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Atypical work: a threat to labour productivity growth? Some evidence from Italy*

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Abstract

Various theories suggest the existence of a negative relationship between the use of atypical employment contracts and productivity growth, arguing that firms' utilisation of atypical contracts may reduce the incentive to innovate and internal training, inducing firms to follow a 'low-road' to competitiveness, based upon cost-cutting strategies.

This paper aims to provide new evidence on the occurrence of these effects in the Italian economy, where changes in labour legislation from the mid-Nineties onwards, associated with an 'institutional' wage moderation period, have brought about a significant process of job creation, but also an appreciable slowdown in labour productivity.

This issue is investigated using a microeconomic approach, taking a rich source of microdata for firms and estimating a dynamic model for labour productivity on a pseudo-panel of firms for the period 2003-2008.

The results support the hypothesis of a negative impact of external labour flexibility on labour productivity growth at firm level, such effect proving stronger for small and medium than for large enterprises and of varying magnitude for the different atypical contracts.

Keywords: firm productivity, temporary workers, pseudo panel, dynamic model
JEL: D22, J23, J41, C23

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Introduction

Over the last two decades, the phenomenon of atypical employment has become of great importance in the labour markets of many countries. The use of non-standard contracts has become widespread, especially in countries characterised by rigid employment protection legislation (EPL),[1] where the aim of reducing unemployment rates has been pursued through 'partial labour market reforms,' focused on liberalising atypical contracts as opposed to deregulating the traditional employment relationship, which is strongly protected by unions (Blanchard and Landier, 2002; Duranti, 2011). The increasing use of temporary workers has developed dual labour markets – and societies: workers with permanent contracts are largely shielded from shocks while temporary workers face all types of risk. The implications of this phenomenon are manifold, and following the expansion of atypical employment several studies have investigated the consequences that this phenomenon may have on workers' careers (Casquel and Cunyat, 2004; Gagliarducci, 2005; Güell and Petrongolo, 2007; Berton et al., 2007; Ichino et al., 2005; Picchio, 2006; de Graaf-Zijl, 2015) and on labour market performance (Blanchard and Landier, 2002; Cahuc and Postel-Vinay, 2001; Boeri and Garibaldi, 2007; Nunziata and Staffolani, 2007; Jaimovich and Pages-Serra, 2009). In addition, following the slowdown in labour productivity experienced by some European countries from the end of the nineties, increasing attention has been paid to the implications that the rise in atypical employment may have on firm productivity. This last issue appears particularly relevant in the case of Italy, which experienced a serious slowdown in labour productivity growth after 2000, which was partly attributable to a tendency to maintain labour-intensive production processes instead of pursuing a policy of innovation.

There are theoretical reasons for expecting both positive and negative impacts of temporary work on firm productivity. On the one hand, temporary workers my increase competitiveness and productivity by enabling firms to adjust to business-cycle fluctuations and to screen candidates for permanent jobs. On the other hand, the lower firm-specific human capital investment of atypical workers and their lower attachment to the firm may adversely affect productivity. Therefore, empirical studies are crucial to the investigation of the prevailing effects depending on the specific production structure and on the labour market characteristics of the national economic system under investigation. Indeed, analysis of the link between firm productivity and temporary work is very important in order to aid policymakers in designing labour market reforms, and also to guide firms in choosing their labour force composition. The objective of this paper is to contribute to this debate with an original empirical analysis of the relationship between the use of several types of atypical contract and firm productivity in Italy.

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[1] Employment protection legislation is made up of a series of rules which regulate dismissal and which derive from both legislation and collective bargaining. Among other things, EPL covers the monetary compensation necessary to put an end to the working relationship (severance pay), the notification procedures to be respected to fire a worker, and the definition of 'just causes' for dismissal.

