

Temporary Employment and Increasing Earnings Inequality

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Preliminary and incomplete

Abstract

Temporary workers make up a sizeable part of the labor force in many countries, including Korea. This paper uses an extension of a standard efficiency wage model to explain the wage gap between temporary and permanent workers. Temporary workers have a chance to become permanent; this possibility – combined with the existence of an employment rent for permanent workers – gives short-term workers an incentive to work hard. Thus, a high wage to permanent workers 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 labor market reforms 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.¹ These factors may have contributed to increasing inequality, but technology can affect income distribution in ways that are unrelated to skill. Legal and institutional changes, moreover, can influence both relative wages and relative employment. Thus, there is substantial evidence – from truckers and retail clerks to CEOs – that power affects the determination of wages: technological and institutional changes can be ‘power biased’ (Skott and Guy 2007, 2013).

One way in which the Korean labor market reforms since the mid-1990s have affected relative power is by relaxing the constraints on the use of non-regular employment contracts. Non-regular contracts take different forms, including fixed-term and part-time contracts, and we shall use the term ‘temporary’ as a short-hand for these different contracts.² All of the temporary workers typically hope to get ‘permanent’ employment, that is, to get a standard, open-ended employment contract.

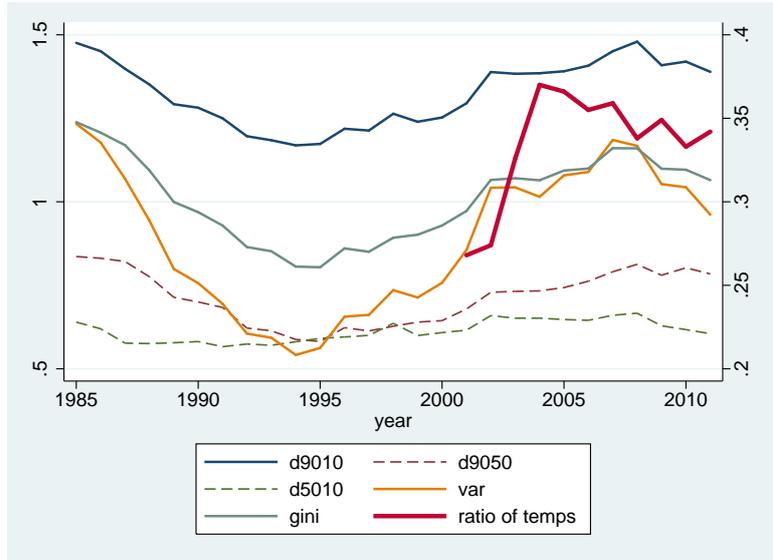
Temporary workers make up a sizeable part of the labor force in many countries. European debates have focused mainly on the employment effects of temporary contracts. In Korea official unemployment rates have been consistently low; the unemployment rate averaged 3.4% over the period from 1990 to 2012, 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 the employment rate, the share of temporary workers among

¹Ahn 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 et al. (2004) suggest that skill-biased technical change increased the wage for high-skill workers.

²In fixed-term contracts the employment relationship is terminated automatically after the fixed-term; part-time work is defined as less than 36 hours of weekly work. Non-regular contracts also include indirect employment (dispatched work and temporary agency work), independent contract work, on-call work/daily work, and tele-work/home-based work.

wage and salaried workers rose by 10.2 percentage points from 2001 to 2004; subsequently the share has fluctuated around 34% with a slight decline after 2007. Earnings inequality also shows a dramatic increase from the mid-1990s; the wage premium for permanent workers is substantial throughout the period and increases slightly (see Figure 1 and Table 1).

Figure 1: Wage inequality and temporary employment in Korea



Note: The five distributional measures are Gini coefficients and 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.

These employment and wage patterns raise several puzzles. If temporary and permanent workers do different jobs, profit maximizing firms will only increase the share of temporary workers in response to a fall in their relative wage. The wage penalty did increase but only modestly. The relative wage w_T/w_P fell by about 6%; the employment ratio L_T/L_P , by contrast, increased by about 50 percent. These figures suggest that temporary and permanent workers are close substitutes. But if

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

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
$L_T/(L_T + L_P)$	26.8%	27.4%	32.6%	37.0%	36.6%	35.5%	35.9%	33.8%	34.9%	33.3%
w_T/w_P	73.9%	76.3%	70.2%	73.4%	70.9%	71.1%	72.1%	68.9%	63.2%	64.7% ^a

^aThe tendency in relative wages after 2007 differs across different datasets. For example, the WSS shows a upward trend in the wage gap in the late 2000s.

that is the case, why do permanent workers receive a large wage premium? 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. In a system with strong labor unions the employment constraints could give permanent workers a strong bargaining position. Korean unions are not strong, however; they have at times been militant but the union density in Korea is very low.

