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Compensation of on-call and fixed-term employment: the role of uncertainty

Marloes de Graaf-Zijl*[1]

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Abstract

In this paper I analyse the use and compensation of fixed-term and on-call employment contracts in the Netherlands. I use an analytical framework in which wage differentials result from two types of uncertainty. Quantity uncertainty originates from imperfect foresight in future product demand. I argue that workers who take over part of the quantity uncertainty from the employer get higher payments. Quality uncertainty on the other hand originates from the fact that employers are ex-ante unable to fully observe a worker's ability and results in lower wages. Using a combination of propensity score and Mahalanobis matching I analyse wage differentials and find that on-call workers receive compensation for providing quantity flexibility. Compensation of fixed-term contracts on the other hand is dominated by the negative wage effect of quality uncertainty. I investigate whether this relation still holds after the 1999 policy change that had a substantial impact on the attractiveness of on-call and fixed-term workers from the employers' perspective. I find that the policy change has not only influenced the use of on-call and fixed-term contracts, but unintentionally also their compensation.

JEL codes: J31, J40, C21

Keywords: temporary employment, wage differentials, uncertainty

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1. Introduction

The use of flexible employment contracts has increased dramatically in Western societies over the last few decades. A wide variety of contracts such as fixed-term contracts, temporary agency work or on-call contracts serve the purpose of providing flexibility to employers in a world where employment protection impedes smooth adjustment of the workforce. The need for flexibility stems from innate uncertainties of production. Regarding labour, these uncertainties can be divided in two types: quantity and quality uncertainty. Quantity uncertainty originates from imperfect foresight in future product demand. Having imperfect knowledge on the amount of labour they will require next period, employers have a need for numerical flexibility in the total number of working hours. Quality uncertainty on the other hand originates from the fact that employers are ex-ante unable to fully observe a worker's ability. As a result, they have a need for flexibility in the sense that they want to dismiss workers whose ability does not match the firm's requirements. Legal probationary periods are often considered too short to determine a worker's qualities.

In this paper I analyse the importance of quality versus quantity uncertainty in wage determination of flexible workers.[2] I show that economic rationale provides clear-cut predictions with respect to the compensation of flexible employment. Quality and quantity uncertainty have different wage implications. Workers generally dislike uncertainty and therefore want to be compensated for it. Whether an employer is willing to provide this compensation differs between quality and quantity uncertainty. An employer who can shift (part of the) quantity uncertainty to the worker is prepared to pay this worker more for this unstable job than he would if this same worker would occupy a stable job. On the other hand, an employer who is uncertain about a worker's ability is willing to pay him less than he would if he knew for sure that the worker would meet job requirements. Therefore economic rationale implies a higher wage for contracts that mainly serve to shift quantity uncertainty from employer to employee and a lower wage for contracts mainly used to cope with quality uncertainty.

My empirical strategy is to use the difference between on-call (flexible hours) and fixed-term employment as identification for the wage impact of quality versus quantity uncertainty. I

[2] The issue of compensation of temporary versus regular workers has been analysed before. E.g. Segal and Sullivan, 1998; Booth, Francesconi and Frank, 2002; Hagen, 2002, McGinnity and Mertens, 2004; Addison and Surfield, 2005, who all use fixed-effect analysis to measure wage differentials between contract types. They generally find negative wage differential for temporary work. The specific role of uncertainty has not been addressed explicitly.

argue that on-call work is mainly used to shift quantity uncertainty from employer to employee and therefore a positive wage differential between on-call and regular workers is to be expected. Fixed-term contracts are used for this purpose as well, but also serve to screen the quality of potential future regular workers. As a result, the wage differential between fixed-term and on-call workers shows the effect of quality uncertainty.

I estimate wage differentials using a unique administrative dataset from the Dutch Ministry of Social Affairs and Employment. This dataset provides extremely detailed information on wages and other payments to workers, such as personal bonuses, profit sharing, shift allowance and inconvenience allowance. Furthermore, the dataset provides observations on multiple workers per firm. This implies that the data allow me to investigate the importance of firm-specific effects, which I calculate as the firm-effect in a standard wage regression. These firm-specific effects contribute to the justification of the conditional independence assumption laying at the basis of the (propensity score) matching technique that I use. Mahalanobis matching is performed using tenure, working hours, age, gender and the propensity score, in which I include education level, job level, type of vacancy, industry, occupation, firm size and the firm-specific effect. I argue that this information provides all characteristics that determine selection into on-call and fixed-term employment, such that the actual observation of individuals is due to randomness or quality uncertainty. Since it is the effect of quality uncertainty that I want to measure, it should not be included in the list of matching variables.

The paper is organised as follows. In section 2 I present the analytical framework that I use in this paper. It shows the economic rationale behind the effect of quality and quantity uncertainty on wages and formulates hypotheses. In section 3 I describe the data that I use to analyse wage differentials, discuss some variables that I use in the analyses, and provide descriptive statistics. Section 4 gives a detailed description of the estimation method, with special attention for the conditional independence assumption laying at the basis of (propensity score) matching techniques. In section 5 I present the estimation results that confirm the predictions based on the analytical framework. Section 6 discusses the results of a policy change on both the use and the compensation of on-call and fixed-term contracts. Section 7 concludes.

2. Analytical framework

The main purpose of this paper is to determine the effect of uncertainty as a reason for wage differentials between regular and flexible workers. Other research that focussed on wage differentials usually found negative wage differentials (see e.g. Segal and Sullivan, 1998; Booth, Francesconi and Frank, 2002; Hagen, 2002, McGinnity and Mertens, 2004; Addison and Surfield, 2005), but the effect of uncertainty has not been addressed explicitly. Economic rationale does provide clear-cut predictions with respect to the compensation of flexible employment. The argument starts with the recognition that employers experience two types of uncertainties regarding their workforce: quantity and quality uncertainty. Quantity uncertainty originates from uncertainty about future product demand. Having imperfect knowledge about the amount of work in the next period, employers are uncertain about the number of workers (or working hours) they will need next period. Therefore, they have a need for numerical flexibility in the number of workers (or working hours). Quality uncertainty on the other hand stems from the fact that employers are ex-ante unable to fully observe a worker's ability. This factor plays a main role in search models that include temporary employment, such as Blanchard and Landier (2002).

The two types of uncertainty have different implications for wages. Workers generally dislike uncertainty and therefore want to be compensated for it. Whether an employer is willing to provide this compensation differs between quality and quantity uncertainty. An employer who can shift (part of the) quantity uncertainty to the worker is prepared to pay this worker more for this unstable job than he would if this same worker would occupy a stable job. This is the theory of compensating wage differentials, founded on Rosen's (1974) seminal work. Assuming workers are risk averse, the lack of certainty is a negative job characteristic and is compensated by a higher wage. Rosen's theory is based on a model of perfect matching, where all workers get matched to their desired jobs, and does not allow for on-the-job search. Hwang, Mortensen and Reed (1998) have shown that, in the presence of on-the-job search, the equilibrium job distribution need not show evidence of compensating wage differentials. Instead they derive a positive relationship between wages and non-wage job amenities, despite the fact that workers' indifference curves are downward sloping (see also Lang and Majumdar (2003) for the same result in a non-sequential search framework). They show that in a labour market characterised by frictions in matching workers with firms, high-cost firms can coexist with low-cost firms in

equilibrium. Firms with greater cost efficiencies in producing a job amenity not only offer greater value of that amenity, but also offer job bundles that have an overall higher value. They do so because their lower costs mean greater opportunity costs in having vacancies go unfilled. For my framework this implies that I can write the wage of workers providing numerical flexibility (w_f) as:

$$w_f = w_b(1+\alpha) \qquad \text{with } -1 < \alpha < \infty$$

where w_b is the basic wage, for workers on 'regular' contracts, i.e. who do not provide numerical flexibility because they work a fixed number of hours and are protected by employment regulations.

