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# Labor Market Reform and Wage Inequality in Korea

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# DEPARTMENT OF ECONOMICS

## Working Paper

### Labor market reform and wage inequality in Korea

by

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AMHERST**

# Labor market reform and wage inequality in Korea

Hyeon-Kyeong Kim\* and Peter Skott†

## Abstract

Temporary workers make up a sizeable part of the labor force in many countries and typically receive wages that are significantly lower than their permanent counterparts. This paper uses an efficiency wage model to explain the wage gap between temporary and permanent workers. High-performing temporary workers may gain promotion to permanent status, and a high wage to permanent workers therefore serves a dual purpose: it affects the effort of both permanent and temporary workers. Applying the model to the Korean experience, we discuss the effects of the labor market reforms in 1998 on inequality.

**Keywords:** Temporary workers, inequality, deregulation, efficiency wages, Korea.

**JEL Classification:** J31, D33

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# 1 Introduction

A large and growing literature discusses the causes of increasing Korean inequality. Offshoring, greater exposure to the global market, and skill-biased technological change have figured prominently in this discussion.<sup>1</sup> These factors may have contributed to increasing inequality, but legal and institutional changes can also influence both relative wages and relative employment. In this paper we focus on two changes: labor market reforms have reduced the employment protection for permanent workers and relaxed the constraints on the use of non-regular employment contracts. These reforms, we argue, may help account for the observed patterns of employment and wages.

Non-regular contracts can take several forms, including fixed-term contracts (the employment relationship is terminated automatically after the fixed term), part-time work (defined as less than 36 hours of weekly work), indirect employment (dispatched work and temporary agency work), independent contract work, on-call work/daily work, and tele-work/home-based work. The different forms of non-regular employment share a common feature: all non-regular workers typically hope to gain ‘permanent’ employment, that is, to get a standard, open-ended employment contract. Fixed-term workers make up the majority of the non-regular workers, and we shall use the term ‘temporary’ as a short-hand for the various non-regular contracts.

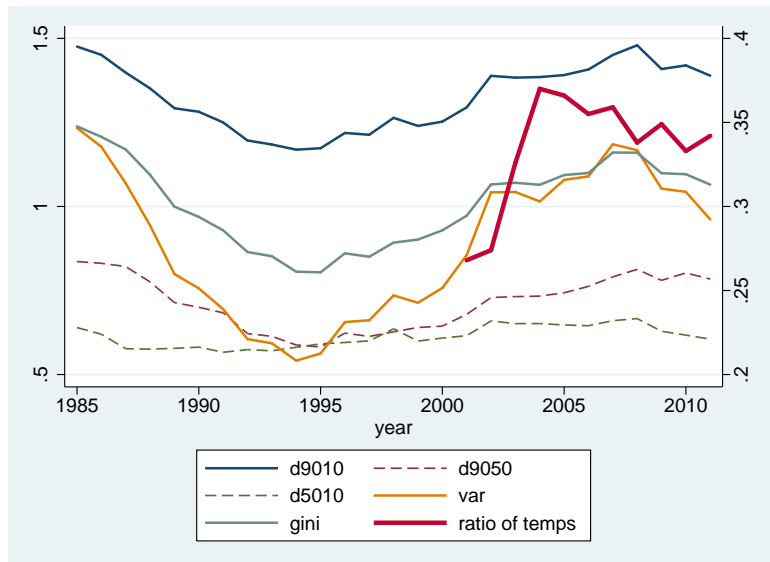
Temporary workers make up a sizeable part of the labor force in many countries and a substantial literature addresses different aspects of this phenomenon. European debates have focused mainly on the employment effects of temporary contracts (Cahuc and Postel-Vinay 2002). Employment effects have been less of a concern in Korea; official unemployment rates have been consistently low, averaging 3.4% over the period from 1990 to 2012 with peaks of 7% during the East Asian crisis in 1998 and 3.7% in the recent recession. In contrast to these modest fluctuations in unemployment, wage inequality shows a dramatic increase from the mid-1990s (see Figure 1). The increase

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<sup>1</sup>Ahn et al. (2007) point to offshoring to lower-income East Asian countries as a source of downward pressure on the demand for low-skill workers; Hur et al. (2005) and Jeong and Choi (2004) suggest that skill-biased technical change increased the wage for high-skill workers.

in inequality coincided with pronounced movements in the share of temporary workers: it rose by more than 10 percentage points from 2001 to 2004 followed by a decline of about 3.5 percentage points between 2004 and 2012 (Table 1). The wage premium for permanent workers was substantial throughout the period and increased slightly after 2008. The movements in relative wages after 2008 differ across different datasets; according to the Wage Structure Survey<sup>2</sup>, the relative wages has slightly increased; the EAPS supplement, by contrast suggests a decrease (Table 1). However, the broad picture is one of a stable wage premium.

