



Is temporary employment damaging to health? A longitudinal study on Italian workers



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ABSTRACT

Working conditions have changed dramatically over recent decades in all the countries of European Union: permanent full-time employment characterized by job security and a stable salary is replaced more and more by temporary work, apprenticeship contracts, casual jobs and part-time work. The consequences of these changes on the general well-being of workers and their health represent an increasingly important path of inquiry.

We add to the debate by answering the question: are Italian workers on temporary contracts more likely to suffer from poor health than those with permanent jobs? Our analysis is based on a sample of men and women aged 16–64 coming from the Italian longitudinal survey 2007–2010 of the European Union Statistics on Income and Living Conditions. We use the method of inverse-probability-of-treatment weights to estimate the causal effect of temporary work on self-rated health, controlling for selection effects.

Our major findings can be summarized as follows: firstly, we show a negative association between temporary employment and health that results from a statistical causal effect in the work-to-health direction, and does not trivially derive from a selection of healthier individuals in the group of people who find permanent jobs (selection effect). Secondly, we find that temporary employment becomes particularly negative for the individual's health when it is prolonged over time. Thirdly, whereas temporary employment does not entail significant adverse consequences for men, the link between temporary employment and health is strongly harmful for Italian women.

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1. Introduction

Working conditions have changed dramatically over recent decades in all the countries of European Union, and flexible forms of employment have become increasingly more relevant. Permanent full-time employment characterized by job security and a stable salary is replaced more and more by temporary work, apprenticeship contracts, casual jobs and part-time work. The diffusion of new forms of flexible and temporary work contracts has transformed the labor market entry and exit conditions, leading to growing instability in employment relationships (Benach et al., 2000). Between early nineties and the first decade of two thousand the share of temporary employment rose on average from 10% to 16% in the Euro area and perceived job insecurity increased simultaneously (Caroli and Godard, 2013; Eurofound, 2010).

The consequences of these changes on the general well-being of workers and their health represent an increasingly important path of inquiry. Some scholars have suggested that flexible forms of employment may lead to general benefits for workers (e.g., Natti, 1993; Benach and Muntaner, 2007; Guest and Clinton, 2006; Kalleberg et al., 2000; La Valle et al., 2002). When flexible jobs are a voluntary choice rather than an involuntary constraint – e.g., professional consultants or self-employed people – flexible, contingent and non-standardized conditions can enhance job satisfaction and quality of life, particularly for highly skilled workers (Guest and Clinton, 2006). Research from U.S., European Nordic countries and UK have shown that flexible works may entail higher wages (Kalleberg et al., 2000), and may represent a way to sample a variety of occupational experiences or a necessary phase towards a more integrated position in the labor market (Booth et al., 2002; Natti, 1993; Virtanen et al., 2005). Positive effects, in particular for women, may derive from the fact that these forms of flexible work allow to control working time, helping the

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reconciliation between paid work and family life (La Valle et al., 2002). On the other hand, however, the majority of scholars argue that flexible working arrangements imply negative consequences for both occupational prospects and private life, including health status, mainly due to their greater insecurity and poorer working conditions (e.g., Benavides et al., 2000; Ferrie, 2001; Ferrie et al., 2005; Benach and Muntaner, 2007). This negative relationship is strengthened by the fact that, in contemporary societies, flexible work is increasingly becoming a necessity.

The majority of previous research addressed this relationship by examining associations, where both health and employment were measured at the same time. Cross-sectional studies are not suitable to disentangle selection effects (Benach et al., 2004; Benavides et al., 2000; Virtanen et al., 2003; Benach et al., 2014) and the need to rely on longitudinal data is straightforward. However, even when one adjusts for prior health status and other covariates, standard regression designs might not represent a solution (Oakes and Johnson, 2006). Only a few attempts have been made to assess statistical causality. Kim et al. (2008) and Quesnel-Vallee et al. (2010) applied propensity-score methods respectively to South Korea and U.S. data, while Caroli and Godard (2013), Cottini and Lucifora (2010) and Ehlert and Schaffner (2011) analyzed the relationship between work and health for a large group of European countries using fixed effects and bivariate probit models. All these authors proved the existence of a health gap in favor of permanent employees.

Our objective is to evaluate whether having a temporary contract in Italy, with respect to have a permanent employment, leads to a different assessment of one's own health, taking into account potential selection effects. This issue has never been studied for the Italian case because, even if some of the previously cited studies included Italy, none of them displayed separate analysis for this country. We use data coming from the European Union Statistics on Income and Living Conditions (EU-SILC), and we propose using the method of inverse-probability-of-treatment weights to estimate the causal effect of temporary employment on self-rated health. This method allows us to check for the potential selectivity of healthier individuals in the group of people who find permanent jobs. Another element to take into account in this research context (Benach et al., 2014) – and the proposed method enables to do this – is that having a temporary contract may in turn increase the risk to have another temporary contract the year after, in a sort of vicious circle.

This paper adds new and relevant contributions to literature. Firstly, to the best of our knowledge, this study represents one of the few analyses addressing the existence of a statistical causal effect of temporary work on health status instead of a simple association. Secondly, it is the first analysis for Italy, and thirdly, it explicitly looks at gender differences.

2. Theoretical and empirical background

2.1. Previous findings

In recent years the term precarious employment has been used quite broadly to indicate a continuum of *atypical* employment conditions that, with different pace, have been introduced in several European countries beside the *standard* full-time permanent jobs (Benach and Muntaner, 2007). The term precarious employment implies a multidimensional concept embodying (dis)continuity in time, job (in)security, lack of rights and social protection, low levels of wages and earnings (Benach and Muntaner, 2007; Benach et al., 2014). In most academic research and in public health field, common one-dimensional concepts relates to flexible, atypical, casual, non-standard, and temporary

employment. These terms are often used as synonymous, due to the impossibility to consider all the dimensions simultaneously, if not theoretically at least empirically.

Substantial international literature exists that has attempted to investigate the consequences of job precariousness, whatever defined, on individual well-being by using several outcome indicators, from Europe (e.g., Gash et al., 2007; Virtanen et al., 2005; Laszlo et al., 2010; Artazcoz et al., 2005) to the U.S. (e.g. Quesnel-Vallee et al., 2010) and Eastern Asia (Kim et al., 2008). Negative effects have been found in Europe for job satisfaction (Benach et al., 2004; Benavides et al., 2000) and life satisfaction (Scherer, 2009), even if contradictory results do exist (Bardasi and Francesconi, 2004). In terms of health consequences, a plethora of outcomes has been considered (Virtanen et al., 2005). Psychological disorder, mental distress and depression are generally amplified by precarious work (Callea et al., 2012; Caroli and Godard, 2013; Cottini and Lucifora, 2010; Quesnel-Vallee et al., 2010) from United States to Europe, except for Finnish workers (Virtanen et al., 2003). Consequences on physical health and chronic diseases are not well established, while someone finds differences between temporary and permanent employment (Benavides et al., 2000), someone else does not (Benach et al., 2004; Virtanen et al., 2003). Overall, a detrimental effect of precarious employment on self-rated health has been observed in many high-middle-income countries (Caroli and Godard, 2013; Ehlert and Schaffner, 2011; Kim et al., 2008), even if this relationship has not the same magnitude or significance everywhere (Bardasi and Francesconi, 2004; Gash et al., 2007; Laszlo et al., 2010; Rodriguez, 2002).