In a situation where employees are protected against dismissal, an employer who is uncertain about a worker's ability is willing to pay him less than he would if he knew for sure that the worker would meet job requirements. Therefore I can write the wage of workers with uncertain ability to meet requirements (w_u) as:[3]

$$w_u = w_b(1-\gamma) \qquad \text{with } 0 < \gamma < 1$$

A similar framework has been explored by Moretti (2000), who uses individual unemployment history as an approximation for the quality uncertainty and determines α by comparing seasonal agricultural workers in the US with workers in similar permanent jobs. In this paper I use a different identification strategy. I use the wage differential between fixed-term workers, regular workers and on-call workers as identification for determining α and γ. Both fixed-term and on-call contracts provide numerical flexibility to the firm. A situation of quality uncertainty on the other hand is typically one where fixed-term contracts are used to avoid potential firing costs. Firing costs are incurred if the employer dismisses a worker who is employed on an indefinite contract. These costs consist of severance payments paid to the employee, but more importantly of the implicit costs of lengthy layoff procedures. As OECD (1999) shows, the Netherlands scores high on these procedural inconveniences. To avoid firing costs employers prefer fixed-

[3] One expects a big wage jump for workers who stay after the period of quality uncertainty. To test this hypothesis panel data are needed, which I do not have. McGinnity and Mertens (2004) and Addison and Surfield (2005) address this issue. McGinnity and Mertens find evidence of this wage jump at the change of contract. The evidence in Addison and Surfield is only weakly in support of this hypothesis.

term contracts as extended probationary periods if they are uncertain whether an applicant meets job requirements.

So fixed-term contracts are used for both quality and quantity uncertainty. On-call contracts are only used to skive off quantity uncertainty. From estimating wage differentials between on-call workers and regular workers I can determine α.[4] Subsequently I can derive γ from the wage differential between fixed-term and on-call workers.

Some case study evidence on this issue is provided by Houseman et al. (2003), who study the use of temporary agency workers in the US. This study, carried out in 2000, finds two different pay regimes for temporary agency workers. In the health care sector temporary agency nurses are paid higher than nurses with a regular contract. In this way, wages of regular nurses are stabilized at a relatively low level. Had these temporary agency nurses not been available, wages of regular nurses would have risen as a result of the tight labour market. Temporary agency nurses are thus compensated for providing quantity flexibility. In the automobile sector the authors find a completely different situation. Here too labour market shortages are a reason for using temporary agency workers. In this sector everyone who desired a regular contract had long since found it and no on-call workers were available in these years. Only a group of 'risky' workers, with criminal records, spotty work history and little or no education or experience in manufacturing settings, was left. These 'risky' workers are hired from temporary help agencies and get paid a lower wage than regular workers in the same company. These temporary agency workers get a wage penalty for their quality uncertainty.

3. Data

In this paper I use a unique administrative dataset collected by the Dutch Ministry of Social Affairs and Employment. For this so-called Terms of Employment Developments database (AVO) an annual sample is drawn from both employers and employees in the private sector. In the first step a stratified sample (by industry and firm size) of employers is drawn, and subsequently a sample is drawn from the employees in those organisations. Each year a new sample of employers and employees is drawn, so the data have no panel character. Civil servants

[4] To eliminate the effect of low-paying versus high-paying firms I use firm fixed-effects in the model estimation. See section 4 for further details.

visit the selected firms and collect information on the terms of employment of the selected employees from the wage administration. They do so for two set moments, namely October of the current year and October one year earlier. Apart from a detailed list of terms of employment also some personal and firm characteristics are gathered. The variable that is essential in my analysis, the type of contract, is available in the AVO on 1997 and 2002. These data distinguish open-ended contracts, with or without flexible working hours, and fixed-term contracts, with or without flexible working hours. Unlike most other variables, the type of contract is not available at two moments in time. We only know the type of contract at the last date. For the analysis this implies that I cannot determine the effect of an individual changeover from one contract to another.

In this paper I focus on low-educated workers for reasons of homogeneity. Since this group forms the major share of both fixed-term and on-call workers the number of observations is sufficient to focus on this sub-sample. Table 1 gives an overview of the compensation variables in the pooled dataset and their average values for the four employment contracts for low-educated workers. All financial elements are corrected for inflation (to 1998 prices) and converted into Euros. The quality of the dataset is clearly shown by the details in which wages are measured. All wage components are registered separately.

The AVO-data distinguish seven types of gross wage components. The first and obviously the largest one is the basic wage belonging to the function the employee occupies. It is presented here as the basic monthly wage that a worker receives. A second wage component consists of personal bonuses, extra payments on top of the basic wage e.g. related to personal performance. The third wage component, tariffs and provision, is a specific type of payment related to effort, e.g. related to sales. The most important category of employees that is rewarded on this basis is salesmen. The fourth wage component is the shift allowance, extra payments related to working in shifts, at irregular hours, during evening, night or weekend. The fifth component is the inconvenience allowance, based on filthy or unpleasant work. Wage in kind represents the monetary value of the wage components that are not paid in money but in goods (e.g. board and lodging). Finally the remaining wage component consists of extra periodical payments not mentioned above, such as commuting allowance. All these wage components together add to the gross monthly wage. Dividing this by the number of working hours (excluding overtime) gives the gross hourly wage. We can clearly see that workers in regular contracts have the highest

hourly wage, on all components of the wage. The only exception is tariffs and provisions, which per hour are highest for the people with flexible working hours. Adding extra yearly payments, such as profit sharing, or extra payments according to the collective agreement, does not change this fact. I should note that overtime payments are excluded from the wage presented here, and is not used in the analysis. Reason is that I do not know the number of hours worked overtime. Table 1 shows that overtime payment is registered, but the number of overtime hours is not. As a result I cannot control for overtime and overtime payment in my analysis. This does not appear to be a great problem, since the pattern in overtime payment per type of contract mimics the other pay components.

