

# **Effect of Korean Rehabilitation Services on Work Resumption by Occupational Segments**

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This study empirically examined how participation in the programs of Workers' Compensation Insurance rehabilitation services affects the resumption of work by occupational segments. Accordingly, this study combined data from the Korean Employment Survey for Workers with Occupational Disabilities with Korea Workers' Compensation and Employment Insurance Administrative Database and employed a propensity score matching method and a mixed logit model. Our empirical findings corroborate that well-targeted rehabilitation services differentiated by occupational segments are highly effective and desirable.

*Keywords:* Rehabilitation service, Occupational disability, Work resumption, Occupational segments

*JEL Classification:* I38, J62, J68

## **I. Introduction**

Workers' Compensation Insurance (WCI) is a crucial component of the social safety net of Korea for workers with occupational disability, which is defined as a work-related illness or injury that prevents a person from working and is categorized by 14 grades. In 2016, 34,330 Korean workers with occupational disability were newly entitled to WCI

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benefits.

The work resumption of workers with occupational disability is a key policy goal of the WCI rehabilitation services since the implementation of Five Year Plan for Workers' Compensation Rehabilitation Service in 2001. Work resumption means that a worker with occupational disability could return to her time-of-injury work. Employment quality typically deteriorates when a worker with occupational disability moves to other jobs.<sup>1</sup> However, despite the large amount of money spent on these rehabilitation services every year, the work resumption rate has been low. In 2011, 9,640,903,000 KRW was spent in covering rehabilitation service costs, but the work resumption rate was only approximately 38.7 percent.

This study aims to provide empirical evidence on whether rehabilitation services for workers with occupational disability have been effective according to the policy goal. The two representative programs covered by WCI are the Individual Rehabilitation Service (IRS) and the Work Resumption Subsidy (WRS). The IRS is one type of recuperation treatment that mainly provides psychosocial treatment and social adaptation programs directly to workers at the early stage of medical care. The WRS provides subsidies to employers who retain their workers with occupational disability of grades 1 to 12 for six months or longer after medical treatment is completed. Hence, the IRS incentivizes workers to resume work, whereas the WRS incentivizes employers to preserve an employment relationship with workers. Naturally, we hypothesize that each program may have different impacts on work resumption by occupational segments and that the effects by occupational segments may be different according to programs, such as the IRS and the WRS.

For empirical analysis, we combine data from the Korean Employment Survey for Workers with the Occupational Disabilities with those of Workers' Compensation and Employment Insurance Administrative Database. We then construct a comprehensive dataset of the choices of the disabled worker to return-to-work and her individual characteristics, such as demographic information, injury

<sup>1</sup>According to the Korean Employment Survey for Workers with Occupational Disabilities in 2011, the social security insurance application rate was roughly 40 points higher, and the average hourly pay was approximately 6,000 KRW higher for work resumption compared with job change.

characteristics, occupational characteristics, and experience with rehabilitation services. Moreover, to control possible selection bias and the unobservable characteristics of workers, we use the propensity score matching method and the mixed logit model.

The rest of the paper is organized as follows. Section II reviews the previous research on prognostic factors for resuming work and the definitions of occupational segments. Section III addresses the data and the empirical model. Section IV provides the econometric analyses of the effects of participation in rehabilitation services on work resumption by occupational segments. Finally, Section V concludes and discusses the policy implications.

## **II. Previous Research and Occupational Segments**

The variables identified as prognostic factors for the work resumption of workers with occupational disabilities include rehabilitation service experiences, demographic characteristics, injury characteristics, and occupational characteristics.

The previous research has affirmed the inconsistent effects of participation in rehabilitation services. Several researchers validate that workers participating in rehabilitation services, such as psychosocial treatment and social adaptation programs, are more likely to resume work (Dasinger *et al.* 2000; Blackwell *et al.* 2003). However, other researchers indicate no differences between participants and non-participants (Greenwood *et al.* 1990).

Sex and age are major demographic characteristics reported in the literature. Older workers are less likely to resume work, but the influence of gender in this aspect is unclear (Rossignol *et al.* 1988; Cheadle *et al.* 1994; Oleinick *et al.* 1996). While researchers find no differences, others report that males are less likely to resume work (Dasinger *et al.* 2000; McIntosh *et al.* 2000; Krause *et al.* 2001).