These differences may be outcome-specific (e.g., Bardasi and Francesconi, 2004; Rodriguez, 2002; Artazcoz et al., 2005) or may depend on the context, i.e. the labor market arrangements (Ehlert and Schaffner, 2011), the health and safety regulations (Cottini and Lucifora, 2010), or the level of welfare state or unemployment protection (Scherer, 2009). Indeed, welfare state, labor market and family arrangements have been advocated to play a role in mediating the effects of flexible employment on individual health (Benach et al., 2014; Cottini and Lucifora, 2010). Even if evidence is sometimes mixed and inconclusive, temporary workers in Scandinavian countries (notably in Finland) do not generally present a poor health status (Virtanen et al., 2003, 2005), as well as in the United Kingdom (Bardasi and Francesconi, 2004; Rodriguez, 2002; Virtanen et al., 2005). On the contrary, adverse consequences on health are usually depicted in Central and Southern European countries, namely France, Greece, Germany, Italy, Portugal and Spain (Cottini and Lucifora, 2010; Ehlert and Schaffner, 2011; Laszlo et al., 2010; Rodriguez, 2002), where the commitment of the State in these issues is weaker.

2.2. Pathways between temporary work and health

There are a number of potential pathways through which flexible forms of employment might damage health (Benach et al., 2014). Unemployment and job insecurity are two of the principal mediating factors that lead temporary employment to be negatively associated with health (Benach et al., 2000; Caroli and Godard, 2013; Virtanen et al., 2005). Unemployment has been found to deteriorate mental health (Murphy and Athanasou, 1999) due to the financial difficulties or extreme psychological strain that it triggers (Pearlin, 1989). Moreover, it has been argued and demonstrated that job insecurity has negative effects on physical and psychological well-being (Bohle et al., 2001; Waenerlund et al., 2011), self-rated health, psychiatric morbidity or long standing illness (Ferrie et al., 2005). Temporary work shares some positive features with employment, but it implies some unfavorable conditions as unemployment does (Benach et al., 2000). Fixed-term

workers lose their jobs more frequently than those on permanent contracts, simply because their contracts run out within short periods (usually several months to a year, Eurostat, 2002). These more intermittent employment histories, from one side, increase the risk of unemployment and, from the other side, increase job insecurity experienced by the worker. Moreover, temporary workers tend to be less satisfied with their jobs than permanent workers, and this dissatisfaction is especially related to job insecurity (Kim et al., 2008). Finally, temporary employment, like unemployment, may not completely fulfill functions guaranteed by employment, i.e. to structure one's day, to enable regular contacts with others, and to give a sense of self-worth (Warr, 1987).

Other explanations of the mechanisms linking temporary employment and health refer to the economic strain associated with the comparatively lower protection of flexible contracts. Fixed-term jobs are on average connected to relatively lower remunerations (Eurofound, 2010; Gash and McGinnity, 2007), reduced access to benefits, lack of prospects for promotion, and different power relationships or rights at work (Benach and Muntaner, 2007; Benavides et al., 2000; McGovern et al., 2004). All these characteristics have been suggested as additional potential psychosocial and material factors that shape the negative relationship between temporary work and health (Benach et al., 2000; Virtanen et al., 2003, 2005).

Temporary contracts often involve poor working conditions, physically heavy works, a higher risk of accidents and exposure to harmful substances (Eurofound, 2010, 2013). Flexible workers carry out more monotonous, repetitive and unskilled tasks, have less work autonomy and stricter supervisory control, and are more often affected by unsocial working hours or irregular and unplanned working times (e.g., Eurofound, 2010; McGovern et al., 2004; Gash et al., 2007). Adverse working environment, scarce job quality and unfavorable working conditions may cause distress in both physical and psychological health for the workers involved (Cottini and Lucifora, 2010; Klein Hesselink and van Vuuren, 1999; Scherer, 2009; Virtanen et al., 2005).

Only a few studies have directly and explicitly considered gender issues in this subject. When a gender perspective has been adopted, some studies revealed that the relationship between health and temporary work is shaped differently for men and women. Menendez et al. (2007), reviewing research referring to different countries from Europe to United States and Canada, outlined that the health of women is disproportionately affected by employment flexibility. Women work under temporary contracts more frequently than men, and temporary employment is more likely to have an adverse effect on them, for example in terms of mental and self-rated health (Artazcoz et al., 2007; Campos Serna et al., 2013), as well as of anxiety and depression (Callea et al., 2012). This harmful link is usually attributed to a sort of *horizontal gender segregation* that channels employed women into a restricted range of female occupations, also characterized by a *vertical division* (Artazcoz et al., 2007), i.e. minor prestige, limited career opportunities, lower wages. When also considering equal conditions of temporary contracts or job titles, women suffer often from lower pay, shorter-term contracts and less qualified jobs compared to men (Eurofound, 2013). Moreover, in line with the advices of Artazcoz et al. (2007) and Benach et al. (2014), gender differential could be interpreted in the light of the interactions between job, family life and domestic labor. It is not surprising that, among high-middle-income countries, gender differences have been found mostly in Southern European countries – Italy and Spain in particular (Artazcoz et al., 2005; Callea et al., 2012; Campos Serna et al., 2013) – where gender inequality is still pervasive in both work and family arrangements (Del Boca et al., 2012).

