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Mind the gap, please! The effect of temporary help agencies on the consequences of work accidents

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Non-technical summary

The extensive use of temporary work has raised concerns about its economic consequences. One of these dimensions refers to work accidents. Aggregate indicators suggest that some relationship might exist between the use of temporary contracts and the incidence of work accidents. However, the relevant issue is whether within a country temporary workers tend to show higher rates of work accidents than their permanent counterparts (and whether their consequences of are worse). Given the increasing significance of flexible employment and the share of Temporary Help Agencies (THAs) on labour market intermediation in many countries, another feature (which is relevant from a policy perspective) is whether workers employed through THAs are more likely to suffer work-related accidents than the rest of workers (and whether their consequences are also worse).

This paper investigates the relationship between the types of contract held by workers and some consequences of work accidents. The data we use are the individual files from the 2004 Spanish Statistics on Accidents at Work (*Estadística de Accidentes de Trabajo*, EAT). This dataset is based on administrative registrations of work-related accidents containing all the work accidents occurred during a whole year. We have analysed the influence of the types of contract on the probability of having a serious/fatal accident and on the number of working days lost, after controlling for a set of personal, job and accident characteristics. The results show that workers employed through THAs exhibit a lower probability of suffering a serious/fatal accident and lower duration of absence after a work-related accident, in comparison with workers holding "direct" temporary contracts and workers holding open-ended contracts whose working conditions and personal characteristics are the same. This might be interpreted as an indication that, although the short duration of their assignments may be a potential factor increasing the probability of suffering an accident and the consequences of it, agency temporary workers potentially benefit from specific training (safety and health programmes) provided by THAs in order to avoid work accidents.

MIND THE GAP, PLEASE!
THE EFFECT OF TEMPORARY HELP AGENCIES ON THE CONSEQUENCES OF WORK ACCIDENTS

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Abstract

Using data from a Spanish register on work-related accidents, this paper analyses the effect of contract types on two consequences of accidents: the probability of suffering a serious/fatal accident and the number of working days lost after an accident has happened. The focus is on the difference among temporary workers hired through temporary help agencies, direct temporary workers and open-ended workers. We find that workers hired through temporary help agencies are less likely to suffer serious/fatal accidents and the durations of their absences are shorter when they are, compared with workers holding either open-ended contracts or "direct" temporary contracts once personal, job and accident characteristics are controlled for.

Keywords: work accidents, temporary help agencies, temporary employment
JEL Classification: J28, J41

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1. INTRODUCTION

The extensive use of temporary work has raised concerns about its economic consequences, in particular in terms of its effects on job quality and working conditions. One of these dimensions refers to work accidents. Aggregate indicators suggest that some relationship might exist between the use of temporary contracts and the incidence of work accidents; in countries where the proportion of temporary employment is high the rates of work accidents also tend to be high. However, the issue in this paper is whether within a country temporary workers tend to show higher rates of work accidents than their permanent counterparts (and whether the consequences are worse). Given the increasing significance of flexible employment and the share of Temporary Help Agencies (THAs) on labour market intermediation in many countries, another feature (which is relevant from a policy perspective) is whether workers employed through THAs are more likely to suffer work-related accidents than the rest of workers (and whether the consequences are also worse).

Empirical studies on work accidents usually focus their attention on the incidence of accidents. In general, the evidence suggest that temporary employment, although correlated on average with higher accident rates, is not so significant when personal and job characteristics are controlled for (Hernanz and Toharia, 2006). However, no empirical evidence is available on the potential differential effect of diverging forms of temporary employment, distinguishing between workers hired through THAs and workers holding "direct" temporary contracts, due to the lack of appropriate data. At the same time, although there is a growing literature investigating the screening and training of agency temporary workers and the relative success of these workers in their transition to permanent jobs, there are no previous studies attempting to analyse the impact of this type of flexible employment on the consequences of work-related accidents. This paper aims at partially filling these gaps. Thus, the contribution of this piece of research lies on three areas.

First, it analyses the relationship between the types of contract held by workers and some consequences of work accidents. In particular, it examines whether the accidents are similar (with respect to their characteristics and consequences) when faced by distinct groups of workers classified according to their contract types. Moreover, it investigates to what extent the consequences of work accidents (in terms of the degree

of injury and the duration of absence) vary among permanent workers, "direct" temporary workers and workers employed through THA. This makes it possible to investigate whether there is a genuine effect of the types of contract on the consequences of work accidents, once working conditions and other variables are controlled for.

Second, the dataset used in the empirical analysis, an administrative register containing all the work accidents occurred during a whole year and their characteristics, contains a wide set of variables, making it possible to take into account personal characteristics, job attributes and characteristics related to accidents, which may potentially influence their consequences.

Third, the analysis focuses the attention not only on one but on two dimensions of work accidents' consequences: the degree of injury and the duration of absence. This allows us to examine whether there are differences in both dimensions across workers grouped according to their contracts: for instance, whether agency temporary workers suffer less severe accidents and experience shorter absences compared to their temporary and permanent counterparts. Some of these issues cannot be analysed using survey data but only with our administrative dataset.

The paper is organised as follows. In Section 2, I present previous studies on accidents and provide a background regarding the functioning of THAs and their expected influence on the consequences of work-related accidents. Section 3 introduces the dataset used in the paper as well as some basic descriptive statistics. Section 4 presenst the econometric analysis which, by estimating logistics regressions on the probability of suffering a serious/fatal accident and binomial negative regressions on the number of working days lost, captures the specific effect of the types of contract on these consequences of accidents, once personal, job and accident characteristics are controlled for. Finally, Section 5 concludes.

