing one. In this respect, the enactment of mandatory retirement can be understood as being inclusive of the raised retirement age.

Then, what effects would the enactment of mandatory retirement or the raising of the legal retirement age have on the labor market? Would this enactment lead to the prolongation of employment for aged workers with the ability to work as the policy authorities had intended? This article attempts to answer these questions and hypothesizes that similar achievements cannot be reasonably expected due to differences in the situations pertaining to different countries. However, a theoretical analysis on the effects of this enactment of mandatory retirement on the labor market is possible when a country enforces a retirement age as mandatory in accordance with the law under a situation where companies and workers are voluntarily concluding contracts without any restriction on mandatory retirement in the labor market. First, this study conducts a theoretical analysis on the effects of enacting mandatory retirement on employment. This study is focused mainly on the question regarding what choices companies and workers would make to optimally respond to this new restriction where mandatory retirement is legally enacted in comparison to when there was no restriction imposed on retirement.

Next, this study analyzes whether the results derived from such theoretical analysis could be empirically verified. In this regard, South Korea's experience in enacting mandatory retirement is crucial. South Korea's enactment of mandatory retirement and the radical raise in retirement

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2) Reasons and Major Detail for Partial Revision of Enactment No. 11791, National Law Information Center

age by about five years significantly affected the labor market due to the increased labor cost for companies. Thus, if the labor market data collected during this period in South Korea can be strictly processed to identify the effects of enacting mandatory retirement on employment, this will serve as essential empirical evidence.

II. Effects of Enacting Mandatory Retirement

1. The Model

A delayed wage contract, which refers to wage contracts in which a worker receives less than the marginal value he or she has contributed when they are young and receive more after retirement, reduce the incentive for workers to shirk. Suppose an individual has a lifelong marginal value of productivity of labor V(t), which reflects productivity improvement through work experience, and a wage rate W(t). Let's denote the optimal delayed wage contract $\widehat{W}(t)$, which induces a high level of effort to the optimal choice of workers under the contract, and corresponding VMP $\widehat{V}(t)$. Also let's represent the life-time reservation wage path that reflects the opportunity cost for such labor input $\widehat{R}(t)$. Under this wage contract, both workers and employers can reap greater benefits than if they are not.

Figure 1. Mandatory retirement and early retirement
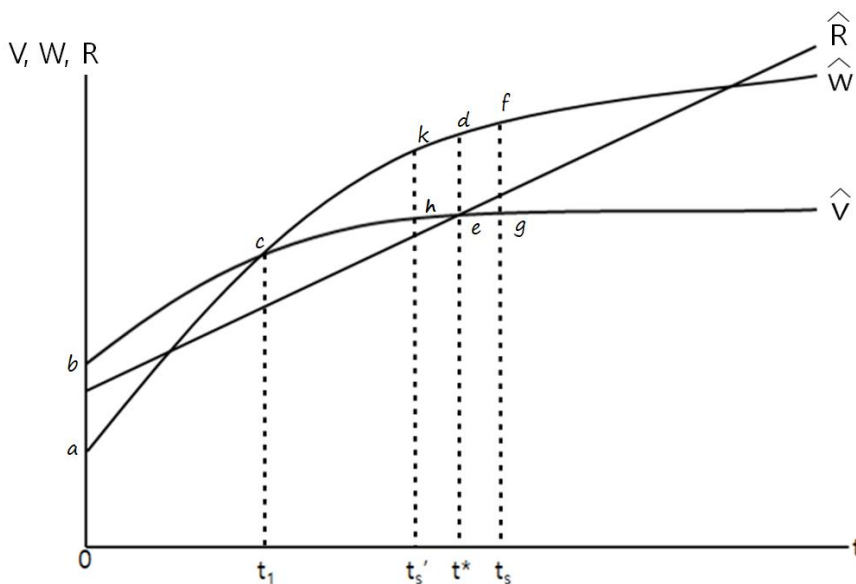
Under this wage contract, the time when the present value of the amount received less young and later more is equal to each other, ie $abc = cde$ in figure 1, is the termination date of the employment contract. But at that point, the wage that the worker receives exceeds their marginal productivity, so mandatory termination of employment contracts is necessary in advance. If $\widehat{V}(t) = \widehat{R}(t)$ at time t^*, then $\widehat{W}(t)$ that satisfies equation (1) is the optimal balance path and t^* is the mandatory retirement time in this contract made by voluntary transactions between the firm and the worker. Lazear (1979) looks here for important reasons why a mandatory retirement exists.

2. Early Retirement

The term "mandatory retirement" refers principally to the end-of-employment date set by the employment contract concluded by free trade between a company and a worker rather than the mandatory retirement age enforced by a country. However, in reality, many countries set the mandatory retirement age by law to impose this restriction on economic actors.