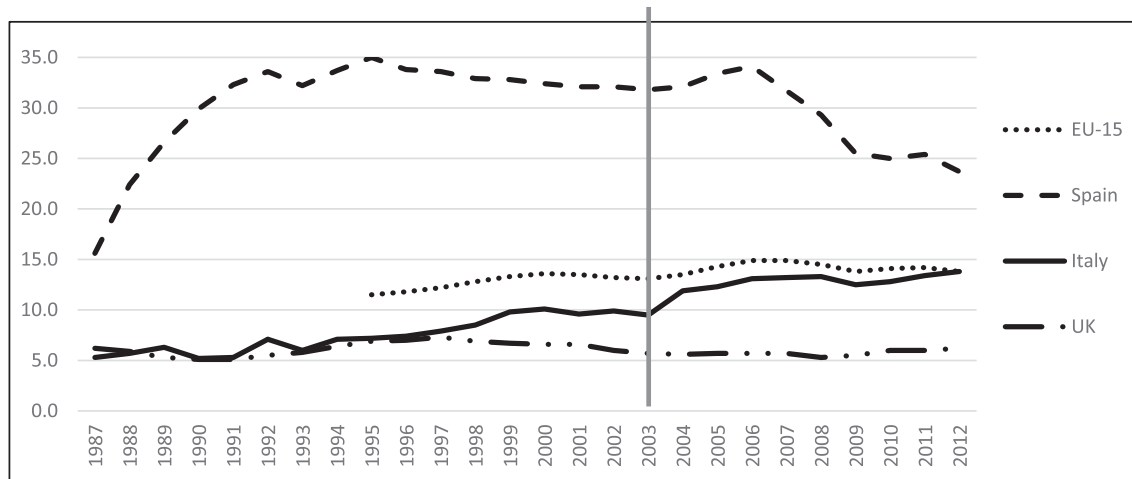
Finally, among the explanations of the work–health relationship, a relevant role is played by selection effects. Literature suggests that the association between work and health may be bidirectional (Barnay, 2014; Benavides et al., 2000): precarious employment could worsen health status (causation hypothesis) as above discussed, and vice-versa, a precarious health status may prevent access to better employment conditions (selection hypothesis), including more stable jobs. Certain individuals might have characteristics that result in poor health conditions and temporary commitment in the labor market. For example, lower socio-economic conditions are associated with poorer health (e.g., Mackenbach et al., 2008), but they are also associated with certain kinds of jobs – manual, stressful, hard – that in turn are typically more likely to be temporary and expose workers to higher risks for their health (Eurofound, 2010, 2013). The processes of selection and causation are not mutually exclusive (Goldman, 2001), and selection must be taken into account to measure the net effect of the type of employment on health.

3. Diffusion of temporary contracts in Italy and Europe

The spreading of various forms of flexible and temporary employment has been observed in almost all European countries over recent years. While some countries registered relevant quotas of temporary workers as early as the '80s, the increase became substantial almost everywhere at the beginning of the '90s, albeit at a different growth rate. United Kingdom (Fig. 1) is the European country with the lowest level of temporary contracts (less than 10%); similar values are registered for other continental countries, like Belgium, Luxembourg and Austria. Conversely, among the countries with the highest values of temporary workers, we find Spain (about 24%), Portugal and Poland (more than 20%). Italy, with 14–16% of temporary workers in the first decade of 2000's, is in line with the majority of Western European countries.

The Italian labor market has traditionally been heavily regulated, particularly with respect to the forms of contract that employers might offer: until the '80s the large majority of contracts were permanent, thus contributing to maintain fairly low levels of job insecurity. The reforms of the '90s progressively introduced several new contractual forms with a high degree of flexibility both in working time and duration, like part-time, project-based and occasional works, slowly starting the process of deregulation and flexibilization of the labor market (Fig. 1). The reform introduced in 2003 (the Biagi Law) produced an acceleration in the diffusion of temporary contracts, and one year later they were increased of 26%. That law approved liberalization measures concerning public and private local agencies, and introduced (or revised) several forms of non-permanent contract, i.e. job-on-call, job sharing, part-time, apprenticeship, training, fixed-term and project-based work (Tompson, 2009). Even if Biagi Law introduced some improvements in the social rights of these employees, these contracts remained characterized by lower wages, inferior bargaining power and lower level of rights and social protection.

The labor market reform process has occurred in most of the European countries (Tompson, 2009), however some characteristics have made the impact of the diffusion of temporary contracts particularly negative for workers' life in Italy. First, the spreading of flexible and temporary contractual forms in Italy has been the highest in Europe over the 1997–2008 period (OECD data) and involved mostly young workers. Within a few years, the Italian labor market has been characterized by a relevant quota of “young” insecure workers employed with several flexible contractual forms beside “old” secure workers employed with a unique type of permanent job contract. Second, there is evidence that for the young Italians temporary employment improbably represents a stepping-



Note: EU-15 average available from 1995. The vertical line marks 2003, the year of introduction of Biagi Law in Italy.

Fig. 1. Percentage of temporary workers out of the total number of workers in selected European countries (the countries with the highest and the lowest level of temporary contracts, Italy, and EU-15 average), Eurostat data, 1987–2012.

stone to permanent positions (Eurostat, 2002); moving in and out of temporary employment on a regular basis makes most of the temporary workers particularly exposed to unemployment. Third, these new contractual forms are characterized on average by lower wages, benefits and social protection with respect to permanent employment – e.g., training, sickness and parental leave, unemployment insurance – and differences in Italy are exacerbated (Tompson, 2009). Welfare state and social security systems are not well implemented in Italy for non-permanent workers – as for unemployed people – thus placing them in a vulnerable position.

The number of temporary, involuntary part-time, seasonal, and casual workers in Italy amounted to about four million in 2012, with an increase of about 23% with respect to four years before. On the contrary, permanent occupations in the same period registered a loss of more than one million of jobs (Ires CGIL, 2012). These data show a continuous increasing relevance of flexible and temporary employment, both in absolute and relative terms.

Beside the most relevant social stratifiers, like individuals' class location or migrant status (Benach et al., 2014; Menendez et al., 2007), temporary contracts are not equally distributed according to demographic characteristics like gender and age (Eurofound, 2013; Eurostat, 2002). The proportion of employees with temporary contracts is generally higher for women than for men. In Italy, where the disproportion is not one of the highest in the EU (Eurostat, 2002), the gender differential was about 6 percentage points in 2007 (EU-SILC data), and it slowly decreased in 2010 to 3.9 (11.6% for males vs. 15.5% for females). Moreover, according to EU-SILC data, over 50% of working women in Italy are employed in professions (e.g., keyboard-operating office clerks, customer and shop assistants, (pre-)primary school teachers) overall characterized by higher precariousness and inferior job conditions. Italian EU-SILC data also reveal that just under 50% of temporary workers is under 35, and another third is under 45, consistently with the European average.

The aforementioned remarkable and rapid changes in labor market structure, the peculiarities of the Italian institutional setting, and the strong gender differentials existing in family roles (Del Boca et al., 2012; Saraceno and Naldini, 2011), make the Italian case an interesting framework for the study of the effects of temporary employment on individual health and well-being. However, despite the increasing importance of these forms of flexible

employment and the central role of the link between precariousness and health in the political and sociological debate (Benach and Muntaner, 2007), very few empirical studies have investigated these issues for Italy and, more generally, for Southern European countries.