Table 1 Compensation of low-educated workers by employment contract

	Indefinite term, hours not flexible (=regular)		Fixed-term, hours not flexible (=fixed-term)		Indefinite term, hours flexible (=on-call)		Fixed-term, hours flexible (=mix)*	
	1997	2002	1997	2002	1997	2002	1997	2002
Wage								
basic monthly wage	€ 1353	€ 1512	€ 1127	€ 1182	€ 507	€ 497	€ 419	€ 384
personal bonus	€ 3	€ 7	€ 4	€ 2	€ 1	€ 1	€ 1	€ 0
tariffs and provisions	€ 8	€ 5	€ 5	€ 3	€ 1	€ 0	€ 0	€ 0
shift allowance	€ 32	€ 34	€ 10	€ 24	€ 12	€ 9	€ 4	€ 5
inconvenience allowance	€ 3	€ 2	€ 0	€ 1	€ 0	€ 0	€ 0	€ 0
wage in kind	€ 1	€ 0	€ 1	€ 1	€ 0	€ 0	€ 1	€ 0
other wage	€ 13	€ 16	€ 10	€ 7	€ 2	€ 1	€ 0	€ 0
total monthly wage	€ 1413	€ 1576	€ 1157	€ 1218	€ 523	€ 508	€ 425	€ 390
total hourly wage	€ 9.43	€ 11.13	€ 7.77	€ 9.10	€ 7.40	€ 8.09	€ 6.12	€ 6.30
extra payment collective agreement	€ 65	-	€ 15	-	€ 6	-	€ 3	-
profit sharing	€ 108	€ 122	€ 34	€ 17	€ 0	€ 2	€ 1	€ 1
other extra payments	€ 130	€ 288	€ 32	€ 133	€ 3	€ 73	€ 1	€ 14
total hourly wage incl. yearly payments	€ 9.59	€ 11.00	€ 7.81	€ 9.00	€ 7.41	€ 8.00	€ 6.12	€ 6.00
overtime pay	€ 63	€ 68	€ 41	€ 38	€ 8	€ 7	€ 16	€ 15

* this group is excluded from the model estimation, see footnote 6.

In table 2 I present personal and job characteristics of the four employment contracts. We can clearly identify some aspects on which the types of contracts differ from one another. Not surprisingly tenure is smallest in temporary jobs. Since these contracts automatically expire at the end of the agreed term, and a maximum sequence of three temporary contracts with the same employer applies, tenure in temporary jobs can never be long. Because tenure differs to such a large extent between these types of contract I will give special attention to the way to treat tenure in my analysis (see section 4). Tenure in on-call jobs is longer than in temporary jobs, but not as

long as in regular jobs. Another unsurprising observation is that working hours are substantially smaller in on-call jobs than in both regular and temporary jobs.

A lower age and a higher female participation in temporary and on-call jobs are observations that are in agreement with earlier findings in the literature. Females especially occupy on-call jobs to a larger extent than males. And younger workers are especially over-represented in temporary jobs. Even within the group of low-educated workers, the education level is somewhat lower in on-call jobs. This is not true for temporary jobs. Accordingly function levels are also lower for on-call contracts, which to a lesser extent also holds for temporary contracts. There are some differences between function types and industry. On-call work is mostly found in the health care sector. Firm size does not seem to be of great importance for the types of contracts. Fixed-term workers more often occupy jobs originating from vacancies that were difficult to fill. This might be explained by the fact that employers who cannot find a regular worker for a certain position are inclined to hire agency workers to fill the position temporarily until a suitable candidate is found.

Table 2 Personal and job characteristics of low-educated workers per employment contract

	Indefinite term, hours not flexible		Fixed-term, hours not flexible		Indefinite term, hours flexible		Fixed-term, hours flexible	
	1997	2002	1997	2002	1997	2002	1997	2002
age	37.3	38.28	28.6	31.28	34.9	33.6	27.3	25.06
female	0.32	0.40	0.32	0.50	0.84	0.70	0.69	0.50
Job characteristics								
tenure	7.8	8	0.3	0.8	4.3	3.8	0.8	0.5
hours per week	34.3	31.6	34.1	30.1	15.9	14.1	15.6	13.1
large part-time (>40%)	0.16	0.23	0.20	0.32	0.35	0.32	0.27	0.29
small part-time (<40%)	0.07	0.12	0.07	0.14	0.54	0.63	0.61	0.66
collective agreement	0.79	0.86	0.64	0.86	0.93	0.85	0.75	0.81
hard to fill vacancy	0.01	-	0.16	-	0.01	-	0.05	-
low job level	0.22	0.22	0.27	0.34	0.73	0.52	0.61	0.60
medium low job level	0.66	0.68	0.68	0.62	0.26	0.46	0.38	0.37
medium high job level	0.12	0.10	0.05	0.04	0.01	0.02	0.02	0.03
high job level	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Occupation								
technical	0.45	0.43	0.49	0.39	0.06	0.08	0.10	0.14
administrative	0.09	0.09	0.07	0.08	0.02	0.03	0.01	0.02
IT	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
commercial	0.11	0.12	0.14	0.12	0.28	0.19	0.25	0.18
care	0.33	0.34	0.29	0.40	0.65	0.66	0.63	0.66
creative	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
executive	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.00
Industry								
agriculture	0.03	0.03	0.05	0.04	0.01	0.05	0.08	0.01
mining	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
manufacturing	0.23	0.24	0.12	0.14	0.03	0.06	0.03	0.04
public utilities	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
construction	0.11	0.12	0.10	0.12	0.00	0.00	0.01	0.02
trade	0.23	0.23	0.23	0.26	0.30	0.27	0.34	0.22
hotels and restaurants	0.04	0.04	0.07	0.05	0.06	0.24	0.29	0.46
transport	0.09	0.06	0.07	0.04	0.03	0.07	0.05	0.05
finance	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
business services	0.08	0.08	0.27	0.14	0.41	0.06	0.06	0.09
health care	0.12	0.12	0.06	0.14	0.12	0.18	0.09	0.06
culture and recreation	0.04	0.04	0.03	0.06	0.02	0.08	0.04	0.04
Firm size								
1-4 employees	0.14	0.14	0.16	0.19	0.09	0.17	0.21	0.32
5-9 employees	0.08	0.08	0.11	0.10	0.03	0.17	0.10	0.11
10-19 employees	0.10	0.10	0.08	0.11	0.06	0.10	0.09	0.19
20-49 employees	0.13	0.13	0.14	0.15	0.05	0.20	0.22	0.11
50-99 employees	0.08	0.10	0.05	0.08	0.03	0.09	0.07	0.09
100-199 employees	0.09	0.08	0.07	0.07	0.04	0.07	0.05	0.07
200-499 employees	0.11	0.15	0.10	0.12	0.08	0.06	0.17	0.04
>=500 employees	0.26	0.21	0.29	0.18	0.61	0.15	0.08	0.07

4. Empirical method

To analyse the wage differentials econometrically, I use kernel matching. The main idea behind this approach is that of conditional independence. That is, if we know all variables *Z* that influence the selection into temporary contracts, we can take assignment to temporary employment to have been random: $(Y_{1i}, Y_{0i}) \perp C_i, Z_i$. Comparing two individuals with the same observable characteristics *Z*, one of whom has a temporary contract (*C*=1) and one of whom has a regular contract (*C*=0), is like comparing those two individuals in a randomised experiment (Heckman, Lalonde and Smith, 1999). This means that matching estimators try to resemble an experiment by choosing a comparison group from the regular employees such that the selected group is similar to the temporary employees in observable characteristics. Then, the average treatment effect on the treated can be calculated as:

$$E(Y_1 - Y_0 \mid Z, C = 1) = E(Y_1 \mid Z, C = 1) - E(Y_0 \mid Z, C = 0)$$

If the number of *Z* variables is small, we can estimate this equation by matching individuals directly on *Z*. We could stratify the data into subgroups with the same value of *Z* and calculate the average wage differential between the temporary and regular workers in each subgroup. As the number of variables increases, forming these subgroups with identical *Z* becomes harder. Therefore Rosenbaum and Rubin (1983) suggest the use of the propensity score to reduce the dimensionality of the matching problem. They show that if $(Y_{1i}, Y_{0i}) \perp C_i, Z_i$ then $(Y_{1i}, Y_{0i}) \perp C_i, p(Z_i)$, where $p(Z_i)$ is the propensity score – the probability of being in a temporary job given *Z*. This propensity score can be estimated by standard binary choice methods like probit or logit.