To examine the effects of enacting a mandatory retirement age, suppose that the government mandates employment until a certain age t_s for some reason. For this legal retirement age to be meaningful, t_s must be greater than t^*, the contract retirement age. In this case, following relationship is satisfied. $W(t_s) > R(t_s) > V(t_s)$, where $t_s > t^*$. As a result, workers will try to work longer for an extended period of time $(t_s - t^*)$, and eventually, gain additional benefits as much as A in equation (2), that is $edfg$ in figure 1, which exceeds the workers' own marginal productivity. However, the company will experience a loss of A. Therefore, a company goes bankrupt.

$$(2) \quad \int_{t^*}^{t_s} \widehat{W}(t) e^{-rt} dt \ - \ \int_{t^*}^{t_s} \widehat{V}(t) e^{-rt} dt \ \equiv A .$$

This response can be largely divided into two categories. First, companies respond to obtain the initially intended results by terminating the employment contract at the original voluntary retirement age t^* rather than the legally enforced mandatory retirement age t_s to avoid bankruptcy. This intend can be realized as an equilibrium under full information knowing that the worker may not receive as much as A due to bankruptcy after $(t_s - t^*)$ period of additional work. In this case, the mandatory retirement legislation has no effect on economic agents' decision-making. However, there is a problem where the legal retirement age and the

actual retirement age are separated.

Second, because a worker may demand their legal retirement age t_s through a lawsuit when t^* is reached in the first case, companies would avoid this situation. Rather than terminating the employment contract $t_s{}'$ earlier than the original optimal equilibrium retirement age t^*, the company can decide to provide workers with additional benefits amounting to A for workers according to the enactment of mandatory retirement.[3]

$$\int_{t_s{}'}^{t^*} \widehat{W}(t)e^{-rt}dt \ - \ \int_{t_s{}'}^{t^*} \widehat{V}(t)e^{-rt}dt \ = \ A \,.$$

The worker then becomes indifferent between working for the company up to the original retirement age t^* and terminating the employment relationship with the company and only working up to $t_s{}'$ in exchange for receiving the new offer A. This worker can receive at least as much as his or her VMP from other companies, that is $\int_{t_s{}'}^{t^*} \widehat{V}(t)e^{-rt}dt$.

Thus, a company can provide the amount A for the worker and terminate the contract with the worker at $t_s{}'$. This company prevented the loss as much as A that will occur in the future by terminating the contract with this worker early. As shown in Figure 1, amount A corresponding to the area *hkde* is not a wage paid for worker's current work, but rather a delayed payment of what this worker paid less when he or she was young. Therefore, companies do not suffer losses from this. Eventually, early retirement of workers occurs earlier than the retirement age of the contract.[4] Furthermore, the gap widens between the legal and actual retirement age.

In fact, this type of new contract is not unfamiliar in South Korea. This type of contract, known as early retirement or early resignation, is also a common method when employment adjustments are necessary. This contract is called voluntary resignation or voluntary retirement. We can find the reason for the existence of such retirement compensation, in other words termination payment or consolatory payment, if early employment adjustment is made in the presence of the mandatory retirement system.

It is highly likely that the corporate response to the implementation of the Retirement

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3) Of course, the timing of early retirement may be shorter or longer than $t_s{}'$. The $t_s{}'$ presented by this study is one of the reasonable criteria that is not arbitrary.

4) Even without enaction of the mandatory retirement age, the employment contract may be terminated earlier than t^* by voluntary transactions between companies and workers at an earlier date than the termination of employment under a delayed wage contracts. However, due to the legalization of the retirement age, early retirement is inevitable.

Extension Act is being made smoothly without causing much trouble by utilizing this early retirement model. Moreover, because company losses that are incurred as a result of the mandatory retirement age are significantly high in South Korea where the slope of the wage curve is steeper than that in other countries, this type of transaction is likely to be used in the labor market.

3. Wage Peak System

Companies may respond to the legislation of retirement age through wage adjustment, not employment adjustment. For some $t_s''(\leq t^*)$, a new wage schedule $\widetilde{W}(t)$, which satisfies Equation (4), would allow company losses to be zero, allowing employment to continue until the legal retirement age.

$$(4) \quad \int_{t_s''}^{t_s} \widehat{W}(t)e^{-rt}dt \; - \int_{t_s''}^{t_s} \widetilde{W}(t)e^{-rt}dt \; = A$$

The specific form of $\widetilde{W}(t)$ may be various. First, a wage system could prevent wages from rising after a certain age. Second, a wage system could allow the wage to fall after a certain age as shown in Figure 2. Third, a wage system allows wage to follow the original wage schedule $\widehat{W}(t)$ until t^* and subsequently $\widehat{V}(t)$ until t_s.