4. Method and data

4.1. General methodological framework

We rely on Marginal Structural Models (MSM) (Robins et al., 2000), a propensity-score based approach which uses inverse-probability-of-treatment weights (IPTW) estimators. MSM are a relatively new class of causal models used in medical studies (e.g., Hernan et al., 2000; Robins et al., 2000) or, more rarely, in economic applications (Lechner, 2009; Mariani et al., 2013). They enable to properly consider situations where time-dependent covariates for the event of interest also predict subsequent exposure, and where past exposure predicts subsequent level of the covariates. It is straightforward that studies aiming at considering the complex relations among past and present health conditions, occupational status, feedback relationships and other interrelated socio-economic characteristics may profit of this framework.

MSM require the usual assumptions made in the potential outcomes framework. First, we rely on the SUTVA (Stable Unit Treatment Value Assumption) according to which the potential values of outcome and covariates for each individual are only functions of his/her own treatment history up to that point in time. Second, the unconfoundedness (or ignorability) assumption implies that, conditional on pre-treatment covariates, treatment assignment is independent from potential outcomes. It means that adjusting for differences in observed pre-treatment covariates removes biases from comparisons between treated and control units, thus entailing a statistical causal effect. According to Rosenbaum and Rubin (1983), in order to reduce the multi-dimensionality of the problem, the unconfoundedness assumption is satisfied conditioning on the propensity-score.

The estimation of the causal effects through MSM is a two-stage process. In the first step, one computes the IPTW; in the second step, one uses IPTW to estimate the statistical causal effect of a given treatment as function of parameters of the MSM. In next

paragraphs, we describe in detail the data and variables used, and the implementation of the statistical procedure.

4.2. Data

Our empirical analysis is based on EU-SILC, a survey carried out for Italy by the Italian Institute of Statistics. EU-SILC collects information on nationally representative random samples of private households in all European countries (Eurostat, 2010) following individuals for 4 years, thus offering the possibility to trace their employment histories and, in parallel, their socio-demographic characteristics and their evaluations of health during time. To the best of our knowledge, this is the first time that EU-SILC data are exploited to analyze these issues, at least as for Italy.

We select data from the Italian EU-SILC panel of the years 2007 to 2010. Our analysis is carried out on the sample of men and women aged 16–64 in 2007, each of them interviewed every year in the period considered; we consider, first, the whole sample, and then men and women separately.

4.3. Outcome variable

Our outcome variable is self-rated health, according to the question suggested by the World Health Organization “How is your health in general?”. We dichotomized the responses considering value 0 if an individual answers *good* or *very good*, and 1 if he/she reports *fair*, *poor* or *very poor* general health, as often done in previous studies (e.g., Rodriguez, 2002; Ferrie et al., 2005).

In spite of the popular use of self-rated health in population surveys and empirical research, its appropriateness has been often put to question. Because of its subjective nature, self-rated health may suffer from person-specific heterogeneity, so this evaluation could be downward biased for pessimistic individuals or could change across cultures or populations (Prinja et al., 2012). These potential limitations impose to be careful in case of cross-population comparisons. However, other studies have established that self-rated health is closely linked to objective health conditions (Egidi and Spizzichino, 2006), physical and emotional well-being (Bayliss et al., 2012), and it is a valid predictor of mortality (Idler and Benyamini, 1997). Validity of self-rated health has also been proved in evaluating health changes after health promoting interventions (Perruccio et al., 2010). Overall, it allows for a global, complete and reliable evaluation of the general individual health status and well-being: respondents, when assessing their condition, are able to account simultaneously for the different dimensions of health. EU-SILC includes this variable each year, while other specific dimensions of health linked with working conditions, like mental health, vitality, depression and stress (Virtanen et al., 2005), are not collected in the survey.

4.4. Covariates

We define temporary employment depending on the duration of the contract: people declaring to have a fixed-term contract are considered temporary, opposite to permanent workers who have an open-ended contract. As for part-time contracts, we include them in the definition of temporary employment only when the condition of fixed duration is met. In order to precisely and unambiguously identify the type of contract in our analysis (Artazcoz et al., 2005; Virtanen et al., 2005), we exclude self-employed people. This exclusion is often made in this kind of studies (e.g., Bardasi and Francesconi, 2004; Caroli and Godard, 2013) and it is driven by two considerations: first, self-employed people may have individual characteristics that differentiate them with respect to fixed-term workers – e.g., entrepreneurship,

managerial skills, higher wage aspirations (Kalleberg et al., 2000); second, the nature of self-employment is profoundly different with respect to temporary contracts stipulated with an employee. Indeed, self-employment is sometimes considered different also from permanent employment (Virtanen et al., 2003).

Potential confounding factors, associated with both health and employment status, include demographic and socio-economic variables, work-related factors, and objective health status. It is well-known that health deteriorates with age; at the same time, temporary contracts are prevalent among young people. Age is introduced in our model as a categorical variable (<25 years; 25–34; 35–44; 45 and over). Our interest is to account for age differences and this formulation represents a satisfactory trade-off between model fit and sense of the analysis. Marital status, an element correlated with health even if evidence is not unequivocal, is categorized distinguishing between individuals in couple (married or cohabitant) and currently not in couple.

Italy displays several regional differences with respect to various domains of life, including labor market, health conditions and health services, with a clear-cut North-South divide (Pirani and Salvini, 2012). We introduce the area of residence as covariate, distinguishing between North, Centre and South. Even if regional or local differences may persist within these three areas, this regional level accounts for most of the territorial variability in Italy (Pirani and Salvini, 2012); moreover, NUTS-2 regions are not available in the longitudinal section of Italian EU-SILC.

The socio-economic status of individuals is appraised through the highest level of education achieved and the subjective evaluation of one's own financial situation, two aspects undeniable linked both to health status (e.g., Mackenbach et al., 2008) and working conditions (e.g., Eurofound, 2010). We grouped the educational level into low (primary and lower secondary education), medium (upper secondary education) and high (post-secondary and tertiary education). The evaluation of the economic and financial situation refers to the household in its entirety and it derives from the question “Thinking of your household's total income, is your household able to make ends meet, namely, to pay for its usual necessary expenses?”. The answers vary according to the degree of difficulty declared, ranging from “with great difficulty” to “very easily”.

Following standard practice, occupations (based on Isco-88 classification) are categorized into three groups. A first group includes basic and elementary occupations (plant and machine operators and assemblers, craft, agricultural and fishery workers); a second group includes occupations with medium level of skills (technicians, associate professionals and clerks); a third group refers to occupations implying higher levels of competences and expertise (legislators, senior official and managers, professionals).