2. BACKGROUND

Safety at work has been dealt in the literature from a theoretical and an empirical point of view. In theoretical terms, there have been models that have justified the presence of public regulation based on the lack of perfect information or the existence of incomplete markets (such as Diamond and Mirrlees, 1977; Oi, 1974), because without market failure riskier jobs would simply receive higher compensation and

agents would have right incentives to properly invest in job safety. From an empirical point of view, Bauer *et al.* (1999) use a bivariate count data model to analyse the differences in work accident rates between German and immigrant workers in manufacturing in Germany. Graham and Shakow (1990) study the relationship between the existence of a segmented market and work accidents. Worrall and Butler (1983) analyse the differences in health conditions and accident risk between workers belonging to a trade union and others.

Given the lack of databases containing detailed information on the personal and job characteristics of workers suffering work accidents, there are very few studies that have dealt with the issue of relating contract types and work accidents (Duprè, 2001; Barone and Vinci, 2001; Amuedo-Dorantes, 2002; Hernanz and Toharia, 2006).[1] The most complete investigation is that performed by Hernanz and Toharia (2006) who, using data from the 1999 Labour Force Survey 'ad hoc' module, undertake a comparative analysis between Spain and Italy in which they decompose the gross differences in the probability of work accidents by types of contract into a specific component related to the contract held by the worker and a component related to the job (mainly, the industry and the occupation). They find that job and personal characteristics of temporary workers tend to be associated with higher work accident probabilities, while the intrinsic nature of the contract is associated with higher accident probabilities for open-ended workers.

None of the previous studies, though, have devoted attention to the potential differences in the probability of suffering an accident and/or their consequences between workers hired through THAs and the rest of temporary worker contract types. The reason has been the lack of appropriate data. However, the investigation of this topic appears to be relevant since, although labour flexibility is often associated with job insecurity and precariousness, it could be the case that some beneficial forms of temporary employment also exist for workers.[2]

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[1] The exception is Guadalupe (2003), who finds a positive effect of temporary contracts on the probability of suffering a work accident, using aggregate data from administrative statistics for Spain. See Hernanz and Toharia (2006) for a thorough review of the empirical literature.

[2] There is a strand of the literature that analyses the screening and training of temporary workers by THAs, on the one hand, and the success of these workers in the probability of being hired on a permanent basis, on the other hand. Their findings are contradictory regarding the effects of THAs. Some of these studies for a variety of countries are Abraham (1990), Melchionno (1999), Houseman (2001), Ichino et al. (2004), Autor and Houseman (2005), García-Pérez and Muñoz-Bullón (2005), and Amuedo-Dorantes et al. (2006).

THAs are private companies that hire temporary workers and send them out to work on the premises of client firms. Their key feature is that workers remain on the THA's payroll while working for the client company. This means that temporary workers are under the client firm's direct supervision but receive a pay-check from the THA.

In Spain, THAs were allowed to operate for the first time in 1994 (14/94 Law).[3] This law established several constraints in THAs activities, based on the observation of abuses related to social dumping and encouraged employment precariousness traditionally associated to the historical experiences of this sector in Spain and in other countries (EIRR, 1995; Muñoz-Bullón, 2004). One restriction refers to sort of sectors and occupations in which THAs cannot operate. THAs are forbidden to place workers at the disposal of client companies to perform tasks regarded as particularly dangerous, such as jobs in the building sector which may involve risk of burying, falls and the like, in sectors such as mining and quarrying, including open-pit mining and offshore platforms, and manufacturing of explosive materials (Royal Decree 216/1999).

In some countries (Germany and Italy), some sort of regulation also exists, establishing limits to the duration of the assignment or even the proportion of temporary agency workers over the number of employees on the client company, and forbidding in some cases the hiring of the worker on the part of the client employer. However, in other countries (in Anglo-Saxon countries such as Australia and New Zealand) there is no limitation on the sectors or occupations in which the THAs can operate.

Another restriction in Spain is that there exists a requirement that THAs must compulsorily allocate resources for the general training of their workers above a minimum threshold. THAs are obliged to devote at least 1 percent of their payroll costs to the training of workers sent to temporary assignments. The State conducts unannounced inspections to determine whether THAs are in compliance. If the inspection discloses the violation of the training requirements, the agency is fined.

What is the expected influence (if any) of being hired through THAs on the probability of suffering an accident and on the consequences of it? On the one hand, the combination of above-mentioned restrictions could bring about the result that agency

[3] THA contracting has become a growing area, accounting for almost 16 percent of the total number of temporary contracts in Spain, where about 90 percent of all newly registered employment contracts are temporary and the proportion of temporary employment is the highest in Europe (more than 30 percent of total wage and salary workers since the early 1990s).

temporary workers face lower probabilities of having an accident and less serious consequences of it, since they would be employed in less risky jobs and they potentially benefit from specific training provided by the THA in order to enhance their productivity and avoid work accidents.[4] On the other hand, agency temporary workers are constantly starting new jobs where they have to carry out their duties with limited knowledge of the client company. The short duration of the assignments could be a potential factor increasing their probability of suffering an accident and the consequences of it, since they lack adequate experience in the specific job they perform in the client firm. Therefore, the answer to the previous question remains an empirical issue.

3. DATA AND DESCRIPTIVE STATISTICS

In this section, I present the data used in the paper and summarize the main descriptive statistics. In turn, this will serve to characterise the work-related accidents suffered by individuals classified according to the contract types.

3.1. Data

The data used are the individual files from the 2004 Spanish Statistics on Accidents at Work (*Estadística de Accidentes de Trabajo*, EAT). This dataset is based on administrative registrations of work-related accidents made by employers (when the injured is an employee) or by the worker herself (when the injured is a self-employed) and collected by the labour authorities (Ministry of Labour and Social Affairs). As already mentioned, one of the advantages of this dataset is that it allows a joint analysis of the characteristics of the individuals who have suffered an accident together with those of the jobs and the accident itself.