To perform our analysis, an original dataset of Italian firms has been specifically built for this study, covering both manufacturing and service sectors. In the absence of longitudinal data on firm economic performance and staff, information collected on the same cohort of firms in repeated cross sections is linked with a pseudo-panel approach to effectively conduct an evaluation of the dynamic relationship between firm productivity growth and the use of temporary workers. An empirical model is designed and tested on this dataset with alternative specifications. Several types of atypical worker are considered in order to verify whether their impacts on firm productivity differ.

Therefore, our contribution to the literature is novel in many respects. First of all, a more informative definition of productivity is used in the analysis: firm-level productivity is measured as value added per hour worked – instead of value added per worker, as in most empirical studies. Thus, part-time employees and atypical workers with flexible working hours are accounted for and this measure is shown to make a difference in evaluating the incidence of temporary labour in the total workforce. Second, evidence is provided to show how different types of atypical workers (employed and external) affect productivity growth differently, indicating that not all atypical contracts should be treated equally in the literature and in policy intervention. Third, the business sector and firm size in terms of employee numbers is taken into consideration when assessing the impact of atypical work on enterprises. Finally, the use of firm cohort data allows the relationship between productivity and temporary work to be studied over time without losing most of the informative content of microdata.

Our findings confirm a negative relationship between the use of atypical work and firm productivity, in particular for small and medium enterprises (SMEs). For large ones (LEs), this negative effect is confirmed for external atypical workers, while the results for dependent temporary workers are more controversial and differ according to firm size and sector.

The paper is organized as follows. The first section describes the Italian institutional background and presents some stylised facts concerning atypical work. Section 2 briefly reviews the existing literature on the effect of atypical work on firm productivity and Section 3 describes the data used in the empirical analysis. The model and the econometric approach are explained in Section 4. The results of our empirical analysis are presented and discussed in Section 5, and Section 6 concludes.

1. Atypical contracts in Italy

1.1 The institutional background

In the last twenty years, the Italian labour market has undergone significant reforms. Starting from the mid-nineties, reforms have acted by liberalising non-standard contracts, which are considered a means of circumventing the rules typical of open-ended contracts and of reducing the costs of adjusting employment. These have been named 'partial labour market reforms', because they aim at reforming the labour market at the margin by liberalising atypical contracts instead of deregulating the traditional

employment relationship. However, after a decade of increasing and often improper use of atypical contracts, a new wave of reforms has progressively set some limitations on Italian firms' use of atypical contracts (Fornero Law, 2012; Jobs Act, 2015). At the same time, some changes have been introduced in the field of dismissals from open-ended contracts in order to reduce the dualism of the Italian labour market. Therefore, the period of our analysis (2003-2008) is one in which atypical work increased significantly and acquired a certain relevance in terms of its share of the total workforce in Italy.

Referring to this period, the atypical workers in the Italian labour market can be broadly divided into two categories according to the worker's relationship with the employer: temporary employees and external staff. The most popular contracts within the first category are apprenticeships and fixed-term contracts. The fixed term contract is fully comparable to an open-ended contract,[2] thus entailing the same amount of social security contributions and meaning no cost saving for the firm. The apprenticeship contract, instead, is quite particular, being one of the so-called *causa mista* contracts, which require the firm to provide the worker with some training while involving lower social security contributions for the employer. The duration of this contract depends on the business sector, while the age of the apprentices varies with the type of apprenticeship contract stipulated. The regulatory framework for apprenticeship has undergone significant transformations in the last 15 years, with several reforms (L. 196/1997, d. lgs. 276/2003) attempting to increase the proper use of this contract, which was otherwise frequently used by Italian employers as a form of cheap and temporary labour supply (Tiraboschi, 2011; Steedman, 2012).

