Disability Employment Incentives, Levy, and the Labor Demand for Persons with Disabilities

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Abstract

This paper investigates the impact of disability employment incentive and levy on the demand for disabled labor in Korea. I examine changes in the number of disabled employees in companies as the program evolves over the years. Using data from the Survey on the Employment Status of the Disabled in Business, I construct a four-year panel dataset on companies' employment status. Economists have paid less attention to this area because the available open-access data has limited information for economic analysis. Moreover, because companies must self-report their employment status under Korea's disability employment incentive and levy program, it is endogenous. To address these issues, I employ the reduced form approach of simultaneous instrumental variables. I use the maximum amount of incentive or levy for companies eligible or subject to the programs as my key independent variable. The panel fixed effect analysis indicates that incentive increases the number of employees with disabilities, while levy decreases it. This result is consistent with the idea that incentive reduces the cost of hiring workers with disabilities. The reduction in employees with disabilities due to levy can be explained by the fact that large corporations might prefer to pay levy rather than hire employees with disabilities, given the difference in amounts between incentive and levy.

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1   Introduction

The employment of persons with disabilities (PWDs) remains a significant area of concern in both social and economic policy. In South Korea, despite various government initiatives, such as the Mandatory Employment Quota System and the provision of financial incentives and penalties, the employment rate for PWDs remains substantially lower than for the general population. As of 2024, only about 37% of the population of PWDs is economically active, compared to 65% for the general population ([KEAD, 2024]). The Korean government implements various policies to assist the daily and social lives of PWDs, including disability pensions, disability allowances, rehabilitation support programs, the establishment of accessible and rehabilitation facilities, and loans for independent living. Even considering that some PWDs may be unable to participate in the workforce due to the severity of their disabilities, the economic participation rate is still low.

The welfare service most desired by PWDs is income support ([KIHASA, 2023]). [Meyer and Mok, 2019] found that disability is associated with poor economic outcomes and about two thirds of PWDs in their sample never return to work in the long run.[Autor et al., 2019] suggest that receiving disability insurance increases total income and consumption expenditures, but reduces labor income. In this process, the spouse's labor supply plays an important role in mitigating the reduced labor income. However, since some spouses may need to invest time in assisting their companion, the government should support mechanisms that enable both PWDs and their spouse to participate in the labor force. While policies for income support are important, it is equally critical to help those PWDs who wish to participate in economic activities find employment opportunities.

According to the 2023 Survey on the Employment Status of the Disabled in Business, provided by Korea Employment Agency for Persons with Disabilities (KEAD), 82.4% of enterprises in sample do not hire any employees with disabilities (EWDs). Since the sample is based on a population drawn from Statistical Business Registers, it can adequately represent the overall sample. To encourage the hiring of PWDs, the Korean government has implemented policies that offer incentives to companies exceeding mandatory em-

ployment quotas and impose penalties on those that fail to meet the required quotas. However, the effectiveness of these policies can vary depending on the characteristics of the companies, such as their size and the industry in which they operate.

This study aims to evaluate how companies change their employment decisions when the size of financial incentive and levy changes. By analyzing firm-level data, we reveal that incentives positively influence the employment of PWDs, while levies have a negative impact. Specifically, a 1 percentage point increase in the ratio of maximum incentives to average wage expenditures leads to a 0.06% increase in the share of EWDs. On the other hand, a 1 percentage point increase in the ratio of maximum penalties to wage expenditures results in a 0.01% decrease in the share of EWDs.

The heterogeneity analysis provides insights into whether differentiated approaches–based on firm size or industry–could more effectively promote the employment of PWDs. For smaller firms (with 5 to 49 employees), levy can have a positive effect on employment of PWDs. However, as the size of the company increases, the positive effect of incentive decreases, and the negative effect of levy becomes more pronounced. Incentive has the most substantial positive effect in industries like utilities, construction, and business support services. Levy shows a negative impact across almost all industries, but the magnitude of this effect does not significantly vary between industries, except in a few cases.

The findings suggest that the current initial prices of incentive and levy may not be optimal. Instead, it may be more effective to tailor policies based on company size and industry characteristics, particularly by adjusting the levy rates for larger firms to enhance their impact on employment decisions.

This study contributes to the existing literature by providing an in-depth analysis of the heterogeneous effects of disability employment incentive and levy across different firm sizes and industries in South Korea. While prior research has predominantly focused on the general impact of such policies, this paper expands the understanding by demonstrating how the effectiveness of these financial mechanisms varies based on company characteristics. By leveraging firm-level data and applying the reduced form approach

from [Gruber, 1997], the study highlights the limitations of a one-size-fits-all policy and argues for a more nuanced, targeted approach to enhance the employment of PWDs. This research not only fills a gap in the economic literature on disability employment in Korea but also offers policy-relevant insights for improving labor market outcomes for PWDs.

2 Disability Employment Policies for Employers in Korea

The employment policies related to the employment of PWDs for business owners in Korea is based on the Mandatory Employment Quota System. Employers in Korea, who employ more than 50 employees, are obliged to employ PWDs at a certain rate of their total number of employees. The mandatory employment rates vary by the type of business, whether the company is a public or private. Table 1 shows a trend of the mandatory employment rate from 1991 to 2024. The mandatory employment rate has been on the rise as the government continues to amend related laws over time. The state and local government, as well as public institutions, are subject to a slightly higher mandatory employment rate compared to private companies. In 2024, government and public institutions are subjected to 3.8% of mandatory employment of PWDs, whereas private enterprises are subjected to 3.1%. A public or private enterprise employing 100 employees is required to hire about 3 PWDs to meet the mandatory employment level. A public institution employing 10,000 employees is required to hire 380 individuals to meet the criteria, whereas a private institution having the same number of employees is required to hire 310 individuals. The difference of the mandatory employment rate depending on whether the enterprise in public or private has a greater impact as the size of the company increases.