Finally, we consider two confounding factors accounting for health status. The first one indicates the presence/absence of long-standing illness (measured by chronic illness declared by individuals, e.g., hypertension, diabetes, heart diseases, arthrosis; see Istat, 2007 for more details); the second one indicates persons suffering any type of limitation in daily activities (disability).

4.5. Inverse-probability-of-treatment weights

Let us indicate with $C(t)$ our treatment variable, that is the type of contract declared by individuals in the survey at each time t , with $C = 1$ for workers under temporary contract (the treated) and $C = 0$ for workers under permanent contract (the controls or untreated). In our analysis the time indicator t specifies years from 2007 to 2010. Y is the outcome variable affected by the treatment, i.e. self-rated health, with $Y = 0$ meaning good health, and $Y = 1$ less than good health. The history of covariates during time is indicated with

the vector $\bar{\mathbf{L}}$, whereas \mathbf{B} indicates the same covariates measured at baseline, i.e. in $t = 2007$, the first year of the panel. Since our aim is to estimate the causal effect on the health outcome Y in $t = 2010$, in order to account for the pattern of treatments and covariates, we compute IPTW at time points $t = 2008$ and $t = 2009$. Clearly, each person may be treated in both years or may be treated and control in two distinct years. The final individual-specific IPTW for treatment C at the end of the period of observation T is given by the product of his/her weights computed at each time point t :

$$IPTW(T) = \prod_{t=0}^T W^C(t) \times W^E(t)$$

$$= \prod_{t=0}^T \frac{f(C(t)|\bar{\mathbf{C}}, \mathbf{B})}{f(C(t)|\bar{\mathbf{C}}, \bar{\mathbf{L}}, \mathbf{B})} \times \frac{f(E(t)|\bar{\mathbf{C}}, \mathbf{B})}{f(E(t)|\bar{\mathbf{C}}, \bar{\mathbf{L}}, \mathbf{B})}$$

The denominator of $W^C(t)$ is the probability, obtained through a logistic regression model, of having a given type of contract in t , conditional on individual covariates (during time and at baseline, $\bar{\mathbf{L}}$ and \mathbf{B} respectively), and conditional on one's own previous history of permanent-temporary contracts, $\bar{\mathbf{C}}$. The numerator of $W^C(t)$ is used to "stabilize" the weights and prevent large standard errors and variance (Hernan et al., 2000; Robins et al., 2000; Hernan and Robins, 2013). These probabilities of treatment, namely propensity-scores, are estimated including all possible covariates known to be associated with employment condition and health, regardless of their statistical significance (Caliendo and Kopeinig, 2005; Oakes and Johnson, 2006; Kim et al., 2008).

$W^E(t)$, where E denotes the exit from the sample both for attrition or job loss (i.e. unemployment), are the inverse-probability-of-exit weights, and they are used to "correct" the IPTW (Fewell et al., 2004). The exclusion from the analysis of individuals with missing values would introduce selection bias (Hernan and Robins, 2013), above all when attrition or unemployment represent selective processes with respect to individual characteristics, included the contract C and the outcome Y . At the beginning of the period, in 2007, data contained information for 278 male and 347 female temporary workers. Four years later, we register a loss of more than 40%, however IPTW corrected for attrition enable to account for the characteristics of these "lost" individuals.

By weighting each individual on his/her IPTW we simulate a pseudo-population in which there isn't association between time-dependent/baseline observed covariates $\bar{\mathbf{L}}$ and \mathbf{B} , and treatment C or the risk of exit from the sample E . In the pseudo-population, unlike the actual population, treatment assignment is unconfounded by measured covariates. That is, the association between treatment C and outcome Y in the pseudo-population consistently estimates the statistical causal effect of C on Y .

4.6. Marginal structural models

In the second step of the procedure, the causal coefficient can be unbiasedly estimated by a standard analysis in the pseudo-population. Due to the short duration of the panel and the need to adequately control for pre-treatment covariates, we concentrate our analysis on the statistical causal effect of the type of contract in 2009 on the self-rated health in 2010. This effect is estimated through a logistic regression model controlled for individual confounders measured at baseline \mathbf{B} (Robins et al., 2000), in which IPTW are used as population weights: $Y_{(t=2010)} = \alpha + \beta_1 C_{(t=2009)} + \beta_k \mathbf{B}$. β_1 is our main parameter of interest and it represents the causal effect.

Alternatively, to study the persistence of temporary employment we estimate the logistic model $Y_{t=2010} = \alpha + \beta_n \bar{\mathbf{C}} + \beta_k \mathbf{B}$,

where $\bar{\mathbf{C}}$ is a categorical variable representing the history of contracts in 2008–2009, i.e., permanent–permanent, temporary–permanent, permanent–temporary, and temporary–temporary.

In the next section, we present models results estimated for men and women together ($N = 1831$, 334 of which are temporary workers), and separately for men ($N = 1181$, with 154 temporary workers) and women ($N = 650$, with 180 temporary workers). Additional details about IPTW's distributions and balancing issues between treated and controls are presented in the Appendix.

5. Results

Table 1 shows the effects of temporary employment on self-rated health estimated through both a standard approach (logistic regression model) and a marginal structural model. The response variable is self-rated health (0 = good; 1 = less than good), and odds ratios (OR) indicate the increased odd of temporary employment compared to permanent employment. It is worth noting that in 2010 about 16% of the Italian men in the EU-SILC sample evaluated their health less than good, while self-rated health was poor for 20 women out of 100.

The OR to report less than good health for temporary workers (model 1), estimated by a standard regression logistic model, is 1.41 (95% confidence interval, hereafter CI 0.97–2.05), meaning that having a temporary job in 2009 is associated with about a 40% higher odd of not reporting good health in 2010. Adopting a marginal structural model, the estimated OR rises to 3.75 (CI 1.89–7.44). This result not only confirms the previous association, but the statistical causality also makes the negative link stronger.

Let us now look at the persistency over time in the model estimated with the MSM approach. With respect to a worker with an history of permanent contracts, we found that if a permanent contract is followed by a temporary one (model 2), the odd of reporting less than good health is more than 4 times higher (OR = 4.39, CI 1.84–10.51), while having temporary contracts for two consecutive years corresponds to a nearly 3 times higher odd (OR = 2.97, CI 1.50–5.87); it is evident that passing from a situation of a secure (i.e. permanent) job to that of an insecure (i.e. temporary) job is particular deleterious for individual well-being. It is interesting to note that when temporary employment is limited in time (i.e. one year) and it is later followed by a permanent position, this situation does not significantly damage health (OR = 1.32, CI 0.34–5.07).