Figure 2. Wage peak system
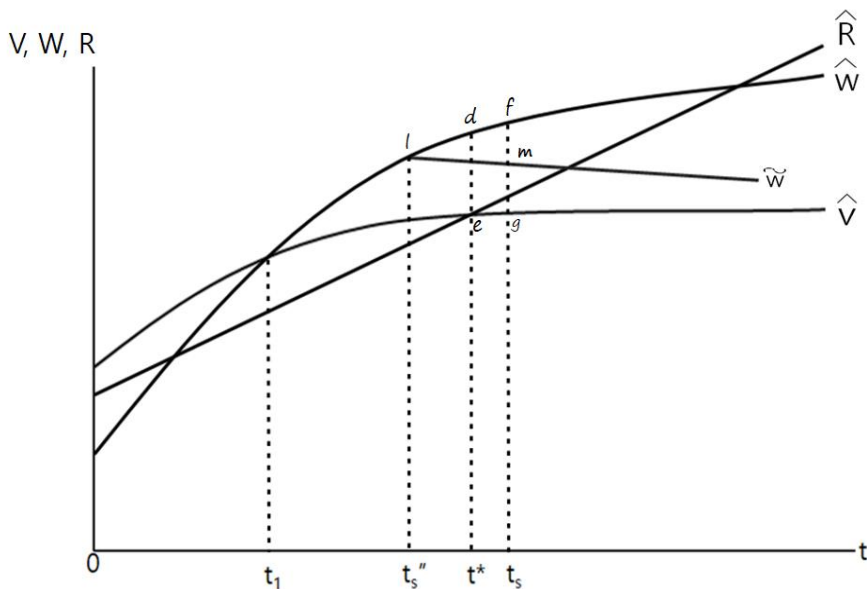
In any form, employment can be maintained to the legal retirement age of t_s, if the company's loss of $edfg$ is adjusted by lfm, which has the same present value as the corporate loss due to the legislation of the retirement age of t_s. In South Korea, where the slope of the wage curve is highly steep, such wage adjustment has been very prevalent before and after the enactment of mandatory retirement; this wage adjustment scheme is called the wage peak system.

III. The Empirical Model

1. Labor Demand

To perform empirical analysis, it is necessary to establish a model for analysis. This study intends to explore this issue in terms of labor demand as the profit maximization behavior of a company by considering that the raised retirement age will have a direct effect on corporate labor demand. First, assume a production function is as follows. $Y = AF(L, K)$. Here, Y refers to output, A production technology, and L and K the amount of labor and capital invested, respectively.

Under this situation, the optimal labor demand L^* is determined as a function of input price, output and production technology as a result of the company's optimization or profit maximization behavior. If we log linearize the labor demand function and represent the wage rate as w and the rent rate of capital as r, expressions such as equation (5) would be possible.

(5) $\ln L^* = \alpha_0 + \alpha_1 \ln A + \alpha_2 \ln(w/r) + \alpha_3 \ln Y$.

2. Difference in Differences

Difference in differences (DD) is an empirical analysis method that can be used to analyze the effects of law enforcement. The DD can produce highly convincing and persuasive results if the basic conditions required by this method are met. Thus, this study will additionally introduce and utilize this DD in the model to conduct empirical analysis. In other words, this study establishes a model for empirical analysis by additionally introducing the DD, which is useful for evaluating the performance of the introduction of a specific system, in addition to

equation (5), which gives the profit maximization behavior of a company.

This study defines the treatment group as companies that continue to apply the mandatory retirement system and selects a comparison group with companies that do not continue to apply the mandatory retirement system[5]. Based on these considerations, a regression model can be established to evaluate employment performance depending on whether or not to continue to apply the mandatory retirement system R_j[6], as shown in Equation (6).

$$(6) \quad \Delta \ln L_{jt}^* = \beta_0 + \beta_1 R_j + \beta_2 \Delta \ln A_{jt} + \beta_3 \Delta \ln w_{jt} + \beta_4 \Delta \ln Y_{jt} + \beta_5 X + \Delta \epsilon_{jt}.$$

The effect of the retirement age legislation can be estimated by introducing a new dummy variable which is 0 in the case of establishments with the retirement age of 60 or older and is 1 in the case of the retirement age under 60 among businesses implementing the mandatory retirement system. The former is appropriate as a comparison group because it is not affected by the legislation. Businesses with a retirement age of less than 60 are subject to the legislation, so they become treatment group.

3. Early Retirement

In the previous theoretical analysis, we looked at the fact that the legislation of retirement age will lead to early retirement. However, in equation (6) to be used for regression analysis, the dependent variable is expressed as the employment growth rate of each business, so it cannot be used to analyze early retirement. To explicitly introduce early retirement, let's change the left side of equation (6) as follows. The employment growth rate can be expressed as $\Delta L/L$, and ΔL is the same as the difference between the number of job accession J and the number of job seperation S, so $\Delta L = J - S$. Here, S will be consisted of seperations according to various reasons, that is, S_i. Early retirement is one of them. Namely,

$$S = \sum_{i=1}^{k} S_i.$$

Therefore, we can change the left side of equation (6) as follows.

$$\Delta \ln L_{jt}^* = J/L - \sum_{i=1}^{k} S_i/L.$$

The variable of particular interest in this paper is early retirement, and if early retirement S_k

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5) This matter will be discussed just as below in more detail.
6) The values of 1 and 0 are assigned to the businesses that are the implementing mandatory retirement system, and those that are not implementing this system, respectively.

at the time of t of company j is expressed as S_{kjt}, there will be no big problem even if the regression equation (6) is expressed as (7).