The work accident files (*partes de accidentes de trabajo con baja*, PAT) are filled when the accident brings about the absence of the injured from the working place for at least one day (excluding the day when the accident occurred) and after having received a medical report of absence. These files contain all the information related with

[4] The limited evidence we have on that for the Spanish case comes a survey on THAs (Muñoz-Bullón, 2004). According to this survey, nearly 80 percent of THAs provided to their temporary employees training suited to specific client firms and over half of them implemented safety and health programmes for their workers.

the accident, the place where has occurred and the worker who have suffered it. This information is the following:

- Some attributes of the establishment and the firm to which the injured worker belongs to.

- Some characteristics of the establishment where the accident has happened when this establishment is different from that where the worker is affiliated (firms using THAs services, contractors and subcontractors, etc.).

- Workers' personal and professional characteristics.

- Circumstances, environment and way in which the accident occurred.

Since 2003, the notification procedure takes place through an electronic system called *Delta@*. Furthermore, some new variables not considered previously have been included, among them a group of variables trying to describe exhaustively and sequentially the causes, circumstances and consequences of the accident.

Two variables are of special interest for our purposes: the types of employer and the types of establishment. The former refers to the firm to which the injured worker belongs to, making it possible to distinguish between main firm, contractors/ subcontractors, and THA. Combining this with the variable giving the types of contract held by the worker allows the construction of the main variable "contract types", which distinguishes among workers with open-ended contracts, workers with a "direct" temporary contract, and temporary workers employed through THA.[5] The latter variable, which refers to the establishment where the accident has happened, makes it possible to distinguish between establishments belonging to the firm where the worker is employed, with the same address; establishments belonging to the firm where the worker is employed, with a different address; contractors/subcontractors; and firms using THAs services.

Some exclusions have been applied to the data. First, those cases corresponding to work-related accidents which brought about an absence (with medical report) have been selected. Second, self-employed individuals have been excluded. Third, observations corresponding to employees working in public administration and health have been deleted. The reason for this is that THAs cannot operate in these sectors by law, so it seems sensible to exclude them from the comparative analysis since their

[5] There are various types of temporary work contracts: casual contract, per task contract, training contract, work-experience (practice) contract, and interim contract. For a description of them, see Toharia and Malo (2000).

inclusion would generate obvious biases. Therefore, the following empirical analysis focuses on employees who work in agriculture, manufacturing and services except in public administration and health. The total number of observations is 865,350.

3.2. Descriptive statistics

Table 1 provides descriptive statistics to compare the consequences of work-related accidents across workers grouped by types of contract.

Table 1. The consequences of work-related accidents suffered by workers with open-ended contracts, with temporary contracts, and hired through THA.

	Distributions			Relative presence	
	Open-ended	Temporary	THA	THA/ Open-ended	THA/ Temporary
Observations	400,537	442,015	22,798		
DEGREE OF INJURY					
Minor	98.6	98.5	99.2	1.01	1.01
Serious	1.3	1.3	0.7	0.58	0.55
Fatal	0.2	0.1	0.1	0.32	0.36
TYPE OF ASSISTANCE					
In a hospital	9.9	9.9	11.0	1.11	1.10
In a surgery	90.0	90.0	89.0	0.99	0.99
HOSPITALIZATION					
No	97.6	97.8	86.7	0.89	0.89
Yes	2.4	2.2	13.3	5.57	6.19
DURATION OF ABSENCE					
1 week	24.4	29.1	34.2	1.40	1.18
2 weeks	25.9	27.7	28.8	1.11	1.04
3 weeks	11.7	11.3	10.7	0.92	0.95
4 weeks	19.5	15.7	14.2	0.73	0.91
1-2 weeks	11.5	10.2	8.2	0.71	0.80
+2 weeks	7.1	6.0	3.8	0.54	0.63
Average duration (days)	23.9	21.5	17.4		

To begin with, the first aspect to be highlighted is the fact that, once an accident has happened, workers hired through a THAs are substantially less likely to be seriously

injured (about twice) or killed (three times) than the rest of workers. In spite of that, they are more likely to have medical assistance in a hospital and much more likely (around six times) to be sent into a hospital.

Furthermore, agency temporary workers are over-represented in work-related accidents that bring about few non-working days (up to one week), whereas they are under-represented in accidents resulting in long absences (more than four weeks). This makes the average number of non-working days lower among the group of workers employed through a THA (17.4 days) than among the rest of workers ("direct" temporary workers show an average of 21.5 days, while workers with open-ended contracts are close to 24 days). This could be considered a natural result given the very nature of the contracts: temporary contracts (and above all temporary assignments through THAs) are not likely to imply longer absences since they might result in a termination of the contract itself.

Regarding the types of injury (not reported in the table), the large majority of work-related accidents suffered by the three groups of workers can be classified in two categories: "superficial wounds and injuries" and "dislocations and sprains". The share of the first category is larger among agency temporary workers than among the rest of workers (in particular, than among workers with an open-ended contract), whereas the importance of the second category is similar (although a bit lower as compared again with workers holding open-ended contracts). At the same time, temporary workers employed through THAs are less prone to suffer "physical trauma, multiple injuries or heart attack".

One of the reasons why the consequences of work-related accidents vary among groups of workers classified by contract types could be that jobs and establishments where the accidents occur also differ. To uncover potential relationships between the consequences of accidents and the characteristics of jobs and establishments, Table 2 provides descriptive statistics for a set of variables (tenure, occupational group, establishment size and establishment industry) broken down by contract types group.[6]

[6] Descriptives on the rest of personal, accident, job and establishment attributes are not reported but available from the authors upon request.

