한국고용노사관계학회 발표논문 Brief

경제사회노동위원회 김명환 전문위원

□ 비정규직 고용이 인사담당자의 주관적 생산성 인식에 미치는 영향

○ 연구동기

- 한국정부는 비정규직보호법 제정, 공공부문 고용형태전환 등 정책적 노력을 기울이고 있음. 그럼에도 불구하고 왜 여전히 한국노동시장에서 이들의 비율이 여전히 높은 수준(34%~38%)을 유지 하는가?
- 비정규직 증가 원인은 기업의 비정규직 활용 동기와 밀접히 관련됨
- 본 연구는 비정규직 활용이 기업내부의 노동생산성에 대한 인식에 미치는 영향을 분석함으로써, 정부 규제에도 불구하고 비정규직을 지속적으로 활용하려는 기업의 선호 내지 동기를 분석함

○ 선행연구 동향

- 다수의 선행연구는 비정규직 고용의 경제적 이유에 초점을 두어 수익성, 매출액, 노동비용 등에 미치는 영향을 분석함
- 그러나 비정규직의 활용이 기업의 재무적 지표에 긍정적 또는 부정적 또는 절충적(역U자) 영향을 미치는지 여부에 대해 실증적으로 명확한 결론을 내리지는 못함
- 한편 조직행동과 관련하여, Weber(1991)는 각 행동이 결과의 성공 여부에 관계없이 내재적 가치에 대한 의식적인 믿음에 기반을 둔다는 Value rational basis of social behavior 개념을 소개했고, March and Simon (1993)은 특정 행동이 이미 상황에 존재하는 규칙의 결과라는 Logic of appropriateness 개념을 제시함
- 이러한 이론들에 따르면, 경제적·재무적 동기의 충족여부와 무관하게 기업 내부노동시장과 관련된 비경제적·사회적 요인도 인력구조 등의 결정에 영향을 미칠 수 있음(Osterman과 Burton, 2006).

○ 핵심 아이디어

- 연공급제 등 강한 내부노동시장을 특징으로 하는 한국의 경우, 비정

규직 증가이유를 분석할 때에 재무적·경제적 이유 뿐 만 아니라 조직 규범, 인식 및 관행 같은 비경제적 이유로 인해 형성된 선호(preference) 역시 고려할 필요가 있음

- 따라서 한국기업은 IMF 이후 비정규직 증가로 인해 형성된 내부노동시장의 가치관에 의해 실제 경영성과(재무적 지표)와는 무관하게 비정규직 활용에 대해 긍정적인 인식을 가지므로 강한 규제에도 불구하고 한국의 비정규직 비중은 여전히 높다는 가설이 제시될 수 있음

○ 데이터

- 사업체패널(WPS, surveyed from 2007 to 2013)*

  * 종속변수가 2013년도까지 격년으로 조사됨

○ 분석방법

- 핵심설명변수: 기업 내 전체 근로자 중 비정규직의 비중(IRR)
- 종속변수: 인사관리자의 주관적 노동생산성 인식(리커트 5점 척도법)

본 연구의 종속변수는 리커트 5점 척도법으로 측정된 인사관리자의 주관적 노동생산성 인식으로 순서형 이산변수(ordinal discrete variable)에 해당함. Ferrer-i-Carbonell and Frijiters (2004)와 Blanchflower and Oswald (2011)는 종속변수가 인식 또는 만족도일 경우, 선형 및 비선형(순서형) 분석방법을 상호 비교할 것을 제안함. 이에 선형분석방법인 OLS, Two-way panel linear models과 순서형 분석방법인 Cross-section ordered probit model, Panel ordered probit model의 결과를 상호 비교함

  * 종속변수의 설문항목은 '①Very low compared to identical industry', '②Low compared to identical industry', '③Similar to identical industry', '④High compared to identical industry', '⑤Very high compared to identical industry'임

- Panel probit model 중심의 인과효과 분석

여러 방법을 상호 비교하면서도, 종속변수가 순서형 이산변수라는 점을 고려하여 선형분석방법 보다는 순서형 분석방법인 순서형 포로빗 모형들에 초점을 맞추되,

관측되지 않은 이질성(unobserved heterogeneity)을 통제하기 위해 그 중에서도 Panel ordered probit model의 결과를 중심으로 인과효과를 분석함

○ 주요결과

- 분석결과, 종속변수가 순서형 이산변수인 점을 감안하여 활용된 Panel ordered probit model을 포함한 모든 선형 및 순서형 모형에서 기업 내 비정규직 구성비율이 높을수록 인사관리자는 자사의 노동생산성에 대한 긍정적인 인식을 가지는 것으로 분석됨
- 구체적으로 panel ordered probit model의 한계효과를 살펴보면, 비정규직 비율이 1% 증가할 때, '노동생산성이 매우 낮다', '노동생산성이 낮다', '노동생산성이 보통이다'의 응답확률은 음(-)이지만, '노동생산성이 높다', '노동생산성이 매우 높다'의 응답확률은 양(+)인 것으로 관찰됨
- 따라서 기업의 내부노동시장에서 비정규직 활용에 대한 긍정적인 인식이 확산되었기 때문에 정부의 지속적인 규제에도 불구하고 한국의 비정규직 비중은 여전히 높다는 본 연구의 문제의식이 어느 정도 타당함을 확인함

○ 시사점

- 본 연구에 따르면, 기업의 내부노동시장에서 비정규직에 대한 선호내지 긍정적 인식이 존재하므로, 비정규직의 과도한 사용을 억제하기 위한 다양한 법규와 정책에도 불구하고 한국의 비정규직 비율은 여전히 높음
- 최근 인천국제공항공사 정규직 전환을 둘러싼 노사 간 또는 노노 간 갈등에서도 확인할 수 있듯이, 한국의 비정규직 문제해결에 있어 비정규직보호법에 따른 차별 금지·공공부문 고용형태전환 등과 같은 정부의 직접규제나 고용의무부과로는 한계가 있음
- 따라서 기업 내부노동시장 구조 및 인식변화를 유도할 수 있는 포괄적인 정책대안이 요구된다고 할 수 있음

Effect of Irregular Worker Employment on Subjective Labor Productivity Perceptions of HR Managers

Myounhwa Kim*, Giseung Kim**

< Abstract >

We examine the reason the proportion of irregular workers is still high in the Korean labor market, despite various government regulations, by focusing on personnel managers' subjective perceptions of labor productivity, which is a non-economic reason. As a result of the analysis, in all of the cardinal or ordinal models, including the panel ordered probit model that considers the ordinal discrete dependent variable, a higher proportion of irregular workers in the workplace make it more likely that human resource (HR) managers positively recognize labor productivity. Thus, a comprehensive policy alternative is needed that includes ways to change the structure, perceptions, and practices of internal Korean labor markets that encourage irregular employment.

* Economic, Social & Labor Council
** Pusan National University, Department of Economics

Ⅰ. Introduction

Since the 1997 Asian financial crisis, the proportion of irregular workers in the Korean labor market has gradually increased and reached a maximum of 37% in 2004. The first reason to be mentioned for this high proportion of irregular workers is the employer's motivation to reduce labor costs. Under the mainstream career management practice in Korea, in which an employee works for a long time in a specific workplace and is promoted to a high-level position,[1] enterprises have been limited in the efficient utilization of labor given limited labor costs resulting from rising wages following promotions on the basis of seniority (Kim and Kim, 2013). Therefore, an easy explanation is that the proportion of irregular workers in the Korean labor market is high because firms in Korea have hired a number of such workers, who come with easy dismissal and relatively low wages, to mitigate the burden of labor costs (Kim, 2018).

Meanwhile, because irregular employment is characterized by low wages and employment instability, the Korean government has made multiple policy attempts to regulate the proliferation of irregular workers. A typical case is the Irregular Worker Protection Law enacted in 2007. Because this EPL imposes employer obligations to switch the employment form and prohibit discrimination against irregular workers, the possibility exists to limit the labor cost reduction function of irregular employment. In other words, increasing quasi-fixed labor costs, such as social insurance premiums, severance pay, and training costs resulting from employment form transition obligations, clearly reduce companies' motivation to utilize irregular employment for economic reasons (Nam and Park, 2010; Yoo and Kang, 2013; Kim and Kim, 2014).[2]

Note that despite the government's continued employment regulation on

1) This process is called seniority-based personnel management and is mainly observed in Korea's and Japan's labor markets.