Figure 1: Wage inequality and temporary employment in Korea



Note: The five distributional measures are the Gini coefficient, the variance in log hourly wages, and log wage differentials between 90th and 10th (d9010), between 90th and 50th (d9050), and between 50th and 10th (d5010) percentile. The distributional statistics are computed using the Wage Structure Survey (WSS) 1985-2012. For calculating the share of temporary workers, the EAPS supplement 2001-12 are used.

While clearly not conclusive, these simple patterns suggest that changes in the prevalence of temporary contracts could help explain the rise in equality; this hypoth-

<sup>2</sup>The survey has information about wages, but they have different definitions of temporary workers.

Table 1: The share of temporary workers and the relative wages

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
$L_T/(L_T + L_P)(\%)$	26.8	27.4	32.6	37.0	36.6	35.5	35.9	33.8	34.9	33.3	34.2	33.3
$w_T/w_P(\%)$	72.6	75.5	69.0	71.9	69.6	71.5	72.3	69.4	63.6	65.6	68.2	68.7

Source: The EAPS supplement 2001-2012

esis gains support from the results in Kim (2014). Controlling for worker characteristics as well as changes in sectoral composition, Kim’s decomposition shows that, depending on the precise method of decomposition, the rising share of temporary workers can account for 20-30 percent of the growth in inequality between 2001 and 2005.

The rise in temporary employment may be the result of labor market reforms, but this explanation leaves several puzzles. A 50 percent rise in the employment ratio  $L_T/L_P$  was accompanied by a relative wage  $w_T/w_P$  that was virtually the same in 2001 and 2004. This pattern could be explained by assuming that temporary and permanent workers are close substitutes but differ in terms of productivity, with permanent workers being more productive. Anecdotal evidence, however, suggests that temporary workers do not have a lower productivity (see below). More importantly, the explanation is at odds with the findings that temporary workers tend to receive a lower pay after controlling for worker and job characteristics (Ahn 2004). And if the two groups are close substitutes and equally productive, why do permanent workers receive a large wage premium? Korean firms may face constraints that prevent them from using temporary contracts, but no legal or institutional constraints compel firms to offer their permanent workers a large wage premium. The presence of powerful unions could have explained the wage premium but Korean unions are not powerful; they have at times been militant, but the union density is very low.

In this paper we show how a wage gap between temporary and permanent workers can be explained using an efficiency wage model. Temporary workers have a chance to become permanent, and this possibility – combined with the existence of an employment rent for permanent workers – gives temporary workers an incentive to work hard.

Empirically, the transition rate from temporary to permanent is significant: on average about 23 percent of temporary workers are promoted to permanent status after one year (EAPS supplement 2003-07). Thus, a high wage to permanent workers serves a dual purpose: it affects the effort of both permanent and temporary workers. Taking into account legal and institutional constraints on the use of temporary workers and on firms' ability to dismiss permanent workers, an efficiency model along these lines can be used to shed light on some of the effects of the Korean reforms.

Institutional constraints can take a variety of forms. In Korea some job categories cannot be filled with temporary agency workers. Other constraints come in the form of limits on the possibility to roll over temporary contracts. The ability of firms to dismiss permanent workers is curtailed by restrictions, too; some of these restrictions affect the average termination rate (but not the determination of who gets dismissed); others restrict the ability of the firm to single out low performance workers.<sup>3</sup> The specific Korean reforms and their implications for the parameters of the model will be discussed in section 3. But the key element in our argument is both simple and intuitive, however: temporary workers may be motivated by the prospect of promotion to permanent status. This argument is supported by a variety of studies.

Lautsch (2002) presents evidence for two Boston-based companies, Polaroid and Sarco, for the period 1996-97. The study describes four management systems for contingent work. Each of the four systems has distinct labor practices, including wage rules and career ladders. The use of temporary workers in Polaroid Digital Products exemplifies our argument. At Polaroid, temporary and permanent workers worked side-by-side in the same occupations. Despite their temporary status the temporary workers performed at least as well as permanent workers in the same jobs. The prospect of a permanent position motivated them to work hard: a survey showed that 75% of

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<sup>3</sup>Restrictions of this kind are analogous to the restrictions that follow from an inability to monitor the performance of individual workers. Thus, the effects of a relaxation of firing constraints can be similar to those of 'power-biased technical change' (Skott and Guy 2007, 2013). From this perspective the Korean reforms involve 'power-biased institutional change'.

the temporary workers accepted a temporary position hoping to gain promotion to permanent status if they performed well. This hope was justified: the best-performing temporary workers (roughly the top 20%) were in fact rewarded by getting permanent employment.

Engellandt and Riphahn (2005) show that Swiss employees with a fixed-term contract do significantly more overtime work and are less absent than those with an open-ended contract. They interpret this finding as signaling behavior from temporary workers who want to get a permanent position. Booth et al. (2002) and Givord and Wilner (2009) reach similar conclusions using U.K. and French data. Givord and Wilner find that the transition rate from temporary employment to a permanent position is slightly higher when workers perform overtime work; Booth et al. conclude that high effort among temporary workers is positively correlated with the probability of career advancement.