Table 1: Changes in the Mandatory Employment Rate

Year		1991	2009	2010	2012	2014	2017	2018	2019	2022	2024
State and Local Government	Public Servants	2	3	3	3	3	3.2	3.4	3.4	3.6	3.8
	Non-Public Servants	-	-	2.3	2.5	2.7	2.9	2.9	3.4	3.6	3.8
Public Institutions	Public Enterprise/Quasi-Governmental Organization	2	2	3	3	3	3	3.2	3.4	3.6	3.8
	Local Public Enterprise	2	2	2.3	2.5	3	3.2	3.2	3.4	3.6	3.8
Private Enterprises		-	2	2	2.3	2.5	2.7	2.9	2.9	3.1	3.1

Under the mandatory employment quota system, there are two policies aimed at increasing the demand for EWDs. First, employers exceeding the mandatory employment level receive incentive. Even though the mandatory employment quota is subjected to employers with more than 50 employees, an incentive is given regardless of the size of business. Incentive is calculated by multiplying the initial amount of incentive and the exceeding number of EWDs. The initial amount of incentives are shown in Figure 1. The initial amounts of incentive are uptrend and differ by the severity of disability and sex of employees. The amounts are decided and announced by KEAD and known to be an equation of monthly average wage and price.
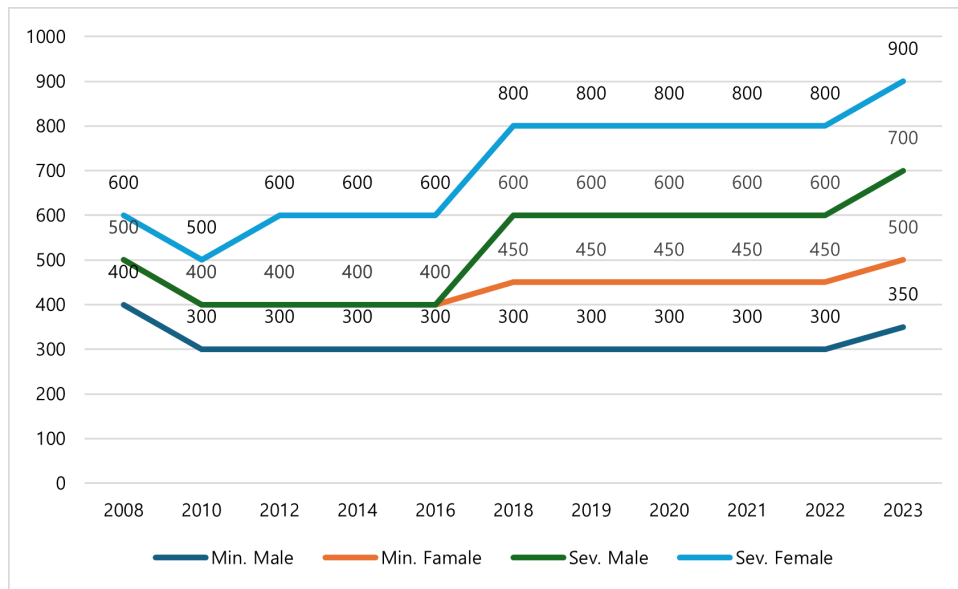
Figure 1: Initial Amounts of Incentive (₩1,000)

Second, if a company with more than 100 employees fails to meet the mandatory employment rate, a levy is imposed for the number of EWDs that were not hired. The calculation of the levy is a function of the number of unemployed PWDs and the initial amount of levy. Initial amounts of levy are an equation of the costs of employment of PWDs and are a universal amount by one EWDs regardless of severity or sex. The trend of initial amount of levy is shown in Figure 2.

Meanwhile, KEAD implements various employer support policies in addition to the Mandatory Employment Quota System. First, there is a system where a business itself can be registered as a "Standard Workplace for PWDs," receiving continuous support

Figure 2: Initial Amounts of Levy (₩1,000)

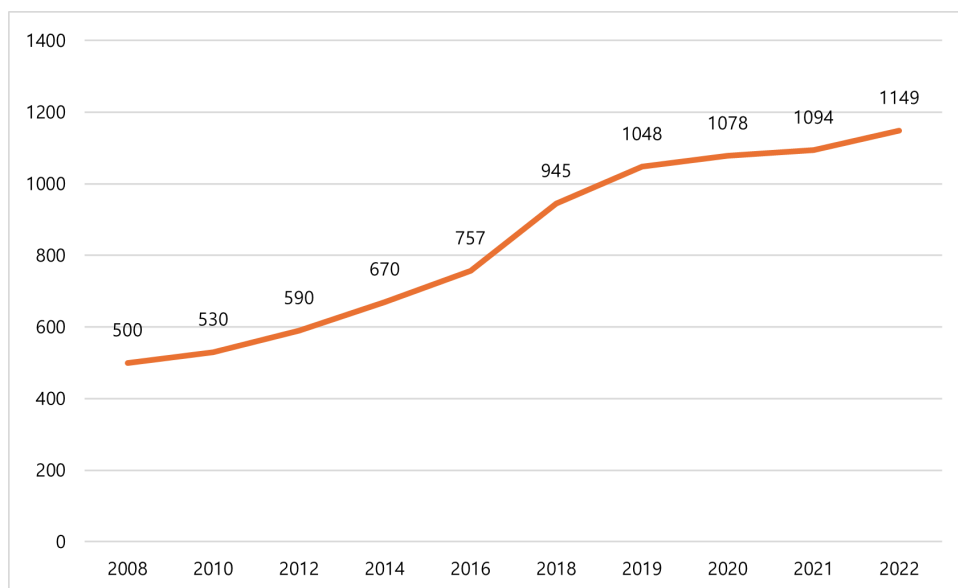related to employing PWDs such as funds and tax benefits. A Standard Workplace for PWDs refers to a business with a work environment centered around the needs of EWDs. Companies that subcontract to these Standard Workplaces can receive exemptions from some of the levy for not employing PWDs.