2) A reduction in working conditions disparity by employment form due to discrimination prohibition against irregular workers is also predicted to occur with similar consequences.

irregular workers, the proportion of irregular workers of total wage workers is still high, at approximately 30%. This proportion even tends to increase again to 33% in 2018 and 36.4% in 2019. Why does this proportion in the Korean labor market maintain a high level despite continuous government restrictions?

Many previous studies analyzed the impact of the utilization of irregular workers on labor productivity, sales, and labor costs by focusing on economic reasons. However, no consistent empirical results were provided regarding whether a positive, negative, or eclectic causal relationship exists between the proportion of irregular workers and financial indicators (Matusik and Hill, 1998; Sung et al., 2009; Giannetti and Madia, 2013; Noh et al., 2015; Kim, 2018). Therefore, the high proportion of irregular workers in the Korean labor market cannot be explained solely by economic indicators.

A corporate organization is a social entity that adapts to various social and cultural environments, and the preferences and choices of the organization's members are closely related to the cultural environment surrounding the individual (DiMaggio and Powell, 1983). Therefore, decision makers can determine the composition of various employment forms in the direction required by the value and norms they believe are formed by the organization's environment regardless of actual performance (Kim, 2007). If so, perceptions, values, customs, organizational norms, and others on irregular workers formed in the internal labor market are also expected to significantly affect an increase in the irregular employment form. In other words, both financial indicators, such as sales and labor productivity, and non-economic or social indicators, such as preferences or subjective perceptions of irregular workers, can significantly affect the persistent employment of irregular workers.

From this point of view, this study focuses on the value and social perception of the internal labor market—unlike previous studies. Concretely, the possibility that HR managers' perceptions formed during the steady increase in irregular workers in the Korean labor market might have

affected these workers' continuous employment is expected. To do this, a hypothesis is developed that states that because internal decision makers who adjust employment are positively aware of irregular workers regardless of actual financial performance, the proportion of Korean irregular workers is still high despite the government's regulation. In other words, by analyzing the effect of the irregular worker's employment on the subjective labor productivity perceptions of HR managers, the intrinsic motivation of firms to maintain a high proportion of irregular workers despite government regulations is examined.

In this context, this study is conducted as follows. First, previous research is reviewed, and whether the effect of HR practices on irregular workers can be analyzed separately by being divided into financial performance and perceptions is examined. Next, after merging the Workplace Panel Survey (WPS) of 2007 to 2013, the effect of irregular worker utilization on the HR manager's labor productivity perceptions through various methodologies is analyzed. Concretely, the causal effect of the utilization of irregular employment as measured by the irregular worker rate (IRR) on the perception of productivity as measured by a five-point Likert scale is examined, unlike previous studies that used financial performance as a dependent variable. The empirical analysis is conducted using linear and ordered panel models considering the heterogeneity of cross-sectional observations and time series trends.

Ⅱ. Literature Reviews

The reason enterprises utilize the irregular employment form is the expectation that irregular workers positively affect economic performance, such as labor productivity, sales, labor costs, and others. Many previous studies also intensively analyzed the effect of irregular employment on an enterprise's financial performance. In contrast, criticisms have been raised

that the reason Korean companies that strongly maintained an internal labor market employ irregular workers cannot be explained by economic reasons alone (Hong, 2012). Previous studies argued that non-economic reasons, such as organizational norms, perceptions, and practices, should be considered together (Kim, 2007).

These two perspectives, which are related to the reason that irregular workers are employed, make us recognize that the following two mechanisms are reasonable. One mechanism is that employers employ irregular workers because their utilization positively affects companies' financial indicators. The other mechanism is that employers coordinate irregular workers' employment scale because irregular employment gives the HR department a subjective perception of employees' labor productivity.

Therefore, we review previous studies that analyzed the effect of irregular workers on the economic indicators of enterprises. Then, research methodologies utilized to analyze the effect of key independent variables on the subjective perceptions of the economic units in these previous studies are introduced.

1. Relationship between Irregular Employment and Economic Indicators

A number of studies performed empirical analyses of whether companies obtain economic benefits when employing irregular workers. However, consistent theories that explain the aggregate effect of irregular worker employment have yet to be established. Theories or empirical studies on the corporate performance effect show conflicting results (Kleinknecht et al., 1998; Becker, 2004) because irregular workers' employment provides both costs and benefits to employers.

First, theories and studies that argue a positive effect between irregular employment and corporate performance are reviewed. The theoretical background that supports the positive effects of hiring irregular workers is reflected in the learning theory. According to this point of view, the

knowledge that an organization accumulates is a source of a competitive advantage that other organizations cannot imitate. Therefore, the externalization of labor using the irregular employment form reduces costs and provides a good opportunity to introduce and shape new knowledge within the organization (Matusik and Hill, 1998).

In a similar vein, irregular workers newly entering from outside the organization stimulate a desire for change in existing employees and promote change and innovation throughout the organization (Storey et al., 2002). Concretely, Atkinson (1984) announced that if employers arrange regular workers in core positions of the organization and irregular workers in non-core tasks, labor utilization efficiency can be increased. Nayar and Willinger (2001) also presented that an increase in the irregular employment form reduced direct labor costs, such as wages, fringe benefits, and indirect labor costs including recruitment costs, employment costs, and training costs, among others, thus increasing the enterprise's cash flow. Matusik and Hill (1998) argued that irregular workers positively influence corporate profits because they provide specific knowledge and experience gained from their diverse working experiences.[3)]

Meanwhile, the results of the empirical analyses supporting these claims were also published. Valverde et al. (2000), who researched irregular employment in the manufacturing sector in 12 European countries, also announced that irregular workers' employment promoted corporate performance as measured using the proportion of total income to labor costs. Wong (2001), who conducted case studies of four foreign enterprises in Hong Kong, also argued that irregular workers' strategic utilization positively affects corporate performance.

Preceding research commonly claimed that employing irregular employment reduces a company's labor cost. When employing labor as regular workers, the labor cost is a fixed cost. However, when using

3) In addition, they stated that if all personnel types are directly employed, the burden of firms' personnel expenses is very high; therefore, outside professional labor is hired as an irregular employment form.

various employment forms, these personnel expenses are variable costs. When labor cost is a variable cost, enterprises can quickly respond to changes in the environment, and using irregular workers promotes corporate profits. Previous studies also argued that the influx of external labor through irregular employment can contribute to securing an organization's competitive advantage because it enables the organization to gain access to new expertise.

Second, other previous studies that reported that irregular employment negatively affects corporate performance pointed out that cost savings from the utilization of irregular workers is difficult to realize, and workers' motivation is low. According to social exchange theory, excessive employment of irregular workers forms an exchange relationship between low attraction and low contribution for organizations and employees. Such a low investment by an organization in its employees and the low contribution of an organization's employees have negative effects on corporate performance (Blau, 1964). Companies that employ irregular workers reduce their investment in human resources (Foote and Folta, 2002). Therefore, the employer has the obvious advantage of reducing costs when hiring irregular workers but must bear irregular workers' implicit costs, such as low productivity or high turnover rates. For labor cost reductions to increase an enterprise's profits, the decrease in productivity must be less than the decrease in labor costs. However, for this reason, employing irregular workers is likely to significantly reduce productivity than expected.

Giannetti and Madia (2013) focused on social exchange theory and pointed out that employing irregular workers causes high turnover rates, low capital investments, weakening of social relations within companies, and lowers corporate performance. According to Nollen (1996), employment flexibility reduces short-term labor costs. However, in the medium and long terms, irregular employment can negatively affect corporate performance because it likely reduces productivity because of lower motivation. In addition, Michie and Sheehan-Quinn (2002) reported that the

increase in irregular workers negatively affects productivity, profit rates, quality, and—especially—technological innovation, and reduces corporate performance.