In this paper I use Mahalanobis matching on tenure, working hours, age, gender and a propensity score that is based on education level, function level, type of vacancy, industry, occupation, firm size and a firm-specific effect. Separate (Mahalanobis) matching on tenure and working hours is necessary because these issues are major distinguishing features of the type of employment contract, but are essentially endogenous with respect to the type of contract. Separate (Mahalanobis) matching on age is applied because age is to a larger extent a determinant of wages than of employment contracts. Separate matching on gender was necessary

to improve before-after variable differences between on-call and regular workers. All-in-all a large amount of personal and job characteristics are included in *Z*. Van der Valk (2005) shows that the main personal characteristics determining temporary and flexible work are age, gender, ethnicity and having young children (especially for women). Hagen (2003) finds that previous employment history is an important determinant of temporary work. The main personal information that I miss in *Z* concerns ethnicity, having children and the individual's labour market history. Having children might not be such an important omission since age is included in the data. Individual labour market history is a main determinant of quality uncertainty. Therefore – given the set-up of this study – it is not a problem that the data lack information on labour market history. Since it is just the effect of this uncertainty that I want to measure, I do not want to have it in my *Z*. Would it be included in *Z*, I would not be able to determine the effect of quality uncertainty. It would be cancelled out by matching on this feature. Therefore I argue that I have enough information to assure that I can establish two individuals who have approximately the same characteristics, except for their level of quality uncertainty, such that the fact that one receives a regular job and the other does not is either random or a result of quality uncertainty.

One of the advantages of matching is that one only compares the comparable. People who by their nature can only be in one of the situations are disregarded. This is called the 'overlap problem' or 'common support problem'. You only look at people who can be in either situation and who are 'accidentally' observed in one of them. In general this improves the quality of the matches and thus of the results. However, Lechner (2001) notes that by imposing the common support restriction some high quality matches may be lost at the boundaries of the common support. In my application I apply the common support restriction, since I regard it as an essential feature for the estimation method.

5. Estimation results

Estimation results for the propensity score are given in table A1 in the appendix. The results confirm that both fixed-term and on-call contracts are used mostly at the lowest job levels. On-call work and fixed term contracts are relatively often used for relatively easy repetitive tasks. This is in accordance with the conclusion from De Graaf-Zijl (2005) that these types of employment contracts are especially attractive in situations with little firm-specific human capital. Among the low-educated workers those with only primary education have the lowest

probabilities of working on fixed-term contracts. This might be explained from the fact that this group consists mostly of older workers, who have gained experience that compensated their lack of education. Fixed-term contracts are often used whenever a vacancy was had to fill. This implies that firms choose to fill the vacancy temporarily with a person that needs screening or one that will be replaced once a more suitable candidate is found. Regarding industry table A1 shows that fixed-term contracts are used relatively often in construction, trade and business services. On-call work is mostly used in restaurants and catering industry, but also in health care, trade, transport and culture and recreation. With respect to occupation we see that fixed-term contract are least used in executive functions, whereas on-call contracts are used mainly in care, commercial or creative functions. The firm size pattern is unclear. An interesting finding from the propensity score estimation is that firms that pay relatively well – and thus have a positive firm-specific effect derived from the fixed-effect wage analysis (see table A2) – use relatively less fixed-term and on-call contracts.[5] This is in accordance with findings of De la Rica (2003), who analyses a large sample of Spanish workers. She also finds evidence of segregation of fixed-term workers into low-paying firms. A possible explanation for this phenomenon is that high wages are paid by high-surplus firms and these do not need flexibility. Also, these findings are in accordance with the theoretical model of Hwang, Mortensen and Reed (1998), who derive a model in which firms with greater cost efficiencies offer job bundles that have an overall higher value – in terms of both wage and non-wage job amenities – than the bundles of less efficient firms.

Table 3 shows the results of the Mahalanobis matching on tenure, working hours, age, gender and the propensity score for low-educated workers in 1997. These matching results are clearly in line the predictions based on my analytical framework. Low-educated on-call workers receive a wage premium of 4.8 percent, whereas low-educated workers on a fixed-term contract receive a wage penalty of 5.3 percent compared to regular workers.[6] This implies that the estimated wage premium for taking over quantity uncertainty α is 0.048. The estimated wage penalty for quality uncertainty γ is 0.101. Tables A3b and A3d in the appendix show that matching on observables successfully reduced the bias in most variables. As robustness check,

[5] Robustness checks show that the matching results do not crucially depend on the inclusion of the firm fixed effect in the propensity score.

[6] Both on-call and fixed-term workers have been matched to a control group of regular workers. In order to estimate γ matching on-call workers directly with fixed-term workers would have been sufficient. However, the control group was too small in this case.

the same analysis was repeated for the year 1998. The estimated wage differentials are very similar to those in 1997.

The negative wage differential found for fixed-term workers is in accordance with earlier findings using different estimation techniques (e.g. Segal and Sullivan, 1998; Booth, Francesconi and Frank, 2002; Hagen, 2002, McGinnity and Mertens, 2004; Addison and Surfield, 2005). Most of these studies use fixed-effect analysis and find that an individual earns less when he works on a fixed-term contract than if this same individual works on a regular contract. The findings from these papers are in accordance with the predictions from the model based on quality uncertainty too. If one follows an individual over time and first observes him in a fixed-term job that later on is converted into a regular job, one expects this person to receive a wage rise at the conversion of the contract because at that moment quality uncertainty has vanished.