Significant injury characteristics include injury severity, medical care duration, and mental illness. Workers with less severe injuries and shorter medical care durations are more likely to resume work (Johnstone *et al.* 2003; Dasinger *et al.* 2000; Krause *et al.* 2001; Nieuwenhuijsen *et al.* 2004). However, research findings regarding mental illness and cognitive impairment are varied and inconsistent (Nieuwenhuijsen *et al.* 2004; Johnstone *et al.* 2003).

Finally, important occupational characteristics include time-of-injury

jobs and company size. Research findings on time-of-injury jobs are mixed. Certain studies verify that workers who engage in physically demanding jobs, such as construction work, are less likely to resume work (Mackenzie *et al.* 1998; Nieuwenhuijse *et al.* 2004), whereas others report no differences among jobs (Rossignol *et al.* 1988; Cheadle *et al.* 1994). Research findings regarding company size measured by employers or payroll tax are mixed. Krause *et al.* (2001) and Infante-Rivard and Lortie (1996) corroborated that workers at large companies are likely to resume work, whereas Oleinick *et al.* (1996) and Cheadle *et al.* (1994) affirmed no significant effect on work resumption.

However, no previous studies have distinguished policy effects by programs and occupational segments. As we had discussed, different rehabilitation service programs may affect work resumption differently by occupational segments because their incentive target groups may differ. This study adopts the tripartite occupational segmentation proposed by Gordon *et al.* (1982) and Waddoups and Assane (1993), such as independent primary, subordinate primary, and secondary jobs. The independent primary job segment is characterized by white-collar workers, competitive salaries, stable employment, internalized behavioral norms, and high autonomy, whereas the subordinate primary job segment is defined by skilled craft, relatively high wages, narrowly defined job classification, specific tasks, and institutionalized impersonal rules. The common employment-friendly labor environment defines these two occupational segments as the primary job segment. Meanwhile, the secondary job segment is characterized by poor working conditions, such as low wages, unstable employment, menial labor, and unwritten rules. Primary job segment employers may make an effort to retain workers' human capital (*e.g.*, experience, knowledge, skills) through job retention. Secondary job segment employers do not regard the capacity of their workers highly because they think anyone can do menial work (Boston 1990; Gordon *et al.* 1982; Waddoups and Assane 1993; Cui 2016).

Following the Korean Standard Occupational Classification, we first categorize worker time-of-injury jobs into five types, namely, management and office jobs, professionals, technical and mechanical handling posts, service and sales positions, and simple labor. Subsequently, on the basis of Gordon *et al.* (1982) and Waddoups and Assane (1993), we re-categorize the five types of jobs into three occupational segments, namely, independent primary (management

and office jobs and professionals), subordinate primary (technical and mechanical handling posts), and secondary (service and sales positions and simple labor).

### III. Data and Methods

We combine data from Workers' Compensation and Employment Insurance Administrative Database ("the Database") with data from the Korean Employment Survey for Workers with Occupational Disabilities ("the survey"), which cover all newly entitled workers with occupational disabilities status. We use demographic information, injury characteristics, and rehabilitation service experiences from the survey, whereas we obtain occupational characteristics and disabled worker's choices of return-to-work, such as work resumption, job change, self-employment, and unemployment, from the Database. Table 1 presents the definitions of these variables.

The survey was conducted from 2002 to 2011. However, the worker-level data of the survey are not publically available. In this study, we can use only the data of 2011, which were made available through our request for disclosure of this non-public data to the Korea Labor Welfare Corporation.

The worker injured by industrial accident is required to obtain a disability grade from the WCI within three years after the date of the termination of recuperation treatment by law. Hence, our data of the Survey in 2011 include workers who terminated recuperation treatment between 2008 and 2011. However, for the following two reasons, in our analysis, we include only the workers who ended recuperation treatment between April 27, 2010 and June 30, 2011. First, a policy change was implemented in the WRS grant in April 27, 2010, in which the eligibility of the WRS grant was extended from workers with the disability grades 1–9 to workers with grades 1–12. Second, six months are typically required for most workers with new entitlements to resume work.<sup>2</sup> In addition, we exclude non-regular workers, such as daily construction workers, and workers who could not return to their former jobs for exogenous reasons including the liquidation of former

<sup>2</sup>In 2011, 95.3 percent of the workers with occupational disabilities who returned to work found jobs within six months.

