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2015

Online at <https://mpra.ub.uni-muenchen.de/61405/>

MPRA Paper No. 61405, posted 18 Jan 2015 14:45 UTC

# The Impact of Precarious Employment on Mental Health: the Case of Italy\*

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December 1, 2014

## Abstract

In this paper, we investigate the impact of precarious employment on mental health using a unique dataset that matches information on mental health with labour characteristics for a set of employees in Italy. We examine the causal effect of temporary contracts, their duration and the number of contract changes during the year on psychotropic medication prescription. To this end, we estimate a dynamic probit model, and deal with the potential endogeneity of regressors by adopting a control function approach, recently advanced by Wooldridge (2014). Our results show that the probability of psychotropic medication prescription is higher for workers under temporary job contracts. More days of work under temporary contract as well as more changes in temporary contracts significantly increase the probability of being depressed. We also find that moving from permanent to temporary contracts increases depression; symmetrically, although with a smaller effect in absolute value, moving from temporary to permanent contracts tends to reduce it. An exploratory data analysis corroborates the hypothesis that depression developed after a movement to precarious employment may permanently affect future job trajectories.

One lesson to learn from our empirical work is that policies aimed at enhancing the flexibility of the labour market to boost firms' competitiveness, if increasing the precariousness of employment, may also produce sides effects on the wellbeing and mental health of employees, ultimately having consequences on firms' productivity and health care costs.

**Keywords:** Precarious employment, mental health, prescriptions.

**JEL Classification:** J01, C33, C36.

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\*The authors thank CRISP for the data and for helpful suggestions on the interpretation of results.

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# 1 Introduction

In the last decades, industrialised countries have experienced a significant increase in the proportion of people under temporary employment. This trend could reflect, in part, the need of firms facing higher competition to promptly adjust to changes in supply and demand conditions. Further, new technology has allowed fragmenting the production process and outsourcing certain tasks, a trend that has been associated with less stable employment (ILO, 2008). A recent ILO report documents a steady increase in temporary employment in the OECD countries since the 1980s, with a 55 per cent rise between 1985 and 2007, which grows to 115 per cent when focusing only on the European Union (ILO, 2011). The global economic recession erupted in 2008 has diminished the bargaining power of many employees, creating fewer opportunities to secure permanent jobs that ultimately may guarantee stability and planning for the future of the household. As also emphasised by the ILO (2012) World of Work Report, in many countries where employment growth has resumed after the global crisis, jobs tend to be provided on a short-term basis, with involuntary part-time work and temporary employment increasing in most countries.

There is still no universally accepted definition for precarious employment, given its multi-dimensional nature that may vary across countries and the economic and social structure of the labour market. However, precarious employment can be seen as employment relations characterized by high uncertainty, low income, and limited social benefits and statutory entitlements (Vosko, 2010). As pointed by some authors, it also includes dimensions such as individualized bargaining relations between workers and employers, low wages and economic deprivation, limited workplace rights and social protection, and powerlessness to exercise workplace rights (Benach *et al.*, 2014). Precarious employment often is associated to poor working conditions or physically heavy work, and higher risk of accidents (Gash *et al.*, 2007). These features are likely to impact on workers' physical and mental health conditions, as well as their overall well-being, thus resulting in lost employment, absenteeism, lost firm productivity and premature retirement.

There is a growing empirical literature measuring the effect of job precariousness on the mental health of people, although the debate is still open. The study of the impact of precarious employment on mental health requires special attention due to the bidirectional relationship between job instability and health. As pointed by a consistent body of literature, individuals with mental illness (e.g., depression) are less likely to be employed, and have lower earnings, work absences, reduced labour supply, and lower on-the-job productivity than those without mental illness (see, among others, OECD, 2011, and Frijters *et al.*, 2014). Hence, individuals suffering from mental health problems may also systematically differ in their propensity to find a stable work. However, most empirical studies have investigated the link between health and forms of precarious employment without taking into account such bidirectional relationship.

Based on cross-sectional survey data from 15 European countries, Benavides *et al.* (2000)