(7) $\quad S_{kjt} / L_{jt} \approx \beta_0 + \beta_1 R_j + \beta_2 \Delta \ln A_{jt} + \beta_3 \Delta \ln w_{jt} + \beta_4 \Delta \ln Y_{jt} + \beta_5 X + \Delta \epsilon_{jt}.$

In this study, equation (7) will be used for regression analysis together with equation (6).

4. Unbiased Estimator for the DD Design

The selection of comparative groups is crucial for analyzing the effects of the legislation using DD. This study set 2011, which is before May 2013 when the Act was revised, to be the reference period (before), and 2015, which was after the revision, to be the comparison period (after)[7]. The treatment group includes businesses that implemented the mandatory retirement system as of both 2011 and 2015, and the comparison group includes businesses that did not implement the mandatory retirement system as of both 2011 and 2015. If the treatment and comparison groups are not defined as such, including businesses that changed the status of the implementation of the mandatory retirement system in this analysis, the employment effects caused by executing the legislation would be determined as an estimator with bias. This will be discussed in more detail below.

We can also set the treatment group and the comparison group differently. As already seen, businesses with a retirement age of 60 or older can be selected as a comparative group, and businesses with a retirement age of 59 or less can be defined as a treatment group.

Now let us introduce the DD design. Equation (8) introduces a basic DD design into the context of this study; j and t are subscripts representing business and time, respectively. Y_{jt} is a variable representing the employment level at the time t of business j, and R_j is a variable having a value of 1 or 0, depending on whether or not the business j is running the mandatory retirement system or whether or not the business j is running the mandatory retirement age under 60. Furthermore, P_t has a value of 1 or 0 depending on whether it is post- or pre-treatment. In this situation, the purpose of this analysis is to estimate the coefficient of the interaction term denoted by β_3 or the employment effect resulting from the legislation.

(8) $\quad Y_{jt} = \beta_0 + \beta_1 R_j + \beta_2 P_t + \beta_3 R_j \cdot P_t + \epsilon_{jt},$

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7) The WPS includes survey data from odd years only.

$$R_j = \begin{cases} 1 \ \text{if} \ operating \ MRS \\ 0 \ \ \ \ \ \ otherwise \end{cases} or \ \ R_j = \begin{cases} 1 \ \text{if} \ MR \ age \ is \ under \ 60 \\ 0 \ \ \ \ \ otherwise \end{cases},$$

$$P_t = \begin{cases} 1 \ \text{if} \ post\text{-}treatment \\ 0 \ \text{if} \ pre\text{-}treatment \end{cases}.$$

Let us take a look at the unbiased estimator under this situation. In other words, take a look at the estimation of the employment effects caused by the legislation. Figure 4 visually shows the situation in equation (8). The employment level of businesses that are implementing the mandatory retirement system is $\beta_0 + \beta_1$ before the legislation. However, because the employment level of the businesses that are implementing the mandatory retirement system is β_0, the difference between them is β_1.

Suppose that the retirement age is now raised by law. Then, the employment level of the businesses that are implementing the mandatory retirement system becomes $\beta_0 + \beta_1 + \beta_2 + \beta_3$. Thus, the differences in employment levels before and after the legislation become $\beta_2 + \beta_3$, and the differences in employment levels between the businesses that are and are not implementing the mandatory retirement system are $\beta_1 + \beta_3$. In this state, another difference results in the desired β_3.

To accurately estimate the employment effect caused by the legislation of interest, the treatment and comparison groups must be consistent with what shown in Figure 3. In other words, the treatment group must include businesses that are implementing the mandatory retirement system both before and after the legislation. Moreover, the comparison groups must include businesses that are implementing the mandatory retirement system both before and after the legislation. If the treatment and comparison groups are well established in this manner, the desired β_3 can be accurately estimated.

Figure 3. Unbiased Estimator for the Design

		Legislation		Difference
		Before	After	
MRS / MR Age	Implemented / MR Age under 60	$\beta_0 + \beta_1$	$\beta_0 + \beta_1 + \beta_2 + \beta_3$	$\beta_2 + \beta_3$
	Non-implemented / MR Age 60 or over	β_0	$\beta_0 + \beta_2$ $(\beta_0 + \beta_1 + \beta_2)$	β_2 $(\beta_1 + \beta_2)$
Difference		β_1	$\beta_1 + \beta_3$ (β_3)	β_3 $(\beta_3 - \beta_1)$

However, if the comparison group is not well defined in this manner, the estimate will be biased. Suppose, for example, that the comparison group includes the businesses that were not implementing the mandatory retirement system before the legislation and began implementing the mandatory retirement system after the legislation. Then, the employment level of the comparison group after the raised retirement age would not be $\beta_0 + \beta_2$, as shown in Figure 3, but $(\beta_0 + \beta_1 + \beta_2)$ with β_1 added. Accordingly, the difference after the raised retirement age becomes (β_3), and not $\beta_1 + \beta_3$ as shown in Figure 3. Thus, the DD result becomes $(\beta_3 - \beta_1)$, not β_3.