As well as the various employment contracts, some contractual arrangements exist by means of which firms can use the labour services of external staff without actually hiring them. In particular, this second category of atypical work comprises temporary agency work and employer-coordinated freelance contracts (*contratti di collaborazione coordinata e continuativa* or *Co.Co.Co*., and *collaborazioni a progetto,* or *Co. Co. Pro.)*. Temporary agency work implies a triangular relationship, where the agency hires a worker who is employed in a firm under its supervision. This type of contract was introduced into the Italian system by the *Pacchetto Treu* (L. 196/1997), which opted for reduced regulation and left much decision-making on the subject to collective bargaining. The success of this type of contract has eased its approval by unions, which have thus used it widely in collective bargaining. The flexibility provided by the agency contract has a cost to the employer, which must pay the agency costs. Employer-coordinated freelance contracts are of a semi-subordinate nature, since the collaborator is formally self-employed, although in practice working in a position of subordination. These contracts have existed since the early 1970s and have been over-used by Italian firms for decades because of their very limited social security costs. In 2003 the *Biagi*

[2] According to legislative decree 368/2001, from both the economic and legal points of view fixed-term employees must be treated in the same way as those with open-ended contracts.

Law regulated them, allowing their use only for the performance of one or more specific projects or parts of them, autonomously organised by the worker depending on the result.

1.2 Atypical work in Italy: demand and supply sides

The liberalisation of atypical contracts has stimulated an increasing share of non-standard workers in the total number for about a decade. During the economic crisis which started in 2008, numbers of atypical workers reduced for the first time since the liberalisation of this type of working relationship, the workers involved being the first to be dismissed at the onset of recessionary times.

Recent data (referring to 2014) show that atypical workers represent 13.6% of total employment, while just after the first reforms of the Italian labour market in 1998 they accounted for only 8.63% of total Italian employees.[3] However, the use of atypical work differs significantly according to firm type, as highlighted by the Longitudinal Survey on Firms and Employment (*Rilevazione longitudinale su imprese e lavoro*, Rlil)[4], which distinguishes between the various atypical contracts available to Italian firms. Table 1 shows that atypical employment contracts, i.e. fixed-term and apprenticeship contracts, are used by 28.7% of Italian firms,[5] while external contracts (agency work and employer-coordinated freelance work) are used in 42% of enterprises. Among atypical employment contracts, fixed-term is the type used by more firms, while only 13% of enterprises employ apprentices. Employer-coordinated freelance contracts are the type most commonly used by Italian firms, at 41.3%; conversely, temporary agency contracts are used by only a small percentage (2.4%). Rlil data show that the use of atypical contracts varies not only according to firm size but also to geographical area and the business sector of the firm. Indeed, atypical contracts are used more in northern Italy than in the south; moreover, firms operating in the secondary sector make greater use of atypical contractual forms, with the exception of employer-coordinated freelance work, which is more frequent in service firms.[6]

In the 2010 Rlil survey, firms were asked which among a list of possible reasons was the most important for them to use various labour contractual arrangements. As Table 2 shows, firms reported temporary requirements (seasonal needs and peaks in demand) as the main reasons for their use of fixed-term contracts. However, particularly for small and medium firms, the use of this contract as a screening device before offering permanent jobs to workers is the most important reason for 24% of these firms. This

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[3] The international comparison is based on Eurostat data, which also include among atypicals those with a *causa mista* contract.

[4] Rlil is a survey carried out by ISFOL. The Rlil sample for 2010 contains information on 24,459 private firms in non-agricultural sectors; these firms are mostly small-sized (almost 98.6% of the sample have fewer than 50 employees).

[5] Only firms employing at least one worker are considered in the analysis.

[6] See Duranti (2009) for a logit estimation of the firm characteristics influencing the probability of using different types of atypical work.

motivation is also reported by all enterprises as the most important for hiring apprentices (89% of LEs and 82% of SMEs), as shown in Table A.1 in the Appendix.

When answering the same question concerning employer-coordinated freelance contracts, the predominant reasons for firms of all sizes for employing external atypical workers are attempts to meet temporary requirements and the need to have skilled people for non-core business activities; screening job candidates is only cited by 7.1% of SMEs and 3.9% of LEs. Similarly, temporary agency workers are rarely used for screening potential open-ended employees, but are seen as a tool to face seasonality and to meet temporary needs (Table A.1 in the Appendix). Hence, external temporary workers may help firms to handle variability in demand and avoid situations of underutilised production factors but employed atypicals are also hired as a first step in a screening process.