found that precarious employment, in the form of fixed term, temporary contract and sole traders, is consistently and positively associated with job dissatisfaction but negatively associated with absenteeism and stress. Adopting a logistic regression approach, Rodriguez (2002) used a measure of perceived health for a sample of workers from Britain and Germany between 1991 and 1993 and found that full-time employees with fixed-term contracts in Germany are 40 percent more likely to report poor health than those who have permanent work contracts. However, the author also found a small and insignificant association of poor health status with marginal employment in Britain. More recently, Quesnel-Vallee *et al.* (2010) performed a propensity score analysis on a cohort of American men and women followed from 1979 to 2010, finding a significant effect of temporary work on depressive symptoms for those who had been exposed to temporary work in the two years preceding the outcome measurement. Similar adverse effects on mental health are reported by Cottini and Lucifora (2010) by performing a panel data analysis based on three waves of the European Working Conditions Survey. The authors address the potential endogeneity of working condition and mental health within workplace by exploiting the variation across countries and over time in workplace health and safety regulations, as well as in regulations on working time flexibility, to identify the causal effect of adverse working conditions on mental health distress. They show that a set of job characteristics such as working in shifts, performing complex and intensive tasks and having restricted job autonomy lead to a higher probability of reporting mental health problems, and they also find evidence of a positive causal effect of adverse overall working conditions on mental health distress. Waenerlund *et al.* (2011), focusing on a sample of workers aged 42 years old in Sweden, found that temporary employees have a higher risk of both non-optimal self-rated health and psychological distress. A negative influence on self-rated health and psychological well-being exerted by certain contractual and working conditions is found by Robone *et al.* (2011), using twelve waves of the British Household Panel Survey. To reduce concerns about reverse causality, the authors include previous health status, lagged one period, in the empirical models. To deal with potential endogeneity of job insecurity, Caroli and Godard (2014) adopt an IV approach taking as instruments the natural layoff rate in the sector where the individual is employed interacted with the stringency of the employment protection legislation in her country. Using cross-country data from the 2010 European Working Conditions Survey, the authors show that, when endogeneity is accounted for, the health-damaging effect of job insecurity is confirmed for a subgroup of health outcomes, namely self-rated health, being sick in the past 12 month, suffering from headaches or eyestrain and depression or anxiety, while for other health variables, the impact of job insecurity appears to be insignificant.

However, there is also research according to which temporary or atypical employment does not have long-lasting detrimental effects on self-rated health of workers. Sverke *et al.* (2002) carried a meta-analysis of 37 surveys conducted between 1980 and 1999 showing that job insecurity is associated with a higher prevalence of psychiatric disorders, after controlling for demographic and work environment characteristics. Virtanen *et al.* (2002), using cross sec-

tional survey from 8 Finnish towns, reported that both men and women with fixed-term employment had better self-rated health compared to their permanent counterparts. Focusing on the first 10 waves of the British Household Panel Study, Bardasi and Francesconi (2004) found that atypical employment does not have long-lasting detrimental effects on self-rated health of workers. To deal with the issue of reverse causality, the authors adopt various strategies, such as including individual fixed effects, controlling for previous employment status, as well as analysing the effects of changes in labour market status on changes in health outcome to weed out unobserved heterogeneity. Artazcoz *et al.* (2005) reported no differences for Spain in mental health between workers with fixed-term and permanent contracts. A cross sectional study by Keuskamp *et al.* (2013), while pointing at strong association between casual full-time employment and poor physical health, found no significant relation between casual full-time or part-time employment and poor mental health, in a sample of Australian workers in 2009. It is important to observe that existing scientific literature on the impact of precarious/temporary employment on (mental) health are mostly based on survey data for one or more countries. Also, most of these studies try to deal with the endogeneity problem by including in the empirical model previous health or employment status, or by adopting an instrumental variable approach where instruments are usually aggregate variables, such as new regulations in terms of working time flexibility or unemployment rate.

In this paper, we wish to estimate the impact of precarious employment on the mental health of people by investigating whether it is associated to higher probability of getting psychotropic medication prescription. We identify precarious employment with temporary employment, namely, all employment relations other than those with unlimited duration, including fixed-term and subcontracted jobs, as well as work done on projects, on call and through temporary-help agencies. As also pointed by Benach *et al.* (2014), one can consider temporary workers to be in an objective state of job insecurity. We match administrative data from the Ministry of Labour in Italy on a set of employee with data on their psychotropic drug prescriptions for the years between 2007 and 2011. In Italy, like in other advanced economies, standard employment, in the form of full-time, permanent work arrangements, has long been regarded as the norm, and the framework within which labour law, collective bargaining and social security systems developed. However, the past decade has witnessed a rise in non-standard forms of employment, in the form of temporary, part-time or informal employment. In 2012 in Italy, seven employees out of ten were recruited on fixed-term contracts. Badly designed employment regulations have been pointed, among other reasons, as making employers reluctant to recruit under permanent contracts in Italy (ILO, 2008).

Our empirical analysis uses data on workforce resident in the Lombardy region of Italy. This region is the most densely populated and the main industrial area of the country, workers from this region represent around 18.5 per cent of national employment, 25 per cent if focusing on the industrial sector only, and produce more than 20 per cent of Italian Gross Domestic

product. One important reason for taking this region is that in its firms the incidence of non-standard labour contracts is significantly high, when compared to the rest of Italy. Finally, a further advantage of focusing the analysis on this region, rather than the entire nation, is that we mitigate the significant heterogeneity in the labour markets and health care systems existing across Italian regions.

The data set, comprising over 13 millions of worker-year observations, which cover most workforce present in the area, offers a unique opportunity to assess the precariousness of job contracts, and investigate its role in developing mental health disorders. In our analysis, rather than using, as in most studies, a measure of self reported psychological health, we assume that mental health problems occur when the worker has been dispensed one or more prescriptions of psychotropic drugs, for two or more consecutive terms within a year. We link precarious or temporary employment to three key features of the job pattern associated to a worker, the type of job contract under which he is employed, whether this is permanent or temporary, the number of days worked under this contract, and the number of changes in job contract observed over time. We assume that the mental health status follows a dynamic panel data regression with group-specific effects. To control for unobserved heterogeneity in the context of a dynamic nonlinear panel, we follow Wooldridge (2005b) and use Chamberlain (1980)'s device to obtain a distribution of the outcome variable conditional on initial values and exogenous explanatory variables. To deal with the issue of bidirectional relationship between job instability and health, we adopt a two-step control function approach, a method recently advanced by Wooldridge (2014) to estimate nonlinear models with endogenous explanatory variables. For a given worker in the data set, we take as instruments a set of variables that characterise precariousness within the firm whether she is employed. These variables are valid instruments as long they do not directly affect the mental health status of the worker, but rather only indirectly through their impact on the labour variables. It is plausible to think that these variables computed at firm level are not influenced by the mental health of a single worker, but rather reflect to a large extent the recruiting policy of firms.