Secondly, there are programs in place to reduce the financial burden on employers necessary for employing PWDs. The government provides partial support for loan interest required for facilities needed to employ PWDs. To increase accessibility for EWDs, businesses can receive support to improve their basic infrastructure for disability-friendly facilities. After employing PWDs, the costs for appointing and deploying work guides necessary for employment management are supported or financed as well.

Additionally, for businesses offering free job placement services, there is a program that provides financial support to these businesses when they facilitate the employment of PWDs, provided the individuals work continuously for a certain period. Also, there are programs to officially certify businesses that have established facilities friendly to PWDs and to reward those who have contributed to the employment of PWDs.

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3 Literature

The employment of PWDs is not a topic that has received significant academic attention in the field of economics in Korea, thus our research aims to contribute to the broadening the study of disability employment. By pinpointing reports on employment data for PWDs in Korea, we can provide the landscape of this research. [Jeong, 2018] presents statistics on the mandatory employment policy for PWDs, referencing data from the 2017 Survey on the Employment Status of the Disabled in Business conducted by Employment Development Institute (EDI) at KEAD. The data shows an increasing employment rate for EWDs since 2008, but employment rates in public services, public institutions, and private companies fall slightly below the mandatory quota. In 2017, the population of PWDs aged 15 and older was approximately 2.6 million, with 38.7% of them economically active. Given that the overall employment rate for the general population was 61.3%, the employment rate for PWDs, particularly those in manual labor, was notably lower. In 2021, [KEAD, 2021] released key findings from the 2021 Survey on the Economic Activity of the Disabled, with a sample of 11,000 registered PWDs aged 15 and older. The employment rate slightly declined from the previous year, while the unemployment rate, which had been decreasing, saw a significant increase. Additionally, the data reveals shift in employment trends: regular jobs decreased while part-time and temporary jobs increased, and among the unemployed, the number of employers dropped while self-employed workers increased.

Moreover, our research contributes to studies on Korea's disability employment incentive or levy. [Yoo, 2017]'s in 2017 used Two-Stage Least Squares method to estimate the employment effect of disability incentive, showing that a 10,000 won increase in incentive leads to a 4.67% rise in disabled employment, with slightly higher effects for severely disabled and female workers. [Han et al., 2020] further adds to the literature by examining dead-weight loss in disability incentive, showing that larger companies and severely disabled workers incur higher dead-weight losses, with male workers also linked to higher losses than female workers.

Key factors that attract attention in research on disability employment in general

are accommodation and labor supply. [Hill et al., 2016] studied the impact of employer accommodations on retaining newly EWDs and preventing insurance claims. They found that while accommodations such as job modifications and flexible schedules improve employment chances in the short term, their effects diminish over time. Only about a quarter of newly EWDs received accommodations. Despite improving short-term employment, accommodations did not significantly reduce applications for disability insurance, indicating that those benefiting from accommodations are not the same as those considering disability insurance. [Stern, 1996] analyzes the impact of disability on labor force participation by separating supply and demand effects using a semi-parametric method. He estimates that improving public transportation for PWDs has a greater impact on increasing labor force participation than reducing employer discrimination. Policy tools like vocational rehabilitation and income maintenance programs affect wages and participation. Stern concludes that supply-side factors, like accessibility improvements, have a stronger effect on labor participation of PWDs than demand-side interventions, such as wage subsidies. However, he notes that this approach is new and lacks detailed cost analysis. [Acemoglu and Angrist, 2001] conducted an analysis on the Americans with Disabilities Act (ADA), which has been in effect in the United States since 1992. The ADA was aimed at prohibiting discrimination against people with disabilities in employment by requiring employers to provide reasonable accommodations. According to their findings, the cost of providing these accommodations led to a reduction in employment instead.

There are not many economic studies on employment of PWDs in Korea, but there are various studies focusing on business management or welfare. We find the reason for the minute economics research in this field in Korea is the limited availability of data for individual researchers. [Choi and Sohn, 2021] used 2019 Survey on the Employment Status of the Disabled in Business data to analyze the factors affecting the employment rate of people with disabilities in companies. Their results, based on various types of descriptive statistical analyses, showed that having experience receiving employment incentives, paying employment levies, and a sense of social responsibility for employing PWDs had a positive effect on the employment rate. However, perceptions of the work attitudes of

disabled workers had a negative impact on the employment rate. [Lee and Hwang, 2021] also used the same data to identify the factors that determine the employment of PWDs. They argued that policies should be implemented to foster a positive perception of employing PWDs and to create a social atmosphere and environment where employing PWDs becomes a necessity, not a choice.

To summarize, our research contributes in three ways. First, our research complements the potentially limited economic studies on employment of PWDs in Korea. Second, it examines the effectiveness of the government's incentive and levy systems aimed at promoting employment of PWDs. Third, since these incentive and levy affect the employment costs for companies, they need to be considered in addition to the costs of accommodation or infrastructure, which are actively studied in current disability employment research.

4 Data

4.1 Employment Data

Our primary data is the Survey on the Employment Status of the Disabled in Business of 2019, provided by KEAD. This data is conducted annually and is publicly available cross-sectional data. The survey consists of a basic survey and an in-depth survey. The basic survey targets companies with at least one employee, while the in-depth survey focuses on companies with five or more employees, depending on the purpose and content of the survey. We only use in-depth survey data because it has more information about economic status of companies. The population and sampling frame are based on the Census on Establishments and the corporate population list of the National Statistical Office, using the most up-to-date lists available as of the survey year. This is the only firm-level data collected from companies among four datasets provided by KEAD to public with open access. Since the 2019 data includes information on the employment status of the companies from 2016 to 2019, we built a panel dataset based on that information.