VI. Empirical Analysis

1. Data

The data used for analysis was gathered from the Workplace Panel Survey (WPS; Korea Labor Institute). The WPS is suitable for empirical analysis in this study because the data have been created by investigating whether to implement the mandatory retirement and retirement age in addition to the variables necessary to analyze the profit maximization behavior of companies.

The WPS basically targets businesses with a size of 30 persons or more. The WPS data show that businesses with a mandatory retirement system accounted for 77.2% (using existing samples only) in 2015. This ratio is similar to 76.3% of the businesses implementing the mandatory retirement system among businesses with a size of 30 persons or more in the supplementary survey in the Report on Labor Force Survey at Establishments (Ministry of Employment and Labor, 2015), which is a representative dataset on mandatory retirement. Another supplementary survey conducted by the Report on Labor Force Survey at Establishments (2017) revealed that the proportion of entire businesses implementing the mandatory retirement system, including businesses with a size of less than 30 persons, is only 18.7%. Eighty percent or more of businesses in sectors such as electricity, gas, steam, water suppl, and the financial and insurance industries are implementing the mandatory retirement system. The proportion of businesses with unions implementing the mandatory retirement system reached 94.7%.

2. Basic Statistics

The basic statistics of the major variables to be used for empirical analysis are presented in Tables 1 through 4. Table 1 and 2 is for equation (6) and concerning that 2011 and 2015 datasets was combined as panel and 2011 and 2017 datasets as well.[8] Table 3 and 4 is for equation (7).

Table 1. Basic statistics for equation (6): 2011 - 2015

	Entire		Establishment that were implementing the MRS		Establishment that were not implementing the MRS	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Employment growth rate	−0.003	1.016	−0.006	0.961	0.018	1.601
Whether MRS continued	0.856	1.298	1.000	0.000	0.000	0.000
Real sales growth rate	−0.007	2.934	−0.027	2.925	0.111	3.011
Increase rate of real labor costs per capita	0.036	1.344	0.031	1.284	0.070	2.001
Obs. weighted	7,002		5,994		1,008	

Table 2. Basic statistics for equation (6): 2011 - 2017

	Entire		Establishment that were implementing the MRS		Establishment that were not implementing the MRS	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Employment growth rate	0.021	1.105	0.014	1.088	0.091	1.385
Whether MRS continued	0.906	1.133	1.000	0.000	0.000	0.000
Real sales growth rate	−0.220	4.898	−0.250	4.935	0.066	3.723
Increase rate of real labor costs per capita	0.133	1.210	0.142	1.141	0.052	2.225
Obs. weighted	7,104		6,436		668	

Table 3. Basic statistics for equation (7): 2011 - 2015

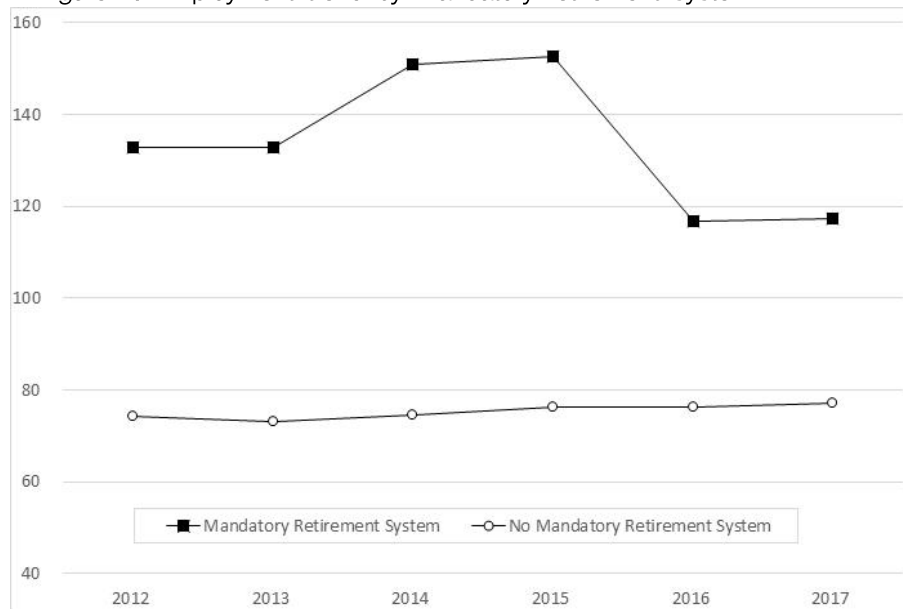|	Entire		Mandatory retirement age			
			60 or over		Under 60	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Separation ratio of age 55~59	0.073	0.260	0.058	0.203	0.077	0.271
Employment growth rate	−0.010	1.193	−0.090	1.504	0.014	1.090
Whether MRS continued	1.000	0.000	1.000	0.000	1.000	0.000
Real sales growth rate	−0.020	2.909	−0.098	1.916	0.004	3.106
Increase rate of real labor costs per capita	0.044	1.440	0.101	1.978	0.027	1.268
Obs. weighted	5,885		1,359		4,525	