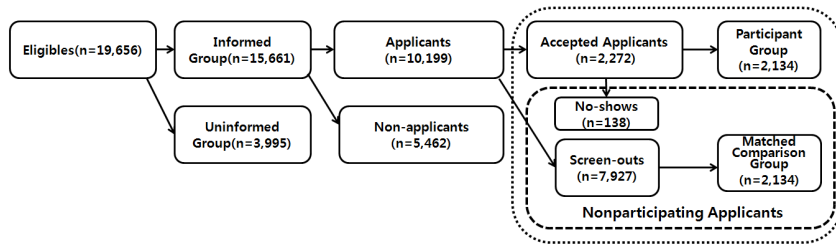
**TABLE 1**  
DEFINITION OF OBSERVABLE VARIABLES

Variables		Definition of variables
Alternatives	Return-to-work outcomes	Work resumption = 1, job change = 2, self-employment = 3, Unemployment is the outside alternative
Demographic characteristics	Age	Over 40s = 1, under 40s = 0
	Nationality and sex	Korean male = 1, the others = 0
Injury characteristics	Severity	Continuous variables (rate of loss of labor capacity)
	Medical care duration	Continuous variables (days)
	Mental illness	Disability part: neuropsychiatry = 1, the other part = 0
Occupational characteristics	Occupational segment	Management and office job = 1, professionals = 2, technical and mechanical handling post = 3, service and sales position = 4, simple labor = 5
	Company size	Continuous variables (number of full-time employees)
Rehabilitation service experiences	IRS participation	Participation experience = 1 No participation experience = 0
	WRS beneficiary	Beneficiary = 1 Otherwise = 0

employers.

We then use the internal comparison group and propensity score matching methods to control selection bias. Thereafter, we choose the IRS participation group (treatment group) and the matched comparison group (control group) (Figure 1).

Not all eligible workers affected by industrial accidents are informed about the IRS because the availability of the service is irregularly publicized and because the counselors of the initial consultation for the service are temporarily and randomly assigned. Informed workers who give positive responses in the initial consultation are categorized IRS applicants, whereas the rest are considered non-applicants. Approximately one-third of informed workers are non-applicants, and typical reasons for not applying include poor health, personal reasons, or

**FIGURE 1**

FLOW DIAGRAM FOR ANALYSIS SAMPLE

other plans.

In a typical empirical analysis, non-applicants are considered the control group, which may give rise to a self-selection problem. To avoid this, we construct the treatment and control groups among the applicants. Applicants who are admitted to and attend the programs are called “participants,” whereas applicants who were not admitted are called “screen-outs.” We believe that the admission of the applicants to the programs is exogenous based on in-depth interviews with eight rehabilitation counselors of Korea Workers’ Compensation and Welfare Service. Initially, applicants can be admitted only when the programs are available and the dates of the program offerings are exogenous as applicants depend on the availability of operating agencies (such as social welfare and vocational training centers) and the associated hospitals. Note that the locations of the operating agencies and the associated hospitals are important to the workers with occupational disabilities. The availability of the operating agency depends on the financial situation of Korea Workers’ Compensation and Welfare Service. In addition, even if the program is available, a minimum number of applicants is required for several programs, such as the psychotherapy and empowerment programs. Table 2 shows no significant differences in observable characteristics between participants and screen-outs.

In this study, we go further to exclude the self-selection problem. We matched participants with their nearest neighboring screen-outs using propensity scores based on individual characteristics, such as demographics, injury, and occupational characteristics. After propensity score matching, the difference between the treatment and control groups further decreased (see Tables 2 and 3).