We believe that our rich data set combined with the use of recently advanced econometric methods allows us to estimate more accurately than previous studies the effect of employment instability on mental health.

The rest of the paper is organized as follows. Section 2 describes the data and presents a preliminary exploratory data analysis. Section 3 introduces our regression model and explains our econometric approach. Section 4 comments on regression results, while Section 5 explores the mental health consequences of moving to precarious employment. Finally, Section 6 concludes.

## 2 Data and sample construction

We collected data from different sources. First, we gathered administrative data on workforce resident in the Lombardy region, in the years from 2007 to 2011 from the Italian Ministry of Labour. Since 2007, it is mandatory for Italian firms to notify electronically all hires and separations, extensions or conversions of job contracts. The data system known as Compulsory Communications (CC) records each workforce movement in private and public Italian firms. For each worker movement, it provides information on the date of the event, the identity of the worker, the identity of the firm and a set of worker characteristics including her age, gender, nationality, educational level, and residence. It also includes information on the type of contract, whether this is a part-time or full-time job, and the sector of activity of the firm according to the ATECO classification.

It is important to stress some limitations of this source of data. First, we observe that it does not include information on all existing workforce, but rather only on those workers that have started or terminated an employment contract anytime after the year 2007. Therefore, the data set does not include workers having a permanent or temporary position that has not changed over the 5-year sample period. By construction, the data set is unbalanced towards young workers as it captures all workers that enter in the labour market for the first time during the sample period, while it does not include older workers having a stable position since before 2007. Another limitation of these data is that it is not possible to know what happens to the workers once her contract is terminated, whether she becomes unemployed, self-employed, or rather moves outside the labour force; we only know that she is not anymore under a job contract.

We have matched these data with information on antidepressant, mood stabilizers and antipsychotics prescriptions dispensed by GPs or specialists to any of the workers appearing in the CC data set. Data on prescriptions have been collected from the Lombardy Region. We have focused on this set of medications as these are used to treat major psychiatric disorders of Axis I (Clinical Disorders) in the Diagnostic and Statistical Manual of Mental Disorders.<sup>1</sup> Finally, we have collected information on gender-specific unemployment rate in the region from the Office of National Statistics, and on the amount of redundancy funds transferred to the sector where the various firms operate in order to cover the loss in production due to adverse economic conditions from the Social Security Institution. The latter variable is expressed in number of hours paid by the pension institute to each firm within each sector of activity, according to the ATECO classification. We refer to Table 1 below for a list of the variables appearing in the data set with their definitions. We remark that our variable for mental health ( $h_{it}$ ) takes value of 1 if the person has received at least one medical prescription for two or more

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<sup>1</sup>The selection of these medications was made through consultation of a psychiatrist. Some psychotropic antiepileptic drugs were excluded because they are usually not used for psychiatric disorders (a list of medications included in the analysis is available upon request).

consecutive terms within year  $t$ , as an indication that this person is affected by mental health problems.

Table 1: Definition of variables

Variable	Description
$h_{it}$	1 if person $i$ is affected by mental health problems in year $t$
$Age_{it}$	Age of person $i$ in year $t$
$Female_i$	1 if person $i$ is male
$High\ school_{it}$	1 if person $i$ has completed high school in year $t$
$University\ degree_{it}$	1 if person $i$ has a university degree in year $t$
$Non-Italian\ citizenship_{it}$	1 if person $i$ has non-Italian citizenship in year $t$
$Milan_{it}$	1 if person $i$ is resident in Milan in year $t$
$Temporary_{it}$	1 if person $i$ holds a temporary contract in year $t$
$N.\ days\ empl._{it}$	n. of days worked over the year $t$
$N.\ of\ contract\ changes_{it}$	n. of new contracts held by person $i$ in year $t$
$Redundancy\ pay_{st}$	n. of hours paid by the pension institute to sector $s$ in year $t$ (in 10,000,000)
$Unemployment\ rate_t$	Gender-specific unemployment rate in the region in year $t$

In order to obtain an annual panel data, a decision had to be made on which job contract each worker has in the years when he changes contract. In this paper, we have decided to assign to each worker observed in a specific year, the job contract for which he has worked the longest number of days within the year, i.e., the job contract that has been prevalent within the year. We have dropped workers younger than 18 and older than 65 years old, and all observations related to firms having 10 or less job contracts active within a year. In fact, in order to find suitable instruments to deal with the endogeneity of our key variables, we need to have enough variation within firm so that we can exploit information on job contracts within each firm. After this cleaning procedure, we have obtained a person-year data set of around 2.6-2.7 million workers observed over 2007 to 2011.