Table 3 Estimation results propensity score matching for low educated employees (kernel with Mahalanobis matching on tenure, age, sex, working hours and propensity score)[7]

	Average hourly wage of matched flex	Average hourly wage of matched regular	Difference in Euro	Boot-strapped standard error	Diff. in %	Number of matched flex
1997						
Fixed-term versus regular	€ 7.843	€ 8.279	- € 0.436*	0.060	- 5.3%	2155
On-call versus regular	€ 8.255	€ 7.877	+ € 0.378*	0.189	+ 4.8%	1236
1998						
Fixed-term versus regular	€ 7.859	€ 8.289	- € 0.430*	0.042	- 5.2%	2099
On-call versus regular	€ 8.887	€ 8.493	+ € 0.394*	0.141	+ 4.4%	141

* = statistically significant at 95% confidence level

6. Results of a policy change

In January 1999 the so-called Flexibility and Security Act was constituted. This new act aimed at increasing opportunities for employers to use flexible and temporary labour, and at the same time increasing employment rights of the flexible workforce. Table 4 shows that the use of flexible and temporary employment has shifted since 1999. In 1997 13 percent of all workers was

[7] When estimating differences between fixed-term and regular workers all workers who work a flexible number of working hours are excluded from the analysis. When estimating wage differentials between on-call and regular employees all individuals on contracts with definite durations are excluded.

employed on a fixed-term contract and 13 percent on an on-call basis. In 2002 these numbers were 15 percent and 5 percent respectively.[8]

Table 4 Share of temporary and flexible employment in stock and flow

Variable	Indefinite contract Hours not flexible		Fixed-term contract Hours not flexible		Indefinite contract Hours flexible		Fixed-term contract Hours flexible	
	1997	2002	1997	2002	1997	2002	1997	2002
Share in stock of employment	76%	81%	10%	13%	10%	3%	3%	2%
Share in people 'staying'	88%	93%	1%	4%	10%	3%	1%	1%
Share in flows:								
Coming	35%	35%	45%	53%	9%	3%	11%	9%
Leaving	63%	66%	18%	24%	11%	5%	7%	5%

Source: AVO, own calculations

Even though the effect of the policy change on the use of fixed-term and on-call contracts cannot be disentangled from other circumstances that have changed between 1997 and 2002, the shift in the use seems a logical consequence of the policy change. The conditions for using fixed-term contracts have been relaxed by the Flexibility and Security Act. Before 1999 employers could conclude only one fixed-term contract with a worker. The second contract with the same worker was automatically of indefinite duration. Since 1999 employers have the right to close more than one fixed-term contract with the same worker. Only the fourth contract, or the last contract in a sequence of contracts of which the period between the start of the first contract and the end of the last contract exceeds 36 months, is automatically indefinite. Using fixed-term workers has thus become more attractive since 1999 and this may explain the slight increase in the use of these contracts between 1997 and 2002.

Regarding on-call work the Flexibility and Security Act enhanced the legal position of workers in this work arrangement in a number of ways. It restricted the period during which the employer can fully shift the underutilisation risk to the employee. Before 1999 zero hour contracts could last indefinitely. The employer did not need to pay the worker when there was insufficient work. Since 1999 zero hour contracts are restricted to the first six months of the contract. From that moment on employers need to pay a worker even if there is insufficient work.

[8] Fixed-term workers clearly play a more dominant role in the flows than in the stock of employment. The fact that the share of temporary workers in the quits/layoffs is much lower than in hirings, might suggest that conversion of fixed-term into open-ended contracts is an important phenomenon (see also Zijl and Van Leeuwen (2005) for an overview of studies analysing this phenomenon). The finding that the share of fixed-term contracts among 'stayers' has increased only slightly, even though legally employers are now allowed to offer a sequence of three fixed-term contracts, corroborates this suggestion.

The amount of payment depends on the average number of hours the worker was called on during the three preceding months. Another feature introduced by the Flexibility and Security Act is the minimum payment of three hours. Even if the actual duration of the call does not exceed two hours, a worker should be paid three hours wage. Finally the Flexibility and Security Act removed the legally doubtful existence of an employment contract in some cases of on-call work. It states that a worker who worked at least 20 hours per month during three months presumptively has an employment contract. All three adjustments introduced by the Flexibility and Security Act concerning on-call contracts reduced attractiveness of this type of contract for employers and can therefore explain the significant reduction of the use of on-call work between 1997 and 2002.

Table 5 shows that also compensation of on-call and fixed-term workers has shifted between 1997 and 2002. As shown in the previous section, on-call workers received a wage premium in 1997, which can be interpreted as a compensation for the fact that they took over a significant part of the quantity uncertainty of employers. In 2002 this wage premium has vanished; it is no longer statistically significant and even negative. As argued before, on-call workers nowadays automatically become more or less regular part-time workers after 6 months. This may explain why on-call workers no longer receive a wage premium. They no longer take over a substantial part of the quantity uncertainty from the employer. The wage penalty for fixed-term contracts on the other hand has slightly diminished. This too can be explained as a result from the policy change. Employers may nowadays offer a sequence of fixed-term contracts to the same employee. As a result the quality uncertainty of the group working on this type of contract is smaller than it was in 1997, when employers were allowed to offer no more than one fixed-term contract per employee.

Table 5 Estimation results propensity score matching for low educated employees (kernel with Mahalanobis matching on tenure, age, sex, working hours and propensity score)

	Average hourly wage of matched flex	Average hourly wage of matched regular	Difference in Euro	Boot-strapped standard error	Diff. in %	Number of matched flex
2002						
Fixed-term versus regular	€ 9.705	€ 10.085	- € 0.381*	0.055	- 3.8%	3000
On-call versus regular	€ 7.989	€ 8.240	- € 0.252	0.147	- 3.0%	641

* = statistically significant at 95% confidence level

NB: Hourly wages in 1997 (table 3) have been calculated excluding the number of holidays and shorter working hours. Hourly wages in 2002 have been calculated using the number of hours including holidays and shorter working hours, since holidays were no longer included in the data.

The policy change has implication for the determination of α and γ from the analytical framework. Based on table 5, the estimated α for 2002 is –3.0 percent and the estimate for λ is 0.8 percent. However, I must stress that the model framework is no longer appropriate because of the policy change. On-call workers no longer take over a substantial part of the quantity uncertainty from the employer. This implies that the wage differential between regular and on-call workers can no longer serve as a good approximation for α, which in turn implies γ cannot be determined.

7. Summary and conclusion

In this paper I have analysed an administrative dataset from the Dutch Ministry of Social Affairs and Employment using an analytical framework in which uncertainty plays a major role. I have distinguished two types of uncertainty. Quantity uncertainty originates from imperfect foresight in future product demand. Quality uncertainty on the other hand originates from the fact that employers are ex-ante unable to fully observe a worker's ability. The two types of uncertainty have different implications for wages. An employer who can shift part of the quantity uncertainty to the worker is prepared to pay this worker more for this unstable job than he would if this same worker would occupy a stable job. An employer who is uncertain about a worker's ability is willing to pay him less than he would if he knew for sure that the worker would meet job requirements. In this paper I have used the wage differential between fixed-term workers, on-call workers and regular workers as identification for determining the positive compensation for quantity uncertainty and the negative wage effect of quality uncertainty. Both types of contract provide numerical flexibility to the firm. However, fixed-term contracts are also used in

situations of quality uncertainty to avoid potential layoff costs. Using propensity score matching I have analysed wage differentials and found that in 1997 on-call workers received compensation for providing quantity flexibility. Compensation of fixed-term contracts on the other hand is dominated by the negative wage effect of quality uncertainty.

These results were found for the situation before the introduction of the Flexibility and Security Act in 1999. In this paper I have shown that the positive wage effect for on-call work was not longer present in 2002. This might be the result of an unintended effect of the policy change. The new act has introduced more security for on-call workers. As a result on-call workers nowadays automatically become more or less regular part-time workers after 6 months. This implies that on-call workers in the Netherlands no longer take over a substantial part of the quantity uncertainty from the employer, which makes them less attractive. It has led to a substantial decrease in the use of these contracts and also a significant reduction of the wage-premium of on-call work. Fixed-term contracts on the other hand have seen their use extended as a result of the Flexibility and Security Act. Employers may nowadays offer a sequence of fixed-term contracts to the same employee. This broadened the use of fixed-term work and led to a slight increase in the use of fixed-term work arrangements. Also, as a result of this extended use, the quality uncertainty of the group working on this type of contract is smaller than it was in 1997, when employers were allowed to offer no more than one fixed-term contract per employee. This may be the cause of the slightly smaller negative wage differential for fixed-term workers in 2002 than in 1997.