The Labour Force Survey (*Indagine sulle Forze di Lavoro)* conducted by ISTAT helps with analysis of atypical work from a supply-side perspective as it provides detailed information on the features of Italian workers employed under non-standard contracts. Analysis by level of education shows that atypical workers are generally better educated than standard employees, since almost 20% of them hold a university degree or a higher qualification. The over-representation of atypicals among workers with a high level of education is mostly due to fact that people holding temporary contracts are frequently young: Istat (2012) reports that in 2011 35% of Italian workers aged between 18 and 29 were employed under non-standard contracts, while this share was much lower (13.4%) for the total workforce. Despite their average high level of education, atypical workers are over-represented in unskilled occupations: the share of workers with a temporary contract employed in unqualified occupations is more than twice that of standard employees (18.5% vs. 9.1%).

2. Related literature

There is a growing stream of literature engaged in the empirical exploration of the relationship between the use of flexible contracts and productivity growth.[7] Most studies, however, are confined to using aggregate national or sectoral data (Bassanini et al. 2009; Lisi, 2013; Damiani and Pompei, 2010) and only a few evaluate the impact on productivity of the use of atypical work using firm-level data, the main reason being that data on temporary workers are absent from most enterprise datasets. Empirical analysis has mostly been developed in countries where the use of atypical contracts is substantial or has increased disproportionately in recent years. For example, a few studies examine the impact of the use of temporary workers in Dutch firms (Dekker and Kleinknecht, 2004; Kleinknecht et al., 2006) and others evaluate the occurrence of this phenomenon in Spain (Sanchez and Toharia, 2000; Dolado and Stucchi, 2008, Alonso-

[7] These studies are part of the wider stream of literature on the effects of Employment Protection Legislation (EPL) and the consequent effect on productivity of workforce turnover (see Blakemore and Hoffman, 1989; Auer at al., 2005; Autor et al., 2007; and Bassanini et al., 2009).

Borrego, 2010), finding some evidence of a negative effect of atypical work on labour or total factor productivity growth. Hirsch and Mueller (2012) investigate the effect of temporary agency work on the productivity of German firms, allowing for a flexible relationship between the two variables. Using a large panel of firms, they find a non-linear hump-shaped productivity effect of temporary agency work use with a maximum positive effect for firms hiring temporary external workers at about 11% of the total workforce.

The boom in atypical contracts and the productivity slowdown simultaneously occurring in Italy at the beginning of the new century stimulated empirical analysis of the relationship between the two phenomena at the firm level. Boeri and Garibaldi (2007) find a negative effect of the share of fixed-term contracts on labour productivity growth in a sample of Italian manufacturing firms already during the period 1995–2000. The same result is obtained by Lucidi (2008) and Lucidi and Kleinknecht (2010), who highlight the relevance not only of flexibilisation of the labour market but also of wage bargaining reforms to the productivity slowdown in Italy. More recently, Lotti and Viviano (2011) provide further evidence of the existence of a negative relationship between the use of fixed-term contracts and the lower labour productivity of Italian manufacturing firms. Finally, an analysis by Addessi (2011) based on a panel of Italian manufacturing enterprises indicates that the effect of atypical work on productivity dynamics may be persistent, since the labour-contract choice affects not only the productivity of workers but also their contribution to its long-term evolution.

The existing empirical studies mainly refer to four channels through which the use of atypical labour can impact on firm labour productivity. First, the use of atypical labour influences the innovation policy of a firm, which indeed has an impact on labour productivity. On the one hand, the availability of various forms of flexible and often cheap labour provides firms with an incentive to maintain labour-intensive production, following a 'low road' to competitiveness based on cost-cutting.[8] Moreover, short-term labour relations may favour the leaking of trade secrets and technological knowledge, thus discouraging R&D investment and innovation (Lucidi and Kleinknecht, 2010). A negative impact of 'low road' human resource management practices on innovation was found for the British economy by Michie and Sheehan (1999). However, 'more flexibility' (and thus higher labour turnover) might be favourable to a firm's innovation activity, because a greater inflow of new workers may enrich a firm's pool of innovative ideas and open up new networks. Altuzarra and Serrano (2010) provide some evidence of the occurrence of such an effect, finding that the probability that a Spanish firm will innovate and invest in R&D increases as the proportion of atypical workers increases, but only up to a certain threshold, above which it