Korean research that analyzed the effect of the utilization of irregular workers on companies' economic indicators was actively conducted. Kwon (2004) conducted an empirical analysis using exchange theory and concluded that irregular workers' employment increases the quantitative flexibility and reduces the proportion of labor costs, but negatively affects operating profits by increasing turnover and decreasing labor productivity. These analysis results were used to argue that to increase long-term profits, employers should minimize irregular worker employment or introduce a rational irregular labor management system. To control the endogeneity problem caused by unobserved heterogeneity, Sung et al. (2009) estimated the fixed effect model by constructing the WPS as panel data and then reported that labor costs, productivity, and profitability declined when the proportion of irregular workers is high. Moreover, Kim et al. (2014) analyzed the impact of the change in irregular employment on corporate performance by conducting random coefficient growth modeling using WPS. The study found that the increase in the proportion of irregular workers has a statistically significant effect on the decrease in net profits over time.[4)]

Similarly, few prior studies on Korea showed that irregular employment positively affects productivity and profitability, whereas a number of studies

4) In addition, additional domestic studies are as follows: Lee and Kim (2006) conducted OLS using WPS and reported that changes in the irregular employment proportion increase labor costs per capita and reduce labor productivity and net profit during the term, resulting in a negative effect on a company's profitability and productivity. According to Hong (2012), when the proportion of irregular workers increases by 1%, productivity significantly decreases by approximately 0.31%–0.42%. When the proportion of indirect employment increases by 1%, productivity decreases by approximately 0.75%–1.0% but is not statistically significant. He explained that irregular employment reduces labor costs, which are offset by declines in productivity, eliminating the impact on profits. Lee et al. (2013) analyzed the relationship between fixed-term employment and business performance by attempting a cross-sectional analysis and longitudinal section analysis. The results of the analyses showed that the utilization of fixed-term workers did not positively influence financial performance and did not improve organizational culture.

suggested that the impact of irregular worker employment is negative or not statistically significant (Kim, 2018).

Meanwhile, an eclectic argument on the relationship between irregular worker employment and management performance has been proposed. Empirical studies using this argument assume non-linear relationships between them. This eclectic approach is based on portfolio theory, which states that for an enterprise to adapt to a rapidly changing competitive environment, externalizing labor at an appropriate level is inevitable. That is, if the proportion of irregular workers in an organization increases to an appropriate level, the organization's efficiency increases but then decreases if the fit point is exceeded.[5] Concretely, Noh et al. (2015) conducted OLS and announced that irregular worker employment has an inverted U-shaped relationship with financial performance as measured in per capita operating profit. Similarly, Lee and Park (2017) conducted a random effect model by constructing balanced panel data using WPS and then argued that the proportions of both direct and indirect employment of irregular workers are inverted U-shape relationships with net profits. However, Kim (2018) opposed this eclectic relationship between irregular employment and corporate performance. To verify that the influence of the proportion of irregular workers on profitability is an inverted U-shape, he added a square term of the irregular employment rate as an explanatory variable, but its coefficient is not statistically significant.

Other studies analyzed the effect of irregular employment on corporate performance by dividing direct and indirect employment. Kim (2018) produced results of the analysis that divided the irregular employment form into direct and indirect employment, and then announced that the turnover rate is lowered and profitability is improved when irregular workers are converted into the regular employment form. Concretely, Kim (2018) argued that the labor cost and the turnover rate is lowered if direct irregular

5) This viewpoint shows that finding an appropriate level of labor externalization is important. The proportion of irregular workers who can achieve the highest performance is the maximum point of the inverted U-shape.

employment is converted into regular workers, and the profitability is increased if indirect irregular employment is converted into direct employed irregular workers. Kwon (2015) pointed out that indirect employment has a significant positive relationship with both financial performance and industrial accidents such that the impact of indirect employment on business performance is double-sidedness, whereas the effect of the percentage of direct employment on business performance is not statistically significant.

2. Organizational Motivation of Irregular Workers Employment not Based on Financial Indicators

As explained so far, many previous studies focused on whether or not employers actually achieved the purpose of irregular worker employment. However, both economic reasons and organizational motivation not based on financial indicators should be considered important reasons companies employ irregular workers (Osterman and Burton, 2006; Hong, 2012). In this regard, Weber (1922) introduced the concept of the value rational basis of social behavior, which means that each action is based on a conscious belief in intrinsic value regardless of the success of the outcome. March and Simon (1993) presented the notion of the logic of appropriateness, meaning that certain actions result from rules that already exist in the situation. These theories suggest that the actual financial performance of HR management practices on irregular workers and the subjective predictions or perceptions of personnel managers on the existence of that financial performance can be analyzed separately.

Thus, how HR managers perceive the impact on productivity when the proportion of irregular workers in the internal organization changes is important. In other words, if the personnel manager's productivity perception is positively shaped by values and social perceptions of the internal labor market formed by the expansion and routines of irregular worker employment, the percentage of irregular employment is predicted to

be maintained at higher than a certain level. In this regard, Osterman and Burton (2006) explained that economic factors and non-economic or social factors related to the internal labor market can affect the structure of the labor market, such as wages, employment, and workforce composition.

However, unlike the research topic of the relationship between irregular worker employment and economic performance, no previous study analyzed the effect of the percentage of irregular workers on the organization's perception of subjective labor productivity. Therefore, previous studies in which the dependent variable is the subjective perceptions of economic units are first reviewed. Although the subject of these previous studies is different from that of this study, their suggestions on the method of analysis helped establish this study's methodology and interpret the analysis results.

3. Methodologies Utilized to Analyze the Subjective Perceptions of Economic Units

In previous studies in which the dependent variables are an economic unit's subjective perception, OLS, the linear panel model, and the cross-sectional and panel ordered probit models (OPM) are primarily considered the main methodologies. Of these, OLS can be utilized as the simplest analysis methodology. Lee (2014) used OLS and reported that irregular workers' overall job satisfaction has respectively negative, positive, and positive effects on subjective perceptions measured on a five-point Likert scale in organizational commitment, overall life satisfaction, and current health. Generally, the linear panel model is evaluated by a more appropriate regression analysis method than the OLS because panel data are collected by repeatedly observing observations. Therefore, a model utilizing these data can reflect dynamic relationships and unobserved heterogeneity in the analysis. For example, Jung (2018) applied fixed effect model analysis—a kind of linear panel model—to the analysis of job satisfaction by employment form. His study showed that, in

worker groups with low degrees of major match, education levels, and required skills, job satisfaction measured on a five-point Likert scale is higher for regular workers than irregular workers. However, in a worker group in which these indicators are high, employment form does not affect job satisfaction. If the subjective satisfaction of an economic unit is used as a dependent variable, subjective perception is observed only in relative order and not at an absolute level; therefore, both OLS and linear panel models have limitations.

To control the heterogeneity between cross-sectional observations when considering the characteristic of ordinal variables, a number of previous studies analyzed the effect of independent variables on the subjective perception or satisfaction using ordered response models (Frey and Stutzer, 2000; Stutzer, 2004; D'Addio et al., 2007; Dorn, 2008). Moon (2013) conducted a panel OPM to analyze the factors that affect life satisfaction measured on a five-point Likert scale and then reported that regular workers' life satisfaction is statistically significantly higher than that of irregular workers.[6] Meanwhile, Ferrer-i-Carbonell and Frijiters (2004) and Blanchflower and Oswald (2011) proposed a comparison of continuous and ordinal analysis methods with each other to analyzed awareness or satisfaction. Therefore, the causal relationship related to subjective perception or satisfaction can be interpreted more appropriately by comparing the analysis results of OLS, the panel linear model, and cross-sectional and panel OPM as proposed in the previous studies that have been reviewed so far.

Ⅲ. Descriptive Statistics and Correlation Analysis

Labor-related data targeting individual enterprises include the KLIPS of the Korea Labor Institute and the Report on Labor Force Survey at

6) He concluded that the irregular employment form negatively affects life satisfaction and objective working conditions, such as wages.