Table 2 is the descriptive statistics of our data. The number of companies is 2,409. Total number of observations for four years is 9,504. About 54% of total observation accounts

to companies located in one of the metropolitan areas in Korea; Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, and Ulsan. Most of the observation is a registered corporate (87%). The average monthly wage paid to all workers at the companies is approximately 3.12 million KRW (about 2,330 USD), which is higher than the average monthly wage of total population in 2019 (1.73 million KRW, about 1,300 USD). The average monthly wage for EWDs is about 2.52 million KRW (about 1,880 USD). The largest company employs around 52,000 workers, while the smallest company has 2 employees. On average, companies employ 545 workers, but the company at the 50th percentile employs 173 workers. Companies employing people with disabilities make up about 86% of the data. Among them, the company that employs the most has 1,368 EWDs.

Companies that are subjected to incentives, which means they are hiring a larger number of EWDs than the number of mandatory levels, take about 26%. Companies that are subjected to levies, which means they are failing to fulfil the mandatory level of employment of PWDs, are about 71%. All financial variables used in our analysis are CPI-adjusted (2020=100). Finance variables such as revenue, profit, asset, and debt are in the unit of 1,000,000 KRW.

4.2 Policy Status during 2016-2019

We utilize key figures related to South Korea's mandatory employment rate for EWDs, as well as the initial prices for incentive and levy aimed at influencing corporate hiring behavior. Between 2016 and 2019, the mandatory employment rate gradually increased from 2.7% to 3.1%, reflecting a strengthening policy to integrate PWDs into the workforce. The initial amounts of incentive, which vary based on gender and the severity of the disability, remained stable during this period, with severely disabled females receiving the highest incentive of 800,000 KRW in 2019. On the other hand, the levy imposed on companies failing to meet the employment quota saw a significant increase, rising from 757,000 KRW in 2016 to 1,048,000 KRW in 2019. These figures provide the empirical basis for analyzing how financial incentive and levy affect corporate decisions regarding the employment of PWDs. Table 3 organize the figures used in our analysis.

Table 2: Descriptive Statistics

Variables	Mean	Std. Dev.	Minimum	Maximum
HQ in Metropolitan Area	0.537	0.499	0	1
Individually-owned Business	0.050	0.218	0	1
Corporate	0.865	0.341	0	1
Non-Business Corporate	0.084	0.278	0	1
Having a Union	0.289	0.453	0	1
Disability-Friendly Infrastructure	0.432	0.311	0	0.909
Monthly Wage Expenditure	2,026,946,997	9,730,158,638	3,437,104	396,000,755,712
Monthly Avg. Wage for All Employees	3,120,812	1,201,616	526,807	9,310,018
Monthly Avg. Wage for Employees WDs	2,517,613	1,602,479	0	9,011,620
Revenue	442,634	2,741,259	40	64,630,796
Profit	24,541	165,368	-611,570	5,513,003
Asset	999,154	7,388,176	0.958	184,300,000
Debt	936,240	12,233,277	0.958	537,100,000
The Number of Total Employees	545	1,906	2	52,586
The Number of Employees WDs	8.743	37	0	1,368
Currently Employing PWDs	0.863	0.344	0	1
Mandatory to Employ PWDs	0.866	0.340	0	1
Qualified for incentives	0.261	0.439	0	1
Subjected to Levies	0.705	0.456	0	1
Maximum Incentives	76,424	612,396	0	13,352,528
Max. Incentives/Avg. Wage Expenditure	0.027	0.306	0	8.571
Maximum Levies	6,659,019	25,801,326	0	1,022,408,320
Max. Levies/Avg. Wage Expenditure	0.292	0.345	0	3.716
Share of Employees WDs	0.020	0.043	0	0.870

Table 3: Revisiting Initial Prices From 2016 to 2019

Year	Mandatory Employment Rate	Initial Prices for Incentives (KRW)				Initial Prices for Levies (KRW)
		Min. Male	Min. Female	Sev. Male	Sev. Female	
2016	2.7%	300,000	400,000	400,000	600,000	757,000
2017	2.9%	300,000	400,000	400,000	600,000	757,000
2018	2.9%	300,000	450,000	600,000	800,000	945,000
2019	3.1%	300,000	450,000	600,000	800,000	1,048,000

5 Model

5.1 Labor Demand for the Disabled

To consider the factors that determine a company's decision to employ PWDs, we can begin with a simple production function and maximization problem for a company.

$$Y = F(L, K) \tag{1}$$

$$\text{Max. } \pi = PY - wL - rK \tag{2}$$

In Equation 1, Y represents output (production), L represents labor, and K represents

capital. In Equation 2 π denotes profit. P is the price of the output. w is the price of labor, the real wage, and r refers to the price of capital, usually known as rent. To derive labor demand, it is common to assume homogeneous labor and fixed capital. However, to derive the labor demand for PWDs, we are assuming heterogeneous labor which yields new production function and maximization problem as:

$$Y = F(L_A, L_D, \bar{K}) \tag{3}$$

$$\text{Max. } \pi = PY - w_A L_A - w_D L_D - r\bar{K} - C(L_D) + S(L_D) \tag{4}$$

where L_A denotes for the workers without disabilities. L_D denotes for the workers with disabilities. $C(L_D)$ represents the cost related to employing PWDs such as costs for job adjustments, equipment purchases, and facilities. $S(L_D)$ represents the public support from government regarding the employment of PWDs. If the company does not employ PWDs, the terms involving EWDs in the right-hand side will disappear, and the production function and optimization problem will revert to the same as 1 and 2.

However, to examine the impact of government programs on a company's employment of PWDs, we could use a simple OLS; however, there are two reasons why this may not be appropriate. First, according to the KEAD, both employment incentive and levy can be received or paid through self-reporting by companies. A company can apply for the incentive and become a beneficiary, but it can also choose not to apply. Since the initial amount for incentive varies depending on factors such as gender and severity of disability, the final amount of incentive may vary based on the characteristics of the employee being reported. Additionally, companies must report and pay levy directly, and failure to self-report could result in disadvantages. Lastly, the available data is limited. Information such as whether a company receives incentive and the amount received, or whether they pay levy and the amount paid, is not disclosed to individual researchers. Therefore, a simple OLS analysis cannot determine the impact.