At a more anecdotal level, there is significant evidence that workers see low paid, temporary positions as a possible route to a permanent job. An interview with a Korean temporary worker – Miss Kim, 27 – in E-daily News, August 2, 2011, provides an example. Miss Kim started to work in a public business as an intern in 2009. According to the interview, she expected to transition to a permanent position if she worked harder than existing permanent workers; because of this expectation, she accepted a very low wage. The willingness of both students and non-students in many countries to accept unpaid internships can be explained along similar lines (although in principle internships are supposed to include a strong educational component for the benefit of the intern).

The model in section 2 presents a simple formalization of wage setting in a labor market with temporary and permanent workers. Section 3 discusses the application of the model to the Korean labor market reforms after the 1997 crisis. To be clear, the model – like any stylized model – leaves out many features that may have influenced inequality. Thus, there is no claim that the model fully explains the rise in Korean wage inequality. The aim is more modest: to highlight a particular mechanism that



may have played a part. Section 4 concludes.

## 2 The model

Temporary and permanent workers are not always identical in terms of qualifications, and they sometimes perform different tasks. Any such differences may clearly help account for differences in pay. In many cases, however, permanent and temporary workers receive different wages even though they seem to perform the same tasks and have equivalent skills. The model focuses on these cases: we assume that all workers are identical with respect to qualifications and that they are perfect substitutes in production. Disregarding non-labor inputs, the output of the representative firm is given by

$$Y = F(e_P L_P + e_T L_T) \quad (1)$$

where  $L_i$  denotes the number of workers with  $i$ -type contract and  $e_i$  is the workers' effort. The model is set in discrete time. Workers are hired at the beginning of a period and cannot be fired until the end. We assume that workers cannot move directly from unemployment to a permanent job; all permanent workers achieve their status by being promoted from a temporary position.

**Temporary workers** Temporary workers work for one period; at the end of this period they are either dismissed or promoted to the status of permanent worker. They choose the level of effort to maximize the expected value of the stream of future utility:<sup>4</sup>

$$\max_{e_T} V_T = w_T - v(e_T) + \beta[p(e_T)V_P + (1 - p(e_T))\bar{u}] \quad (2)$$

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<sup>4</sup>Dismissed workers either become unemployed or get a temporary contract at another firm. In equilibrium the value of these two states will be equal (see below). Thus, the expression in (2) covers the possibility that dismissed temporary workers move to another temporary position.

where  $w_T$  is the wage rate for temporary workers,  $v(e_T)$  the disutility associated with the effort  $e_T$ , and  $\beta$  the discount factor;  $\bar{u}$ ,  $V_T$  and  $V_P$  denote the expected present value of future utility streams for an unemployed worker, a temporary worker and a permanent worker, respectively;  $p(e_T)$  is the probability that a temporary worker gains permanent status at the end of the contact period. The solution to the maximization problem (2) satisfies the first order condition

$$v' = \beta p'[V_P - \bar{u}] \quad (3)$$

Consider the two functions  $p(e_T)$  and  $v(e_T)$ . Given the permanent-worker wage premium, the incentives for temporary workers are stronger, the higher is the sensitivity of promotion to effort. The ability of firms to link promotion to effort is constrained, however, by the monitoring technology which determines the sensitivity of observed performance to variations in actual performance (effort). It seems reasonable to suppose that a firm's ability to distinguish between the effort of two workers will depend on the ratio of their productivity. Using a simple specification with this property, we assume the  $p(e_T)$  is log linear (with a ceiling at 1 and a floor at zero):

$$p(e_T) = \min\{\max\{0, \bar{p} + \lambda \log \frac{e_T}{\bar{e}_T}\}, 1\} \quad (4)$$

where  $\bar{e}_T$  the average effort of the firm's temporary workers. The value of  $\lambda$  is taken to be determined by the available monitoring technology; the value of  $\bar{p}$ , which bears no necessary relation to monitoring, determines the average rate of promotion. Turning to the disutility of effort,  $v(e_T)$  is taken to be strictly increasing and convex. Using a standard functional form, let

$$v(e_T) = e_T^\gamma, \quad \gamma > 1 \quad (5)$$

Given the functional forms in (4) and (5), the first order condition (3) implies that

$$e_T = \left[ \frac{\beta \lambda}{\gamma} (V_P - \bar{u}) \right]^{\frac{1}{\gamma}} \quad (6)$$