In this paper we show how a wage gap between temporary and permanent workers can be explained using an extension of the standard efficiency wage model. Temporary workers have a chance to become permanent. This possibility – combined with the existence of an employment rent for permanent workers – gives temporary workers an incentive to work hard. A high wage to permanent workers serves a dual purpose: it affects the effort of both permanent and temporary workers. An efficiency wage model along these lines can be used to determine the equilibrium composition of employment as well as the wage structure. Legal and institutional constraints, which limit what firms can do, need to be taken into account, however, and labor market reforms can be described in the model by shifts in certain parameters. Thus, the model may shed light on how the Korean reforms contributed to the observed movements in temporary work and inequality.

Institutional constraints can take a variety of forms. In Korea some job categories cannot be filled with temporary agency workers (these restrictions were relaxed in 2007). Other constraints come in the form of limits on the possibility to roll over

temporary contracts. The ability of firms to fire permanent workers is curtailed by restrictions too; some of these restrictions affect the average firing rate (but not the determination of who gets fired); others restrict the ability of the firm to single out low performance workers.³ The specific Korean constraints will be discussed in sections 3. The key element in our argument is general, however, and 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, and equal or lower pay, 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 the temporary workers accepted a temporary position hoping that 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.

An interview with a Korean temporary worker – Miss Kim, 27 – in E-daily News, August 2, 2011, tells a similar story. 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. Her low wage is typical. A survey in June 2012 by the Ministry of Employment and Labor, temporary workers are paid about 63.6% of permanent workers' hourly wage (57.2% in 2010 and 61.3% in 2011) and get lower or no fringe benefits such as employment insurance, public pension

³Restrictions of this kind are analogous to the restrictions that follow from an inability to monitor and determine 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).

plan, and health insurance. These wage differences and a desire for job security make permanent jobs extremely attractive.

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. Engellandt and Riphahn 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.

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 since the 1997 crisis. 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

$$Y = F(e_P L_P + e_T L_T) \tag{1}$$

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 achieved 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:⁴

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

where w_T is the wage rate for temporary workers, $v(e_T)$ the disutility associated with the effort e_T , and β 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 effort.⁵ Using a simple specification with this property, we assume a log linear relation (with a ceiling at 1 and a floor at zero):

⁴Dismissed 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.

⁵'Effort' may have no natural cardinal scale. Implicitly, however, the specification of the produc-

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

where \bar{e}_T the average effort of the firm's temporary workers. The value of λ is taken to be determined by the available monitoring technology; the value of \bar{p} , determines the average rate of promotion. Turning to $v(e_T)$, we assume that the disutility of effort takes the following form

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

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 (3)-(4)). 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

tion function (1) pins down a particular cardinal representation: effort is measured in terms of its productivity.

is through promotion from a temporary position.⁶ Using (2) and (5)-(7), we get an expression for w_T :

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

$$= \beta \left(\frac{\lambda}{\gamma} - p \right) V_p + \left[1 - \beta \left(1 - p + \frac{\lambda}{\gamma} \right) \right] \bar{u} \quad (9)$$

w_T is increasing in λ but decreasing in p and β . An increase in λ (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 or an increase in the discount factor, 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 and \bar{u} , finally, 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 λ is sufficiently high), a rise in w_T may be needed to satisfy the participation constraint. Analogously, an increase in \bar{u} tightens the participation constraint, given V_P , and therefore raises w_T for any given effort; the induced reduction in effort may offset this effect if λ is high.

⁶This 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.

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

$$V_P = w_P - v(e_P) + \beta(\alpha(e_P)V_P + (1 - \alpha(e_P))\bar{u}) \quad (10)$$

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, we assume – the effect of effort on the individual worker's risk of dismissal, that is, $\alpha'(e_P) > 0$.