[8] Following one line of thought (Vergeer and Kleinknecht, 2007; Lucidi, 2008; Lucidi and Kleinknecht, 2010), such a corporate strategy may be favoured by a modest growth in real wages. This is what happened in Italy from the nineties onwards because of the combined effect of the new system of wage bargaining introduced in the early nineties and of the lower wages usually paid to atypical workers (for some empirical evidence on the lower wages of temporary workers, see Bentolila and Dolado, 1994; Rossetti and Tanda, 2007; and Picchio, 2006).

decreases. Similarly, Zhou et al. (2011) find that high shares of employees on temporary contracts have a positive impact on firm innovation performance.[9]

A second way in which flexible labour use may influence productivity growth concerns training and human capital accumulation. Indeed, employers may be reluctant to invest in the human capital of fixed-term workers, because the payback period for the investment would be too short. In addition, temporary workers themselves may hesitate to acquire firm-specific skills if they do not feel a long-term commitment to their employers (Lucidi and Kleinknecht, 2010). Moreover, large-scale use of atypical work and the consequent high personnel turnover may hinder the accumulation of 'tacit' knowledge, thus weakening a firm's historical memory (Kleinknecht et al., 2006). Empirical evidence of a lower probability of atypical workers being involved in any work-related training has been provided for the UK by Arulampalam and Booth (1998) and for Spain by Albert et al. (2005) and Cabrales at al. (2014). Using a cross country approach, the latter also highlight that a negative relationship between job instability and training in the workplace only holds in countries, like Italy and Spain, characterised by highly segmented labour markets, while no evidence is found for countries, like Denmark, where temporary contracts are mainly stepping stones towards more stable jobs.

A third channel through which the use of temporary work contracts may influence productivity growth is the level of effort exerted by workers. Starting from the assumption that atypical contracts are often used by employers as screening tools, some empirical studies (Engellandt and Riphahn, 2005 for Switzerland; Ghignoni, 2009, for Italy) find that temporary workers are incentivised to make more effort (measured as the number of unpaid overtime hours) in order to increase the probability of moving on to a permanent contract. However, analysis of the Italian labour market highlights that temporary workers only make more effort than permanent workers if they expect their contract to be converted into a permanent one (Ghignoni, 2009). The same conclusion is reached by Sànchez and Toharia (2000), who find that an increase in the proportion of fixed-term workers has a negative effect on the average effort level of the firm, because it makes conversion of a fixed-term contract less probable. A more recent work by Battisti and Vallanti (2013) indicates that the presence of a large share of temporary contracts may also imply a reduction in open-ended workers' motivation and effort; indeed, a larger share of fixed-term workers implies a lower probability of dismissal of permanent workers, at the same time increasing the degree of precariousness inside firms.

Lastly, flexible contracts allow firms to adapt more rapidly to fluctuations in demand, thus increasing their marginal efficiency and determining productivity gains through lower levels of labour hoarding (Malgarini et al., 2013). In the same way, the use of atypical contracts makes it easier for a firm to replace

[9] The authors specify that the use of temporary workers has a positive effect on 'imitative' (or 'new to the firm') products, but not on 'new to the market' products.

less productive people with more productive workers, favouring the screening process and thus increasing the probability of finding good matches (Kleinknecht et al., 2006).

In summary, temporary work arrangements can affect firm productivity through different mechanisms, and the overall effect mostly depends on the motivations behind their use. Hence, the use of temporary workers might have a positive effect when used to adjust the labour force more flexibly and rapidly or to screen potential new employees. On the other hand, using temporary agency workers can decrease firm productivity via lower firm-specific human capital accumulation or lower motivation. Therefore, firms face a trade-off between increased flexibility and the possibility of screening new employees on the one hand and less firm-specific human capital accumulation and employee motivation on the other.