Establishments (LFSE) of the Ministry of Employment. The LFSE is collected to provide the basic data needed to analyze employment trends and labor conditions on the demand side of the labor market and to develop policies. This survey covers 25,000 sampled establishments with one or more employees across all industries, excluding the agriculture, forestry, and fishing sectors; therefore, a wealth of data are collected. The LFSE contains the results of designated sample enterprises from the monthly survey on the number of workers, job openings, hires, separations, wages, and hours worked. Meanwhile, the WPS includes workplaces across the country with 30 or more employees, and the surveys are conducted using 3,400 workplaces sampled to represent workplaces in Korea through stratified sampling. Because this survey aims to systematically understand labor demand, employment structure, corporate HRM systems, and labor-management relations of Korea, it includes information on employment management and HRM through a follow-up survey on sample enterprises. Specifically, workforce and financial performance information are investigated as basic data of the workplace. Regarding personnel management, various questionnaire investigations are conducted for HR managers, labor relations managers, and employee representatives.[7)]

Similarly, the WPS contains more extensive surveys on the internal labor structure, management performance, and labor-related perceptions in the internal labor market relative to LFSE. Therefore, the WPS is used for the analysis. In this study, panel data are constructed using WPS surveyed every other year, from 2007 to 2013, because HR managers' subjective perceptions of labor productivity, which is used as a dependent variable, was only investigated until 2013. In this study, unbalanced panel data with time gaps[8)] are constructed using the four-year WPS data to include as

7) Questionnaires for HR managers include workplace characteristics, employment status and employment management, compensation and evaluation, HRM, and work organization, among others. Moreover, the structure and process of negotiations, management participation, labor-management council operations, business management participation, and others are surveyed as questionnaires for labor relations managers and employee representatives.

8) The panel data include a balanced panel in which each observation has data figures for

many observations as possible and to consider the variability of the variables.

The descriptive statistics of the dependent variable, which is the HR manager's subjective and relative perception of their workplace's labor productivity, are presented in Table 1 and are first reviewed. Dependent variables' questionnaire items—surveyed on a five-point Likert type scale—were as follows: ①Very low compared to identical industry, ②Low compared to identical industry, ③Similar to identical industry, ④High compared to identical industry, and ⑤Very high compared to identical industry. The survey results showed that the proportion of responses to questionnaire item ③ is the highest, at 68.32%. The response rates of questionnaire items ④ and ② are 21.94% and 7.45%, respectively. Meanwhile, the response rates of questionnaire items ① and ⑤ are 0.59% and 1.70%, respectively. The average value of the dependent variable is 3.167; therefore, HR managers are observed to have positive perceptions about their workplaces' labor productivity in broad outlines.

Table 1 Descriptive Statistics of Dependent Variable

	①Very low	②Low	③Similar	④High	⑤Very high
Frequency of responses	38	482	4,418	1,419	110
	(0.59)	(7.45)	(68.32)	(21.94)	(1.70)
Obs	6,467	Average	3.167	S.D	0.598

Source : Korea Labor Institute, 「Workplace Panel Survey」 in 2007, 2009, 2011 and 2013
Note: Rate of response are on parentheses

Table 2 shows the results of the descriptive statistics analysis on the mean and standard deviation of the key independent variable and the

the same period and an unbalanced panel with every period unobserved for each observation. In many cases, labor market surveys are unbalanced panels because of the attraction of individual workers or enterprises. Although the balanced panel has the advantage of homogeneity of observations, it has the disadvantage that the characteristics of all observations are not adequately reflected because of observations that have not participated in the survey in a specific year or newly added observations are excluded from the analysis.

control variables used. The proportion of irregular workers—the key independent variable in this study—is 19.0%.[9] It is measured as the proportion of irregular workers to the total number of paid employees. Here, irregular workers refer to fixed-term contract, part-time contract, dispatched, subcontractor/service provider, and special/independent contract workers, which are defined as the irregular employment form by the Korea Tripartite Commission in 2002.

In this study, control variables are classified into workplace characteristics-related variables, HRM and work organ-related variables, and main product market-related variables.

9) Percentages by year are, 20.9% in 2007, 17.4% in 2009, 20.0% in 2011, and 18.3% in 2013.

Table 2 Descriptive Statistics of Key Independent Variable and Control Variables

	Variable	Information	Obs	Average
Key independent variable	IRR	Percentage of irregular worker among all wage employers	6712	0.190 (0.469)
Workplace Characteristics related variables	Capital area	Whether the workplace is located in the capital area	7017	0.574 (0.495)
	Subcontracting arrangements	Whether to sign subcontracting arrangements	7017	0.275 (0.446)
	Turnover rate	Natural logarithm of turnover rate	7017	0.220 (0.444)
	Unionization rate	Trade union organization rate	7017	0.221 (0.326)
	State of industrial relations	①Very bad ②Bad ③Average ④Good ⑤Very good	7017	3.772 (0.642)
HRM & Work Organ related variables	Operation of HRM	①Base on individual performance ③Medium ⑤Base on teamwork	7017	3.141 (0.970)
	Quality of HRM about irregular worker	①Utilize as many irregular worker as possible ③Medium ⑤Utilize regular workers as much as possible	7017	3.946 (0.951)
	Focus of HRM	①Maximizing the short-term performance of workers ③Medium ⑤long-term development of workers	7017	3.547 (0.854)
	Whether HRM support the achievement of business	①Absolutely ②Yes ③Somewhat ④Not very much ⑤Not at all	7017	2.356 (0.665)
	Link between HRM and business strategy	①Absolutely ②Yes ③Somewhat ④Not very much ⑤Not at all	7017	2.555 (0.876)
	Multi-function training	Whether the firm provides multi-function training	7017	0.290 (0.454)
	Primary goal of HRM	①Savings on fixed labor costs ③Medium ⑤Employer loyalty to the enterprise	7017	3.454 (0.877)
	HRM about qualified person	①Recruit them from outside ③Medium ⑤Nurture them through long-term employment	7017	3.792 (0.831)
Main products market related variables	Market competition on main product	①Very intense ②Intense ③Average ④Not very intense ⑤Not at all intense	7017	2.164 (0.951)
	Price competitiveness on main product	①Much cheaper ②Cheaper ③Similar to competitor's price ④More expensive ⑤Much more expensive	6369	2.927 (0.563)
	Quality competitiveness on main product	①Much higher ②Higher ③Similar ④Lower ⑤Much lower	6474	3.680 (0.700)
	Market demand on main product	①Rapidly increasing ②Increasing ③Steady ④Declining ⑤Rapidly declining	7017	2.881 (0.952)

Source : Korea Labor Institute, 「Workplace Panel Survey」 in 2007, 2009, 2011 and 2013
Note: Standard deviation are on parentheses

First, workplace characteristics-related variables are capital area, subcontracting arrangements, turnover rate, unionization rate, and the state of industrial relations. Among them, the state of industrial relations is surveyed using a five-point Likert scale. Concretely, 57.4% of the observations are located in metropolitan areas, that is, Seoul, Gyeonggi, and Incheon, and 27.5% have subcontracts. The turnover and unionization rates are 0.22% and 22.1%, respectively, and the HR manager recognized that overall industrial relations are generally positive.

Second, HRM and work organ-related variables are HRM operations, HRM quality of the irregular worker, HRM focus, whether HRM supports the business's achievements, the link between HRM and the business strategy, multi-function training, primary HRM goal, and HRM for qualified persons. All other variables, except for multi-function training, are surveyed using a five-point Likert scale. Concretely, the HRM operations show that enterprises manage their labor using a balanced set of individual performance and teamwork. Regarding irregular workers, HRM quality and HRM focus indicate that companies emphasize long-term development than short-term performance improvements.

Meanwhile, regarding HRM's support of the business' achievements and links between HRM and the business strategy, HR departments' recognition of other department members and the degree of the linkage between personnel-related issues and business strategies were usually at a medium level on the whole. As observed in HRM about qualified people, firms tend to foster internally qualified people through long-term employment, and 29.0% of workplaces offer multi-function training and education. This finding indicates that the primary goal of HRM is to reinforce employee loyalty to the enterprise rather than to reduce fixed labor costs.

Third, the key product market-related variables are main product market competition, main product price competitiveness, main product quality competitiveness, and main product market demand. The main product market competition shows that these corporate products' domestic market competition is fierce. In addition, the surveyed companies perceived the

main product price competitiveness as medium and the quality of the competitiveness as positive. Meanwhile, the degree of recognition of the market demand for the main products is displayed at an intermediate level on the whole.