Table 1
Models results: effects of temporary employment on self-rated health.

	Men & women	Standard logistic regression			Marginal structural model		
		OR	95% Confidence intervals	$P > z$	OR	95% Confidence intervals	$P > z$
Mod. 1	Permanent 09 (ref.)	1.00			1.00		
	Temporary 09	1.41	(0.97–2.05)	0.069	3.75	(1.89, 7.44)	0.000
Mod. 2	Permanent 08	1.00			1.00		
	–permanent 09 (ref.)						
	Temporary 08	1.02	(0.45–2.31)	0.968	1.32	(0.34, 5.07)	0.686
	–permanent 09						
	Permanent 08	1.41	(0.62–3.17)	0.413	4.39	(1.84, 10.51)	0.001
	–temporary 09						
	Temporary 08	1.36	(0.83–2.23)	0.229	2.97	(1.50, 5.87)	0.002
	–temporary 09						

Note: The models account for individual covariates (age, marital status, area of residence, education, financial situation, kind of occupation, presence of chronic illness and disabilities) measured at baseline $t = 2007$.

This global effect conceals strong gender differences, indeed. The estimation of models separately by gender reveals that for men temporary employment does not significantly worsen health, even if the relationship is negative (OR = 2.06, CI 0.76–5.57, Table 2, model 1a). This result is confirmed when considering the sequence of contracts in 2008–2009 (model 2a).

Conversely, women with a temporary contract have an almost 5 times higher odd (OR = 4.95, CI 2.10–11.69) of suffering of less than good health compared to their permanent employment counterparts (model 1b). In addition, with respect to a woman with an history of permanent contracts, both a two-year period of consecutive temporary contracts and a permanent contract followed by a temporary one, lead to a significant worsening of health (model 2b), at least from the subjective point of view (with OR = 5.56, CI 1.86–16.61 and OR = 4.28, CI 1.83–10.02, respectively).

6. Discussion

6.1. Overall findings

The key strength of this study lies in the marginal structural model framework adopted. We used longitudinal data in a counterfactual approach to estimate the causal effect of temporary employment on self-rated health, for the first time in Italy.

Our major findings can be summarized as follows: firstly, in contemporary Italy temporary employment is not simply associated with worse health compared to permanent employment, but the negative link results from a statistical causality from employment to health. Secondly, we find that temporary employment becomes particularly negative for the individual's health when prolonged over time. When a temporary contract is followed by a permanent one within a reasonable lapse of time – e.g., one year –

no negative consequences are observed on the worker's health. Thirdly, Italian women's health is strongly affected by the negative consequences of temporary employment, while for Italian men the estimated effect, even if in the same direction, does not reach statistical significance.

The methodology used enables us to interpret the association found as statistical causality. However, the lack of information about possible mediators prevent us to precisely identify or isolate which is (are) the most relevant pathway(s) through which temporary employment deteriorates health in the Italian context. The determinants of these results need further investigations and, for the time being, interpretative lines can only be hypothesized.

6.2. A focus on gender differences

Why is women's health disproportionately affected by the negative consequences of temporary employment? In our opinion, there are three different potential mechanisms at play, even if they cannot be tested here.

A first mechanism could derive from the horizontal and vertical segregation that characterize the Italian labor market (Eurofound, 2013; European Commission, 2013). Notwithstanding some changes in recent years, Italian female participation in the labor market is one of the lowest among European countries (50.5% in 2012); even when a woman is employed, it occurs mainly in non-standard kinds of employment, i.e. temporary jobs, as illustrated in the previous sections. Whereas job dissatisfaction, job insecurity and worse contractual conditions have been identified as strong mediators in the negative relationship between temporary contracts and health (Bohle et al., 2001; Cottini and Lucifora, 2010; Ferrie et al., 2005; Kim et al., 2008; Klein Hesselink and van Vuuren, 1999), these factors are especially damaging for women. For Italian youth a period of temporary work is currently an obligatory step in the phases of entry into the labor market, and young men are not exempt. Temporary work represents a transient state for young men more so than for young women (European Commission, 2013), however. The latter have a higher risk of staying trapped in the vicious cycle of temporary contracts (Campos-Serna et al., 2013; European Commission, 2013), and therefore of suffering negative consequences, also in terms of health.

A second specificity which may help in explaining the gender differential in employment–health relationship, and that the Italian context shares with other Southern European countries, is the gender division of household responsibilities and housework. Regardless of their employment status, Italian women are often obliged to suffer the greatest burden of domestic labor and childcare (Del Boca et al., 2012); these roles make it very hard for them to balance work and family responsibilities (Saraceno and Naldini, 2011). Women in precarious jobs tend to suffer constant variations of work schedules and their major concern is simply to have enough hours of work (Menendez et al., 2007). This strong (and double) burden, joined with the concerns of job insecurity, may have serious consequences on their psychological and physical health. In such a context, where the transition from the traditional gender role division to more equal positions between men and women is far from being achieved, these consequences are probably amplified. Again, due to lack of data, this mechanism cannot be empirically verified for the Italian case, but it combines with the findings of Callea et al. (2012).

Finally, we think that a third mechanism plays a relevant role in understanding our results. Job precariousness implies economic strains and difficulties, with consequent troubles in establishing the desired life pattern, e.g., in terms of union formation and parenthood objectives (Vignoli et al., 2012). The majority of precarious

Table 2

Models results: effects of temporary employment on self-rated health, men and women separately.

	Standard logistic regression			Marginal structural model		
	OR	95% Confidence intervals	$P > z$	OR	95% Confidence intervals	$P > z$
Men						
Mod. Permanent 09 (ref.)	1.00			1.00		
1a Temporary 09	0.82	(0.43–1.57)	0.550	2.06	(0.76–5.57)	0.154
Mod. Permanent 08	1.00			1.00		
2a –permanent 09 (ref.)						
Temporary 08	1.48	(0.45–4.86)	0.519	2.20	(0.55–8.76)	0.265
–permanent 09						
Permanent 08	0.88	(0.32–3.59)	0.854	2.34	(0.60–9.10)	0.220
–temporary 09						
Temporary 08	0.90	(0.37–2.16)	0.813	1.95	(0.55–6.90)	0.298
–temporary 09						
Women						
Mod. Permanent 09 (ref.)	1.00			1.00		
1b Temporary 09	1.92	(1.19–3.09)	0.007	4.95	(2.10–11.69)	0.000
Mod. Permanent 08	1.00			1.00		
2b –permanent 09 (ref.)						
Temporary 08	0.81	(0.25–2.58)	0.716	1.15	(0.24–5.53)	0.861
–permanent 09						
Permanent 08	1.85	(0.65–5.30)	0.250	5.56	(1.86–16.61)	0.002
–temporary 09						
Temporary 08	1.91	(1.01–3.59)	0.045	4.28	(1.83–10.02)	0.001
–temporary 09						

Note: The models account for individual covariates (age, marital status, area of residence, education, financial situation, kind of occupation, presence of chronic illness and disabilities) measured at baseline $t = 2007$.

workers are young people (and particularly young women), and this situation makes their transition to adulthood even more challenging, increasing the risk of life dissatisfaction (Scherer, 2009) and a state of emotional, mental and physical distress and depression (Virtanen et al., 2003; Quesnel-Vallee et al., 2010; Callea et al., 2012). These consequences appears more pronounced in women (Callea et al., 2012), above all in Southern European countries where the level of guarantees (in terms of duration but also maternity leave and sickness) is still limited (Del Boca et al., 2012). These aspects are indirectly captured by a general and global health indicator such as self-rated health.