Table 2 gives some summary statistics on the sample. In our regression analysis, we classify individuals into three age groups in order to distinguish workers that have recently accessed the labour market (aged 18 to 34), from those that have been in the labour market presumably for a longer time (aged 35 to 49), and from those workers that are in the process of leaving the labour market (aged 50 and over). In fact, it is likely that these groups have different expectation towards their job career, and may react in a different manner to job precariousness, which in turn may affect their mental health status. Table 2 clearly shows, as expected, that young workers are over-represented in the data set, when compared to older workers.



Table 2: Descriptive statistics on labour data

	2007	2008	2009	2010	2011
n. workers					
18-34	1,412,792	1,293,179	1,220,880	1,158,338	1,080,092
35-49	951,277	951,515	984,037	1,024,469	1,063,719
50 and over	368,357	388,997	426,098	469,871	513,093
All sample	2,732,426	2,633,691	2,631,015	2,652,678	2,656,904
% in population: <sup>(*)</sup>					
18-34	74.20	69.23	66.52	64.57	61.13
35-49	41.51	40.79	41.55	42.83	44.12
50 and over	19.45	20.45	22.21	24.17	26.00
All sample	44.87	43.16	42.97	43.28	43.19

<sup>(\*)</sup>: Population in the same age group, source: Eurostat.

Table 3 reports a set of descriptive statistics for the health and labour variables, as well as a set of socio-demographic variables, for all sample and for the sample divided into age groups. As expected, the percentage of people with at least one prescription increases with age. As for the labour variables, as proxy for precariousness, we include whether the (prevalent) contract is permanent (which comprises both permanent contracts and apprenticeship) or temporary contracts, which includes fixed term, project-based contracts and contracts through temporary agencies. Around 35 to 47 per cent of the workers have a temporary contract, and work on average, over 200 days within the year. A worker changes job contract on average around 0.2 to 0.4 times during the year, depending on their age.

Table 3: Descriptive statistics on health and labour data

	18-34	35-49	$\geq 50$	All sample
Health variables				
% with at least one medical prescription	2.29	4.25	5.47	3.60
Labour variables				
Temporary (%)	46.51	34.14	35.18	39.74
N. of days empl. (average)	202.8	234.5	227.5	219.5
N. of contract changes (average)	0.401	0.284	0.215	0.323
Redundancy pay* (average)	2.675	2.77	2.875	2.750
Unemployment rate (%)	-	-	-	4.775
Socio-demographic variables				
Age (average)	27.51	41.168	55.73	37.70
Female (%)	46.03	46.09	41.08	45.20
High school (%)	47.91	53.89	58.12	51.93
University degree (%)	13.44	11.17	8.29	11.71
Non-Italian citizenship (%)	25.71	23.33	12.95	22.58

(\*) : in 10,000,000.

Table 4 shows summary statistics on a set of variables characterising job precariousness. In this paper, we attach to precarious employment three key features of job patterns experienced by a worker, the type of job contract under which he is employed, whether this is permanent or temporary, the number of days worked under this contract, and the number of changes in job contract observed over time. In our data set, temporary contracts last on average 375 days, while permanent contracts (excluding those that do not end in 2011), terminate on average after over 2 years. As expected, workers with a permanent position tend to change contract less frequently and work for a larger number of days within the year when compared to workers with temporary job. Temporary contracts, while lasting less than permanent contracts, are characterised by much higher variability in terms of number of days worked within the year. This is explained by the large variety of different contracts under this category, which includes fixed term, on-project and contract through temporary job agency. It is interesting to observe that older workers tend to work more over the year, and have less frequent contract changes than the youngest.

Table 4: Statistics on job precariousness

	Type of contract	
	Temporary	Permanent
N. different contracts in the data set	664,571	3,787,782
Average length (n. of days) <sup>(*)</sup>	375.16	811.81
Std. dev. length (n. of days) <sup>(*)</sup>	389.43	612.70
	All workers	
% of workers that do not change job within the year	66.25	76.57
N. of days worked within a year	119.97	284.19
	Class 1: age 18 to 34	
% of workers that do not change job within the year	63.25	81.81
N. of days worked within a year	118.03	275.52
Std. dev. (n. of days)	133.80	110.45
	Class 2: age 35 to 49	
% of workers that do not change job within the year	66.84	83.95
N. of days worked within a year	127.87	288.49
Std. dev. (n. of days)	139.35	101.02
	Class 3: age 50 and over	
% of workers that do not change job within the year	75.05	87.87
N. of days worked within a year	109.17	292.52
Std. dev. (n. of days)	141.34	100.08

<sup>(\*)</sup>: To compute these figures we have excluded those job contracts that on 31/12/2011 are still open.