Before examining causal analysis models on the impact of IRR on subjective perceptions of labor productivity, a correlation analysis is conducted to examine the relevance of the variables used in regressions. Table 3 shows that the correlation coefficient of subjective perception on labor productivity and IRR, which did not control other variables, is 0.048, indicating a positive correlation between two variables. Similar to IRR, capital area, subcontracting arrangements, state of industrial relations, HRM operations, HRM quality about irregular workers, HRM focus, multi-function training, primary HRM goal, HRM about qualified persons, main product market competition, main product price competitiveness, and main product quality competitiveness are observed as variables that are positively correlated with HR managers' subjective perceptions of labor productivity. In contrast, turnover rate, unionization rate, whether HRM supports the business's achievements, the link between HRM and the business strategy, and main product market demand are negatively correlated with the subjective perceptions of labor productivity.

However, because Table 3 presents only numerical values that do not control other variables that can affect the dependent variable, the causal relationship between IRR and the HR manager's subjective perceptions of labor productivity must be analyzed using appropriate regression models.

Table 3 Results of Correlation Analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Subjective perceptions on labor productivity	1.000																		
IRR	0.048 (0.000)	1.000																	
Capital area	0.013 (0.302)	-0.003 (0.783)	1.000																
Subcontracting arrangements	0.021 (0.098)	0.026 (0.031)	0.020 (0.096)	1.000															
Turnover rate	-0.019 (0.135)	0.011 (0.379)	0.037 (0.002)	-0.001 (0.942)	1.000														
Unionization rate	-0.033 (0.008)	-0.020 (0.088)	-0.129 (0.000)	-0.036 (0.003)	-0.114 (0.000)	1.000													
State of industrial relations	0.183 (0.000)	0.004 (0.755)	-0.019 (0.108)	0.018 (0.136)	-0.048 (0.000)	0.045 (0.000)	1.000												
Operation of HRM	0.047 (0.000)	-0.024 (0.041)	-0.041 (0.001)	-0.030 (0.011)	-0.023 (0.052)	-0.010 (0.409)	0.053 (0.000)	1.000											
Quality of HRM about irregular worker	0.045 (0.000)	-0.130 (0.000)	0.059 (0.000)	0.031 (0.009)	-0.001 (0.917)	-0.015 (0.220)	0.155 (0.000)	0.103 (0.000)	1.000										
Focus of HRM	0.113 (0.000)	-0.005 (0.657)	0.003 (0.804)	-0.011 (0.379)	-0.047 (0.000)	0.022 (0.064)	0.143 (0.000)	0.378 (0.000)	0.275 (0.000)	1.000									
Whether HRM support the achievement of business	-0.140 (0.000)	-0.018 (0.133)	-0.034 (0.004)	-0.032 (0.008)	0.038 (0.002)	-0.084 (0.000)	-0.228 (0.000)	-0.062 (0.000)	-0.133 (0.000)	-0.199 (0.000)	1.000								
Link between HRM and business strategy	-0.120 (0.000)	-0.059 (0.000)	-0.071 (0.000)	-0.052 (0.000)	0.038 (0.001)	-0.098 (0.000)	-0.139 (0.000)	-0.057 (0.000)	-0.068 (0.000)	-0.163 (0.000)	0.525 (0.000)	1.000							
Multi-function training	0.098 (0.000)	0.034 (0.004)	-0.013 (0.280)	0.048 (0.000)	-0.040 (0.001)	0.073 (0.000)	0.095 (0.000)	0.021 (0.084)	-0.025 (0.038)	0.094 (0.000)	-0.224 (0.000)	-0.192 (0.000)	1.000						
Primary goal of HRM	0.099 (0.000)	-0.003 (0.836)	0.025 (0.037)	0.006 (0.624)	-0.048 (0.000)	0.042 (0.000)	0.152 (0.000)	0.209 (0.000)	0.214 (0.000)	0.342 (0.000)	-0.162 (0.000)	-0.179 (0.000)	0.074 (0.000)	1.000					
HRM about qualified person	0.076 (0.000)	0.009 (0.462)	0.035 (0.003)	0.016 (0.194)	-0.033 (0.006)	0.049 (0.000)	0.143 (0.000)	0.173 (0.000)	0.390 (0.000)	0.412 (0.000)	-0.182 (0.000)	-0.161 (0.000)	0.064 (0.000)	0.360 (0.000)	1.000				
Market competition on main product	0.020 (0.100)	-0.021 (0.083)	-0.057 (0.000)	-0.126 (0.000)	-0.038 (0.001)	0.106 (0.000)	-0.014 (0.251)	0.016 (0.188)	-0.021 (0.072)	0.008 (0.520)	0.070 (0.000)	0.090 (0.000)	0.022 (0.066)	0.059 (0.000)	0.024 (0.045)	1.000			
Price competitiveness on main product	0.018 (0.166)	-0.024 (0.055)	0.017 (0.166)	0.020 (0.110)	-0.002 (0.858)	-0.007 (0.565)	0.010 (0.442)	-0.023 (0.065)	0.039 (0.002)	0.006 (0.610)	0.009 (0.486)	0.014 (0.268)	-0.048 (0.000)	-0.011 (0.390)	-0.003 (0.835)	0.006 (0.650)	1.000		
Quality competitiveness on main product	0.263 (0.000)	-0.006 (0.631)	0.025 (0.042)	0.102 (0.000)	-0.033 (0.009)	-0.046 (0.000)	0.224 (0.000)	0.007 (0.598)	0.096 (0.000)	0.138 (0.000)	-0.160 (0.000)	-0.108 (0.000)	0.110 (0.000)	0.115 (0.000)	0.120 (0.000)	-0.066 (0.000)	0.047 (0.000)	1.000	
Market demand on main product	-0.126 (0.000)	-0.026 (0.030)	-0.041 (0.001)	0.025 (0.038)	0.039 (0.001)	0.074 (0.000)	-0.048 (0.000)	-0.052 (0.000)	-0.002 (0.876)	-0.085 (0.000)	0.084 (0.000)	0.106 (0.000)	-0.086 (0.000)	-0.081 (0.000)	-0.083 (0.000)	-0.041 (0.001)	0.080 (0.000	-0.131 (0.000)	1.000

Ⅳ. Methodology

Originally, binary response models were proposed for cases in which the dependent variable has a dual value,[10] and they have since been extended to cases in which the dependent variable has multiple values, such as the multinomial choice models, the ordered response models, and so on (Aitchison and Silvey, 1958; McKelvey and Zavoina, 1969). Of these, multinomial choice models are mainly utilized when the order of the select categories of the dependent variable do not have a specific meaning.[11] HR managers' subjective perceptions of labor productivity—a dependent variable of this study—is actually in the form of a continuous variable greater than zero, and respondents must select their preferences from five categories specified in the questionnaire items. In other words, this variable is not continuous but is ordinal. In such cases, linear estimation models such as OLS or linear panel models are not likely suitable for estimation (Lee, 2009). Specifically, when estimating the linear model using qualitative variables such as ordinal variables, the predicted value might be derived outside the range of the dependent variable, and the probability distribution of the dependent variable does not meet linear regression analysis assumptions. To solve these limitations of linear estimation or multinomial choice models, ordered response models that can be utilized when the dependent variable means an order was proposed (Stefan and Rainer, 2006).

The continuous latent utility, y_{it}^{*}, which determines the category of HR

10) The binary response model for estimating $\Pr(y_i = 1) = F(X, \beta)$, $\Pr(y_i = 0) = 1 - F(X, \beta)$ is classified into a linear probability model, a probit model, and a logit model. In the linear probability model, which is a method for estimating a linear function, the variance, $Var(u_i)$, of the residual varies with ; therefore, $F(X, \beta)$ might be greater than 1 or less than 0. Therefore, an analytical model with probabilities in the 0-1 range is required. Models that satisfy this are the non-linear probit and logit models.