5.2 Gruber's Reduced Form Approach

[Gruber, 1997] analyzes how unemployment insurance (UI) helps stabilize consumption during periods of unemployment. Gruber finds that UI significantly reduces the drop in consumption, which could otherwise fall by 22% without it. With UI, the average consumption drop is only 6.8%. The more generous the UI benefits, the better it smooths consumption, but there are also behavioral distortions caused by UI. Gruber concludes that finding the optimal level of UI benefits is essential to balance its consumption smoothing benefits with its potential negative effects on behavior.

Gruber uses UI eligibility as a regressor instead of UI benefits. He conducts a reduced form analysis using the simulated model in the equation below for three reasons instead of directly using the benefit amounts. Equation 5 is Gruber's specification.

$$\Delta C_t = \alpha + \beta_1 X_t + \beta_2 \mathrm{UI}_t + \epsilon_t \tag{5}$$

First, the receipt of unemployment benefits and the amount received are endogenous. Second, the data on actual UI receipt are very noisy. These issues of endogeneity and data quality could be addressed using an instrumental variable estimation method. However, third, only the reduced form regression yields the coefficient that is meaningful to policy makers. The meaning of the reduced form coefficient obtained from the regression of the equation is the effect of legislated changes in the UI replacement rate on consumption smoothing. In contrast, the coefficient from the instrumental variable method represents the effect of changes in UI receipt on consumption smoothing. Since government cannot affect UI receipt, from the perspective of government policy design, the former is more relevant than the latter, which is why he chose to analyze the equation using a reduced form regression.

5.3 Our Model with Maximum Values

Since we also have issues as Gruber had in 1997, we calculate and use the maximum amounts of grant that a company could possibly have received or paid. We have employ-

ment information from 2016 to 2019 in our sample. We know the mandatory employment rate from 2016 to 2019. Therefore, we are able to identify which company was subjected to incentive and which company was subjected to levy, which means that we know which companies are overachieving the mandatory employment level and which companies are failing to meet the mandatory employment level. Moreover, we know the initial amounts for both incentive and levy from 2016 to 2019. We are then able to multiply two numbers to calculate the maximum amount of incentive that a company could have gotten if it was incentive-receiving company, or the maximum amount of levy that a company could have paid if it was levy-paying company. Now we are utilizing these maximum values as what Gruber did with his model.

Our dependent variable is the share of EWDs to the total employees. Our main regressors are the ratio of the maximum incentive to the average wage expenditures and the ratio of the maximum levy to the average wage expenditure, all of them as monthly values. The regression model is as following:

$$\left(\frac{D\_EMP}{EMP}\right)_{it} = \beta_0 + \beta_1 \left(\frac{\text{MaxIncen}}{\text{WageExp}}\right)_{it} + \beta_2 \left(\frac{\text{MaxLevy}}{\text{WageExp}}\right)_{it} + \beta_3 \delta_{it} + \beta_4 \tau_{it} + \epsilon_{it} \quad (6)$$

D_EMP is the number of EWDs. EMP is the number of total employees. $MaxIncen$ is the maximum amount of incentive that a company i could have received in year t. $MaxLevy$ is the maximum amount of levy that a company i could have paid in year t. $WageExp$ is the monthly wage expenditure of a company i's in year t, which is the multiplication of the number of total employees and the average monthly wage of total employees. δ_{it} is the company fixed effect. τ_{it} is the year fixed effect. ϵ_{it} is the idiosyncratic error. Table 4 shows the descriptive statistics of the maximum values and the dependent variable. The average maximum incentive is 76,424 KRW. The largest amount of incentive is 13,352,528 KRW. The average maximum levy is 6,659,019 KRW. The largest amount of levy is 1,022,408,320 KRW. The average share of employees with disabilities is 2%. The variables *Max. Incentives/Avg. Wage Expenditure* and *Max. Levy/Avg. Wage Expenditure*, used as dependent variables, will be abbreviated as *Max. Incen. Ratio* and *Max. Levy Ratio*, respectively, in the forthcoming parts.

Table 4: Descriptive Statistics - Dependent Variables

Variables	Mean	Std. Dev.	Minimum	Maximum
Maximum Incentives	76,424	612,396	0	13,352,528
Max. Incentives/Avg. Wage Expenditure	0.027	0.306	0	8.571
Maximum Levies	6,659,019	25,801,326	0	1,022,408,320
Max. Levies/Avg. Wage Expenditure	0.292	0.345	0	3.716
Share of Employees WDs	0.020	0.043	0	0.870

6 Results

6.1 Main Results

Table 5 shows the main results of panel fixed effect regression having the ratio of the number of EWDs to the number of total employees as a dependent variable. Column 3 indicates that, with full control variables and year fixed effects, as one percentage point of the ratio of maximum incentive to the average wage expenditure increases, the share of EWDs increases by 0.06%. Moreover, as one percentage point of the ratio of maximum levy to the average wage expenditure increases, the share of EWDs decreases by 0.01%. Straightforwardly, incentive increases and levy decreases the share of EWDs. Considering the monthly average wage in our sample is about 3,130,000 KRW, if one company is spending 1 billion KRW in the wage expenditure, which means having about 3,200 employees, then for the incentive-receiving company, 10,000,000 KRW more incentives would make the company hire 0.06% more EWDs. On the other hand, for the levy-paying company, 10,000,000 KRW more levy to pay would make the company hire 0.01% less EWDs.