To these matched data, we apply the mixed logit model to control for the unobservable characteristics of workers with occupational

**TABLE 2**  
COMPARISON OF PARTICIPANTS AND SCREEN-OUTS (BEFORE MATCHING)

Worker characteristics					Applicants		Test statistics
					Participant group ( $n_a = 2,134$ )	Screen-outs group ( $n_b = 7,927$ )	
Demographic characteristics	Age	40 to 65 years			76.5%	75.4%	$\chi^2 = .0^a$
		16 to 39 years			23.5%	24.6%	(d.f. = 1) <sup>b</sup>
	Sex	Male			78.0%	79.6%	$\chi^2 = 2.3$
		Female			22.0%	20.4%	(d.f. = 1)
Injury characteristics	Severity (rate of loss of labor capacity)	Mean (sd)			0.15 (0.15)	0.16 (0.16)	$t = -1.6^c$
	Medical care duration (days)	Mean (sd)			285.7 (464.1)	292.7 (503.4)	$t = -0.6$
	Mental illness	Mental illness			3.0%	3.5%	$\chi^2 = 1.6$
		Otherwise			97.0%	96.5%	(d.f. = 1)
Occupational characteristics	Occupational segment	Primary	Independent	Management and office job	11.2%	12.6%	$\chi^2 = 2.9$
				Professional	6.5%	7.1%	(d.f. = 4)
		Subordinate	Technical and mechanical handling post			51.1%	50.6%
	Secondary		Service and sales position			8.4%	8.7%
		Simple labor			22.8%	20.9%	
		Company size (number of employees)			Mean (sd)	629.2 (276.7)	633.5 (324.5)

<sup>a</sup> $\chi^2$  is Pearson's chi-square independence test statistic. No categorical difference is supported at the significance level of 0.01 in all tests in Table 2.

<sup>b</sup>d.f. indicates the degrees of freedom.

<sup>c</sup>t is the t ratio for testing equality of the means between groups. No mean difference is supported at the significance level of 0.1 in any of the tests in Table 2.



**TABLE 3**  
COMPARISON OF PARTICIPANTS AND MATCHED COMPARISON GROUPS (AFTER ONE TO ONE MATCHING)

Worker characteristics					Applicants		Test statistics
					Participant group ( <i>n</i> <sub>a</sub> = 2,134)	Matched comparison group ( <i>n</i> <sub>c</sub> = 2,134)	
Demographic characteristics	Age	40 to 65 years		76.5%	76.1%	$\chi^2 = 0.7^a$	
		16 to 39 years		23.5%	23.9%	(d.f. = 1) <sup>b</sup>	
	Sex	Male		78.0%	78.6%	$\chi^2 = 0.9$	
		Female		22.0%	22.4%	(d.f. = 1)	
Injury characteristics	Severity (rate of loss of labor capacity)	Mean (sd)		0.15 (0.15)	0.16 (0.16)	<i>t</i> = −0.6 <sup>c</sup>	
	Medical care duration (days)	Mean (sd)		285.7 (464.1)	289.2 (480.7)	<i>t</i> = −0.3	
	Mental illness	Mental illness		3.0%	3.2%	$\chi^2 = 1.1$	
		Otherwise		97.0%	96.8%	(d.f. = 1)	
Occupational characteristics	Occupational segment	Primary	Independent	Management and office job	11.2%	11.6%	$\chi^2 = 2.6$
				Professional	6.5%	6.4%	(d.f. = 4)
		Subordinate	Technical and mechanical handling post	51.1%	51.0%		
	Secondary		Service and sales position	8.4%	8.5%		
		Simple labor	22.8%	22.0%			
	Company size (number of employees)		Mean (s.d)	629.2 (276.7)	631.7 (285.1)	<i>t</i> = −0.3	

<sup>a</sup> $\chi^2$  is Pearson's chi-square independence test statistic. No categorical difference is supported at the significance level of 0.01 in all tests in Table 3.

<sup>b</sup>d.f. indicates the degrees of freedom.

<sup>c</sup>t is the t ratio for testing equality of the means between groups. No mean difference is supported at the significance level of 0.1 in any of the tests in Table 3.

disabilities. For instance, characteristics, such as a relationship with the former employer, might be important to work resumption but are not observed in our data. In the mixed logit model, we consider the interactions between individual characteristics (including unobservable characteristics) and the alternatives available to workers after receiving rehabilitation services.