As indicated by equation (6), temporary workers' optimal effort is independent of the temporary wage but increasing as a function of  $V_P$ , the value function for permanent workers. These properties of equation (6) are quite intuitive (and do not depend on the specific functional forms in (4)-(5)). Temporary workers cannot be fired during the period and are either dismissed at the end of the period or promoted to permanent status. Their wage rate in the temporary job therefore has no incentive effects; it is the prospect of promotion to a permanent position that provides the incentives for temporary workers to put in effort. Because the temporary wage plays no role in the effort decision, employers will want to set it as low as possible; that is, the participation constraint must be binding:

$$V_T = \bar{u} \quad (7)$$

The participation constraint determines the wage  $w_T$ . By assumption unemployed workers never move directly to a permanent job; the only way to get a permanent job is through promotion from a temporary position.<sup>5</sup> Using (2) and (4)-(7), we get an expression for  $w_T$  :

$$\begin{aligned} w_T &= \beta \left( \frac{\lambda}{\gamma} - \bar{p} \right) [V_P - \bar{u}] + (1 - \beta) \bar{u} \\ &= \beta \left( \frac{\lambda}{\gamma} - \bar{p} \right) V_P + \left[ 1 - \beta \left( 1 - \bar{p} + \frac{\lambda}{\gamma} \right) \right] \bar{u} \end{aligned} \quad (8)$$

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<sup>5</sup>This assumption implies that

$$\begin{aligned} \bar{u} &= w_U + \beta(\delta \bar{u} + (1 - \delta)V_T) \\ &= w_U + \beta \bar{u} \end{aligned}$$

where  $w_U$  is the flow utility from being unemployed and where the second equality follows from the determination of  $w_T$  by the participation constraint,  $V_T = \bar{u}$ . Thus,

$$\bar{u} = \frac{w_U}{1 - \beta}$$

The value of  $w_U$  is taken as exogenous; it may reflect a range of factors, including income opportunities in informal subsistence sectors and the level of unemployment benefits.

It follows from (8) that  $w_T$  is increasing in  $\lambda$  but decreasing in  $p$ . An increase in  $\lambda$  (in firms' monitoring ability) generates a rise in effort; with a given promotion rate a compensating increase in  $w_T$  is needed to satisfy the participation constraint. Higher promotion rates, conversely, raise the present value of expected future utility flows, allowing a reduction in the current wage without violation of the participation constraint. Changes in  $V_P$ ,  $\beta$  and  $\bar{u}$  have ambiguous effects. An increase in  $V_P$  reduces the required value of  $w_T$  for any given effort. But effort is not given: the increase in  $V_P$  provides an incentive for temporary workers to raise effort, with negative effects on the utility flow  $w_T - v(e_T)$ ; if this incentive is strong enough (the value of  $\lambda$  is sufficiently high), a rise in  $w_T$  may be needed to satisfy the participation constraint. Analogously, increases in  $\bar{u}$  or decreases in  $\beta$  tighten the participation constraint, given  $V_P$ , and therefore raise  $w_T$  for any given effort; induced reductions in effort may offset this effect if  $\lambda$  is high.

**Permanent workers** Turning to the determination of  $V_P$ , the expected present value of future utility streams for a worker in a permanent job is given by

$$V_P = w_P - v(e_P) + \beta(\alpha(e_P)V_P + (1 - \alpha(e_P))\bar{u}) \quad (9)$$

where  $w_P$ ,  $v(e_P)$  and  $\alpha(e_P)$  denote the wage, the worker's disutility of effort, and the probability that the worker continues in the job in the following period. The sensitivity of a permanent worker's continuation probability to variations in her effort will reflect a combination of institutional constraints on the dismissal of low-performing workers and technical constraints on the ability of firms to monitor the performance of individual workers. These constraints reduce – but do not eliminate – the effect of effort on the individual worker's risk of dismissal, that is,  $\alpha'(e_P) > 0$ .

The value function can be written, alternatively, as

$$\begin{aligned}
V_P &= E\left[\sum_0^{T-1}(w_P - v(e_P))\beta^t + \beta^T \bar{u}\right] \\
&= \bar{u} + [w_P - v - (1 - \beta)\bar{u}]s
\end{aligned} \tag{10}$$

where  $E$  is the expectations operator,  $T$  is the time of job loss and  $s = \frac{1}{1-\beta\alpha}$  can be interpreted as the discounted expected duration of the permanent job.<sup>6</sup> Permanent workers choose the level of effort to maximize the value function. In a steady state (with constant values of  $w_p$  and  $\bar{u}$ ) the first order condition implies that

$$v's = [w_P - v(e_P) - (1 - \beta)\bar{u}]s' \tag{11}$$

As in the specification of temporary workers' probability of promotion, we assume that  $\alpha$  and thereby  $s$  depends on the ratio of the worker's own effort to the average effort  $\bar{e}_P$ . Using a log-linear formulation,