The main results can be explained by using hypothetical examples to illustrate how they affect companies based on their number of employees. In this example, for simplicity, we assume that the incentive rate is 800,000 KRW and the penalty rate is 1,000,000 KRW. Company A employs 100 people, while Company B employs 3,200 people. According to the data, the average monthly wage is about 3.13 million KRW. The results indicate that when the maximum incentive, relative to average monthly wage expenditures, increases by 1 percentage point, companies increase their employment of PWDs by 0.06%. Conversely, when the maximum penalty, relative to average monthly wage expenditures, increases by

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Table 5: Main Results

	(1)	(2)	(3)
Maximum Incentive Ratio	0.0663***	0.0653***	0.0636***
	(0.0140)	(0.0139)	(0.0140)
Maximum Levy Ratio	-0.0323***	-0.0256***	-0.0124***
	(0.00169)	(0.00169)	(0.00223)
Constant	0.0277***	-0.343***	0.374***
	(0.000726)	(0.0169)	(0.0604)
Control	N	Y	Y
Year Fixed Effect	N	N	Y
Observations		9,504	
R-squared	0.306	0.365	0.406
Number of id		2,409	

Notes: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

1 percentage point, companies reduce their employment of PWDs by 0.01%.

In the case of Company A, the monthly wage expenditure is about 310 million KRW. When 3.13 million KRW, which is 1 percentage point of 310 million, is provided as an incentive, Company A increases its employment of PWDs by six employees. This is higher than the mandatory employment level of three employees (3.1% of 100). Since Company A currently employs six EWDs, three of these workers meet the mandatory employment level, meaning the company can receive incentives for the remaining three. Under the current system, they could receive approximately up to 2.4 million KRW as incentives, which is slightly lower than the analyzed level of 3.13 million KRW. Therefore, the current system may not produce the effect of hiring up to six EWDs.

If Company A is required to pay 3.13 million KRW of levy, it would reduce its employment by one EWD This shows that 3.13 million KRW is insufficient to positively affect hiring. In the current system, reducing employment by one worker would result in the company paying levy for three workers, amounting to around 3 million KRW. Since Company A is willing to pay 3.13 million KRW to avoid hiring one EWD, it shows that the current penalty level is similar. Thus, it is uncertain whether Company A, even if subject to the levy, would choose to hire under the current system or to pay levy instead.

In the case of Company B, the monthly wage expenditure is 1 billion KRW. When 10 million KRW, which is 1 percentage point of 1 billion, is provided as an incentive,

Company B increases its employment of EWDs by 1.92 workers. This is far lower than the mandatory employment level of about 99 employees (3.1% of 3,200). Under the current system, if Company B hires only 1.92 EWDs, it would be considered non-compliant. Even if they receive 10 million KRW, they would only hire up to two EWDs. The 10 million KRW is equivalent to the incentive they would receive for hiring an additional 12.5 EWDs, meaning Company B would need to employ a total of 112 EWDs to receive this level of incentive. Since the incentive level is too low, Company B is unlikely to hire more EWDs.

If Company B is required to pay a 10 million KRW of levy, it would reduce its employment by 0.32 EWDs. Under the current system, if Company B only hires 1.92 EWDs, they would be considered non-compliant and would need to pay levy for 97 workers, which amounts to about 97 million KRW. According to the analysis, paying 10 million KRW corresponds to the penalty for 89 workers, which is approximately 89 million KRW. Company B may already be non-compliant and paying up to 99 million KRW in penalties, so the penalty level is too large for Company B. This suggests that the current penalty rates are too low to encourage positive employment changes at Company B.

These interpretations are based solely on wage considerations. If potential costs and opportunity costs, including costs regarding related programs for EWDs, costs in production originating from hiring EWDs instead of workers without disabilities, or costs to build physical infrastructure for EWDs, are considered, the actual costs companies face and the support provided by incentive and levy could differ. Based on this, two implications can be drawn. First, the current system, in terms of cost to companies, encourages non-hiring, regardless of company size. Second, since the perceived cost levels differ by company size, different initial amounts for incentive and levy should be set based on company size. Particularly, the levy rates should vary significantly according to company size.

6.2 Heterogeneous Effects

We analyze through this study how the levels of incentive and levy affect companies differently based on their characteristics. Table 6 shows the results of the analysis using a sample categorized by the number of employees the companies have, with Column 1 representing companies with 5 to 49 employees, Column 2 representing companies with 50 to 299 employees, Column 3 representing companies with 300 to 999 employees, and Column 4 representing companies with over 1,000 employees.

What can be understood from Table 6 is that as company size increases, the positive effect of incentive decreases, while the negative effect of levy increases. Moreover, in the case of levy, the larger the number of employees in a company, the greater the negative impact levy have on the number of EWDs. On the other hand, for small companies with 5 to 49 employees, it was found that levy also have a positive effect. This aligns with the previous example of Company A, where the current penalty level was similar to the analysis result, making it unclear in which direction employment would change. By analyzing heterogeneous effects, it was confirmed that levy also has a positive effect on small companies. This is because small companies are more significantly affected by levy compared to large companies when considering levy as a cost.

Table 6: Regression Results by Firm Size

VARIABLES	5-49	50-299	300-999	1000-
Max. Incen. Ratio	0.0635***	0.0681***	0.0470**	0.00548*
	(0.0225)	(0.0142)	(0.0206)	(0.00326)
Max. Levy Ratio	0.0352*	-0.0123***	-0.0250***	-0.0373***
	(0.0210)	(0.00241)	(0.00325)	(0.00712)
Constant	0.00155	0.344***	0.147**	0.0816
	(0.260)	(0.0758)	(0.0733)	(0.106)
Observations	1,254	4,760	2,557	933
R-squared	0.487	0.423	0.472	0.313
Number of id	317	1,203	648	241

Notes: Robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 7 presents the results of an analysis of samples categorized by industry. While the original data provides 18 industries in total, for the sake of convenience in analysis, similar industries have been grouped together. Table A.10 in Appendix presents the classi-

fication for the sample A to F. Column 1 represents samples from agriculture, forestry and fishing, mining, and manufacturing industries. Column 2 includes samples from electricity, gas, steam and air conditioning supply, water supply, sewage and waste management, material recycling, and construction industries. Column 3 contains samples from wholesale and retail trade, transportation, and storage industries. Column 4 includes samples from information and communication, finance and insurance, and professional, scientific, and technical services. Column 5 represents samples from real estate, business facility management, business support services, and rental services. Finally, Column 6 includes samples from accommodation and food services, education services, health and social welfare services, arts, sports, and recreation services, associations and organizations, repair services, and other personal services.