### 3 The empirical model and estimation strategy

As also pointed by a consistent medical literature, mental illness has a strong recursive component, namely, the occurrence of a mental health problem for an individual at a point in time is likely to increase the likelihood of having mental health problems in the future. In fact, one of the major risk factors for repeated episodes is the presence of residual symptoms that persists after an episode ends (Roy and Schurer, 2013). Accordingly, we assume that the mental health status follows a dynamic panel data regression with group-specific effects. Let  $h_{it}^*$  be the latent (unobserved) mental health status of worker  $i$  at time  $t$ , with  $i = 1, \dots, N$  and  $t = 1, \dots, T$ . We assume the following dynamic model for  $h_{it}^*$

$$h_{it}^* = \alpha_i + \lambda h_{i,t-1} + \beta' \mathbf{x}_{it} + u_{it}, \quad (1)$$

$$h_{it} = 1_{[h_{it}^* > 0]}, \quad (2)$$

where  $\alpha_i$  is an unobserved, individual-specific effect,  $u_{it}$  is an idiosyncratic, serially uncorrelated error term,  $\mathbf{x}_{it}$  is a vector of worker-specific covariates, and  $1_{[\cdot]}$  is an indicator function. The above model allows the occurrence of mental health problems at time  $t$  to depend not only on unobserved heterogeneity,  $\alpha_i$ , but also on the mental health state at time  $t - 1$ . Suppose initially that  $\mathbf{x}_{it}$  contains only strictly exogenous variables. Wooldridge (2005b) has suggested an approach for dealing with the initial conditions problem in non-linear dynamic random effects models that consists of obtaining a joint distribution of  $(h_{i1}, h_{i2}, \dots, h_{iT})$  conditional on the initial value,  $h_{i0}$ , and any exogenous explanatory variables. For this method to work, Wooldridge (2005b) proposes to specify a density for  $\alpha_i$  given  $(h_{i0}, \mathbf{x}_{i1}, \dots, \mathbf{x}_{iT})$  using the Chamberlain (1980)'s device:

$$\alpha_i = \pi_0 + \pi_1 h_{i0} + \boldsymbol{\pi}'_2 \bar{\mathbf{x}}_i + \eta_i, \quad (3)$$

where  $\bar{\mathbf{x}}_i = \frac{1}{T} \sum_{t=1}^T \mathbf{x}_{it}$ , is the time average of the regressors, and  $\eta_i$  is assumed to be distributed  $N(0, \sigma_\eta^2)$ , independent of the regressors, the error term  $u_{it}$ , and the initial conditions. Plugging (3) into (1), under the Probit specification, it is possible to derive the joint distribution of outcomes after the initial period, conditional on the initial value and any strictly exogenous variables (see, also, Wooldridge, 2005a, 2010). Such likelihood has exactly the same structure as the standard random effects Probit model, except for the regressors, which will be now

$$\mathbf{x}_{it}^* = (1, h_{i,t-1}, \mathbf{x}_{it}, h_{i0}, \bar{\mathbf{x}}_i).$$

Hence, with this approach it is possible to add  $h_{i0}$  and  $\bar{\mathbf{x}}_i$  as additional explanatory variables in each time period and use standard random effects Probit software to estimate  $\boldsymbol{\beta}$ ,  $\lambda$ ,  $\pi_0$ ,  $\pi_1$ , and  $\boldsymbol{\pi}_2$ . This approach only works if  $\mathbf{x}_{it}$  is made up of strictly exogenous variables. However, as also previously explained, the variables characterizing the job precariousness of workers, included in  $\mathbf{x}_{it}$  are potentially endogenous. Suppose that  $\mathbf{x}_{it}$  is made up of two sub-vectors, namely:

$$\mathbf{x}_{it} = (\mathbf{z}_{1,it}, \mathbf{w}_{it}),$$

where  $\mathbf{z}_{1,it}$  is a  $k$ -dimensional vector of strictly exogenous covariates, and  $\mathbf{w}_{it}$  is  $p$ -dimensional vector of variables characterizing the job precariousness of worker  $i$  at time  $t$ , potentially correlated with  $u_{it}$ . We observe that some studies lag the variables in  $w$  one period to account for delays in the impact of contractual conditions on health (see, for example, Bardasi and Francesconi (2004), and Robone *et al.* (2011)). However, we note that failing to include the current job contract can lead to an omitted-variable problem as precariousness experienced by the worker within the current year is likely to impact on her mental health. To deal with the endogeneity of  $\mathbf{w}_{it}$ , in this paper we adopt a control function approach, as outlined in Wooldridge (2014), which consists of two steps. Let  $\mathbf{z}_{2,it}$  be a set of exogenous variables, our instruments, affecting  $\mathbf{w}_{it}$ , and let  $\mathbf{z}_{it} = (\mathbf{z}_{1,it}, \mathbf{z}_{2,it})$ . In the *first step*, we regress each variable belonging to  $\mathbf{w}_{it}$  on  $\mathbf{z}_{it}$ , and obtain the corresponding residuals,  $\hat{e}_{k,it}$ .<sup>2</sup> Hence, in a *second step* we include

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<sup>2</sup>In the case of the precariousness index we compute the generalized residuals.