11) For example, if the dependent variable is employment status, respondents' selection categories are presented as employment, unemployment, and non-economic activity. However, in this dependent variable, no particular meaning is given to the order of each selection category.

managers' subjective perceptions of labor productivity, is assumed to be represented by the following linear function:

$$y_{it}^{*} = X_{it}\beta + \lambda_{it}$$

Because y_{it}^{*} is a latent utility that is not observed, it is divided into intervals and is transformed into an observable dependent variable, y_{it}, and then the coefficients of the independent variables, β, and the threshold, θ_J, are estimated. Here, HR managers' subjective perceptions of labor productivity is determined by the absolute level y_{it}^{*}, but y_{it} is not ordinal because it represents the data observed through the HR manager's response. Depending on the threshold θ_J, y_{it} has a value from 1 to 5, and each value does not have the same interval and is shown only in the order of satisfaction.

$$\begin{aligned} y_{it} \quad & = 0, \quad \text{if } y_{it}^{*} \le \theta_0 \\ & = 1, \quad \text{if } \theta_0 < y_{it}^{*} \le \theta_1 \\ & = 2, \quad \text{if } \theta_1 < y_{it}^{*} \le \theta_2 \\ & = 3, \quad \text{if } \theta_2 < y_{it}^{*} \le \theta_3 \\ & = \cdots \\ & = J, \quad \text{if } \theta_{J-1} < y_{it}^{*} \le \theta_J \end{aligned}$$

Using the following estimators, the probability that each category[12] includes observation i can be calculated:

$$\begin{aligned} \mathrm{Prob}(y_{it} = J) \quad & = \mathrm{Prob}\,(\theta_{J-1} < y_{it}^{*} \le \theta_J) \\ & = \mathrm{Prob}\,(\theta_{J-1} < X_{it}\beta + \lambda_{it} \le \theta_J) \\ & = \mathrm{Prob}\,(\theta_{J-1} - X_{it}\beta < \lambda_{it} \le \theta_J - X_{it}\beta) \\ & = F(\theta_J - X_{it}\beta) - F(\theta_{J-1} - X_{it}\beta) \end{aligned}$$

12) Theoretically, θ_J ranges from $-\infty$ to $+\infty$.

where $F(\bullet)$ is the cumulative distribution of error term λ_{it}. Assuming a logit distribution on this error term, it is an ordered logit model. And, assuming a normal distribution, it is an ordered probit model. In general, the probit model is known to have the advantage of not being constrained by homoskedasticity assumptions relative to the logistic model (Lee et al., 2005); therefore, this study takes advantage of OPM.[13] Meanwhile, λ_{it} is assumed to be a one-way error component combines u_i and e_{it}, as follows:

$$\lambda_{it} = e_{it} + u_i$$

where u_i is the unobservable group-specific effect that does not change over time, and e_{it} is the remainder disturbance that varies with time and group following the Gauss-Markov theorem. Moreover, OPM basically assumes that u_i and the independent variables are independent, but no known way exists to test this assumption in advance; therefore, realistically concluding that both are independent of each other is not possible. Thus, the analysis is performed assuming that the heterogeneity of observations and independent variables are independent of each other, as in many previous studies (Eltinge and Sribney, 1996; Rabe-Hesketh et al., 2000).

Note that the estimated coefficients of OPM are not interpreted as variates of the dependent variable for a one-unit change in the independent variable, unlike the linear regression model. In other words, OPM empirical results do not show a marginal effect on y_{it} but a marginal effect on y_{it}^{*}; therefore, independent variables have a non-linear effect on y_{it}. The method for calculating this non-linear effect is to calculate the marginal effect using the marginal probability effect (Boes and Winkelmann, 2006). Specifically, when $\mathrm{Prob}(y_{it} = J)$ is subjected to the partial differentiation for

13) Because OPM estimates the threshold assuming a constant term of 0, the constant term estimates are not presented separately in the estimation results.

each independent variable, the marginal effect of each variable is expressed as follows:

$$\frac{dProb(y_{it}=J)}{dx_{it}} = \frac{d\Phi(\theta_J - X_{it}\beta)}{dx_{it}} - \frac{d\Phi(\theta_{J-1} - X_{it}\beta)}{dx_{it}}$$

$$= [\phi(\theta_{J-1} - X_{it}\beta) - \phi(\theta_J - X_{it}\beta)]\beta$$

where $\phi(\cdot)$ is the probability distribution that represents the first-order differential function of $\Phi(\cdot)$.

Now, an empirical analysis using these models is conducted as follows. First, the Hausman and LR tests are utilized to search for a suitable analysis model. However, because the test results of the model fit is not an absolute criterion, it is impossible to be convinced that the selected model is perfect (Johnston and Dinardo, 1997). Therefore, an analysis is performed using pooled OLS, the panel two-way fixed effect model, the panel two-way random effect model, cross-sectional OPM, and panel OPM. Then, a comparative analysis of the results estimated using these models is conducted. Second, an interpretation of the analysis results using percent changes is presented. Several methods exist to measure the marginal effects. The marginal probability effect in this study, as proposed by Boes and Winkelmann (2006), is used to calculate the marginal effects.

V. Empirical Results

In this study, to analyze the impact of IRR on the subjective perceptions of labor productivity, a causal relationship is estimated between the percentage of irregular workers in the workplace and the perception of labor productivity as recorded by questionnaire items established on a five-point Likert scale.

Table 4 provides the empirical analysis results of the pooled OLS and

panel linear models. Columns (3) and (4) show the results of the panel two-way fixed effect and panel two-way random effect models, respectively. Column (5) presents the results of the additional analysis using the panel group random effect and time fixed effect models. If the null hypothesis[14] is not rejected by the Hausman test—used to confirm which of the panel fixed effect or panel random effect models is the appropriate analysis method—then the panel two-way random effect model is more efficient and consistent. The test result shows that the null hypothesis is rejected at the 1% significance level because the P-value is less than 0.01. Therefore, the panel two-way fixed effect model is confirmed as providing a consistent estimator. However, because the test for model fit does not involve absolute criteria (Johnston and Dinardo, 1997), it is unclear that the model proposed through the Hausman test is complete. Accordingly, the analysis results of each linear estimation model presented in Table 4 are compared.

The sign of the statistically significant estimated coefficients is the same in all models for each dependent variable. Concretely, IRR, state of industrial relations, HRM operation, HRM focus, multi-function training, primary HRM goal, main product market competition, and main product quality competitiveness are found to positively affect the HR managers' subjective perceptions of labor productivity. In contrast, the unionization rate, whether HRM supports the business's achievements, the link between HRM and the business strategy, and main product market demand are observed to have a negative effect. However, methodologies utilized to derive the analysis results in Table 4-3 are mainly applied when the dependent variable is continuous.

14) $H_0 : cov(x, u_i) = 0$ and $cov(x, \mu_t) = 0$

Table 4 Estimations of Pooled OLS and Linear Panel Estimation Models

	Pooled OLS		Panel two-way fixed effect model		Panel two-way random effect model		Panel group random effect and the time fixed effect model	
IRR	0.054***	(0.016)	0.066***	(0.021)	0.053***	(0.001)	0.058***	(0.016)
Capital area	-0.003	(0.015)	-0.09	(0.149)	-0.013	(0.387)	-0.003	(0.017)
Subcontracting arrangements	-0.004	(0.016)	0.016	(0.023)	-0.006	(0.726)	0.001	(0.017)
Turnover rate	0.002	(0.018)	0.011	(0.021)	0.000	(0.995)	0.007	(0.017)
Unionization rate	-0.066***	(0.023)	-0.014	(0.082)	-0.076***	(0.002)	-0.060**	(0.026)
State of industrial relations	0.110***	(0.012)	0.117***	(0.016)	0.111***	(0.000)	0.110***	(0.012)
Operation of HRM	0.013	(0.008)	0.009	(0.010)	0.014*	(0.098)	0.011	(0.008)
Quality of HRM about irregular worker	-0.003	(0.009)	0.006	(0.011)	-0.003	(0.765)	-0.001	(0.008)
Focus of HRM	0.027***	(0.010)	0.008	(0.012)	0.027***	(0.009)	0.020**	(0.010)
Whether HRM support the achievement of business	-0.032**	(0.014)	-0.002	(0.016)	-0.031**	(0.021)	-0.023*	(0.013)
Link between HRM and business strategy	-0.032***	(0.010)	-0.025**	(0.012)	-0.033***	(0.001)	-0.032***	(0.010)
Multi-function training	0.051***	(0.017)	0.005	(0.021)	0.050***	(0.003)	0.043***	(0.017)
Primary goal of HRM	0.016*	(0.009)	0.018*	(0.011)	0.015*	(0.092)	0.017*	(0.009)
HRM about qualified person	-0.007	(0.010)	-0.009	(0.012)	-0.007	(0.504)	-0.006	(0.010)
Market competition on main product	0.034***	(0.009)	0.009	(0.012)	0.035***	(0.000)	0.030***	(0.009)
Price competitiveness on main product	0.015	(0.013)	0.004	(0.018)	0.016	(0.225)	0.010	(0.013)
Quality competitiveness on main product	0.177***	(0.011)	0.131***	(0.015)	0.179***	(0.000)	0.165***	(0.011)
Market demand on main product	-0.043***	(0.008)	-0.042***	(0.011)	-0.045***	(0.000)	-0.045***	(0.008)
Iyear_2009			-0.007	(0.020)			0.000	(0.019)
Iyear_2011			-0.011	(0.021)			-0.008	(0.019)
Iyear_2013			-0.006	(0.022)			-0.015	(0.019)
Cons	2.107***	(0.095)	2.334***	(0.155)	2.116***	(0.000)	2.170***	(0.097)
Sigma_u			0.434				0.235	
Sigma_e			0.504				0.504	
Rho			0.426				0.178	
R^2	R^2 = 0.108 $Adj R^2$ = 0.105		within = 0.060 between = 0.112 overall = 0.094				within = 0.057 between = 0.140 overall = 0.108	
Obs	6,095		6,095		6,095		6,095	