Table 7 shows that incentive has a positive effect in most industries, with the effect size being the largest in the samples from Column 2 and Column 5. The reason incentive shows a particularly strong effect in Columns 2 and 5 may be because these industries are more likely to already have active employment of PWDs. As for levy, it showed a negative effect in all industries except for Column 5. Among these, the coefficients in Columns 3 and 6 were the largest, though not significantly different from those in other industries. This indicates that levy still fail to positively increase the level of employment across most industries.

Table 7: Regression Results by Industry

VARIABLES	A	B	C	D	E	F
Max. Incen. Ratio	0.109***	0.0557***	0.0112***	0.150***	0.0761***	0.0298***
	(0.0156)	(0.0102)	(0.00246)	(0.0396)	(0.00771)	(0.00653)
Max. Levy Ratio	-0.00575**	-0.0101***	-0.0192***	-0.0131***	0.000918	-0.0185***
	(0.00256)	(0.00330)	(0.00377)	(0.00216)	(0.00785)	(0.00420)
Constant	0.192**	0.463***	0.575***	0.115	0.692***	0.126
	(0.0925)	(0.149)	(0.133)	(0.0791)	(0.227)	(0.0802)
Observations	3,767	622	1,611	1,235	1,235	1,034
R-squared	0.525	0.359	0.498	0.437	0.457	0.456
Number of id	950	158	407	311	319	264

Notes: Robust standard errors in parentheses.*** $p<0.01$, ** $p<0.05$, * $p<0.1$

The industry classification is shown in Table A.11.

The analysis of samples divided by the heterogeneous characteristics of companies

shows that while the effects vary according to the number of employees, in the case of industries, incentive produces significant effects only in certain sectors, whereas levy shows little variation across industries. This aligns with the main results, suggesting that it would be more appropriate to implement differentiated incentive and levy policies based on the size of the company's workforce rather than by the type of business.

7   Conclusions

This study analyzes the impact of disability employment incentive and levy on companies' employment of PWDs in South Korea, including the heterogeneous effects based on company size and industry. The results highlight the crucial role that financial mechanisms play in shaping corporate behavior toward employing PWDs, but they also underscore the limitations of a half-uniform policy approach.

One of the key findings is that incentive has a positive effect on increasing the share of EWDs, while levy has a negative effect. A 1 percentage point increase in the ratio of maximum incentive to wage expenditures leads to a 0.06% increase in the employment of PWDs, whereas a 1 percentage point increase in the ratio of maximum levy to wage expenditures results in a 0.01% decrease it. These findings suggest that while financial support encourages companies to hire more PWDs, the levy designed to enforce compliance may inadvertently discourage hiring, particularly when the financial burden is too great if we consider the entire costs associated with employing PWDs.

The study also reveals that the effects of these policies are not uniform across companies of different sizes. Smaller firms (5 to 49 employees) experience a positive impact from levy, likely because these firms are more sensitive to financial burden and thus motivated to meet employment quotas. In contrast, larger firms face stronger negative effects from levy, which suggests that the initial amounts are not sufficient to compel compliance or that the cost of hiring PWDs is too high relative to the levy. This finding indicates that a differentiated approach to levy and incentive based on company size may be necessary to achieve better employment outcomes for PWDs.

Industry analysis shows that incentive works well in certain sectors, particularly utilities, construction, and business support services, where the employment of PWDs could be more active. However, the effect of levy is largely negative across all industries, with minimal variation in its magnitude. This further reinforces the need to reconsider the current structure of levy, as they appear to hinder, rather than promote, employment in most industries.

From a policy perspective, these results suggest that the current one-size-fits-all approach to incentive and levy may not be optimal. Tailoring policies to company size and industry can better address the specific challenges faced by different types of businesses. For smaller firms, levy could continue to be effective, but larger firms may require more substantial incentive or support mechanisms to offset the higher costs associated with employing PWDs. In particular, the levy rates for larger firms may need to be increased to effectively encourage compliance.

Overall, this study contributes to the growing body of literature on disability employment by providing empirical evidence on how financial incentive and levy affect corporate behavior. It underscores the need for more nuanced, targeted policy measures to improve the labor market outcomes for PWDs in South Korea. Future research could explore the long-term effects of these policies and investigate additional factors, such as company culture and infrastructure, that may influence the hiring of PWDs. If richer data could be provided by relevant institutions, it would be possible to conduct an analysis that integrates multiple policies and produces more comprehensive results. Future research should aim to combine various policies and, if possible, separate out the factors that contribute to the costs of employing PWDs for companies.

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A   Appendix

Table A.8: Full Regression Results of Main Analysis

	(1)	(2)	(3)
Maximum Incentive Ratio	0.0663***	0.0653***	0.0636***
	(0.0140)	(0.0139)	(0.0140)
Maximum Levy Ratio	-0.0323***	-0.0256***	-0.0124***
	(0.00169)	(0.00169)	(0.00223)
Number of Employees		-0.00000126	-0.00000148
		(0.0000016)	(0.00000141)
Average Monthly Wage		0.000261**	-0.00208***
		(0.000110)	(0.000255)
Average Monthly Wage for EWDs		0.00117***	0.00124***
		(0.000123)	(0.000129)
Profit		-0.0649	-0.0642
		(0.107)	(0.0936)
Asset		-0.00581	-0.00268
		(0.00379)	(0.00321)
Debt		0.000268	0.000172
		(0.000217)	(0.000200)
Constant	0.0277***	-0.343***	0.374***
	(0.000726)	(0.0169)	(0.0604)
Control	X	O	O
Year Fixed Effect	X	X	O
Observations		9,504	
R-squared	0.306	0.365	0.406
Number of id		2,409	