3. The data

We now turn to a description of the datasets used in the empirical analysis. The data on firms are derived from two surveys carried out every year by the Italian Institute for Statistics (ISTAT) and are part of the Structural Business Statistics (SBS**),**[10] which describe the structure, main characteristics and performance of economic activities within the business economy in the European Union. The Small and Medium Enterprise Survey (*Indagine sulle Piccole e Medie Imprese, PMI*) covers a representative sample of enterprises with less than 100 workers, while the Large Enterprise Accounts (*Sistema dei Conti delle Imprese, SCI*) covers all firms with at least 100 workers.[11]

These datasets report balance sheet data at the firm level. Therefore, there is no limitation on the legal status of the firm and no cut-off on its annual turnover, as frequently happens when several data sources are merged. On the employment side, the number of employees, working hours and labour costs by contract type and by qualification (blue-collar, white-collar, managers and apprentices)[12] are covered. Information on the number and cost of external atypical workers – employer-coordinated free-lance workers and agency workers – is also included.

We exploit these datasets in three different ways which are novel in the empirical literature on this issue: 1) the definition of productivity; 2) the distinction between directly employed temporary workers and external temps; and 3) the sectoral and dimensional disaggregation of firms. The first of these novelties concerns the availability of information on working hours, which allows labour productivity to be measured as real value added per hour worked, instead of considering output per worker as is usually

[10] These data are collected within the context of Council Regulation 58/97 on structural business statistics. According to this regulation, the SBS surveys must be fully representative at the local level and for certain classes of firm size (typically 1–9 workers, 10–19, 20–49 and 50+). The SBS cover the business economy, which includes industry, construction and services, but do not cover agriculture, forestry and fishing, or public administration or (to a large extent) non-market services, such as education and health.

[11] The sample of SMEs varies over time and it includes about 50-60,000 firms. The average population of large enterprises is about 10,000 units.

[12] The data do not allow information on contract types to be crossed with the type of employee qualification. The education levels and skills of the workforce are not available.

done in the related literature. As Lucidi (2012) underlines, the availability of information on working hours is extremely relevant when measuring labour productivity in a framework of increasing use of part-time employees and atypical workers with flexible working hours. Moreover, measuring productivity as real value added per hour worked allows a correct interpretation of firm productivity dynamics in periods characterised by labour-hoarding phenomena, such as 2008, the first year of the recent economic crisis.[13]
A second novelty concerns employment data, which allow an analysis of the relationship between labour productivity and atypical work while taking into account different categories of temporary workers. Indeed, in our analysis we consider two categories of flexible employment according to the worker's relationship with the employer, as explained in Section 1: temporary employees – apprentices and fixed-term workers – and external staff – agency and employer-coordinated freelance workers.[14] These two categories not only differ from the contractual point of view but they are also apparently used by Italian firms for different reasons. As outlined in section 1.2, while fixed-term contracts are mainly used to face temporary requirements and screen potential permanent workers, external temps are mostly employed for special projects or activities outside of the firm's core business. Moreover, these two groups of contractual arrangements can generate differences in career development, skill accumulation, job satisfaction and wages.[15]
Finally, the data refer to both the manufacturing and service sectors and are classified at a very detailed level of disaggregation (5-digit NACE classification of economic activities). Firms of all sizes in terms of number of workers and turnover are considered, and therefore our analysis also covers the micro-firms which characterise a large share of the Italian business economy.