Table 2. Characteristics of jobs and establishments where the accidents happened, by contract type.

	Distributions			Relative presence	
	Open-ended	Temporary	THA	THA/ Open-ended	THA/ Temporary
CONTRACT TENURE					
0 months	0.9	13.2	31.0	33.17	2.36
1 month	12.9	16.7	22.2	1.72	1.33
2 months	1.5	11.7	14.4	9.70	1.23
3 months	1.3	9.0	8.6	6.42	0.96
4-6 months	3.6	17.3	10.6	2.92	0.61
7-12 months	6.5	15.2	4.9	0.75	0.32
>1-2 years	13.4	9.2	3.5	0.26	0.39
>2-4 years	18.9	5.1	2.0	0.11	0.39
>4-8 years	18.3	2.0	1.4	0.08	0.72
>8 years	22.6	0.7	1.3	0.06	1.91
Average tenure (months)	53.3	8.6	6.7		
OCUPATIONAL GROUPS					
Managers	0.4	0.1	0.0	0.11	0.79
Professionals	1.1	0.6	0.2	0.14	0.29
Technicians and assoc. prof.	3.0	1.3	0.7	0.23	0.50
Clerks	5.3	2.5	2.7	0.51	1.06
Personal service workers	7.3	5.7	2.8	0.38	0.49
Salespersons	6.9	3.9	1.5	0.22	0.39
Agriculture skilled workers	2.1	1.6	0.5	0.26	0.34
Construction skilled ws.	8.7	28.3	3.7	0.43	0.13
Industry skilled workers	13.2	7.5	4.3	0.33	0.57
Manufacturing skilled ws.	9.2	4.3	4.7	0.51	1.10
Plant and machine operators	20.1	11.1	11.8	0.59	1.06
Domestic workers	4.7	4.1	2.7	0.58	0.67
Other unskilled service ws.	4.4	3.7	4.5	1.00	1.21
Agriculture unskilled ws.	1.4	3.2	1.7	1.26	0.53
Mining unskilled workers	0.1	0.1	0.0	0.05	0.05
Construction unskilled ws.	1.9	13.4	2.1	1.12	0.16

	Distributions			Relative presence	
	Open-ended	Temporary	THA	THA/ Open-ended	THA/ Temporary
Manufacturing unskilled ws.	6.2	5.6	41.6	6.67	7.39
Transportation unskilled ws.	3.8	3.0	14.5	3.77	4.83
ESTABLISHMENT SIZE					
1-9 employees	22.0	27.8	8.8	0.40	0.32
10-25 employees	20.4	25.3	16.3	0.80	0.64
26-49 employees	14.6	15.5	14.3	0.99	0.93
50-99 employees	11.8	12.1	22.2	1.88	1.84
100-249 employees	12.6	9.6	24.4	1.94	2.53
250-499 employees	7.1	4.3	8.3	1.16	1.91
500-999 employees	4.7	2.2	2.8	0.59	1.25
1000+ employees	5.1	2.0	1.3	0.26	0.65
Missing	1.8	1.2	1.6	0.90	1.36
ESTABLISHMENT SECTOR					
Agriculture	3.3	4.5	0.9	0.26	0.19
Construction	10.6	43.2	1.8	0.17	0.04
Energy and extraction	2.9	1.3	1.0	0.33	0.72
Chemistry	6.4	3.1	10.5	1.65	3.41
Other manufacturing industries	14.0	7.0	20.8	1.48	2.99
Metal goods	15.3	9.7	22.9	1.50	2.36
Wholesale distribution	6.3	3.8	6.5	1.02	1.73
Retail and repairs	13.4	7.4	3.2	0.24	0.43
Hotels and restaurants	7.1	6.0	4.3	0.61	0.72
Transportation	7.7	4.1	10.2	1.33	2.48
Communications	0.8	0.7	0.3	0.32	0.37
Finance	1.2	0.6	0.6	0.47	0.87
Business services	4.4	4.0	9.4	2.11	2.33
Education and research	1.2	0.8	0.2	0.16	0.24
Other services	5.4	4.2	2.8	0.52	0.67

One caution about contract tenure to note here is that it is likely that this variable does not measure properly the length of time the individual has been working for the same firm or in the same job, a feature that could interfere in capturing adequately the effect of tenure on work-related accidents. The figures show clearly that there are substantial differences among the three groups of workers: workers holding open-ended

contracts have an average tenure of 53 months, while the average for temporary workers is less than one year and for workers hired through THAs less than seven months. This implies that the latter are over-represented in the accidents suffered among the group of employees with very short tenures (less than six months if we compare them with workers holding open-ended contracts and less than two months if the comparison is made with the direct temporary workers). This is precisely what was expected since the tasks they perform in the hiring firms are short-term in their very nature.

I now look at occupational groups. The comparison of the distributions for the three groups of workers offers a clear-cut result: once an accident has occurred, the likelihood that an agency temporary worker is involved is higher if the job belongs to a low-skilled/unskilled occupation such as labourers in the manufacturing industry and in the transport sector. This likelihood is also higher as compared with workers holding open-ended contracts in occupations like agriculture and building labourers and as compared with direct temporary contracts in occupations like other unskilled workers in the service sector.

Since there is a legal prescription that firms with 1,000 employees or more in all industries and with 250-999 employees in certain industries have their own prevention service, the size of the establishment where the accident has occurred is a potentially relevant factor in explaining the occurrence and the consequences of accidents, as it can be taken as a proxy of the prevention system that the firms carry out. The figures in the table suggest that temporary workers employed through THAs are more likely (between 1.5 and 3 times) to suffer an accident in medium-sized establishments (between 50 and 500 employees) in comparison with workers holding open-ended contracts and direct temporary contracts (as compared with the latter, the likelihood is even higher in establishments between 500 and 1,000 employees). These results could be interpreted as indicating that having a prevention system on their own reduces the likelihood that agency temporary workers suffer an accident in comparison with the rest of workers.