$$\log s = \bar{s} + \mu \log \frac{e_P}{\bar{e}_P} \tag{12}$$

Equation (12) implies that

$$\frac{s'}{s} = \mu \frac{1}{e_P} \tag{13}$$

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<sup>6</sup>We have

$$\begin{aligned}
V_P &= E\left[\sum_{t=0}^{T-1}(w_P - v(e_P))\beta^t + \beta^T \bar{u}\right] \\
&= [w_P - v(e_P)]E\sum_{t=0}^{T-1}\beta^t + \bar{u}E\beta^T \\
&= [w_P - v(e_P)]E\left(\frac{1 - \beta^T}{1 - \beta}\right) - (1 - \beta)\bar{u}E\left(\frac{1 - \beta^T}{1 - \beta}\right) + \bar{u} \\
&= [w_P - v(e_P) - (1 - \beta)\bar{u}]\frac{1}{1 - \beta}\left[1 - \sum_{T=1}^{\infty}\beta^T(1 - \alpha)\alpha^{T-1}\right] + \bar{u} \\
&= [w_P - v(e_P) - (1 - \beta)\bar{u}]\frac{1}{1 - \beta}\left[1 - \frac{1 - \alpha}{\alpha} \frac{\alpha\beta}{1 - \alpha\beta}\right] + \bar{u} \\
&= [w_P - v - (1 - \beta)\bar{u}]\frac{1}{1 - \alpha\beta} + \bar{u}
\end{aligned}$$

The specification of  $v(e_P)$ , finally, follows from the assumption that all workers are identical; the disutility of effort in permanent jobs takes the same form as (5):

$$v(e_P) = e_P^\gamma, \quad \gamma > 1 \quad (14)$$

Using (13) and (14), the first order condition (11) can be written

$$\gamma e_P^\gamma = [w_P - e_P^\gamma - (1 - \beta)\bar{u}]\mu \quad (15)$$

Hence,

$$e_P = \left[ \frac{\mu}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}} \quad (16)$$

As one would expect, a permanent worker's effort is increasing in permanent workers' wages ( $w_P$ ) but decreasing in the value of unemployment ( $\bar{u}$ ).

Equations (9), (14) and (16) can be used to derive the cost of job loss ( $V_P - \bar{u}$ ):

$$V_P - \bar{u} = \frac{\gamma s}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \quad (17)$$

**Firms** Firms minimize unit labor cost subject to workers' choice of effort and the participation constraints. Using (6), (8), (16) and (17) the minimization problem can be written

$$\min_{w_P, w_T, L_P, L_T, p} w_P L_P + w_T L_T \quad (18)$$

$$s.t. \quad e_P L_P + e_T L_T = 1$$

$$e_P = \left[ \frac{\mu}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}}$$

$$e_T = \left[ \frac{\beta \lambda s}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}}$$

$$w_T = \beta s \frac{\lambda - p\gamma}{\gamma + \mu} [w_P - (1 - \beta)\bar{u}] + (1 - \beta)\bar{u}$$

$$p L_T = (1 - \alpha) L_P \quad (19)$$

$$w_P \geq (1 - \beta)\bar{u} \quad (20)$$

Equation (19) is a steady-state condition: the number of permanent workers can only be constant if the flow into permanent status ( $pL_T$ ) equals the flow out of permanent employment ( $(1 - \alpha)L_P$ ). The inequality (20) is the participation constraint for permanent workers: workers will only accept a permanent job if  $V_P - \bar{u} \geq 0$ ; using (17) this condition can be written as in (20).

**Equilibrium** Consider an institutionally constrained equilibrium in which the ratio of temporary to permanent employees, the average separation rate for permanent employees (and therefore the average value of  $\bar{s}$ ), and the sensitivity of the firing rate for an individual permanent worker to changes in the worker's effort have binding upper limits. In addition to these institutional constraints, we assume that the sensitivity of the promotion rate for temporary workers to variations in effort ( $\lambda$ ) is determined by the given monitoring technology which is taken as exogenous.

As shown in Appendix A, these assumptions yield the following equilibrium solution:

$$w_P = \left[ \frac{\gamma + \mu}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \bar{\alpha})\beta\bar{s}(\lambda - \bar{p}\gamma)} + 1 \right] (1 - \beta)\bar{u} \quad (21)$$

$$w_T = \left[ \beta\bar{s} \frac{\lambda - \bar{p}\gamma}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \bar{\alpha})\beta\bar{s}(\lambda - \bar{p}\gamma)} + 1 \right] (1 - \beta)\bar{u} \quad (22)$$

where  $(1 - \bar{\alpha})$  is the institutionally determined separation rate for permanent workers and  $\bar{p} = (1 - \bar{\alpha})/M$ ,  $\bar{s} = 1/(1 - \bar{\alpha}\beta)$ . Equations (21)-(22) can be used to analyze the effects of labor market reforms that alter the constraints on the use of temporary workers (the ratio  $M$ ) and/ or the constraints on the dismissal of permanent workers (the elasticity  $\mu$  or the average dismissal rate  $1 - \bar{\alpha}$ ).