Workers with occupational disability have four return-to-work alternatives, which are work resumption, job change, self-employment, and unemployment. Self-employment includes small shop or farm owners who hire more than one employee and unpaid family workers who work at least eight hours per week. We will consider unemployment as the outside alternative. In the mixed logit model, applicant  $i$ 's utility from alternative  $j$ , denoted by  $U_{ij}$ , is specified as follows:

$$U_{ij} = \delta_j + \sum_{k=1}^3 \sum_{r=1}^R D_k Z_{ir} \beta_{kr} + \sum_{k=1}^3 D_k V_{ik} \beta_k^u + \varepsilon_{ij}, \quad (1)$$

where  $\delta_j$  is the mean utility of alternative  $j$  (also called the “choice-specific effect”),  $D_k$  is a dummy variable equal to 1 if  $k = j$  and 0 otherwise,  $Z_{ir}$  is an observable characteristic of the applicant,  $V_{ik}$  is an unobservable characteristic of the applicant, and  $\varepsilon_{ij}$  is applicant  $i$ 's idiosyncratic taste for alternative  $j$ . For normalization, we assume that the mean utility level of the outside alternative is zero.

Let  $y_i = j$  if applicant  $i$  chooses  $j$ . Subsequently, in the mixed logit model, the choice probability of alternative  $j$  is calculated as follows:

$$\begin{aligned} \Pr(y_i = j \mid D, Z_i) \\ = \int \frac{\exp(\delta_j + \sum_{k=1}^3 \sum_{r=1}^R D_k Z_{ir} \beta_{kr} + \sum_{k=1}^3 D_k V_{ik} \beta_k^u)}{1 + \sum_j \exp(\delta_j + \sum_{k=1}^3 \sum_{r=1}^R D_k Z_{ir} \beta_{kr} + \sum_{k=1}^3 D_k V_{ik} \beta_k^u)} f(V_i) dV_i, \end{aligned} \quad (2)$$

where  $D = (D_1, D_2, D_3)'$ ,  $V_i = (V_{i1}, V_{i2}, V_{i3})'$ , and  $Z_i = (Z_{i1}, \dots, Z_{iR})'$ . Let  $\beta = (\beta_1, \dots, \beta_R)'$  and  $\delta = (\delta_1, \delta_2, \delta_3)'$ . Given that we have a sufficient number of applicant-level observations, we can obtain the consistent estimates of the  $\beta$  coefficients. In principle, the choice-specific effect ( $\delta_j$ ) can be further specified as a linear function of observable and unobservable characteristics and then estimated if we have a sufficient number of observations at the alternative level.

**TABLE 4**DESCRIPTIVE STATISTICS OF RETURN-TO-WORK OUTCOMES BY OCCUPATIONAL SEGMENT  
(Unit: n, %)

Occupational segments		Return-to-work outcomes				
		Total	Work resumption	Job change	Self- employment	Unemploy- ment
Primary job segment						
Independent	Management and office jobs	496 (100%)	288 (58.0%)	161 (32.5%)	16 (3.3%)	31 (6.2%)
	Professionals	286 (100%)	143 (50.1%)	94 (32.8%)	12 (4.2%)	37 (12.9%)
Subordinate	Technical and mechanical Handling posts	2,176 (100%)	878 (40.3%)	600 (27.6%)	153 (7.1%)	545 (25.0%)
Secondary job segment						
	Service and sales positions	358 (100%)	108 (30.3%)	83 (23.2%)	42 (11.8%)	125 (34.7%)
	Simple labor	952 (100%)	235 (24.7%)	219 (23.0%)	123 (12.9%)	375 (39.4%)
Total		4,268 (100%)	1,652 (38.7%)	1,157 (27.1%)	346 (8.1%)	1,113 (26.1%)

Assuming that unobservable characteristic  $V_i$  follows the multivariate normal distribution and is stochastically independent of observable characteristics, we can integrate function (2) numerically by simulation and then estimate parameters  $(\delta, \beta, \beta^u)$  that maximize the log likelihood function in (3):

$$\sum_i \sum_j I(y_i = j) \log(\Pr(y_i = j \mid D, Z_i)). \quad (3)$$

#### IV. Results

Prior to a full econometric analysis, we examine the work resumption outcomes by occupational segments (see Table 4) and by rehabilitation service experiences (see Table 5). Initially, we affirm that work resumption outcomes are varied across occupational segments. The primary job segment has substantially higher percentages of work resumption outcomes than the secondary job segment. The outcomes