Literature

Adisson J.T. and C.J. Surfield (2005), *'Atypical work' and compensation*, IZA Discussion Paper No. 1477, Bonn: Institute for the Study of Labor.

Blanchard O. and L. Landier (2002), The perverse effects of partial labour market reform: Fixed-term contracts in France, *Economic Journal*, vol. 112, no. 480, pp. F214-244.

Booth, A.L., M. Francesconi and J. Frank (2002), Temporary jobs: Stepping stones or dead ends?, *Economic Journal*, vol. 112, pp. F189-F213.

De la Rica, S. (2003), *Wage gaps between workers with indefinite and fixed-term contracts: The impact of firm and occupational segregation*, DFAEII Working Paper 200306, Universidad del Pais Vasco.

De Graaf-Zijl, M. (2005), *The attractiveness of temporary employment to reduce adjustment costs: A conjoint analysis*, SEO Discussion Paper 40, Amsterdam: SEO Economic Research.

Hagen, T. (2003), *Do fixed-term contracts increase the long-term employment opportunities of the unemployed*?, ZEW Discussion Paper 03-49, Mannheim: Zentrum für Europäische Wirtschaftsforschung.

Hagen, T. (2002), Do temporary workers receive risk premiums? Assessing the wage effects of fixed-term contracts in West Germany by a matching estimator compared with parametric approaches, *Labour*, vol. 16, no. 4, pp. 667-705.

Heckman, J. Lalonde and Smith (1999), The Economics and Econometrics of Active Labor Market Programs, in: O. Ashenfelter and D. Card, *Handbook of Labour Economics* vol. 3A, North-Holland.

Houseman, S.N., A.L. Kalleberg and G.A. Erickcek (2003), The role of temporary agency employment in tight labor markets, *Industrial and Labor Relational Review*, vol. 57, no. 1, pp. 105-127.

Hwang, H., D.T. Mortensen and W.R Reed (1998), Hedonic wages and labor market search, *Journal of Labor Economics*, vol. 16, no. 4, pp. 815-847.

Lang, K. and S. Majumdar (2003), *The pricing of job characteristics when markets do not clear: Theory and policy implications*, NBER Working Paper w9911, Cambridge: National Bureau of Economic Research.

Lechner, M. (2001), *A Note on the common support problem in applied evaluation studies*, Discussion Paper 2001-01, Department of Economics, University of St. Gallen.

McGinnity, F. and A. Mertens (2004), Wages and wage growth of fixed-term workers in East and West Germany, *Applied Economics Quarterly – Konjunkturpolitik*, vol. 50, no. 2, pp. 139-163.

Moretti, E. (2000), Do wages compensate for risk of unemployment? Parametric and semiparametric evidence from seasonal jobs, *Journal of Risk and Uncertainty*, vol. 20, pp. 45-66.

OECD (1999), *Employment protection and labour market performance*, Employment Outlook 1999 Chapter 2.

Rosen, S. (1974), Hedonic prices and implicit markets: product differentiation in pure competition, *Journal of Political Economy*, vol. 82, no. 1, pp. 34-55.

Segal, L.M. and D.G. Sullivan (1998), *Wage differentials for temporary services work: Evidence from administrative data*, Federal Reserve Bank of Chicago Working Paper 98-23.

Van der Valk, J. (2005), Flexible work and working hours in the Netherlands, CBS Working Paper No.14, Voorburg: Netherlands Statistics.

Zijl, M. and M.J. Van Leeuwen (2005), *Temporary jobs: intermediate positions or jumping boards; Searching for the stepping-stone effect of temporary employment*, SEO Discussion Paper no. 38, Amsterdam, SEO Economic Research.

Appendix

Table A1 Propensity score estimates (probit, standard errors in parentheses)

	fixed-term				on-call			
	1997		2002		1997		2002	
Education level (reference: lower vocational)								
primary education	-0.441 (0.046)	**	-0.223 (0.041)	**	-0.176 (0.051)	**	-0.054 (0.069)	
lower general education	0.005 (0.035)		0.020 (0.028)		0.089 (0.040)	*	0.019 (0.049)	
Job level (reference: intermediate task level)								
very simple repetitive tasks	0.972 (0.080)	**	0.742 (0.069)	**	1.245 (0.086)	**	1.556 (0.145)	**
reasonably simple, mainly repetitive tasks	0.860 (0.058)	**	0.646 (0.052)	**	0.853 (0.070)	**	1.217 (0.132)	**
less simple, mainly repetitive tasks	0.550 (0.054)	**	0.367 (0.048)	**	0.481 (0.067)	**	0.763 (0.128)	**
less simple, varied tasks	0.121 (0.056)		0.144 (0.049)	**	0.290 (0.070)	**	0.303 (0.135)	*
compound difficult tasks	-0.260 (0.245)		-0.193 (0.218)		-0.057 (0.244)		-	
executive or analytical tasks	-0.296 (0.555)		-		-		-	
Type of vacancy								
mvvac	1.615 (0.063)	**	-		-		-	
Industry (reference: manufacturing)								
agriculture	-		-0.001 (0.074)		-		0.733 (0.109)	**
mining	-		0.176 (0.120)		-		-	
public utilities	0.110 (0.107)		-0.817 (0.181)	**	-0.546 (0.266)		-	
construction	0.198 (0.040)	**	0.103 (0.041)	*	-0.365 (0.103)	**	-	
trade	0.127 (0.043)	**	0.265 (0.035)	**	0.264 (0.054)	**	0.520 (0.072)	**
restaurants and catering	0.375 (0.082)	**	0.028 (0.071)		0.993 (0.079)	**	1.000 (0.094)	**
transport	0.391 (0.052)	**	-0.004 (0.049)		0.660 (0.063)	**	0.421 (0.091)	**
finance	-0.183 (0.105)		-0.119 (0.107)		0.295 (0.109)	**	-	
business services	0.417 (0.048)	**	0.228 (0.045)	**	0.569 (0.062)	**	0.151 (0.100)	
health care	0.046 (0.067)		0.165 (0.055)	**	0.734 (0.063)	**	0.683 (0.095)	**
culture and recreation	0.047 (0.069)		0.083 (0.061)		0.484 (0.075)	**	0.803 (0.093)	**
Occupation (reference: administration)								
technical	0.077 (0.052)		0.015 (0.045)		0.024 (0.077)		-0.165 (0.116)	
IT	0.236 (0.147)		-0.265 (0.197)		-		-	
commercial	0.063 (0.069)		0.025 (0.058)		1.194 (0.081)	**	0.560 (0.118)	**
care	-0.010 (0.054)		-0.005 (0.046)		0.513 (0.072)	**	0.427 (0.107)	**
creative	0.481 (0.361)		-0.068 (0.198)		1.187 (0.348)	**	0.947 (0.228)	**
executive	-0.522 (0.185)	**	-0.471 (0.141)	**	-0.120 (0.219)		-	
Firm size: (reference: 20-49 employees)								
1-4 employees	0.025 (0.073)		-0.022 (0.068)		0.318 (0.091)	**	-0.352 (0.117)	**
5-9 employees	0.047 (0.056)		-0.098 (0.054)		0.066 (0.081)		-0.190 (0.085)	*
10-19 employees	-0.103 (0.049)		-0.138 (0.049)	**	0.383 (0.065)	**	-0.297 (0.085)	**
50-99 employees	-0.074 (0.043)		-0.068 (0.040)		0.379 (0.061)	**	-0.400 (0.072)	**
100-199 employees	-0.024 (0.043)		-0.007 (0.041)		0.378 (0.061)	**	-0.056 (0.070)	
200-500 employees	-0.043 (0.043)		0.013 (0.040)		0.401 (0.063)	**	-0.772 (0.083)	**
>=500 employees	-0.092 (0.048)		-0.275 (0.045)	**	0.431 (0.063)	**	-0.625 (0.085)	**
Firm specific effect	-0.750 (0.100)	**	-0.408 (0.090)	**	-0.645 (0.125)	**	-2.055 (0.182)	**
Intercept	-1.829 (0.077)	**	-1.345 (0.068)	**	-2.975 (0.107)	**	-2.883 (0.172)	**