### 3 Korean labor market reforms

Before 1997, it was difficult for a Korean firm to terminate employment contracts, even if the firm suffered a general decline in business. Because the economy had been grow-

ing rapidly since the early 1980s, the strict protection of employees had not previously been considered a serious problem. As economic growth slowed in the mid-1990s, however, reforms seemed necessary (Yoo and Kang 2012). Korean policy makers became increasingly influenced by the ‘Washington Consensus’. The dominant view suggested that in an era of increasing globalization Korea’s competitiveness suffered from problems of high costs and low efficiency; these problems, it was argued, could be addressed by a deregulation of the Korean labor market which would reduce labor costs and allow a quick adjustment to economic conditions. A relaxation of employment protection was accelerated by the financial crisis in December 1997; the crisis necessitated a bailout by the IMF, and the bailout was made conditional on the deregulation of dismissal law (Cho and Lee 2007).

In 1998 two key elements of deregulation were implemented (KLI 2008; Cho and Lee 2007). The deregulation of dismissal law had been discussed at the Reform Committee of Korean Industrial Relations in 1996 and spurred by IMF demands, the Tripartite Commission reached agreement on 26 February 1998. This legislation introduced the concept of dismissal of workers for “urgent managerial needs” (Yoo and Kang 2012) and relaxed the strict employment protection on regular contracts.

Employment flexibility was further enhanced in July 1998 by the decision to allow temporary work agencies under the Dispatched Workers Act. Under the new law, dispatching agencies are allowed to hire out workers to firms for up to two years in 26 occupations that require special expertise and experience (OECD 2000). The law may seem restrictive relative to international standards by limiting the relaxation to 26 specified occupations. In a Korean context, however, it marked a significant change (ILO 2011).

These labor market reforms are reflected in OECD indicators of employment protection. The indicator for strictness of regulation on temporary contracts - calculated as a weighted sum of items relating to fixed-term contracts and temporary work agency contracts - falls from 3.125 to 2.125; the indicator for dismissal of employees on regu-



lar contracts falls from 3.036 to 2.369 <sup>7</sup>. Additional labor market reforms were passed in 2006 and 2007 (Yoo and Kang 2012). The effects of these reforms were relatively minor, however, and left the OECD indicators unchanged.

**Wage and employment effects of the 1998 reforms** The reforms, first, reduced employment protection for permanent workers. This increased the sensitivity of a worker's risk of dismissal to changes in her effort (i.e.  $\mu$  shifted up) and raised the average dismissal rate ( $\bar{\alpha}$  and hence  $\bar{s} = 1/(1 - \beta\bar{\alpha})$  shifted down). The relaxation of restrictions on the use of temporary agency workers, second, raised the upper limit of the ratio of temporary to permanent employees ( $M$  increased). The changes in  $M$  and  $\bar{\alpha}$  have opposite effects on the average promotion rate  $\bar{p}$ ; we assume – in line with the evidence – that  $\bar{p}$  was left unchanged by the reform.<sup>8</sup> Table 2 presents comparative statics for changes in  $\bar{s}$  and  $\mu$ .

Table 2: Comparative statics

	$e_P$	$e_T$	$w_T$	$w_P$
$\bar{s} \downarrow$	+	–	$\pm$ if $\lambda - \gamma\bar{p} \leq 0$	+
$\mu \uparrow$	+	–	$\pm$ if $\lambda - \gamma\bar{p} \leq 0$	$\pm$ if $\lambda - \gamma\bar{p} \geq 0$

The reforms unambiguously increase  $e_P$  and reduce  $e_T$ , and a rise in  $M$  increases the share of temporary employment. But The effects on the two wage rates and the relative wage cannot be signed in general. The ambiguity is resolved if  $\lambda = \gamma\bar{p}$ ; in this special case  $w_T$  is unchanged while  $w_P$  increases. A positive value of  $\lambda - \gamma\bar{p}$  reinforces the tendency for wage inequality to increase; a negative value may offset the rise in inequality.

<sup>7</sup><http://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection.htm>

<sup>8</sup>It is convenient to use  $\bar{s}$  and  $\bar{p}$  as shift parameters instead of the two institutionally determined values, the permissible termination rate  $(1 - \bar{\alpha})$  and the maximum ratio of temporary to permanent employment  $M$ . The values of  $\bar{s}$  and  $\bar{p}$  are determined directly by  $(1 - \bar{\alpha})$  and  $M$ :  $\bar{s} = 1/(1 - \bar{\alpha}\beta)$  and  $\bar{p} = (1 - \bar{\alpha})/M$ .

Numerical simulation can be used to evaluate the likely outcomes. Using plausible parameters, we find that the 1998 reforms raise inequality and the employment ratio  $L_T/(L_T + L_P)$  significantly; the relative wage  $w_T/w_P$  is reduced slightly. The details are in Appendix B. The simulations are in line with the data in Figure 1 as well as with the results in Kim (2014).