$\hat{e}_{k,it}$  as additional regressor in model (1)-(2). Given the endogeneity of  $\mathbf{w}_{it}$ , in this second step we relate the heterogeneity only to the strictly exogenous variables,  $\mathbf{z}_{it}$ , and assume that

$$\alpha_i = \pi_0 + \pi_1 h_{i0} + \boldsymbol{\pi}'_2 \bar{\mathbf{z}}_i + \eta_i. \quad (4)$$

We include in the vector  $\mathbf{z}_{1,it}$  the gender and age of worker  $i$ , whether at time  $t$  she holds a university degree or rather has completed high school, if she has Italian citizenship, and a dummy for the sector of economic activity of the firm where worker  $i$  is employed at time  $t$ . In our regression, we have also incorporated the amount of redundancy fund transferred to the sector where the firms operates in order to cover the loss in production due to adverse economic conditions, the regional, gender-specific unemployment rate, and time dummies.

The vector  $\mathbf{w}_{it}$  contains three key variables to proxy the job precariousness experienced by individual  $i$  at time  $t$ : a dummy indicating whether the prevalent contract of worker  $i$  in year  $t$  is temporary ("Temporary"), the number of days worked within the year  $t$  under the prevalent job contract ("N. days empl."), and the number of changes in job contract for worker  $i$  within the year  $t$  ("N. contract changes"). In our regression analysis, we also look at the interaction of these variables, by estimating the impact on the dependent variable of the number of days of work under temporary contract and of number of changes in temporary contracts. We observe that the inclusion of such interaction terms does not require any modifications of the first step of our procedure.

As instruments, we take a set of variables,  $\mathbf{z}_{2,it}$ , that are specific to the firm where worker  $i$  is employed at time  $t$ . More specifically,  $\mathbf{z}_{2,it}$  contains the percentage of workers having the same contract (either temporary or permanent) in the firm where  $i$  is employed at time  $t$ , the average number of days worked within the year by workers in the firm where  $i$  is employed at time  $t$ , and the average number of changes in contract for these workers. These variables are valid instruments as long they do not directly affect the mental health status of worker  $i$ , but rather only indirectly through their impact on the labour variables,  $\mathbf{w}_{it}$ . It is plausible to think that these variables are not affected by the mental health of worker  $i$ , but rather they reflect to a large extent the recruiting policy of firms. Table 5 shows some summary statistics on the selected instruments. We note a consistent average number of active job contracts by firm in one year, although when looking at the median number of contracts by firm, most firms have less than 58 contracts open in a particular year. Noting that all firms in the data set have at least 10 contract open on any year, we believe we hold enough information as well as variability at firm level on the type of contracts open to use it for instrumentation.

Table 5: Descriptive statistics on the selected instruments

Average n. of contracts by firm	439.10
Median n. of contracts by firm	58
Average % of workers with the same type of contract by firm	57.23
average n. of changes in contract for workers in the same firm	0.454
average n. of days worked for workers in the same firm, same contract	267.46

## 4 Empirical results

Table 6 shows results for the estimation of model (1)-(2), using the approach outlined above, for different age groups. To provide an indication of the magnitude of the associations between mental health and the regressors we present average partial effects (APEs). For continuous variables, such as age, these are obtained by taking the derivative of the Probit probabilities with respect to the variable in question. For discrete regressors, such as lagged health status, they are obtained by taking differences.

The coefficient attached to  $h_{i,t-1}$  is positive and significant across all age groups, ranging between 0.0736 for younger workers to 0.1362 for the elderly. This coefficient measures how persistent depression is over time, and it is likely to reflect the endurance of mental disorders, both observable and not observable. The elderly may suffer from more severe forms of depression, perhaps associated to (unobserved in our data set) physical health, explaining the difference in persistence of mental health over time across age groups. More permanent mental health outcomes as one grows old are also confirmed in previous studies (see, for example, Roy and Schurer (2013)).

Looking at our key variables for job precariousness, the coefficient attached to the variable "Temporary" is positive and significant for all age groups, corroborating our hypothesis that temporary contracts, being more precarious than permanent contracts, are more likely to increase mental illness. For the elderly, frequent changes in temporary contracts seems to increase mental health problems, while an opposite effect is observed for younger workers. While the "N. of days empl." is not significant in all regression, when focusing only on temporary contracts all coefficients are positive and significant across the age groups, thus suggesting that working more within a year under a temporary contract is likely to increase the probability of being depressed. To have an idea of the size of the coefficients attached to our key variables, suppose for example, that all workers in a temporary contract in the data set work under this contract one extra year. Under this assumption, the number of workers with temporary contract in the sample increases around 8-10 per cent, depending on the age group. Then, using the predicted outcomes from the estimated regression with this new variable, the number of depressed would increase by around 1, 2.3, 0.8 per cent, for the young, middle and older aged groups, respec-

tively. Suppose now that all workers experience one additional change in temporary contracts then what is in the data set. In this case, all other variables being constant, the number of (predicted) depressed for the oldest age group would rise by 1.3 per cent.

Consistent with previous studies, our results point at the fact that, being a precarious worker, characterised by frequent changes in temporary, short-term contracts, significantly increases the probability of developing mental health problems such as anxiety and depression, that need to be medically treated.

As for the socio-demographic characteristics, despite the division in age groups, it is interesting to note that age still plays an important role in explaining variations in depression across individuals; for the first two age groups, being one year older increases the probability of depression by 0.007 and 0.018, respectively, while for the age group 50 and over it decreases the probability by 0.005, indicating that the relation between age and depression is U-shaped.