Source : Korea Labor Institute, 「Workplace Panel Survey」 in 2007, 2009, 2011 and 2013

Note: Standard error are on parentheses; *** , **, and * denote significant level at 10%, 5% and 1%

Table 5 shows the results of the empirical analysis of OPMs utilized, considering the fact that the dependent variable is an ordinal discrete variable. The first and second columns present the analysis results using cross-sectional and panel OPMs, respectively.

The significance of the estimation coefficient and the direction of the sign are similar to those of the pooled OLS and linear panel models. Concretely, IRR, state of industrial relations, HRM focus, multi-function training, primary HRM goal, main product market competition, and main product quality competitiveness appear to positively affect the HR manager's perception of subjective productivity. In contrast, the unionization rate, whether HRM supports the business's achievements, the link between HRM and the business strategy, and main product market demand are observed to negatively affect the dependent variable.

This study uses Ferrer-i-Carbonell and Frijters (2004) and Blanchflower and Oswald (2011), who proposed a comparison of continuous and ordinal analysis methods to analyze awareness or satisfaction, to introduce all estimates of continuous and ordinal analysis methods. Characteristically, when the magnitude of the estimated coefficients is compared for each model, the coefficients of the cross-sectional and panel OPM in Table 5 are generally larger than those of the pooled OLS and linear panel models in Table 4. The null hypothesis[10] was tested using the LR test to verify whether the panel OPM is suitable for use in this research. The test result showed that the null hypothesis is rejected at the 1% significance level because the P-value is less than 0.01; therefore, the panel OPM estimation is more appropriate than that of the cross-sectional OPM.

Although analysis models include several control variables, the most important independent variable in this study is IRR. In a cardinal analysis, the results for the IRR coefficients of the pooled OLS, panel two-way fixed effect, panel two-way random effect, panel group random effect, and the time fixed effect models are 0.054, 0.066, 0.053, and 0.058, respectively.

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10) $H_0 : \sigma_u = \sigma_\mu = 0$

Table 5 Estimations of Cross-section OPM and Panel OPM

	Cross-section OPM		Panel OPM	
IRR	0.112***	(0.032)	0.147***	(0.039)
Capital area	0.000	(0.031)	-0.002	(0.044)
Subcontracting arrangements	-0.008	(0.033)	0.000	(0.041)
Turnover rate	0.006	(0.035)	0.017	(0.041)
Unionization rate	-0.144***	(0.048)	-0.152**	(0.067)
State of industrial relations	0.229***	(0.025)	0.275***	(0.031)
Operation of HRM	0.027	(0.017)	0.027	(0.020)
Quality of HRM about irregular worker	-0.008	(0.018)	-0.004	(0.021)
Focus of HRM	0.056***	(0.021)	0.045*	(0.024)
Whether HRM support the achievement of business	-0.069**	(0.028)	-0.055*	(0.033)
Link between HRM and business strategy	-0.062***	(0.021)	-0.071***	(0.025)
Multi-function training	0.106***	(0.035)	0.100**	(0.041)
Primary goal of HRM	0.034*	(0.019)	0.043*	(0.022)
HRM about qualified person	-0.013	(0.022)	-0.016	(0.025)
Market competition on main product	0.071***	(0.018)	0.075***	(0.022)
Price competitiveness on main product	0.025	(0.026)	0.017	(0.032)
Quality competitiveness on main product	0.357***	(0.023)	0.392***	(0.028)
Market demand on main product	-0.090***	(0.016)	-0.113***	(0.020)
cut1	-0.526***	(0.203)	-0.777***	(0.245)
cut2	0.663***	(0.196)	0.630***	(0.237)
cut3	2.918***	(0.199)	3.311***	(0.241)
cut4	4.480***	(0.205)	5.168***	(0.251)
sigma2_u			0.414***	(0.038)
R^2	$Pseudo\,R^2$ = 0.063			
obs	6,095		6,095	

Source : Korea Labor Institute, 「Workplace Panel Survey」 in 2007, 2009, 2011 and 2013
Note: Standard error are on parentheses; *** , **, and * denote significant level at 10%, 5% and 1%

Moreover, in an ordinal analysis, the results of cross-sectional OPM and panel OPM are 0.112 and 0.147, respectively. Comprehensively, the same interpretation of the signs of the estimated coefficients was made from the panel two-way fixed effect model and panel OPM—appropriate analysis models in accordance with the Hausman and LR tests—but their magnitudes differed.

Note that unlike linear regression models, directly interpreting coefficients of OPMs as the variate of the dependent variable for a one-unit change in the independent variable cannot be done; therefore, the marginal effect must be estimated separately. Table 6 shows the calculated marginal effects of the independent and control variables. The change in

the probability of the response across IRR and all control variables is observed to be the largest in questionnaire item ④. From it, the sign of the marginal effect changes from minus to plus. As the percentage of irregular workers in the workplace increases by 1, the probability of responding to questionnaire items ①$(y=1)$, ②$(y=2)$ and ③$(y=3)$ decreases by 0.001, 0.014, and 0.023, respectively. However, the response probability for ④$(y=4)$ and ⑤$(y=5)$ increases by 0.035 and 0.002.

Table 6 Marginal Effect of Independent and Control Variables in Panel OPM

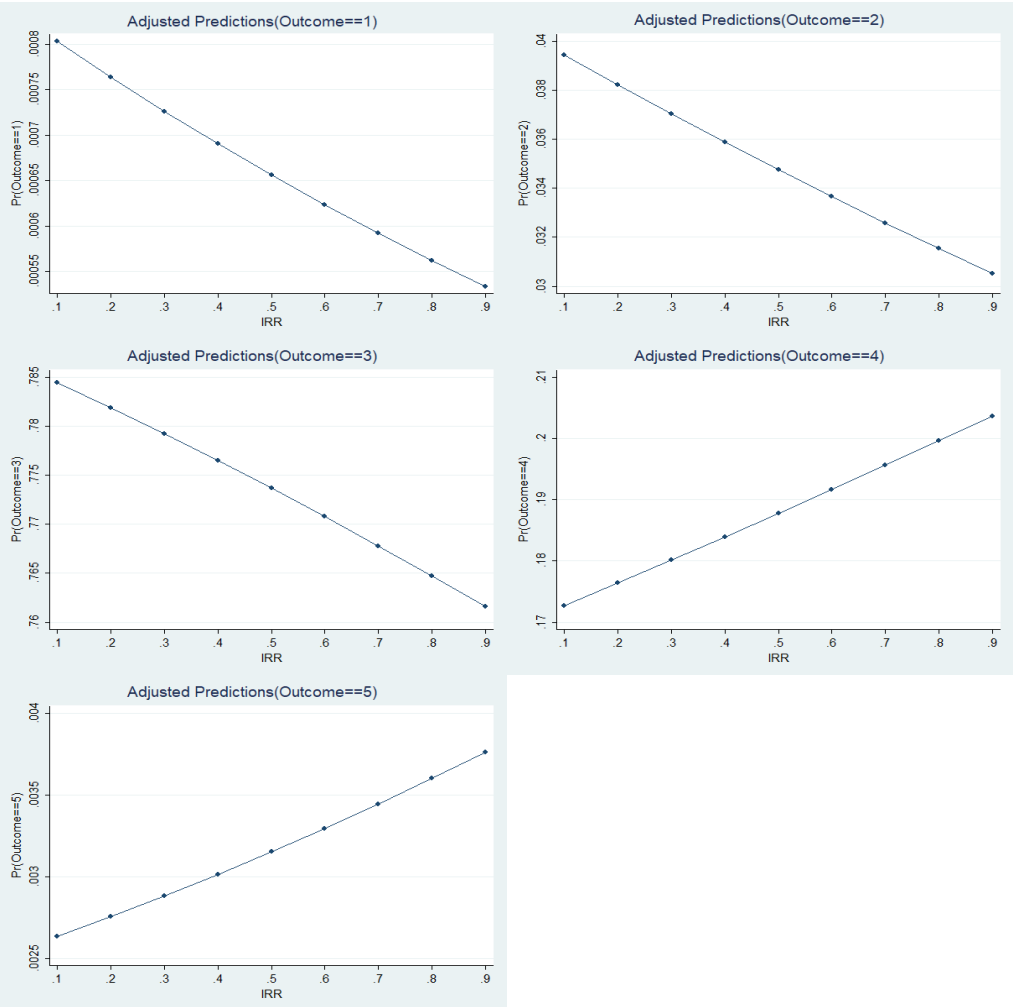
(unit: %)