6.3. Limitations

Some limitations of this study should be pointed out. Firstly, the availability of a longer panel of data would probably improve the analysis, offering the possibility to account for a longer sequence of temporary contracts and thus better analyze persistent effects of precariousness.

Secondly, even if the self-rated health indicator enables to capture most of the broad and various facets of the health concept, as main drawback it precludes the possibility of understanding the specific components of health involved. Due to the aforementioned unequal distribution of working conditions and hazards between men and women, precarious employment may be related to a number of adverse health outcomes with different patterns depending on gender. Therefore the analysis of other health outcomes, including mental or psychological distress, specific diseases and physical pain, would be appropriate. Moreover, the identification of specific health dimensions could suggest intervention policies.

Thirdly, the current dataset supplies longitudinal data offering the possibility to exploit a causal inference method, however, it lacks numerous variables representing potential mediators in the work–health relationship – such as job insecurity, work commitment, working conditions, job satisfaction – which would enable to verify the pathways leading to the effects found.

Future research should have access to, and take advantage of, all the aforementioned elements, in order to effectively enhance the understanding of the consequences of temporary employment. As Benach and Muntaner (2007, p. 277) suggested some years ago in their research agenda on this topic, “a series of fundamental challenges need to be addressed at various key levels”. Among these, availability of quality data is surely the first and unavoidable precondition for capturing the various forms of precariousness and understanding the mechanisms through which precarious employment damages male and female workers' health.

6.4. Conclusions

Italian labor market reforms that introduced so far different kinds of temporary job contracts have often been justified by the need to make the labor market more flexible, to facilitate and/or stimulate entry into the labor market, and to alleviate youth unemployment. However, a general concern is now emerging in Italy, as in other European countries (Artazcoz et al., 2005), regarding the use and abuse of fixed-term contracts. The sense of insecurity arising from temporary employment implies a need for continuous adaptations to different working conditions, contexts, social networks, times and expectations. When the negative side of work flexibility – i.e. precariousness – prevails, this condition on the labor market threatens to turn into precariousness in other domains of life, including health. These consequences would entail relevant social and economic costs. Workers with deteriorated health are likely to suffer more from distress or illness that limit

their working ability and result in poorer work performance, with the negative health outcomes giving rise to a higher burden for the public health system.

Our results cannot be generalized to other contexts, due to the aforementioned peculiarities of the Italian context. In line with Benach et al. (2014), it could also be that the impact of temporary employment on health is even more harmful in times of economic crisis when, in a context of austerity and firms downsizing and restructuring, precariousness is more and more pervasive, entry into the labor market is increasingly more difficult, and working conditions and wages are deteriorating.

It is nonetheless evident that policy measures for temporary workers, in particular for women (e.g., childcare services), are urgently needed. As a long-term objective, a change in the cultural and behavioral context is fundamental as well, towards the elimination of the male-domination and patriarchy in both individual and social structures, namely family, labor market, social and public institutions. Achieving concrete and authentic gender equity in all domains of life is essential to improve female participation in the labor market and, at the same time, to reduce the load and responsibility of women as workers, wives and mothers.

More generally, in addition to gender discrimination on the labor market, discrimination between temporary and permanent workers should be addressed. The enhancing of social security protection, and the increasing of wages and benefits that ensure equal power relationships and rights between the two groups of workers, are all possible instruments for achieving effective equality.

Appendix

IPTW's distribution

Table A1 reports synthetic statistics referring to the IPTW. As described, IPTW have been computed separately for each exposure ($t = 2008$ and $t = 2009$). As recommended in literature (Hernan and Robins, 2013), neither of the two distributions does present extreme values. The (expected) higher variability of the weights in 2009 is due to the fact that their specification includes a longer history of covariates, namely 2007–2008, with respect to weights computed in 2008.

Balancing issues

The populations of treated and controls should be more similar as possible, and covariate balance should be accurately checked for. For this purpose, we discarded from the population of controls those individuals for which the propensity-score is out of the propensity-score distribution of the treated (Lechner, 2009); that is, we defined a common support (c.s.) region based on discarding the $C = 0$ observations with propensity-score lower (higher) than the minimum (maximum) of the $C = 1$ observations. This c.s. selection, which doesn't change the target population of the treated, has been made after the computation of propensity-scores at each time point.

Table A1
Distribution of IPTW, by exposure, men and women.

	Men		Women	
	Mean	St. dev.	Mean	St. dev.
IPTW 2008	1.41	0.28	1.24	0.34
IPTW 2009	1.19	0.86	1.27	1.70
final IPTW (2008*2009)	1.71	1.18	1.69	3.12

Table A2

Distributions of socio-demographic, work-related and health status covariates by type of contract, before and after the procedure of common support selection, men and women.