The coefficient attached to the variable female is positive and significant across all age groups. This result is in line with consistent evidence from epidemiological, and clinical studies that women are more likely to suffer from depression when compared to men. Table 6 also shows that holding a university degree diminishes the probability of suffering from mental health problems relative to workers with less than secondary school (the excluded dummy), for the first two age groups. This result might reflect the fact that highly educated employees have more opportunities in the labour market compared to those with lower education, and this is reflected in their health and mental health status (see Robone et al., 2011).

The coefficient attached to having "Non-Italian citizenship" has a negative sign and is statistically significant. One explanation for this result is that non-Italian workers may have less access to health care, due for example to the lack of information on the availability of different treatments, possibly associated to poor education, cultural difference, and/or language barrier. Further, living in Milan, perhaps because of a better network or a higher concentration of social services in the city, seems to decrease the probability of developing mental health problems. Finally, it is interesting to observe that more hours of redundancy pay seem to exacerbate depression within the middle age group, while a higher unemployment rate has a negative impact on mental health problems for the first two age classes. The negative effect of the gender-specific unemployment rate may be explained by the fact that an increase in unemployment for all workers may make workers more tolerant towards their employment conditions, hence impacting on their mental health.

The bottom part of Table 6 reports variable addition tests for endogeneity (VAT) for each variable suspected to be endogenous (Wooldridge, 2014). The VAT test for the null hypothesis that a variable in  $\mathbf{w}_{it}$  is exogenous is a robust  $t$ -test on the residuals (obtained in the first stage regression) included in the second stage equation. Most VAT tests indicate that our proxies for precariousness have a significant impact, and hence are endogenous, thus confirming the appropriateness of the instrumental variable approach adopted in this empirical analysis.

Table 6: Regression results, average partial effects

	Class 1: 18-34		Class 2: 35-49		Class 3: 50-65	
	Par.	Std.err.	Par.	Std.err.	Par.	Std.err.
$h_{i,t-1}$	0.0787*	0.0003	0.1197*	0.0003	0.1358*	0.0005
Temporary $_{it}$	0.0061*	0.0005	0.0071*	0.0007	0.0037*	0.0013
N. contract changes - Temporary $_{it}$	-0.0005*	0.0002	-0.0001	0.0002	0.0018*	0.0005
N. contract changes $_{it}$	0.0008*	0.0002	0.0004	0.0003	-0.0011	0.0006
N. days empl. $_{it}$ - Temporary $_{it}$	0.0001*	0.0000	0.0001*	0.0000	0.0002*	0.0000
N. days empl. $_{it}$	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Age $_{it}$	0.0071*	0.0003	0.0185*	0.0034	-0.0053*	0.0015
Female $_i$	0.0118*	0.0023	0.0165*	0.0030	0.0004	0.0050
High school $_{it}$	-0.0002	0.0002	-0.0003	0.0002	-0.0002	0.0003
University degree $_{it}$	-0.0049*	0.0002	-0.0042*	0.0003	0.0001	0.0006
Non-Italian citizenship $_{it}$	-0.0117*	0.0002	-0.0192*	0.0003	-0.0266*	0.0007
Milan $_{it}$	-0.0009*	0.0002	-0.0007*	0.0002	0.0000	0.0003
Redundancy pay $_{st}$	-0.0002	0.0002	0.0004*	0.0002	0.0000	0.0004
Unemployment rate $_t$	-0.0033*	0.0013	-0.0036*	0.0017	0.0062*	0.0029
VAT endogeneity tests:						
Temporary	0.0888*	0.0053	0.0801*	0.0051	0.0872*	0.0078
N.contract changes	-0.0004*	0.0000	-0.0003*	0.0000	-0.0004*	0.0000
N. days empl.	0.0044	0.0037	-0.0009	0.0039	-0.0242*	0.0074
Pseudo-R <sup>2</sup>	0.3489		0.3909		0.3983	

Note: (\*): significant at the 5 per cent significance level.

## 5 Exploring the consequences of moving to precarious employment

The above regression results shows that being precarious increases the probability of having one or more prescriptions for medication to treat mental health problems. We now focus on what happens to the mental health of workers, when they face a change in their employment conditions. Specifically, in the regression we include three dummies: "Permanent to temporary $_{it}$ " is a dummy equal to one when worker  $i$  faces a change from a permanent to a temporary contract between  $t - 1$  and  $t$ , and zero otherwise; "Temporary to permanent $_{it}$ " is equal to one only when worker  $i$  faces a change from a temporary contract to another temporary contract between  $t - 1$  and  $t$ ; "Stable temporary $_{it}$ " is equal to one when worker  $i$  keeps a temporary



contract in both periods  $t - 1$  and  $t$ . It follows that the excluded dummy depicts a situation in which a worker  $i$  does not change his situation of permanent contract between  $t - 1$  and  $t$ , i.e., he could change contract, but only for another permanent contract. Results are reported in Table 7. It is interesting to observe that moving from a permanent to a temporary contract significantly increases the probability of being depressed, while, symmetrically, although with a smaller effect in absolute value, moving from a temporary to a permanent contract tends to reduce it, for all age groups. Finally, not being able to move from a situation of temporary contracts increases depression, when compared to a condition of stable permanent contracts.