Finally, once the accident has happened, the likelihood that agency temporary workers are involved is higher when they work in certain sectors of activity, such as chemistry, metal goods, other manufacturing industries, and transports. These are sectors (together with mining and construction) showing high accident rates in Spain (see Hernanz and Toharia, 2006).

To sum up, the descriptive data suggest that workers hired through THAs who suffer work-related accidents are less likely to be seriously injured or be killed and are

more likely to have a short absence after the accident. At the same time, these workers are over-represented in extremely short tenures and in low-skilled and unskilled occupations. They are also over-represented in medium-sized establishments and in sectors with high risk of accidents.

It is likely that all these variables (and others not examined) are correlated, so results concerning the consequences of accidents broken down by contract types might be attributable to the concentration of workers in certain occupations, sectors and firms. The analysis in the coming section shall deal with this issue in a more rigorous way.

4. RESULTS

One of the features of the EAT dataset is that it allows a joint analysis of the characteristics of individuals who have suffered a work-related accident together with those of the jobs and the accidents themselves. As these are correlated, it is necessary to undertake a multivariate analysis which takes into account these correlations to adequately isolate the effect of contract types on the consequences of work-related accidents: the probability of the worker suffering a serious/fatal accident and the duration of the absence after it. In each case, personal, job and firm attributes and characteristics associated with the accident are used as controls in the multivariate analysis.

In particular, the variables used in the regressions have been grouped into four main categories: personal characteristics, which include gender, age and nationality; job attributes, which include tenure and occupational group; establishment characteristics, which include industry, size and region; and accident attributes, which include whether other workers were involved in the accident, the hour of the working time when the accident happened, the day of the week, the types of place, the types of task the worker was performing, and the specific physical activity he/she was doing.

The analysis consists of running several regressions, including as independent variables various sets of variables, reflecting the characteristics of individuals, of the jobs they hold and of the accidents themselves. Following this procedure, we can evaluate the effect of diverse groups of variables on the probability of having a serious/fatal accident and on the duration of absences as well as the potential variations that the contract types variable could suffer depending on the sort of additional independent variables included in the estimation. Our focus is on the difference in the

probability (in the duration) among temporary workers employed through THA, direct temporary workers and open-ended workers.

More specifically, the models we estimate are the following:

- Model (1), in which the only independent variable is the contract types.
- Model (2), in which the independent variables are the contract types and the personal characteristics of the workers.
- Model (3), in which establishment attributes are added to the previous ones.
- Model (4), in which job attributes are added to the previous ones.
- Model (5), in which some characteristics of the accident are included: the moment of time (hour of the working time and day of the week) and whether other workers were involved in the accident.
- Model (6), in which the controls are all the previously considered plus others capturing specific characteristics of the accident (types of place, types of task the worker was performing and specific physical activity).[7]

Furthermore, regressions have been run for all accidents included in the dataset and, to check the robustness of the estimations, regressions have also been run for accidents concerning employees with at most 3 years of tenure, this being for many years the legal maximum duration of temporary contracts in Spain, having remained as a practical rule of thumb for conversion of temporary workers into permanent ones.

4.1. The probability of having a serious/fatal accident

In this subsection, we carry out an econometric estimation on the probability that, once a work-related accident has happened, the accident was serious/fatal rather than minor. Given the dichotomous nature of the dependent variable, the proper model is either a logit or a probit. In this case, a logistic model is estimated.

Table 3 provides the estimate results regarding the effect of contract types on the probability of having a serious/fatal work-related accident (the full results for the largest model are shown in Table A.1 in the Appendix). The upper panel presents the results for all employees; the lower panel for employees with 3 years of tenure or less. This table provides three ways of presenting the results.

[7] Model (6) on the duration of absences also includes the degree of injury as a control variable.

Table 3. Estimate results of logistic models on the probability of suffering a serious/fatal work-related accident.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.
ALL EMPLOYEES												
Coefficient												
Open-ended	-0.044	**	-0.161	***	-0.025		-0.057	**	-0.053	**	-0.048	
Temp. THA	-0.647	***	-0.492	***	-0.266	***	-0.266	***	-0.256	***	-0.191	**
Relative probab.												
Open-ended	0.957	**	0.851	***	0.975		0.945	**	0.948	**	0.953	
Temp. THA	0.524	***	0.611	***	0.766	***	0.766	***	0.775	***	0.826	**
Probability												
Direct temp.	1.49		1.27		2.37		2.88		2.26		3.34	
Open-ended	1.43		1.08		2.32		2.73		2.14		3.19	
Temp. THA	0.79		0.78		1.83		2.22		1.76		2.78	
EMPLOYEES WITH 3 YEARS OF TENURE OR LESS												
Coefficient												
Open-ended	-0.136	***	-0.156	***	-0.039		-0.040		-0.035		-0.034	
Temp. THA	-0.663	***	-0.507	***	-0.287	***	-0.291	***	-0.281	***	-0.223	***
Relative probab.												
Open-ended	0.873	***	0.856	***	0.962		0.960		0.965		0.967	
Temp. THA	0.516	***	0.602	***	0.751	***	0.748	***	0.755	***	0.800	***
Probability												
Direct temp.	1.48		1.27		2.43		2.93		2.31		3.53	
Open-ended	1.30		1.08		2.28		2.77		2.18		3.23	
Temp. THA	0.77		0.77		1.79		2.17		1.71		2.69	
Personal characts.	-		Yes		Yes		Yes		Yes		Yes	
Firm characts.	-		-		Yes		Yes		Yes		Yes	
Job characts.	-		-		-		Yes		Yes		Yes	
Accident characts.	-		-		-		-		Yes		Yes	
Accident char. +	-		-		-		-		-		Yes	

Notes:
The full results of model (6) appear in Table A.1 in the Appendix.
(**) and (***) indicate that the corresponding coefficients are statistically significant at 5 percent and 1 percent, respectively.