	$\frac{dP(y=1\|x)}{dx}$		$\frac{dP(y=2\|x)}{dx}$		$\frac{dP(y=3\|x)}{dx}$		$\frac{dP(y=4\|x)}{dx}$		$\frac{dP(y=5\|x)}{dx}$	
IRR	-0.001	(0.000)	-0.014	(0.004)	-0.023	(0.006)	0.035	(0.009)	0.002	(0.001)
Capital area	0.000	(0.000)	0.000	(0.004)	0.000	(0.007)	0.000	(0.011)	0.000	(0.001)
Subcontracting arrangements	0.000	(0.000)	0.000	(0.004)	0.000	(0.006)	0.000	(0.010)	0.000	(0.001)
Turnover rate	0.000	(0.000)	-0.002	(0.004)	-0.003	(0.006)	0.004	(0.010)	0.000	(0.001)
Unionization rate	0.001	(0.000)	0.014	(0.006)	0.024	(0.010)	-0.037	(0.016)	-0.002	(0.001)
State of industrial relations	-0.001	(0.000)	-0.026	(0.003)	-0.043	(0.005)	0.066	(0.007)	0.004	(0.001)
Operation of HRM	0.000	(0.000)	-0.003	(0.002)	-0.004	(0.003)	0.007	(0.005)	0.000	(0.000)
Quality of HRM about irregular worker	0.000	(0.000)	0.000	(0.002)	0.001	(0.003)	-0.001	(0.005)	0.000	(0.000)
Focus of HRM	0.000	(0.000)	-0.004	(0.002)	-0.007	(0.004)	0.011	(0.006)	0.001	(0.000)
Whether HRM support the achievement of business	0.000	(0.000)	0.005	(0.003)	0.009	(0.005)	-0.013	(0.008)	-0.001	(0.000)
Link between HRM and business strategy	0.000	(0.000)	0.007	(0.002)	0.011	(0.004)	-0.017	(0.006)	-0.001	(0.000)
Multi-function training	-0.001	(0.000)	-0.010	(0.004)	-0.016	(0.006)	0.024	(0.010)	0.001	(0.001)
Primary goal of HRM	0.000	(0.000)	-0.004	(0.002)	-0.007	(0.003)	0.010	(0.005)	0.001	(0.000)
HRM about qualified person	0.000	(0.000)	0.001	(0.002)	0.002	(0.004)	-0.004	(0.006)	0.000	(0.000)
Market competition on main product	0.000	(0.000)	-0.007	(0.002)	-0.012	(0.003)	0.018	(0.005)	0.001	(0.000)
Price competitiveness on main product	0.000	(0.000)	-0.002	(0.003)	-0.003	(0.005)	0.004	(0.008)	0.000	(0.000)
Quality competitiveness on main product	-0.002	(0.000)	-0.037	(0.003)	-0.061	(0.005)	0.094	(0.007)	0.006	(0.001)
Market demand on main product	0.001	(0.000)	0.011	(0.002)	0.018	(0.003)	-0.027	(0.005)	-0.002	(0.000)

Source : Korea Labor Institute, 「Workplace Panel Survey」 in 2007, 2009, 2011 and 2013
Note: P-values are on parentheses

Meanwhile, Figure 1 shows that because negative marginal effects are observed for questionnaire items ①$(y=1)$, ②$(y=2)$ and ③$(y=3)$, the probability of selecting these questionnaire items decreases as the proportion of irregular workers increases. In contrast, because positive marginal effects are observed for ④$(y=4)$ and ⑤$(y=5)$, the probability of selecting these questionnaire items increases as the proportion of irregular workers increases.

Figure 1 Change in Probability of Selecting Each Questionnaire Item



Ⅵ. Conclusion

Since the 1997 Asian financial crisis, the proportion of irregular workers in Korea has increased continuously and has recently been maintained at 30%. In response, the government enacted the Irregular Worker Protection Law to solve problems of low-wage and unstable employment caused by the proliferation of irregular workers and promoted the conversion of the employment form in the public sector to regular workers.

However, despite such policy efforts, the proportion of irregular workers remains high in the Korean labor market. A number of previous studies analyzed the effect of irregular employment on labor productivity, sales, labor costs, and other factors by focusing on economic reasons. However, when analyzing the reasons for the increase in irregular workers in Korea, given the country's strong internal labor market, considering both economic and non-economic reasons is necessary, including organizational norms, perceptions, and practices. Therefore, this study presents a hypothesis that perception, customs, and norms in the internal labor market formed by the spread of the irregular employment form within the organization after the 1997 Asian financial crisis positively affected companies' perception of performance. In other words, if HR managers' subjective perceptions of irregular worker's labor productivity are positively shaped by the values and social perceptions of the internal labor market formed through the expansion and routine utilization of irregular workers, the scale of irregular employment is expected to be maintained above a certain level.

To test this hypothesis, an empirical analysis was conducted using various methodologies suggested by previous studies to examine the effect of the change in the proportion of the irregular worker on perceptions of subjective labor productivity. Concretely, workplace characteristics-related variables, HRM and work organ-related variables, and main product market-related variables are set as control variables of these models that affect the perception of labor productivity, along with IRR, a core

independent variable.

The main results of this study are as follows. First, the pooled OLS, panel two-way fixed effect, panel two-way random effect, panel group random effect, and time fixed effect models—which are panel linear models primarily utilized when the dependent variable is a continuous variable—showed that IRR positively affects the subjective perceptions of labor productivity. Second, these empirical analysis results are similarly presented for cross-sectional OPM and panel OPM, which are utilized when the dependent variable is an ordered discrete variable. However, the magnitude of the estimated coefficients is larger in ordinal analysis models than in linear panel models. Comprehensively, the estimated value of the panel two-way fixed effect model and panel OPM—determined to be appropriate analysis models in accordance with the Hausman and LR tests—have the same interpretation of the coefficients' signs even though their magnitudes differ. Thus, a higher proportion of irregular workers in the workplace makes it more likely that HR managers positively recognize labor productivity. These findings demonstrate the validity of the hypothesis that states that the perception, customs, and norms in the internal labor market formed by the spread of the irregular employment form within the organization after the 1997 Asian financial crisis had a positive effect on companies' perception of performance.

This study provides the following critical policy implications. Because the preference for irregular workers in the internal labor market has had a significant effect, the proportion of irregular workers in Korea remains high despite legislation and policies to restrain the excessive use of irregular workers. This phenomenon suggests that government regulations, such as no discrimination under the Irregular Worker Protection Law and the employment form transition to regular workers in the public sector, have limitations in solving the regular employment problem in Korea. Therefore, the need exists for comprehensive policy alternatives that include ways to change the structures, perceptions, and practices of Korean internal labor markets that encourage irregular worker employment.

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