	Men									Women								
	Temporary N = 154	Before c.s. selection			After c.s. selection			Std. diff. improvement	% Bias reduction	Temporary N = 180	Before c.s. selection			After c.s. selection			Std. diff. improvement	% Bias reduction
		Permanent N = 1358	t-stat	Std. diff.	Permanent N = 927	t-stat	Std. diff.				Permanent N = 997	t-stat	Std. diff.	Permanent N = 470	t-stat	Std. diff.		
Age (in classes)																		
<24	32.5	5.2	-7.1***	0.70	6.9	-6.6***	0.67	0.03	3.7	21.1	4.6	-5.3***	0.39	6.4	-4.5***	0.35	0.35	10.6
25–34	26.0	20.3	-1.5 ns	0.27	24.7	-0.3 ns	0.02	0.07	25.8	28.3	21.6	-1.9*	0.22	26.8	-0.4 ns	0.12	0.15	46.6
35–44	24.7	32.5	2.1**	-0.16	33.1	2.2**	-0.26	-0.10	-61.2	27.2	35.7	3.0**	-0.11	28.3	0.3 ns	-0.12	0.05	-10.1
45 and over	16.9	41.9	7.5***	-0.62	35.3	5.4***	-0.45	0.17	27.3	23.3	38.1	4.2***	-0.32	38.5	3.9***	-0.20	0.42	36.6
Area of residence																		
North	45.4	44.0	-0.4 ns	0.04	49.5	0.9 ns	-0.06	-0.02	-49.5	44.5	39.8	-1.1 ns	0.08	42.1	-0.5 ns	0.01	0.02	82.9
Centre	19.5	7.2	-3.7***	0.36	9.6	-3.6**	0.33	0.03	8.8	12.2	5.9	-2.5**	0.17	8.9	-1.2 ns	0.14	0.22	22.6
South	35.1	48.8	3.2***	-0.29	41.9	1.6 ns	-0.18	0.11	38.9	43.3	54.3	2.7**	-0.18	48.9	1.3 ns	-0.09	0.20	48.7
Marital status																		
Actually not in couple	63.0	27.2	-8.8***	0.72	32.5	-7.2***	0.64	0.07	10.4	40.5	22.3	-4.7***	0.36	24.0	-4.0***	0.37	0.35	-2.0
Actually in couple	37.0	72.8	8.8***	-0.72	67.5	7.2***	-0.64	0.07	10.4	59.4	77.8	4.7***	-0.36	76.0	4.0***	-0.37	0.35	-2.0
Education																		
Low	55.2	43.2	-2.8**	0.18	48.3	-1.6 ns	0.09	0.09	48.5	38.9	26.3	-3.2***	0.27	38.7	0.0 ns	0.05	0.12	80.1
Medium	34.4	39.8	1.3 ns	-0.04	38.5	1.0 ns	-0.04	0.00	2.4	35.5	48.5	3.3***	-0.25	36.2	0.1 ns	-0.03	0.02	89.9
High	10.4	16.9	2.5**	-0.19	13.2	1.1 ns	-0.08	0.12	60.4	25.5	25.2	-0.1 ns	-0.02	25.1	-0.1 ns	-0.02	0.17	-22.3
Chronic illness																		
Yes	7.3	12.0	2.0**	-0.13	10.8	1.5 ns	-0.08	0.06	43.9	10.5	13.3	1.0 ns	-0.05	11.1	0.2 ns	0.02	0.11	63.6
No	92.7	88.0	-2.0**	0.13	89.2	-1.5 ns	0.08	0.06	43.9	89.5	86.7	-1.0 ns	0.05	88.9	-0.2 ns	-0.02	0.11	63.6
Disabilities																		
Yes	6.6	10.8	1.9**	-0.20	10.5	1.7 ns	-0.13	0.08	37.1	18.0	12.9	-1.6*	0.10	15.6	-0.7 ns	0.05	0.16	52.9
No	93.4	89.2	-1.9**	0.20	89.5	-1.7 ns	0.13	0.08	37.1	82.0	87.1	1.6*	-0.10	84.4	0.7 ns	-0.05	0.16	52.9
Self-rated health																		
Good	86.4	81.1	-1.8*	0.21	85.3	-0.3 ns	0.06	0.15	70.4	82.2	78.4	-1.1 ns	0.10	79.4	-0.8 ns	0.03	0.18	69.6
Less than good	13.6	18.9	1.8*	-0.21	14.6	0.3 ns	-0.06	0.15	70.4	17.9	23.9	1.1 ns	-0.10	20.6	0.8 ns	-0.03	0.18	69.6
Ability to make ends meet																		
With (great) difficulty	51.3	30.0	-5.0***	0.44	34.8	-3.8***	0.36	0.08	17.5	39.4	24.9	-3.7***	0.29	35.6	-0.8 ns	0.11	0.33	62.7
With some difficulty	32.5	41.0	2.1**	-0.17	40.2	1.9*	-0.18	-0.01	-3.7	38.9	41.3	0.6 ns	-0.04	35.1	-0.9 ns	0.07	0.10	-81.6
Fairly easily	14.3	22.7	2.8***	-0.24	17.6	1.1 ns	-0.11	0.12	53.0	15.0	26.3	3.7***	-0.25	21.1	1.9*	-0.22	0.02	12.3
(Very) easily	1.9	6.2	3.3***	-0.21	7.4	3.9***	-0.25	-0.04	-21.1	6.7	7.5	0.4 ns	-0.10	7.9	0.5 ns	-0.04	0.17	58.6
Level of skills																		
High	9.1	11.6	1.0 ns	-0.13	10.3	0.5 ns	-0.03	0.10	77.9	15.5	11.0	-1.6 ns	0.09	11.2	-1.2 ns	0.10	0.03	-9.4
Medium	20.8	33.1	3.5***	-0.26	26.5	1.6 ns	-0.13	0.12	48.2	28.3	52.6	6.5***	-0.48	37.2	2.2*	-0.14	0.11	70.2
Low	70.1	55.4	-3.7***	0.32	63.1	-1.7*	0.14	0.18	57.0	56.1	36.4	-5.0***	0.40	50.8	-1.2 ns	0.06	0.26	84.2

Note: * $p \leq .10$; ** $p \leq .05$; *** $p \leq .01$; ns: not significant.

In order to evaluate the appropriateness of this selection, we examined the distributions of the socio-demographic, work-related and health status covariates by type of contract, before and after this procedure (Table A2). Improvements in similarities between treated and controls can be assessed by examining t-statistic, standardized difference and bias improvement. Standardized difference between the two groups and percentage of bias reduction are computed respectively as follows (Caliendo and Kopeinig, 2005):

$$\text{Std. difference} = \frac{100(\bar{x}_{\text{treated}} - \bar{x}_{\text{controls}})}{\sqrt{\frac{s^2_{\text{treated}} + s^2_{\text{controls}}}{2}}}$$

$$\% \text{bias reduction} = 1 - \left(\frac{|\text{Std. difference}_{\text{treated}}|}{|\text{Std. difference}_{\text{controls}}|} \right)$$

where \bar{x} and s^2 are the mean and the standard deviation of a given covariate, computed for treated (temporary) and untreated (permanent) workers. Prior to c.s. selection, the covariate distributions between the populations of temporary and permanent workers were different for almost all the variables considered (Table A2). These unbalances were present indifferently for men and women. However, after deletion of untreated individuals out of the c.s. region of the treated, most of the covariates become balanced between the two groups; differences in terms of socio-demographic covariates disappear, and also for those variables for which differences still remain significant, a large reduction has been performed, as shown by bias reduction.

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