The first one simply gives the coefficients of the categories of the contract type's variable, i.e. open-ended contract and temporary contract through a THA, being the direct temporary contract the reference. In this case, a positive coefficient indicates that the corresponding category increases the probability of suffering a serious/fatal

accident, while a negative coefficient suggests the reverse. As can be seen, an agency temporary worker exhibits a lower probability of suffering a serious/fatal accident as compared with an individual having the same characteristics except that her contract is a direct temporary one. This result holds for all the specifications of the model, although the magnitude of the effect declines as the number of independent variables included in the model increases, being relatively low – but yet statistically significant – when all the possible variables are considered (even those specific to the accident).

The most appropriate way of looking at the size of the effect of contract types on the probability of suffering a serious/fatal accident consists of using relative probabilities. One of the advantages of logistic models is that they allow one to express the estimate results as relative probabilities from the coefficients of each variable. Thus, the estimates provide the relative probability of a change in the corresponding category of a variable with respect to a base or reference category (whose coefficients are equal to one). Therefore, model (1) tells us that the probability that an agency temporary worker suffered a serious/fatal accident is 0.52 times the probability of the reference (an individual with a direct temporary contract). This probability is 0.77 times with models (3), (4) and (5), and 0.83 times with model (6).

Finally, we provide the gross probabilities of having a serious/fatal work-related accident by contract types. Let us remember that the raw data regarding the sample we are using (EAT-2004) give a frequency of serious/fatal accidents of 1.44 per 100 accidents. This frequency is 1.43 for workers holding an open-ended contract, 1.49 for workers holding a direct temporary contract and 0.79 for workers with a temporary contract through a THA. As can be seen, these figures agree with those of model (1), since this model does not include any additional independent variables. When the variables capturing personal characteristics are included, the probabilities (especially those of workers with open-ended contracts) decline, while the addition of variables related to the employer, the job and the characteristics of the accident raises those probabilities, reaching values of around 3 per 100 accidents.

Findings are quite similar when the estimated results for the sample of accidents concerning workers with 3 years of tenure or less are considered, although in this case it the difference between agency temporary workers and their open-ended counterparts is even clearer.

On the whole, all the estimated specifications of the model, independently of the number of included covariates, bring about the result that a worker employed through

THAs exhibits a statistically significant lower probability of suffering a serious/fatal accident in comparison with a worker holding a "direct" temporary contract whose working conditions and personal characteristics are the same. This probability is also lower than that of a similar worker holding an open-ended contract.

4.2. The duration of the absence

Another dimension of interest as regards the consequences of accidents is the length of time a worker remains out of employment. This is analysed using an econometric estimation on the determinants of duration of an absence after a work-related accident, controlling for a set of personal, job and establishment attributes. One of these characteristics is the types of contract held by the injured worker: open-ended contract, direct temporary contract or temporary contract through a THA. In this case, the sort of model estimated is a count data model, since the dependant variable (the number of days of absence) takes up non-negative integer values. In particular, a negative binomial regression is estimated.[8]

Table 4 provides the estimate results regarding the effect of contract types on the duration of an absence after a work-related accident (the full results for the largest model are offered in Table A.2 in the Appendix). It shows not only the coefficients but also the relative probabilities of a change in the corresponding category with respect to the base or reference category (whose coefficients are equal to one). As before, the top panel of the table presents the results for all employees and the bottom panel for employees with at most 3 years of tenure.

[8] Likelihood ratio tests reject the null hypothesis that the parameter reflecting unobserved heterogeneity is zero for all estimated regression, given support for the estimation of Negative Binomial models instead of Poisson models. For a description of count data models, see Winklemann and Zimmerman (1995) and Cameron and Trivedi (1998).

Table 4. Estimate results of binomial negative models on the duration of absence after a work-related accident. Spain: EAT-2004.

	(1)		(2)		(3)		(4)		(5)		(6)	
	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.	Coeff.	Sig.
ALL EMPLOYEES												
Coefficient												
Direct temp.	-0.105	***	-0.008	***	-0.018	***	-0.050	***	-0.002		-0.002	
Temp. THA	-0.318	***	-0.171	***	-0.150	***	-0.209	***	-0.134	***	-0.116	***
Relative probab.												
Direct temp.	0.901	***	0.992	***	0.983	***	0.951	***	0.998		0.997	
Temp. THA	0.727	***	0.843	***	0.860	***	0.811	***	0.875	***	0.892	***
EMPLOYEES WITH 3 YEARS OF TENURE OR LESS												
Coefficient												
Direct temp.	-0.054	***	0.001		-0.006	**	-0.047	***	0.005		0.003	
Temp. THA	-0.268	***	-0.167	***	-0.142	***	-0.205	***	-0.128	***	-0.112	***
Relative probab.												
Direct temp.	0.948	***	1.000		0.994	**	0.954	***	1.005		1.003	
Temp. THA	0.765	***	0.856	***	0.868	***	0.815	***	0.880	***	0.894	***
Personal characts.	-		Yes		Yes		Yes		Yes		Yes	
Firm characts.	-		-		Yes		Yes		Yes		Yes	
Job characts.	-		-		-		Yes		Yes		Yes	
Accident characts.	-		-		-		-		Yes		Yes	
Accident char. +	-		-		-		-		-		Yes	

Notes:
The full results of model (6) appear in Table A.2 in the Appendix.
(**) and (***) indicate that the corresponding coefficients are statistically significant at 5 percent and 1 percent, respectively.