## 4 Conclusion

This paper is motivated by two observations. Temporary workers in Korea, first, earn significantly less than comparable permanent workers. Labor market reforms, second, have been associated with a substantial rise in the proportion of temporary workers and a very modest increase in the wage gap. The theoretical model in this paper can account for these observations and help explain the rise in inequality.

The model is highly stylized and has obvious limitations. From an applied perspective, perhaps the most obvious problem is the focus on a particular mechanism; the model shows why identical workers can get very different wages in equilibrium. This mechanism has, we believe, played a role but clearly the model does not tell the full story. Not all workers are identical, for instance, and the assumption of identical workers excludes many forces that may have contributed to the rise in Korean earnings inequality. The formal analysis, furthermore, introduces several restrictive assumptions, including an exogenously given value of the value of unemployment ( $\bar{u}$ ) and a steady-state assumption. An exogenous value of  $\bar{u}$  would be plausible in a dual economy with a large subsistence sector and a perfectly elastic supply of labor to the modern sector. This description, however, no longer fits the Korean economy. Alternatively, the fixed  $\bar{u}$  could be justified as being part of the steady-state assumption: the wage ratio is independent of  $\bar{u}$ , and the analysis concerns the properties of steady states with a given  $\bar{u}$ . This immediately brings up another weakness; the Korean economy has experienced considerable turbulence in the last 20 years and a convincing analysis of this period requires a relaxation of the steady-state assumption. This and

other extensions of the analysis are left for future research.

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## **Appendix A: Cost minimization**

The representative firm's minimization problem can be written

$$\min_{w_P, w_T, L_P, L_T, p} w_P L_P + w_T L_T \quad (\text{A1})$$

$$s.t. \quad e_P L_P + e_T L_T = 1 \quad (\text{A2})$$

$$e_P = \left[ \frac{\mu}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}} \quad (\text{A3})$$

$$e_T = \left[ \frac{\beta \lambda s}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}} \quad (\text{A4})$$

$$w_T = \beta s \frac{\lambda - p\gamma}{\gamma + \mu} [w_P - (1 - \beta)\bar{u}] + (1 - \beta)\bar{u} \quad (\text{A5})$$

$$pL_T = (1 - \alpha)L_P \quad (\text{A6})$$

$$w_P \geq (1 - \beta)\bar{u} \quad (\text{A7})$$

Substituting (A2)-(A6) in (A1), the problem can be re-written

$$\min_{w_P} \frac{\bar{p}w_P + (1 - \bar{\alpha})\left\{ \beta s \frac{\lambda - p\gamma}{\gamma + \mu} [w_P - (1 - \beta)\bar{u}] + (1 - \beta)\bar{u} \right\}}{\bar{p} \left[ \frac{\mu}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}} + (1 - \bar{\alpha}) \left[ \frac{\beta \lambda s}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}}} \quad (\text{A8})$$

$$s.t. \quad w_P \geq (1 - \beta)\bar{u} \quad (\text{A9})$$

This problem can be expressed more simply as

$$\min_x C[Ax^{1 - \frac{1}{\gamma}} + Bx^{-\frac{1}{\gamma}}] \quad (\text{A10})$$

$$s.t. \quad x \geq 0 \quad (\text{A11})$$

where

$$A = \bar{p} + (1 - \alpha)\beta s \frac{\lambda - p\gamma}{\gamma + \mu} \quad (\text{A12})$$

$$B = (1 - \bar{\alpha} + \bar{p})(1 - \beta)\bar{u} \quad (\text{A13})$$

$$C = \left[ \bar{p} \left( \frac{\mu}{\gamma + \mu} \right)^{1/\gamma} + (1 - \bar{\alpha}) \left( \frac{\beta \lambda s}{\gamma + \mu} \right)^{1/\gamma} \right]^{-1} \quad (\text{A14})$$

$$x = w_P - (1 - \beta)\bar{u} \quad (\text{A15})$$

Assuming the inequality condition (A11) is met, the first-order condition becomes

$$\frac{\gamma - 1}{\gamma} Ax^{-\frac{1}{\gamma}} - \frac{1}{\gamma} Bx^{-\frac{1}{\gamma}-1} = 0 \quad (\text{A16})$$

Hence,

$$w_P - (1 - \beta)\bar{u} = x = \frac{1}{\gamma - 1} \frac{B}{A} \quad (\text{A17})$$

$$= \frac{\gamma + \mu}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \alpha)\beta s(\lambda - \bar{p}\gamma)} (1 - \beta)\bar{u} \quad (\text{A18})$$

and, using (A5),

$$w_P = \left[ \frac{\gamma + \mu}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \alpha)\beta s(\lambda - \bar{p}\gamma)} + 1 \right] (1 - \beta)\bar{u} \quad (\text{A19})$$

$$w_T = \left[ \beta s \frac{\lambda - p\gamma}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \alpha)\beta s(\lambda - \bar{p}\gamma)} + 1 \right] (1 - \beta)\bar{u} \quad (\text{A20})$$