8) However, the public sector was excluded from this analysis, and cross-sectional weight was used as the weight required for this analysis. Because the longitudinal weight was not fully assigned, the longitudinal weight was not used in this study. Furthermore, to eliminate outliers, the cases in which the employment growth rate measured by logarithmic difference exceeded ±1 were excluded from this analysis.

Table 4. Basic statistics for equation (7): 2011 ‐ 2017

| | Entire | | Mandatory retirement age | | | |
| | | | 60 or over | | Under 60 | |
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Separation ratio of age 55~59	0.074	0.276	0.073	0.254	0.074	0.281
Employment growth rate	−0.015	1.578	−0.072	1.620	0.000	1.566
Whether MRS continued	1.000	0.000	1.000	0.000	1.000	0.000
Real sales growth rate	−0.307	4.997	−0.130	2.141	−0.356	5.442
Increase rate of real labor costs per capita	0.136	1.190	0.100	1.490	0.147	1.108
Obs. weighted	5,885		1,340		4,901	

Figure 4 shows the employment trend by the implementation of the retirement age system, a dependent variable to be used for regression analysis. The trend in the ratio of early retirees aged 55 to 59 obtained from the employment insurance DB, that is, the turnover ratio, is presented in Figure 5 by classifying them by retirement age of 60 or older.

Figure 4. Employment trend by mandatory retirement system

Source: Workplace Panel Survey, Korea Labor Institute.

Figure 5. Separation ratio by mandatory retirement age
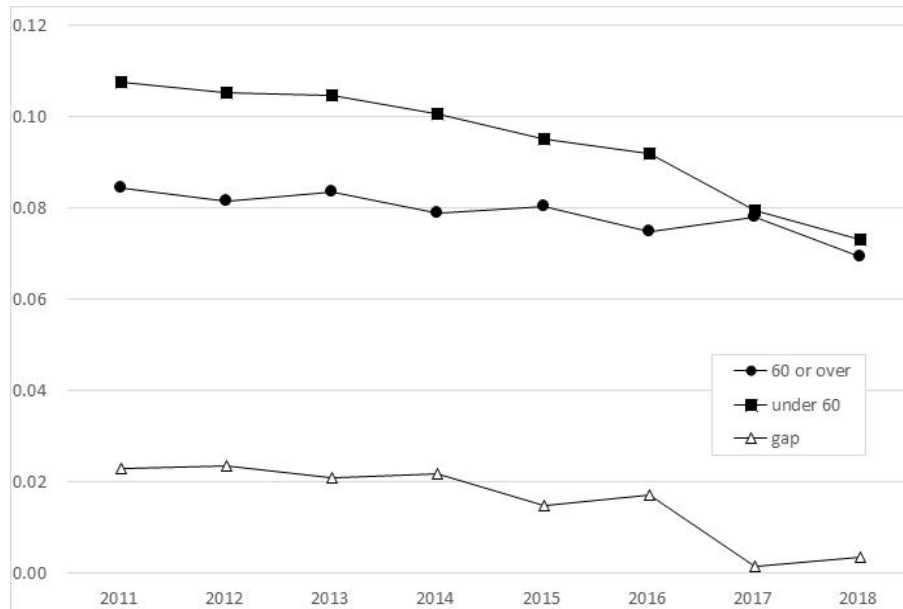
Source: Employment Insurance DB, Ministry of Employment and Labor

3. Estimation Results

A. Early Retirement

Now let us look at the results for estimating the regression equation. Table 3 and 4 are the estimated results for equation (7). As discussed above, the regression equation (7) is to estmate the effect of retirement legislation on early retirement. Table 3 is the result of estimating the effect of early retirement of the retirement age legislation through the implementation of the retirement age system, and Table 4 is estimated through whether the retirement age is 60 years or older.

First, as shown in Table 3, the coefficient estimates of dummy variables indicating whether the retirement age system is implemented are all positive (+) in statistically significant cases. This is the result of the legalization of the retirement age statistically significantly increasing early retirement of businesses operating the retirement age system when businesses that do not operate the retirement age system are used as comparison group. And most of the coefficient estimates for the other major control variables presented in this table are statistically significant.