** = statistically significant at 99% * = statistically significant at 95%

Table A2 (Log) wage regression with firm specific fixed effects

Age	0.170 (0.003) **	
$(Age)^2$	-0.004 (0.000) **	
$(Age)^3$	0.000 (0.000) **	
Tenure	0.015 (0.001) **	
$(Tenure)^2$	-0.001 (0.000) **	
$(Tenure)^3$	0.000 (0.000) **	
Female	-0.049 (0.004) **	
Education (ref: lower vocational)		
primary school	-0.019 (0.005) **	
lower general	-0.006 (0.004)	
Vacancy hard to fill	-0.014 (0.008)	
Weekly working hours	0.001 (0.000) **	
Job level (reference: intermediate task level)		
very simple repetitive tasks	-0.333 (0.009) **	
reasonably simple, mainly repetitive tasks	-0.307 (0.006) **	
less simple, mainly repetitive tasks	-0.205 (0.005) **	
less simple, varied tasks	-0.114 (0.005) **	
compound difficult tasks	0.247 (0.013) **	
executive or analytical tasks	0.195 (0.038) **	
Industry (reference: manufacturing)		
public utilities	0.068 (0.042)	
construction	0.077 (0.014) **	
trade	-0.059 (0.012) **	
restaurants and catering	-0.048 (0.022)	
transport	-0.059 (0.016) **	
finance	0.058 (0.023) *	
business services	0.009 (0.015)	
health care	-0.014 (0.019)	
culture and recreation	-0.025 (0.019)	
Occupation (reference: administration)		
technical	0.015 (0.006) **	
IT	0.000 (0.017)	
commercial	0.028 (0.008) **	
care	0.004 (0.006)	
creative	0.015 (0.035)	
executive	0.087 (0.010) **	
Firm size: (reference: 20-49 empl.)		
1-4 employees	-0.076 (0.014) **	
5-9 employees	-0.031 (0.014) *	
10-19 employees	-0.023 (0.013)	
50-99 employees	0.037 (0.015) *	
100-199 employees	0.048 (0.017) **	
200-499 employees	0.082 (0.017) **	
>=500 employees	0.095 (0.019) **	Nobs = 19346
Intercept	-0.153 (0.037) **	R^2 = 0.590

** = statistically significant at 99% * = statistically significant at 95%

Table A3a Differences in characteristics between regular workers and fixed-term workers 1997, before and after matching

	unmatched		matched		
Variable	fixed-term	regular	fixed-term	regular	% reduction bias
tenure	0.20	8.70	0.18	1.01	-90%
age	28.64	37.37	28.54	29.12	-93%
weekly working hours	35.32	35.71	35.81	35.95	-66%
female	0.311	0.253	0.297	0.297	-100%
education level					
primary education	0.089	0.115	0.091	0.096	-83%
lower general	0.229	0.187	0.215	0.228	-69%
lower vocational	0.682	0.698	0.693	0.676	14%
job level					
very simple repetitive tasks	0.061	0.032	0.055	0.037	-37%
reasonably simple, mainly repetitive tasks	0.292	0.169	0.289	0.294	-96%
less simple, mainly repetitive tasks	0.392	0.326	0.397	0.395	-97%
less simple, varied tasks	0.203	0.345	0.205	0.226	-85%
intermediate task level	0.050	0.116	0.051	0.044	-89%
compound difficult tasks	0.002	0.010	0.002	0.002	-97%
Industry					
public utilities	0.013	0.017	0.013	0.004	143%
manufacturing	0.335	0.410	0.338	0.280	-23%
construction	0.142	0.142	0.149	0.183	7618%
trade	0.150	0.144	0.151	0.159	41%
restaurants and catering	0.035	0.019	0.035	0.041	-65%
transport	0.096	0.083	0.099	0.099	-98%
finance	0.013	0.023	0.013	0.026	28%
business services	0.135	0.068	0.121	0.110	-83%
health care	0.044	0.051	0.043	0.047	-39%
culture and recreation	0.037	0.042	0.038	0.051	158%
Occupation					
administrative	0.086	0.089	0.082	0.090	263%
technical	0.552	0.566	0.565	0.524	184%
IT	0.010	0.006	0.010	0.012	-51%
commercial	0.069	0.064	0.068	0.085	227%
care	0.279	0.251	0.270	0.286	-42%
creative	0.001	0.000	0.001	0.000	-37%
executive	0.003	0.023	0.003	0.002	-96%
Firm size					
1-4 employees	0.038	0.030	0.035	0.051	108%
5-9 employees	0.078	0.060	0.074	0.095	13%
10-19 employees	0.094	0.108	0.093	0.140	217%
20-49 employees	0.186	0.181	0.191	0.220	401%
50-99 employees	0.153	0.169	0.160	0.144	2%
100-199 employees	0.172	0.151	0.170	0.151	-9%
200-499 employees	0.160	0.164	0.154	0.134	374%
>=500 employees	0.120	0.129	0.122	0.066	542%
Firm specific effect	-0.028	-0.004	-0.023	-0.015	-65%