The model loses its efficiency-wage character if the participation constraint (A11) is binding; in this (uninteresting) case, the solutions simplify to

$$w_P = w_T = (1 - \beta)\bar{u} \quad (\text{A21})$$

## Appendix B: Wage effects of Korean reforms

The calendar length of the unit period is taken to be 2 years in the baseline simulation; this unit period fits evidence for the average duration of temporary workers' attachment to the same firm. With this unit period, a standard value for the discount factor is  $\beta = 0.9$ . Our choices of  $\bar{\alpha} = 0.774$  and  $\bar{p} = 0.4$  are based on evidence from the panel data in the EAPS supplement for 2003-07; the data show an annual continuation rate for permanent workers of about 0.88 and an annual promotion rate for temporary workers of about 0.226. The values of  $\bar{\alpha}$  and  $\beta$  can be used to calculate both the expected duration and the discounted expected duration of a permanent job: the expected duration is given by  $1/(1 - \bar{\alpha}) = 4.43$  periods or 8.86 years; the discounted expected duration is  $\bar{s} = 3.321$ . The implied steady-state value of the share of temporary workers in total employment is 0.36.

The remaining parameters in Table B1 ( $\gamma, \mu, \lambda, \bar{u}$ ) are hard to pin down empirically. The chosen value of  $\lambda$  ( $\lambda = 1.2$ ) implies that an individual temporary worker who raises effort (=productivity) by 10% increases her chances of promotion from 0.226 to 0.34; an individual permanent worker who raises effort (=productivity) by 10% reduces her per-period risk of separation from 0.226 to 0.1. These sensitivities seem plausible but we have no real evidence and have not yet carried out a more detailed sensitivity analysis to check the robustness of our results to variations in these assumptions. The values of  $\gamma$  and  $\bar{u}$  were chosen to get a positive relation between  $w_T$  and  $\bar{u}$  (which requires  $1 - \beta(1 - \bar{p} + \frac{\lambda}{\gamma}) > 0$ ) and to achieve an empirically plausible value of the relative wage.

In the baseline scenario the optimal effort levels for each type of contracts are  $e_P = 1.450$  for permanent workers and  $e_T = 1.764$  for temporary workers. The precise values of the effort levels have no significance, but the result fits qualitative evidence which suggests that  $e_T$  tends to be greater than  $e_P$ . Another way to look at the differences in effort comes from noting that for a temporary worker who provides the optimal effort level for permanent employees (1.450), the probability of promotion would be 19%, rather than 22%. The wage rates are calculated using (23) and (24). The results –  $w_T = 9.748$  and  $w_P = 17.375$  – imply that temporary workers obtain 56.1% of permanent workers' wages.

The baseline simulation is in the first column of Table B1; the results of the 1998 reforms are displayed in the second column. The 1998 scenario assumes a decrease in annual continuation rate of permanent workers by 0.06 and an increase in  $\mu$  by 0.5.<sup>9</sup> These changes produce a rise in  $w_P$  and  $e_P$ ; the rise in  $\mu$  makes permanent workers' effort more sensitive to changes in the wage, thus giving firms an incentive to raise  $w_P$ . Temporary workers' effort goes down (because  $V_P$  and the value of promotion drop) but their wage is unchanged (because the two effects of  $V_P$  on  $w_T$  offset each other in the baseline case with  $\lambda - \gamma\bar{p} = 0$ ). As a result, the distribution of income worsens –

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<sup>9</sup>The new continuation rate gives an expected average job duration of 5.1; the observed average duration of permanent jobs in Korea was about 6.2 years in the very early 2000s.

Table B1: Numerical exercises

	base	1998 reforms
$\beta$	0.903	0.903
$\bar{\alpha}$	0.774	<b>0.672</b>
$\gamma$	3.000	3.000
$\mu$	2.000	<b>2.500</b>
$\lambda$	1.200	1.200
$\bar{u}$	100.0	100.0
$\bar{p}$	0.400	0.400
$\bar{s}$	3.321	<b>2.874</b>
$e_P$	1.450	<b>1.591</b>
$e_T$	1.764	<b>1.644</b>
$w_T$	9.748	<b>9.748</b>
$w_P$	17.375	<b>18.618</b>
$w_T/w_P$	0.561	<b>0.524</b>
$L_T/(L_T + L_P)$	0.361	<b>0.450</b>
Variance of log wage	0.077	<b>0.104</b>



temporary workers now earn 52.4% of the permanent wage (down from 56.1%) – and the ratio of temporary employment increases to 45% (up from 36.1%).