Notes: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A.9: Full Regression Results by Firm Size

VARIABLES	5-49	50-299	300-999	1000-
Maximum Incentive Ratio	0.0635***	0.0681***	0.0470**	0.00548*
	(0.0225)	(0.0142)	(0.0206)	(0.00326)
Maximum Levy Ratio	0.0352*	-0.0123***	-0.0250***	-0.0373***
	(0.0210)	(0.00241)	(0.00325)	(0.00712)
Number of Employees	-1.23e-05	-1.03e-05	-3.48e-06	-1.37e-06
	(1.11e-05)	(7.42e-06)	(6.34e-06)	(1.34e-06)
Average Monthly Wage	-0.00202**	-0.00179***	-0.000423*	-0.00214
	(0.000974)	(0.000265)	(0.000218)	(0.00214)
Average Monthly Wage for EWDs	0.00543***	0.000932***	0.000138*	0.00223
	(0.000541)	(0.000103)	(7.38e-05)	(0.00209)
Profit	-9.416	-0.471***	-0.434**	0.147
	(15.76)	(0.150)	(0.178)	(0.191)
Asset	2.721	-0.0830**	-0.0150	-0.0162
	(1.812)	(0.0394)	(0.0128)	(0.0184)
Debt	-7.439**	6.02e-05	0.0176	0.0181
	(3.763)	(7.92e-05)	(0.0132)	(0.0203)
Constant	0.00155	0.344***	0.147**	0.0816
	(0.260)	(0.0758)	(0.0733)	(0.106)
Observations	1,254	4,760	2,557	933
R-squared	0.487	0.423	0.472	0.313
Number of id	317	1,203	648	241

Notes: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A.10: Regression Results by Industry

VARIABLES	A	B	C	D	E	F
Maximum Incentive Ratio	0.109***	0.0557***	0.0112***	0.150***	0.0761***	0.0298***
	(0.0156)	(0.0102)	(0.00246)	(0.0396)	(0.00771)	(0.00653)
Maximum Levy Ratio	-0.00575**	-0.0101***	-0.0192***	-0.0131***	0.000918	-0.0185***
	(0.00256)	(0.00330)	(0.00377)	(0.00216)	(0.00785)	(0.00420)
Number of Employees	-1.17e-07	-2.70e-06	-1.74e-07	5.99e-07	-8.65e-08	-2.61e-06
	(9.91e-08)	(2.72e-06)	(2.94e-06)	(1.76e-06)	(5.25e-07)	(4.15e-06)
Average Monthly Wage	-0.00164***	-0.00257***	-0.00243***	-0.000734***	-0.00434***	-0.00133***
	(0.000347)	(0.000617)	(0.000420)	(0.000277)	(0.00124)	(0.000346)
Average Monthly Wage for EWDs	0.00135***	0.00172***	0.00109***	0.000628***	0.00180***	0.00144***
	(0.000198)	(0.000400)	(0.000198)	(0.000138)	(0.000617)	(0.000211)
Revenue	-0.00866	-0.0129*	0.0847	-0.00436	-0.433*	-0.00491
	(0.0136)	(0.00775)	(0.0714)	(0.00993)	(0.234)	(0.0231)
Profit	-0.190**	-0.00963	6.162	0.0168	0.0154	-0.460**
	(0.0839)	(0.0615)	(3.741)	(0.209)	(2.059)	(0.229)
Asset	0.00836	0.00691	-0.636*	-0.0121	0.143	0.000327
	(0.0132)	(0.00606)	(0.340)	(0.0123)	(0.167)	(0.0457)
Debt	0.000458***	-0.00484	0.391	0.0133	-0.136	0.0206
	(7.70e-05)	(0.00888)	(0.285)	(0.0129)	(0.247)	(0.0400)
Constant	0.192**	0.463***	0.575***	0.115	0.692***	0.126
	(0.0925)	(0.149)	(0.133)	(0.0791)	(0.227)	(0.0802)
Observations	3,767	622	1,611	1,235	1,235	1,034
R-squared	0.525	0.359	0.498	0.437	0.457	0.456
Number of id	950	158	407	311	319	264

Notes: Robust standard errors in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A.11: Industry Classifications

#	Industry Classification	Merge	Obs.
1	농업, 임업 및 어업 (Agriculture, Forestry, and Fishing)	A	40
2	광업 (Mining)		19
3	제조업 (Manufacturing)		3,708
4	전기, 가스, 증기 및 공기 조절 공급업 (Electricity, Gas, Steam, and Air Conditioning Supply)	B	52
5	수도, 하수 및 폐기물 처리, 원료 재생업 (Water Supply, Sewage, Waste Management, and Remediation Activities)		45
6	건설업 (Construction)		525
7	도매 및 소매업 (Wholesale and Retail Trade)	C	860
8	운수 및 창고업 (Transportation and Storage)		751
9	정보통신업 (Information and Communication)	D	376
10	금융 및 보험업 (Financial and Insurance Activities)		333
11	전문, 과학 및 기술 서비스업 (Professional, Scientific, and Technical Services)		526
12	부동산업 (Real Estate Activities)	E	123
13	사업시설 관리, 사업 지원 및 임대 서비스업 (Administrative and Support Service Activities)		1,112
14	숙박 및 음식점업 (Accommodation and Food Service Activities)	F	110
15	교육 서비스업 (Education)		145
16	보건업 및 사회복지 서비스업 (Human Health and Social Work Activities)		653
17	예술, 스포츠 및 여가관련 서비스업 (Arts, Sports, and Recreation-related Services)		43
18	협회 및 단체, 수리 및 기타 개인 서비스업 (Membership Organizations, Repair, and Other Personal Services)		83