Furthermore, looking at the results of Model 3, which controls most of the necessary variables, the legalization of retirement age is increasing the proportion of early retirees by 0.018 over the four years from 2011 to 2015. This is an important result indicating that early

retirement of workers is already statistically significant in the 2011-2015 period, when the retirement age is set by law but has not yet been implemented. Even if it has been legislated but has not yet been implemented, it is clear that laws that have already been established by the time of enforcement will actually be implemented, so companies and workers are actually responding to this in the real sector of increased early retirement.

Meanwhile, the retirement age legislation increased the early retirement rate by 0.018 over the four years from 2011 to 2015, but the degree to which the early retirement rate increased over the six years from 2011 to 2017 was only 0.008. This raises the possibility that another major change occurred in the labor market between 2015 and 2017, significantly lowering the degree of increase in early retirement due to retirement legislation. Otherwise, it is difficult to explain these estimation results in harmony.

Table 3. Estimated results for equation (7)

	2011 - 2015			2011 - 2017		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Whether MRS operates	0.007***	0.006**	−0.002	0.011***	0.012***	0.020***
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Real sales growth rate		−0.006***	−0.010***		0.002***	0.003***
		(0.001)	(0.001)		(0.000)	(0.000)
Increase rate of real labor costs per capita		−0.005**	−0.006***		−0.004	−0.008***
		(0.002)	(0.002)		(0.003)	(0.003)
Additional control variables			Controlled			Controlled

Note: Dependent variable is the separation ratio of age 55~59. MRS means Mandatory Retirement System. Standard errors in parenthesis.

Table 4. Estimated results for equation (7)

	2011 - 2015			2011 - 2017		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
MR Age under 60 or not	0.018***	0.019***	0.018***	−0.003	−0.002	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Real sales growth rate		−0.007***	−0.013***		0.003***	0.004***
		(0.001)	(0.001)		(0.000)	(0.000)
Increase rate of real labor costs per capita		−0.009***	−0.011***		−0.006*	−0.014***
		(0.003)	(0.003)		(0.003)	(0.003)
Additional control variables			Controlled			Controlled

Note: Dependent variable is the separation ratio of age 55~59. MR means Mandatory Retirement. Standard errors in parenthesis.

B. Total employment

Table 5 is the result of estimating the regression equation (6). The estimated results using the two panel data 2011-2015 and 2011-2017 are presented together in this table. As shown in this table, all estimates of the coefficients of the dummy variable for the implementation of the retirement age system, which estimates the total employment effect of the retirement age legislation, are negative (-). And all estimates except one of these negative (-) estimates are statistically significant. These estimation results are important results indicating that the legislation of retirement age is reducing the total employment of companies.

Even during the period 2011-2015, when the retirement age was legislated over the age of 60, but this law has not yet been enforced, companies falling under this law are reducing employment in the real sector compared to those that do not. This is of great significance in that it once again confirms the results seen in the previous change in the early retirement ratio.

Furthermore, according to the estimation results for Model 3, which controls most of the necessary variables, the employment reduction effect of the retirement age legislation in 2011-2015 is estimated to be -0.029, while this effect in 2011-2017 is estimated to be -0.061. This indicates that employment is decreasing even more due to the legalization of retirement age during the period 2015-2017. This indicates that the employment adjustment made after the law actually took effect was greater than the employment adjustment before the legalized law was still enforced.

Table 5. Estimated results of equation (6)

	2011 - 2015			2011 - 2017		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Whether MRS operates	-0.024** (0.009)	-0.008 (0.009)	-0.029*** (0.010)	-0.075*** (0.012)	-0.067*** (0.012)	-0.061*** (0.013)
Real sales growth rate		0.121*** (0.004)	0.131*** (0.004)		0.012*** (0.003)	0.026*** (0.003)
Increase rate of real labor costs per capita		-0.026*** (0.009)	-0.046*** (0.009)		-0.051*** (0.011)	-0.023** (0.011)
Additional control variables			Controlled			Controlled

Note: Dependent variable is total employment growth rate of establishments. MRS means Mandatory Retirement System. Standard errors in parenthesis.

4. The rapid spread of the wage peak system

During the period before the mandatory retirement law for those aged 60 or older came into force, early retirement of workers aged 55 to 59 who are about to retire was increasing, and employment of companies was decreasing. In fact, it was difficult to observe the effect of early retirement of law enforcement after the mandatory law over the age of 60 began to take effect, while the effect of reducing employment of law enforcement was greater than during the period before the law enforcement. How can such contradictory phenomena exist together?

We can find clues to this problem in the wage peak system. As examined through the previous theoretical discussion, it was seen that companies could respond to the legislation of retirement age in the form of inducing early retirement of workers or introducing a wage peak system that suppresses further wage increases.

In fact, since the enforcement of the law, the number of companies introducing the wage peak system in South Korea has been increasing rapidly. This phenomenon is especially stronger in large companies. As shown in Table 6, the proportion of businesses that introduce the wage peak system increases significantly from 12.1% in 2015 to 22.2% in 2017. This increase is particularly noticeable as businesses with 300 or more employees increasing from 27.2% to 53.0% during the same period. In other businesses of different sizes, the proportion of businesses introducing the wage peak system is increasing significantly.