**TABLE 5**  
DESCRIPTIVE STATISTICS OF RETURN-TO-WORK OUTCOMES BY REHABILITATION SERVICE CHARACTERISTICS

(Unit: n, %)

			Return-to-work outcomes				
			Total	Work resumption	Job change	Self- employment	Unemploy- ment
Rehabilitation Service experiences	IRS particip- ation	Yes	2,134 (100%)	1,035 (48.5%)	608 (28.5%)	175 (8.2%)	316 (14.8%)
		No	2,134 (100%)	617 (28.9%)	549 (25.7%)	171 (8.0%)	797 (37.3%)
	WRS beneficiary	Yes	1,379 (100%)	598 (43.4%)	359 (26.0%)	108 (7.8%)	314 (22.8%)
		No	2,889 (100%)	1,054 (36.5%)	798 (27.6%)	238 (8.2%)	799 (27.7%)

are different by rehabilitation service experiences. Here, participation in the rehabilitation services, especially IRS participation, increases the probability of work resumption.

To analyze the extent to which rehabilitation service experiences, such as the IRS and the WRS, affect work resumption by occupational segments, we conduct regression analysis in (3) for each of the five original occupational types to which the former job of the worker belongs. Table 6 shows the coefficient estimates of the interaction terms between worker characteristics and the alternative of work resumption for each of these five regressions.<sup>3</sup> The coefficients of these interaction terms indicate the change in the utility level of work resumption by occupational segments as the worker characteristic change. Hence, if the sign of the estimate is positive, then the worker with a high value for the characteristic has a high probability of work resumption in the segment.

<sup>3</sup> We do not report in Table 6 the estimates of the choice-specific effects nor the coefficients of interaction terms between worker characteristics and the alternatives for job change and self-employment because these occurrences are not our main concern. However, the coefficients of these interaction terms are estimated as follows. The participation in the IRS increases the probability of job change in the independent primary job segment. However, this increase is not as large as in the case of work resumption. Nonetheless, the WRS is not effective for job change nor self-employment.

**TABLE 6**  
EFFECT OF REHABILITATION SERVICES ON WORK RESUMPTION BY OCCUPATIONAL SEGMENTS

Interaction terms			Coefficient (standard error)				
Alternative	Worker characteristics		Primary job segment			Secondary job segment	
			Independent		Subordinate	Service and sales positions	Simple labor
			Management and office jobs	Professionals	Technical and mechanical handling posts		
Work resumption	Rehabilitation service experiences	IRS participation experience	<b>0.3011**</b> (0.0976)	<b>0.3455**</b> (0.1115)	<b>0.3967***</b> (0.1275)	0.0968 (0.2155)	0.0714 (0.0469)
		WRS beneficiary	0.0568 (0.1468)	0.0149 (0.4518)	<b>0.1137*</b> (0.0651)	<b>0.1638**</b> (0.0691)	<b>0.1995***</b> (0.0662)
	Demographic characteristics	age (40 to 65 years)	-0.0324 (0.1211)	<b>-0.2870**</b> (0.1556)	<b>-0.4682***</b> (0.0606)	-0.0922 (0.1487)	<b>-1.1085***</b> (0.3785)
		Sex	<b>0.5038***</b> (0.1506)	<b>0.4870**</b> (0.1984)	<b>0.2170***</b> (0.0649)	<b>0.3246**</b> (0.1371)	<b>-0.8603***</b> (0.2942)
	Injury characteristics	Severity	<b>-0.1142*</b> (0.0652)	<b>-0.1370*</b> (0.0744)	<b>-0.2219*</b> (0.0941)	<b>-0.0370***</b> (0.0094)	<b>-0.2472**</b> (0.1254)
		Medical care duration	<b>-0.0011***</b> (0.0002)	<b>-0.0006***</b> (0.0002)	<b>-0.0007***</b> (0.0001)	<b>-0.0013***</b> (0.0003)	<b>-0.0013***</b> (0.0002)
		Mental illness	<b>-0.4230**</b> (0.2114)	<b>-1.1636*</b> (0.5967)	<b>-0.6133***</b> (0.2346)	<b>-1.5645**</b> (0.6680)	<b>-0.7383*</b> (0.4093)
	Occupational characteristics	Company size	<b>0.00006***</b> (0.00002)	0.000007 (0.00001)	<b>0.00007***</b> (0.00001)	0.0001 (0.0001)	<b>-0.00005***</b> (0.00002)
	# of observations		495	286	2,176	359	952
	# of simulations				600		