All other variables have coefficients that are similar in terms of size and significance to those reported in the previous regression.

Table 7: Regression results: moving to precarious employment. Average partial effects

	Class 1: 18-34		Class 2: 35-49		Class 3: 50-65	
	Par.	Std.err.	Par.	Std.err.	Par.	Std.err.
$h_{i,t-1}$	0.0787*	0.0003	0.1198*	0.0003	0.1358*	0.0005
Permanent to temporary $_{it}$	0.0053*	0.0005	0.0024*	0.0007	0.0029*	0.0013
Temporary to permanent $_{it}$	-0.0009*	0.0003	-0.0011*	0.0003	-0.0009**	0.0005
Stable temporary $_{it}$	0.0049*	0.0004	0.0033*	0.0005	0.0042*	0.0008
N. contract changes $_{it}$	0.0006*	0.0001	0.0012*	0.0002	0.0006	0.0005
N. days empl. $_{it}$	0.0000	0.0000	-0.0001*	0.0000	0.0000	0.0000
Age $_{it}$	0.0064*	0.0004	0.0182*	0.0034	-0.0043*	0.0015
Female $_i$	0.0121*	0.0023	0.0164*	0.0030	-0.0003	0.0050
High school $_{it}$	-0.0002	0.0002	-0.0002	0.0002	0.0000	0.0003
University degree $_{it}$	-0.0047*	0.0002	-0.0039*	0.0003	0.0004	0.0006
Non-Italian citizenship $_{it}$	-0.0118*	0.0002	-0.0196*	0.0003	-0.0272*	0.0007
Milan $_{it}$	-0.0009*	0.0002	-0.0008*	0.0002	0.0001	0.0003
Redundancy pay $_{st}$	-0.0002	0.0002	0.0004*	0.0002	0.0000	0.0004
Unemployment rate $_t$	-0.0035*	0.0013	-0.0036*	0.0017	0.0065*	0.0029
Pseudo-R <sup>2</sup>	0.3488		0.3908		0.3982	

Notes: (\*): significant at the 5 per cent significance level. (\*\*): significant at the 10 per cent significance level.

Table 8 shows some descriptive statistics on workers that experience a change in their employment status, moving from a permanent to a temporary contract over the sample period. To build these statistics, we use the *predicted outcomes* from the first-stage regression in our previous analysis, rather than observed values. In fact, predicted values identify workers that have a temporary or a permanent contract only because of their exogenous characteristics, and not

because they are depressed. As expected, the percentage of workers moving from permanent to temporary contracts decreases with age, while the percentage of workers with first depression episode before or after moving from permanent to temporary rises with age. It is interesting to observe that the average number of contract changes after movement from permanent to temporary is higher for workers that develop a depression episode, although the number of days worked is roughly the same. This result seems to corroborate the hypothesis that depression developed after a movement to precariousness in turn impact on future precariousness pattern, by increasing average future contract changes. Thus, our results seem to indicate that mental health deterioration in precarious workers may permanently affect future job trajectories. However, we observe that the time span of our analysis is too short to fully investigate the job trajectories of workers due to the mental illness triggered by job precariousness.

Table 8: Descriptive statistics on the mental health of workers before and after movement to precarious employment

	Class 1: 18-34	Class 2: 35-49	Class 3: 50-65
% workers moving from permanent to temporary contract:	8.64	6.44	5.17
Av. n. contract changes after movement	0.417	0.298	0.208
Av. n. days worked after movement	194.0	234.5	226.2
% workers with mental health problems before moving from permanent to temporary contract	2.44	4.69	5.22
% workers with first with mental health episode after moving from permanent to temporary contract:	2.79	5.11	6.53
Av. n. contract changes after movement	0.456	0.319	0.207
Av. n. days worked after movement	201.7	228.7	219.9

## 6 Concluding remarks

The main objective of this paper was to study the effects of precarious employment on the mental health of employees during a period of economic recession. After having identified a set of attributes attached to precarious employment, we find that, *ceteris paribus*, being in a status of precarious employment tends to increase the likelihood of developing mental health problems, such as anxiety and depression, that need to be medically treated. Working for many days within the year under temporary contracts, as well as frequent changes in temporary contracts are also observed to increase the probability of being mentally ill, especially for older workers. Finally, we observe that moving from a permanent to a temporary contract tends to deteriorate mental health; symmetrically, shifting from a temporary to a permanent job,

improves the mental health status, although with a milder effect.

One lesson to learn from this is that policies that aim to render more flexible the labour market through the increase of temporary contracts, should also consider the social and economic cost of these reforms in terms of wellbeing and health of workers. On the other hand, policy tools tailored to alleviate mental health stress caused by job precariousness, and better management of mental health problems linked to job instability could not only improve the health of workers but also have a positive impact on the wider economy.

Although our data set is extremely rich, one limitation is its limited time span that does not allow us to follow the job trajectories of the workers, to better estimate the complex interaction between job precariousness and mental health problems. Further, we know little about the characteristics of the firms where workers are employed, as well as other important socio-economic characteristics of the workers, such as income, marital status or the presence of presence of children in the household, which are certainly important determinant of their mental health status.

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