Table A3b Differences in characteristics between regular workers and on-call workers 1997, before and after matching

	unmatched		matched		
Variable	fixed-term	regular	fixed-term	regular	% reduction bias
tenure	4.5	8.7	4.2	4.2	-99%
age	35.0	37.4	34.3	34.3	-100%
weekly working hours	18.2	35.7	19.8	19.9	-99%
female	0.683	0.253	0.731	0.731	-100%
education level					
primary education	0.162	0.116	0.156	0.225	48%
lower general	0.328	0.186	0.335	0.328	-95%
lower vocational	0.510	0.698	0.509	0.447	-67%
job level					
very simple repetitive tasks	0.136	0.033	0.118	0.168	-52%
reasonably simple, mainly repetitive tasks	0.329	0.170	0.326	0.338	-92%
less simple, mainly repetitive tasks	0.329	0.327	0.338	0.337	-70%
less simple, varied tasks	0.153	0.344	0.160	0.125	-82%
intermediate task level	0.050	0.116	0.055	0.031	-64%
compound difficult tasks	0.003	0.010	0.004	0.001	-62%
Industry					
public utilities	0.001	0.017	0.002	0.002	-96%
manufacturing	0.149	0.412	0.175	0.200	-90%
construction	0.010	0.143	0.012	0.026	-90%
trade	0.228	0.144	0.231	0.265	-60%
restaurants and catering	0.094	0.019	0.070	0.066	-94%
transport	0.127	0.084	0.110	0.062	10%
finance	0.023	0.023	0.025	0.023	800%
business services	0.146	0.065	0.142	0.105	-54%
health care	0.165	0.051	0.177	0.209	-72%
culture and recreation	0.057	0.042	0.056	0.042	-10%
Occupation					
administrative	0.036	0.089	0.045	0.063	-67%
technical	0.148	0.570	0.167	0.151	-96%
commercial	0.228	0.064	0.230	0.246	-90%
care	0.583	0.253	0.552	0.536	-95%
creative	0.002	0.000	0.002	0.000	-16%
executive	0.003	0.023	0.004	0.003	-99%
Firm size					
1-4 employees	0.042	0.030	0.042	0.076	198%
5-9 employees	0.052	0.060	0.048	0.100	540%
10-19 employees	0.134	0.108	0.109	0.175	157%
20-49 employees	0.104	0.182	0.113	0.143	-62%
50-99 employees	0.164	0.169	0.160	0.136	379%
100-199 employees	0.146	0.149	0.160	0.149	233%
200-499 employees	0.157	0.162	0.158	0.126	510%
>=500 employees	0.201	0.129	0.209	0.094	58%
Firm specific effect	-0.040	-0.005	-0.034	-0.035	-97%

Table A3c Differences in characteristics between regular workers and fixed-term workers 2002, before and after matching

	unmatched		matched		
Variable	fixed-term	regular	fixed-term	regular	% reduction bias
tenure	0.7	8.8	0.7	1.6	-89%
age	31.4	39.0	31.2	31.8	-92%
weekly working hours	32.8	33.5	33.0	33.2	-83%
female	0.351	0.303	0.347	0.347	-100%
education level					
primary education	0.107	0.109	0.108	0.099	314%
lower general	0.278	0.225	0.276	0.278	-97%
lower vocational	0.615	0.666	0.616	0.623	-86%
job level					
very simple repetitive tasks	0.066	0.039	0.060	0.057	-88%
reasonably simple, mainly repetitive tasks	0.265	0.165	0.264	0.250	-86%
less simple, mainly repetitive tasks	0.392	0.364	0.398	0.418	-27%
less simple, varied tasks	0.224	0.321	0.227	0.230	-97%
intermediate task level	0.050	0.103	0.050	0.044	-89%
compound difficult tasks	0.002	0.007	0.001	0.001	-98%
Industry					
agriculture	0.025	0.027	0.025	0.031	197%
mining	0.009	0.009	0.009	0.007	671%
public utilities	0.002	0.015	0.002	0.001	-97%
manufacturing	0.340	0.396	0.345	0.307	-31%
construction	0.097	0.099	0.098	0.106	275%
trade	0.251	0.180	0.251	0.241	-86%
restaurants and catering	0.030	0.030	0.029	0.045	6479%
transport	0.066	0.090	0.066	0.084	-25%
finance	0.009	0.018	0.009	0.013	-56%
business services	0.099	0.070	0.092	0.098	-76%
health care	0.065	0.061	0.066	0.060	46%
culture and recreation	0.042	0.041	0.042	0.045	405%
Occupation					
administrative	0.083	0.094	0.083	0.097	27%
technical	0.485	0.501	0.489	0.454	120%
IT	0.003	0.005	0.003	0.005	29%
commercial	0.100	0.071	0.099	0.106	-74%
care	0.322	0.307	0.319	0.331	-23%
creative	0.003	0.003	0.003	0.003	-74%
executive	0.004	0.020	0.004	0.004	-98%
Firm size					
1-4 employees	0.036	0.031	0.036	0.043	15%
5-9 employees	0.063	0.061	0.062	0.067	135%
10-19 employees	0.081	0.088	0.081	0.106	307%
20-49 employees	0.142	0.130	0.143	0.155	-3%
50-99 employees	0.179	0.180	0.179	0.195	2874%
100-199 employees	0.176	0.149	0.178	0.149	8%
200-499 employees	0.207	0.184	0.204	0.175	31%
>=500 employees	0.115	0.159	0.116	0.109	-84%
Firm specific effect	-0.012	-0.002	-0.010	-0.009	-91%

Table A3d Differences in characteristics between regular workers and on-call workers 2002, before and after matching

	unmatched		matched		
Variable	fixed-term	regular	fixed-term	regular	% reduction bias
tenure	3.6	8.6	3.5	3.4	-97%
age	33.0	38.8	31.6	31.4	-98%
weekly working hours	14.5	32.8	14.2	14.3	-100%
female	0.652	0.335	0.677	0.677	-100%
education level					
primary education	0.157	0.119	0.165	0.146	-50%
lower general	0.414	0.238	0.393	0.444	-71%
lower vocational	0.429	0.644	0.442	0.410	-85%
job level					
very simple repetitive tasks	0.155	0.045	0.137	0.133	-97%
reasonably simple, mainly repetitive tasks	0.398	0.181	0.385	0.419	-84%
less simple, mainly repetitive tasks	0.347	0.374	0.370	0.354	-39%
less simple, varied tasks	0.085	0.307	0.092	0.081	-95%
intermediate task level	0.015	0.092	0.017	0.013	-96%
Industry					
agriculture	0.078	0.031	0.040	0.041	-98%
manufacturing	0.099	0.420	0.117	0.114	-99%
trade	0.327	0.208	0.368	0.332	-70%
restaurants and catering	0.151	0.035	0.118	0.122	-97%
transport	0.104	0.106	0.085	0.067	832%
business services	0.051	0.080	0.057	0.089	15%
health care	0.082	0.072	0.098	0.130	211%
culture and recreation	0.108	0.048	0.117	0.105	-81%
Occupation					
administrative	0.023	0.091	0.028	0.044	-77%
technical	0.111	0.469	0.133	0.104	-92%
commercial	0.204	0.083	0.228	0.254	-79%
care	0.644	0.354	0.605	0.595	-97%
creative	0.019	0.003	0.005	0.003	-89%
Firm size					
1-4 employees	0.036	0.031	0.040	0.073	490%
5-9 employees	0.117	0.060	0.105	0.126	-64%
10-19 employees	0.093	0.085	0.100	0.110	23%
20-49 employees	0.221	0.126	0.157	0.144	-87%
50-99 employees	0.153	0.175	0.180	0.198	-18%
100-199 employees	0.211	0.135	0.213	0.135	4%
200-499 employees	0.088	0.198	0.105	0.088	-84%
>=500 employees	0.081	0.166	0.100	0.126	-69%
Firm specific effect	-0.079	-0.004	-0.051	-0.048	-97%