According to a study by Nam (2021), the introduction of the wage peak system has the effect of increasing the total employment of businesses, but the employment effect by age group may be different. In other words, he empirically shows that the introduction of the wage peak system can lower the relative wage of the elderly and increase their employment, while increasing the relative wage of the middle-aged, which can be highly substituted for their close age. In this case, the wage peak system acts in the direction of increasing the total employment of companies by reducing the retirement of workers aged 55 to 59 as defined above, but also acts as a force to reduce the employment of middle-aged workers under the age of 55. In this case, early retirement may decrease, but overall employment may decline.

Table 6. Changes in the proportion of businesses implementing the wage peak system.

(unit : %)

	2011	2012	2013	2014	2015	2016	2017	2018
All	2.0	9.6	8.3	9.9	12.1	17.5	22.2	21.5
30~99	8.3	12.1	13.0	14.7	16.1	18.6	24.3	24.8
100~299	11.3	15.9	16.6	15.2	19.3	27.8	35.3	36.7
300 or over	16.2	17.8	18.5	23.2	27.2	46.8	53.0	54.8

Source : Labor Force Survey at Establishments, Ministry of Employment and Labor.

Ⅴ. Conclusion

This study analyzed the effect on employment when the retirement age is not determined by free transactions between workers and companies, but when the government sets the retirement age and forces it by law. First, from the theoretical analysis, it was seen that the legal coercion of the retirement age could lead to early retirement before the legal retirement age reaches. This is the result of voluntary transactions between workers and companies following the compulsion of the legal retirement age.

In order to find empirical evidence, this study focused on and analyzed the Korean experience. Before retirement age was enforced by law in South Korea, many private businesses had a retirement age of 55 in employment contracts with workers. In this state, the revision of the Elderly Employment Act, which forces the retirement age to be 60 years or older, was made in May 2013. The actual application of the revised law has been in effect since 2016 for businesses with 300 or more full-time workers. It has been implemented since 2017 for workplaces with less than 300 employees. Although there is a grace period of three to four years, raising the retirement age by five years at a time is a very big shock to companies in terms of labor costs. This experience in South Korea provides valuable data for this study, which analyzes the employment effect of retirement age legislation.

This paper is for empirical analysis and is mainly used for analysis in combination with data from the Korea Labor Institute's Workplace Panel Survey (WPS) and data on employment insurance DB, an administrative statistic. First, a regression model for empirical analysis was established by combining the results of the company's optimization behavior with the double difference method, and then this model was expanded to a form that can analyze early retirement. Since WPS conducts surveys every other year for odd years, this study selected data from 2011 and 2015 and data from 2011 and 2017 as data for empirical analysis. As the retirement age legislation took place in May 2013, and the retirement age of 60 or older has been implemented since 2016, 2015 is before the enforcement of the law. However, it is a natural choice for economic actors to prepare and respond in advance to issues that are clearly implemented, even before the enforcement after the revision of the law.

The empirical analysis results were consistent with the results of theoretical analysis of the employment effect of retirement age legislation. In other words, it was found that the legal enforcement of the retirement age increased the early retirement ratio of workers aged 55 to 59 who were close to the retirement age in the period prior to the enforcement of the law and reduced the employment of these businesses. According to the results of the panel analysis in 2011 and 2015, the retirement age was set at less than 60, so the early retirement of

businesses subject to the law was increasing compared to those that did not. And the effect of increasing early retirement during 2011-2015 was much greater than that in 2011-2017. Early retirement before the law is still in effect is greater than after the time the law enters into force. These are important results showing that adjustments based on expectations can be made larger than those after the actual law enters into force in the real sector of employment.

Meanwhile, it was found that the employment of businesses that continued to implement the retirement age system during the period 2011-2015 decreased compared to those that did not. The analysis using data from 2011-2017 also showed a decrease in the amount of employment, and the decrease in employment in 2016-2017 was greater than in 2011-2015.

This phenomenon seems to be closely related to the rapid spread of the wage peak system. In 2016 and 2017, the proportion of businesses introducing the wage peak system has increased rapidly, and according to Nam(2021), this lowers the relative wages of the elderly, which can positively affect their employment, leading to a decrease in early retirement of workers close to retirement age. On the other hand, the relative wage of the middle-aged, which can be easily replaced by the elderly due to their close age, increases with the introduction of the wage peak system and negatively affects their employment, reducing overall employment.

As mentioned in the introduction of this study, the revision of the Elderly Employment Act in May 2013 was to "guarantee the opportunity for workers with working ability" as the reason for the revision. In other words, the revision of the law is to "give elderly workers with working ability an opportunity to work." However, according to the results, the legislation of the retirement age rather increased early retirement of workers close to the retirement age and decreased overall employment. This is a different result from the reason for the revision of the law.

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