According to model (1), the relative probability tells us that an agency temporary worker exhibits an absence duration that is 0.73 times the duration for the reference worker (an identical individual holding an open-ended contract). This is exactly what the raw data show: average duration for workers with open-ended contracts is 23.9 days while that for temporary workers hired through THAs is 17.4 days, that is, 6.5 days less or 27.3 percent less, which implies that a agency temporary worker exhibits an average duration that is 0.73 (=1.00-0.27) times that for a worker holding an open-ended contract. This duration is around 0.85 times in models (2), (3) and (4) and amounts to 0.88-0.89 times in models (5) and (6).

Despite the fact that the magnitude of the effect declines as more independent variables are added to the model, the relative probability corresponding to the category of temporary workers employed through a THA is statistically significant in all the estimated specifications. In the case of the "direct" temporary workers category, its probability is the same than that of the reference group once all the potential observable variables are taken into account, even those regarding the characteristics of the accident. These findings remain virtually the same when considering the sample of accidents for workers with 3 years of tenure or less.

Overall, for all the estimated specifications of the model, independently of the number of included independent variables or the sample used, we obtain the result that agency temporary workers exhibit a statistically significant lower duration of an absence after a work-related accident has happened as compared with similar workers holding either "direct" temporary contracts or open-ended contracts.

5. CONCLUSIONS

This piece of research has investigated the effect of the contract types on some consequences of work-related accidents in Spain, using an administrative register containing all the work accidents occurred during a whole year. This database provides the possibility of analysing not only work accidents by contract types, distinguishing among workers holding open-ended contracts, direct temporary workers and agency temporary workers; it also relates these variables to a wide array of personal, job and accident characteristics.

The initial numbers indicate that the consequences of work-related accidents vary with contract types but also that contract type is one of the determinants of the risk and consequences of accidents. Thus, although workers hired through THAs who suffer work-related accidents are less likely to be seriously injured or die and are more likely to have a short absence after the accident, these workers are over-represented in extremely short tenures, in low-skilled and unskilled occupations and in sectors with high risk of accidents. At the same time, they are over-represented in medium-sized establishments but under-represented in the largest ones, which could indicate that having a prevention system on their own reduces the likelihood that agency temporary workers suffer an accident in comparison with the rest of workers.

After presenting these basic descriptive results, a more rigorous multivariate analysis was carried out in order to determine the influence of the contract types on the probability of having a serious/fatal accident and on the number of working days lost, after controlling for a set of personal, job and accident characteristics. The analysis has shown that workers employed through THAs exhibit a statistically significant lower probability of suffering a serious/fatal accident and lower duration of an absence after a work-related accident has happened in comparison with workers holding "direct" temporary contracts and workers holding open-ended contracts whose working conditions and personal characteristics are the same. This results might be interpreted as an indication that, although the short duration of their assignments may be a potential factor increasing the probability of suffering an accident and the consequences of it, agency temporary workers potentially benefit from specific training (safety and health programmes) provided by THAs in order to avoid work accidents.

Given the significance of temporary employment and the share of THAs on labour market intermediation in Spain, the analysis we perform and the results we obtain are relevant from an academic and from a policy point of view. Knowing whether agency temporary workers have less accidents than their temporary counterparts and whether their consequences are less serious constitute relevant issues at the heart of the current debate on the role of THAs. As a matter of fact, the temporary agency industry has been demanding the Government more significance in the latest labour reform: they asked for the broadening of their market, the reduction of costs they face, and the entry in the training sector. But their undaunted, unanimous petition was the abolition of the bans avoiding THAs to work in the so-called risky sectors. This paper has offered one reason to recognize agency work as a valid form of employment in its own right, albeit one that is substantially different from the standard employment relationship.

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APPENDIX

Table A.1. Estimate results of the logistic model (6) on the probability of having a serious/fatal accident. Spain: EAT-2004.

	Coefficient	Relative probability	Significance
Constant	-3,365	0,035	0,000
Contract type (Direct temporary)			
Open-ended	-0,048	0,953	0,067
Temporary THA	-0,191	0,826	0,016
Tenure (Less than 1 month)			
1 month	-0,255	0,775	0,000
2 months	-0,245	0,783	0,000
3 months	-0,231	0,793	0,000
4-6 months	-0,249	0,780	0,000
7-12 months	-0,228	0,796	0,000
>1-2 years	-0,220	0,802	0,000
>2-4 years	-0,281	0,755	0,000
>4-8 years	-0,189	0,828	0,000
>8 years	-0,159	0,853	0,001
Occupation (Manufacturing unskilled workers)			
Managers	0,830	2,294	0,000
Professionals	0,667	1,949	0,000
Technicians and associate professionals	0,327	1,386	0,000
Clerks	0,170	1,185	0,012
Personal service workers	-0,188	0,828	0,013
Salespersons	-0,337	0,714	0,000
Agriculture skilled workers	-0,047	0,954	0,644
Construction skilled workers	0,018	1,018	0,748
Industry skilled workers	-0,077	0,925	0,165
Manufacturing skilled workers	-0,120	0,887	0,051
Plant and machine operators	0,068	1,070	0,175
Domestic workers	-0,243	0,784	0,003
Other unskilled service workers	-0,016	0,985	0,818
Agriculture unskilled workers	-0,098	0,907	0,349
Mining unskilled workers	0,289	1,335	0,303
Construction unskilled workers	-0,101	0,904	0,105
Transportation unskilled workers	-0,190	0,827	0,011
Establishment size(1-9 employees)			
Without information	0,235	1,265	0,000
10-25 employees	-0,266	0,766	0,000
26-49 employees	-0,368	0,692	0,000
50-99 employees	-0,461	0,630	0,000
100-249 employees	-0,681	0,506	0,000
250-499 employees	-0,747	0,474	0,000
500-999 employees	-0,671	0,511	0,000
1000+ employees	-0,771	0,463	0,000