\*\*\*  $p < 0.001$ . \*\*  $p < 0.005$ . \*  $p < 0.01$ .

Table 6 exhibits that IRS participation is likely to lead to work resumption in the primary job segment, whereas its effect is insignificant in the secondary job segment. Recall that the IRS aims to maintain and rebuild professionalism, skill, and physical and psychological ability through early intervention. Hence, the estimation results are consistent with Boston (1990), who confirmed that efforts to improve human capital, such as individual counseling and training, are important for employment performance in the primary job segment.

By contrast, Table 6 indicates that the WRS does not significantly promote work resumption in the independent primary job segment. In the independent primary job segment, wages are relatively high, and, thus, the fixed amount of the WRS is not substantial. However, the program has significant effects on the probability of work resumption in the subordinate primary and secondary job segments.

The interaction terms with demographic characteristics in Table 6 indicate that 40 to 65 year old workers have considerable difficulty resuming work, except in management and office jobs and in service and sales positions. In addition, male workers with disabilities have significant chances of work resumption, except for those workers in the simple labor segment. Regarding injury characteristics, injury severity has significantly negative impacts on the probability of work resumption in the subordinate primary and secondary job segments. Medical duration and mental illness have significantly negative effects across all occupational segments. Finally, regarding occupational characteristics, company size (measured as the number of full-time employees) has significantly positive effects on those working in management and office jobs and technical and mechanical handling positions but significantly has negative impacts on workers in the simple labor segment.

On the basis of the estimates, we further analyze how the marginal effects of rehabilitation services are varied according to the age and sex of the workers. Tables 7 and 8 present the calculations of the marginal effects of experiencing IRS and WRS by the four groups, which are 40 to 65 year old males, 40 to 65 year old females, 16 to 39 year old males, and 16 to 39 year old females. For these calculations, other worker characteristics are chosen if their values are among the top 25%, median, and bottom 25%. These two tables indicate that the marginal effects of the two types of rehabilitation services increase with the severity of injury, medical care duration, and mental illness in all four groups. Moreover, 40 to 65 year old females benefit most from these

**TABLE 7**  
MARGINAL EFFECT OF THE IRS ON THE PROBABILITY OF WORK RESUMPTION BY OCCUPATIONAL SEGMENTS

(Unit: %)

Group by age and sex	Independent primary job segment								Subordinate primary job segment			
	Management and office jobs				Professionals				Technical and mechanical handling posts			
	Male		Female		Male		Female		Male		Female	
	40–65 years	16–39 years	40–65 years	16–39 years	40–65 years	16–39 years	40–65 years	16–39 years	40–65 years	16–39 years	40–65 years	16–39 years
Injury severity												
Top 25%	9.76	9.53	13.89	13.58	14.28	11.64	19.38	16.30	25.93	19.88	28.74	22.63
Median	9.52	9.28	13.56	13.27	14.04	11.43	19.15	16.08	25.63	19.59	28.52	22.33
Bottom 25%	9.32	9.08	13.35	13.06	13.89	11.29	18.96	15.88	25.43	19.40	28.30	22.13
Medical care duration												
Top 25%	9.15	8.92	13.12	12.84	13.83	11.24	18.87	15.82	25.81	19.78	28.70	22.54
Median	8.49	8.28	12.30	12.03	13.33	10.79	18.30	15.27	25.01	19.02	27.86	21.74
Bottom 25%	8.13	7.92	11.84	11.57	13.04	10.55	17.96	14.97	24.56	18.60	27.39	21.29
Mental illness												
Mental illness	12.89	12.60	17.53	17.21	26.40	23.18	31.44	28.52	33.52	28.73	36.08	30.33
Otherwise	9.53	9.28	13.59	13.30	13.78	11.18	18.78	15.75	25.58	20.71	28.43	22.29

Note: The other worker characteristics are set to have the mean value in the calculations.