Permanent workers choose the level of effort to maximize the value function (10). In a steady state (with constant values of w_P and \bar{u}) the first order condition implies that

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

where

$$s = 1/(1 - \beta\alpha) \quad (12)$$

s can be interpreted as the discounted expected duration of the permanent job.⁷ By assumption the continuation probability α is increasing in e_P and it follows that so is s . Analogously to the specification of temporary workers' probability of promotion, we assume that s depends on the ratio of the worker's own effort to the average effort \bar{e}_P . Using a log-linear formulation,

⁷The value function can be written, alternatively, as

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

where T is the time of job loss and $s = \frac{1}{1 - \beta\alpha}$.

$$\log s = \bar{s} + \mu \log \frac{e_P}{\bar{e}_P} \quad (13)$$

where \bar{e}_P is the average effort of permanent workers.⁸ Equation (13) implies that

$$\frac{s'}{s} = \mu \frac{1}{e_P} \quad (14)$$

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 (4):

$$v(e_p) = e_p^\gamma, \quad \gamma > 1 \quad (15)$$

Using (14) and (15), the first order condition (11) can be written

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

Hence,

$$e_P = \left[\frac{\mu}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \right]^{\frac{1}{\gamma}} \quad (17)$$

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 (10) and (17) can be used to derive the cost of job loss ($V_P - \bar{u}$):

$$V_P - \bar{u} = \frac{\gamma s}{\gamma + \mu} (w_P - (1 - \beta)\bar{u}) \quad (18)$$

Firms Firms minimize unit labor cost subject to workers' choice of effort and the participation constraints. Using (6), (8), (17) and (18) the minimization problem can be written

⁸The specification can be seen as a log-linear approximation to a more general functional form.

$$\min_{w_P, w_T, L_P, L_T, p} w_P L_P + w_T L_T \quad (19)$$

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

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

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

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

$$pL_T = (1 - \alpha)L_P \quad (20)$$

$$w_P \geq (1 - \beta)\bar{u} \quad (21)$$

The last two constraints are new and may need comment. Equation (20) 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 (21) is the participation constraint for permanent workers: workers will only accept a permanent job if $V_P - \bar{u} \geq 0$; using (18) this condition can be written as in (21).

Equilibrium Consider an institutionally constrained equilibrium in which (i) the ratio of temporary to permanent employees has an exogenous, binding upper limit ($L_T/L_P = M$), (ii) the average separation rate for permanent employees (and therefore the average value of \bar{s}) is exogenous, and (iii) the sensitivity of the firing rate for an individual worker to changes in the worker's effort is exogenous. In addition to these institutional constraints, we assume that the sensitivity of the promotion rate for temporary workers to variations in effort (λ) is fully determined by the given monitoring technology.

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

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

$$w_T = [\beta \bar{s} \frac{\lambda - \bar{p}\gamma}{\gamma - 1} \frac{1 - \bar{\alpha} + \bar{p}}{\bar{p}(\gamma + \mu) + (1 - \bar{\alpha})\beta \bar{s}(\lambda - p\gamma)} + 1](1 - \beta)\bar{u} \quad (23)$$

where $(1 - \bar{\alpha})$ is the institutionally determined separation rate for permanent workers and $\bar{p} = M/(1 - \bar{\alpha})$, $\bar{s} = 1/(1 - \bar{\alpha}\beta)$.

3 Korean labor market reforms

In the mid-1990s 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.

Before 1997, it was difficult for Korean firms to terminate employment contracts, even for economic reasons. Because the economy had been growing 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). The relaxation of employment protection was legitimated and accelerated by the financial crisis in December 1997; the crisis necessitated a bail-out 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 in order to satisfy IMF demands the Tripartite Commission reached agreement on a new dismissal law on 26 February 1998. This legislation introduced the concept of dismissal of workers for “urgent managerial needs” (Yoo and Kang, 2012). It legitimated economic dismissals 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). The new law retained flexibility in the use of fixed-term contracts: no maximum duration of fixed-term contracts was specified and there were no restrictions on contract renewal (Yoo and Kang, 2012).

A more pro-labor administration took office in 2003. This change of government led to discussions on how to reduce the prevalence of temporary contracts. Two bills on temporary employment (the Act on the Protection of Fixed-term and Part-time Employees and the Act on the Dispatched Employees) were passed in November 2006 and put into effect eight months later, in July 2007. The primary change introduced in the 2007 reform was to restrict the maximum duration of temporary contracts to two years. Any worker who completes two years employment on a temporary contract must be offered a permanent contract (but can be dismissed at no cost to the employer before the two-year mark); workers aged 55 and older are exempt from this provision. The 2007 reform also introduced changes so that a wider range of jobs were allowed for temporary agency work (Yoo and Kang, 2012).

OECD indicators of employment protection reflect the institutional changes in 1998 and 2007. The indicators measure the procedures and costs involved in dismissing individuals or groups of workers as well as the procedures involved in hiring workers on fixed-term or temporary work-agency contracts. The overall indicator shows noticeable drops from 2.74 to 2.03 in 1998 and from 2.03 to 1.90 in 2008. The sub-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 2.25 to 1.69 in 1998 and from 1.69 to 1.44 in 2007. The sub-indicator for dismissal of employees on regular contracts falls from 3.23 to 2.37 in 1998 but is unaffected by the 2007 reforms.