Industry (Agriculture)			
Construction	-0,243	0,784	0,007
Energy and extraction	-0,054	0,947	0,604
Chemistry	-0,104	0,901	0,274
Other manufacturing industries	-0,089	0,915	0,319
Metal goods	-0,320	0,726	0,000
Wholesale distribution	-0,229	0,795	0,014
Retail and repairs	-0,460	0,631	0,000
Hotels and restaurants	-0,298	0,742	0,003
Transportation	-0,211	0,809	0,019
Communications	-0,543	0,581	0,000
Finance	0,026	1,026	0,813
Business services	-0,268	0,765	0,006
Education and research	-0,271	0,763	0,029
Other services	-0,213	0,808	0,021
Autonomous Community(Andalucía)			
Aragón	-0,319	0,727	0,000
Asturias	-0,363	0,696	0,000
Baleares	-0,337	0,714	0,000
Canarias	-0,772	0,462	0,000
Cantabria	-0,345	0,708	0,000
Castilla-La Mancha	-0,307	0,736	0,000
Castilla-León	-0,289	0,749	0,000
Cataluña	-0,335	0,715	0,000
Com. Valenciana	-0,462	0,630	0,000
Extremadura	-0,104	0,901	0,124
Galicia	0,132	1,141	0,000
Madrid	-0,419	0,658	0,000
Murcia	-0,399	0,671	0,000
Navarra	-0,238	0,788	0,002
País Vasco	-0,574	0,563	0,000
La Rioja	-0,623	0,536	0,000
Age (16-25 years)			
26-35	0,094	1,099	0,002
36-45	0,398	1,489	0,000
46-55	0,721	2,056	0,000
56+	0,992	2,696	0,000
Gender (Male)			
Female	-0,676	0,508	0,000
Nationality (Spanish)			
Non-Spanish	0,248	1,281	0,000

Note: the model also includes some accident characteristics such as whether other workers were involved in the accident, the hour of the working time when the accident happened, the day of the week, the type of place, the type of task the worker was performing, and the specific physical activity he/she was doing.

Table A.2. Estimate results of the binomial negative model (6) on the number of days lost after an accident. Spain: EAT-2004.

	Relative probability	Statistical significance
Contract type (Open-ended)		
Direct temporary	0,997	0,310
Temporary THA	0,892	0,000
Tenure (less than 1 month)		
1 month	0,954	0,000
2 months	0,965	0,000
3 months	0,940	0,000
4-6 months	0,934	0,000
7-12 months	0,935	0,000
>1-2 months	0,951	0,000
>2-4 months	0,965	0,000
>4-8 months	0,984	0,001
>8 months	0,998	0,648
Occupation (Managers)		
Professionals	0,935	0,002
Technicians and assoc. professionals	0,913	0,000
Clerks	0,903	0,000
Personal service workers	0,882	0,000
Salespersons	0,894	0,000
Agriculture skilled workers	0,902	0,000
Construction skilled workers	0,892	0,000
Industry skilled workers	0,892	0,000
Manufacturing skilled workers	0,890	0,000
Plant and machine operators	0,898	0,000
Domestic workers	0,874	0,000
Other unskilled service workers	0,877	0,000
Agriculture unskilled workers	0,919	0,000
Mining unskilled workers	0,985	0,684
Construction unskilled workers	0,893	0,000
Manufacturing unskilled workers	0,889	0,000
Transportation unskilled workers	0,865	0,000
Establishment size (Without inform.)		
1-9 employees	0,962	0,000
10-25 employees	0,903	0,000
26-49 employees	0,877	0,000
50-99 employees	0,870	0,000
100-249 employees	0,881	0,000
250-499 employees	0,879	0,000
500-999 employees	0,901	0,000
1000+ employees	0,940	0,000
Industry (Agriculture)		
Construction	0,940	0,000
Energy and extraction	1,010	0,428
Chemistry	0,943	0,000
Other manufacturing industries	0,950	0,000

Metal goods	0,909	0,000
Wholesale distribution	0,933	0,000
Retail and repairs	0,911	0,000
Hotels and restaurants	0,917	0,000
Transportation	0,950	0,000
Communications	0,961	0,008
Finance	0,936	0,000
Business services	0,948	0,000
Education and research	0,962	0,006
Other services	0,936	0,000
Autonomous Community (Andalucía)		
Aragón	1,268	0,000
Asturias	1,312	0,000
Baleares	0,989	0,086
Canarias	1,048	0,000
Cantabria	1,323	0,000
Castilla-La Mancha	1,039	0,000
Castilla-León	1,098	0,000
Cataluña	1,069	0,000
Com. Valenciana	1,105	0,000
Extremadura	1,002	0,783
Galicia	1,331	0,000
Madrid	1,003	0,334
Murcia	1,229	0,000
Navarra	0,990	0,230
País Vasco	1,114	0,000
La Rioja	0,977	0,067
Age (16-25 years)		
26-35	1,133	0,000
36-45	1,315	0,000
46-55	1,503	0,000
56+	1,712	0,000
Gender (Male)		
Female	1,051	0,000
Nationality (Spanish)		
Non-Spanish	0,919	0,000
Degree of injury (Minor)		
Serious	4,130	0,000

Note: the model also includes some accident characteristics such as whether other workers were involved in the accident, the hour of the working time when the accident happened, the day of the week, the type of place, the type of task the worker was performing, and the specific physical activity he/she was doing.