**TABLE 8**  
MARGINAL EFFECT OF THE WRS ON THE PROBABILITY OF WORK RESUMPTION BY OCCUPATIONAL SEGMENTS

(Unit: %)

	Subordinate primary job segment				Secondary job segment							
	Technical and mechanical handling posts				Service and sales positions				Simple labor			
	Male		Female		Male		Female		Male		Female	
Age	40–65	16–39	40–65	16–39	40–65	16–39	40–65	16–39	40–65	16–39	40–65	16–39
Injury severity												
Top 25%	7.50	5.93	8.20	6.02	14.72	13.46	15.06	13.83	17.44	11.21	12.68	6.46
Median	7.43	5.85	8.14	5.95	14.70	13.46	15.05	13.82	17.31	11.05	12.56	6.35
Bottom 25%	7.36	5.81	8.07	5.90	14.69	13.45	15.03	13.81	17.28	10.93	12.44	6.27
Medical care duration												
Top 25%	7.47	5.92	8.20	6.00	14.67	13.37	14.98	13.71	17.34	11.01	12.50	6.32
Median	7.26	5.71	7.98	5.81	14.26	12.88	14.57	13.27	16.70	10.32	11.80	5.79
Bottom 25%	7.16	5.60	7.86	5.71	14.01	12.61	14.36	13.00	16.41	9.94	11.39	5.51
Mental illness												
Mental illness	9.18	7.88	9.88	7.74	18.28	17.75	18.23	17.93	20.24	15.31	16.65	10.24
Otherwise	7.31	5.84	8.10	5.94	14.52	13.27	14.92	13.66	17.25	10.96	12.48	6.29

Note: The other worker characteristics are set to have the mean value in the calculations.



rehabilitation services, except in the simple labor jobs in which 40 to 65 year old males benefit most. Although, 40 to 65 year old females had work resumption disadvantages (see Table 6), the marginal effects of rehabilitation services on work resumption are greatest for that group of workers with occupational disabilities.

## V. Discussion and Conclusion

This study focuses on how experiences in rehabilitation services, such as the IRS and the WRS, affect work resumption according to occupational segments. The IRS emphasizes early intervention, counseling, and recovery of self-control through psychosocial therapy. The studies on early intervention rehabilitation report different effects for workers with disabilities. Certain workers show positive effects (Dasinger *et al.* 2000; Blackwell *et al.* 2003), whereas others (Greenwood *et al.* 1990) indicate little effects for coal miners with back pain. The empirical results of our paper affirm that the effects of the IRS differ across occupational segments. While the effect of the IRS on work resumption is significant for the primary job segment, it is not for the secondary job segment. In the primary job segment, expertise and skills are considerably important, requiring substantial training, experience, and investment in firm-specific human capital over the years. Work resumption is relatively easy in the primary job segment for workers with a strong will to do so. Hence, early intervention through the IRS is effective in the primary job segment. In the secondary job segment, however, human capital is less important, and the IRS is, thus, not effective in promoting work resumption.

The effect of the WRS is varied according to occupational segments. In the independent primary job segment, the average wage is relatively high, and the subsidy has little effect on work resumption. In the secondary and subordinate primary job segments, subsidy reduces the wage burden of employers and encourages the retention of workers with occupational disabilities. Our evidence confirms that the current WRS system should be re-designed, in which the subsidies are offered at a fixed amount, unrelated to the occupational segment or company size. Our results prove that the WRS policy should focus on the secondary and the subordinate primary job segments and be differentiated by company size and wage.

We affirm that the marginal effects of the rehabilitation services on

the probability of work resumption are significant for 40 to 65 year old females although these workers with occupational disabilities have work resumption disadvantages on average.

All these results confirm the necessity of well-targeted rehabilitation services differentiated by occupational segments, which could increase the odds that workers with occupational disabilities will remain in their time-of-injury jobs and improve their post-injury lives.

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