The 1998 reform: $\bar{\alpha} \downarrow, \bar{s} \downarrow, \mu \uparrow, M \uparrow, \bar{p}$ **unchanged** The dismissal of employees on regular contracts was eased in 1998; $\bar{\alpha}$ and hence \bar{s} shifted down. The reduced employment protection for permanent workers also made disciplinary dismissal easier; the sensitivity of the a worker’s risk of dismissal to changes in her effort increased, i.e. μ shifted up. The relaxation of restrictions on the use of temporary agency workers, finally, raised the upper limit of the ratio of temporary to permanent employees ($M \uparrow$). 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.

The 2007 reform: $\bar{\alpha} \uparrow, \beta \uparrow, \bar{s} \uparrow, \bar{p} \downarrow$ The model uses the length of temporary contracts as the unit period. In this setting, limits on the rollover of temporary contracts – and thus on the effective length of temporary employment with the same firm – corresponds to a shortening of the period length; $\bar{\alpha}, \beta, \bar{s}$ and \bar{p} , whose values depend on the calendar length of the unit period, therefore all change.

Wage and employment effects Table 2 presents comparative statics for changes in \bar{s}, β, μ and \bar{p} .⁹ The table is split into two parts; one capturing a stylized version 1998 reform and the other a stylized 2007 reform.

The 1998 reform increases e_P and reduces e_T ; the share of temporary employment also increases. 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. The ambiguities are even greater following the 2007 reforms: none of the effort and wage effects of the combined package of changes in \bar{s}, β and \bar{p} can be signed in general.

Numerical simulation can be used to evaluate the likely outcomes. Using plausible

⁹It 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 $\bar{p} = (1 - \bar{\alpha})/M$.

Table 2: Comparative statics

	e_P	e_T	w_T	w_P
The 1998 reform				
$\bar{s} \downarrow$	+	-	\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 2007 reform				
$\bar{s} \uparrow$	-	+	\pm if $\lambda - \gamma\bar{p} \leq 0$	-
$\beta \uparrow$	-	-	-	-
$\bar{p} \downarrow$	\pm	\pm	+	\pm

parameters, we find that the 1998 reform raises inequality and the employment ratio $L_T/(L_T + L_P)$ significantly; the relative wage w_T/w_P is reduced slightly. The 2007 reform leaves the relative wage unchanged and reduces inequality and the employment ratio 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 (2013). Using decomposition techniques, Kim finds that the rising share of temporary workers can account for 20-40 percent of the growth in inequality between 2001 and 2007, depending on the precise method of decomposition.

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, by implication, help explain the rise in inequality.

The model is highly stylized and has obvious limitations. From an applied perspec-

tive, 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. Not all workers are identical, however, and the assumption of identical workers excludes some of the mechanisms that may have contributed to the rise in Korean earnings inequality (skill biased technical change, for instance). 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 analysis concerns the properties of steady states with a given \bar{u} . This immediately brings up the second weakness; the Korean economy has gone through 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 before the 2007 reform. 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 β 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 λ ($\lambda = 1.2$) 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 γ 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 (22) and (23). 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 and 2007 reforms are displayed in the second and third columns. The 1998 scenario assumes a decrease in annual continuation rate of permanent workers by 0.06 and an increase in μ by 0.5.¹⁰ These changes produce a rise in w_P and e_P ; the rise in μ 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

¹⁰The 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	(i) 1998	(ii) 2007
β	0.903	0.903	0.926
$\bar{\alpha}$	0.774	0.672	0.743
γ	3.000	3.000	3.000
μ	2.000	2.500	2.500
λ	1.200	1.200	0.953
\bar{u}	100.0	100.0	100.0
\bar{p}	0.400	0.400	0.318
\bar{s}	3.321	2.544	3.201
e_P	1.450	1.591	1.450
e_T	1.764	1.644	1.510
w_T	9.748	9.748	7.398
w_P	17.375	18.618	14.109
w_T/w_P	0.561	0.524	0.524
$L_T/(L_T + L_P)$	0.361	0.450	0.447
Variance of log wage	0.077	0.104	0.090

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 – 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%).

The 2007 reform is reflected in the scenario (ii). The unit period now is shorter (one year and a half instead of two); the discount factor and continuation rate per period therefore increase ($\beta, \bar{\alpha},$ and \bar{s} increase) and the promotion rate \bar{p} falls. The shorter unit period also automatically produces a fall in the wages, which are per period. Both wages decline significantly, but the ratio stays constant.