3.1 Building a pseudo-panel of firms

The microdata contained in these datasets offer a rich set of information with which to explore heterogeneous behaviour according to firm characteristics and to different labour contracts. We believe that these features should lead to an original empirical analysis and an innovative contribution to the literature in this field. However, for reasons of confidentiality, these data do not allow us to link firms over time, so they can only be accessed either as repeated cross-sections or as a pseudo-panel. As we aim

[13] In Italy, the phenomenon of labour hoarding has been favoured by the availability of a widely-used short-time-working arrangement, called *Cassa Integrazione Guadagni* (CIG), which allows firms to adjust the hours worked while preserving their workforces.
[14] A higher disaggregation by type of working relationship is deemed unnecessary, given the low number of companies using some labour contracts, such as apprenticeships. On average, in our sample data the hours worked by apprentices represent 6% and 1% of the total hours for SMEs and LEs respectively.
[15] Bruno et al. (2014) find that job satisfaction for young Italian temporary workers is higher for temporary employees with levels comparable to those of permanent employees, while external collaborators are the least satisfied. Job satisfaction can affect the work effort and therefore productivity. Lucidi and Raitano (2009) provide evidence of the existence of a wage gap between different types of atypical contracts, which penalizes external temps compared to fixed-term employees.

to investigate the productivity issue in a dynamic perspective, we build two pseudo-panels, for small and medium enterprises (with less than 100 workers) and for large ones (with 100 or more workers) respectively. This distinction allows investigation into whether different patterns of temporary work use by firms of different size can explain differences in labour productivity. This issue is particularly relevant in Italy, where, according to the 2011 Census, 99 per cent of firms have less than 50 employees (ISTAT, 2013).[16]

The use of pseudo-panel data was introduced by Deaton (1985), who suggested forming cohort-level data if repeated cross sections are available. A cohort is defined as "a group with fixed membership, individuals of which can be identified as they show up in the surveys" (Deaton, 1985, p. 109). Collado (1997) extended this approach to dynamic models. The main assumption behind the construction of a pseudo-panel is that units sharing the same time-invariant characteristics – and therefore allocated to the same cohort – have similar behaviour and can consequently be treated as a single unit. Cohort data have been widely built from household or individual budget surveys, while less often from firm microdata, which are less widespread and more protected for confidentiality reasons.[17]

Although in pseudo-panels microeconomic heterogeneity is reduced, they show some advantages over genuine panels. First of all, the wide availability of cross-sectional data allows researchers to build pseudo-panels covering substantially longer periods than those that can be covered by real panels. Moreover, pseudo-panels are also substantially larger in the number of units that they cover. Finally, pseudo-panel data tend to deal with the attrition problem which is suffered by genuine panels. In cohort data, exit and entry of new units is allowed while maintaining the nature of the panel data over time.

The definition of cohorts creates a trade-off between the number of observations per cohort and the number of cohorts. Indeed, if the first dimension is favoured over the second, there is a risk of grouping individuals with heterogeneous behaviour in the same cohort. Conversely, if a large number of cohorts is designed to preserve variability within the panel, it is possible to obtain a very low number of observations for each cohort, thus leading to inconsistent estimators (Njiman and Verbeek, 1992; Verbeek, 2008). Consequently, for the construction of our pseudo-panel dataset we take into account this trade-off between variability within and among cohorts, eventually choosing to group firms by industry and region. For enterprises with several establishments, the region is assigned according to the geographical location of the headquarters. The lowest regional level is that of the 20 Italian regions, while the industry is considered according to the 5-digit NACE classification of economic activities.[18] A firm's

[16] With this distinction, differences in the design of the underlying surveys – respectively a sample 'rotating' survey for SMEs and a census survey for LEs – are considered as well as the different selection of variables collected with the two questionnaires.

[17] Some examples of applied studies based on firm pseudo-panels are given in Dwenger et al. (2011) and Caponera et al. (2008). Boeri and Garibaldi (2007) use a pseudo-panel in the first part of their empirical work.

[18] If firms are grouped into cohorts according to 3-digit NACE and geographical macro-areas of their headquarters, the loss of heterogeneity is too significant. Therefore, we rely on the option of allowing a higher number of cohorts.

sector and headquarters should remain unchanged over a short time horizon and the location decision should not be influenced by decisions about labour contract types. Therefore, these characteristics of the units can be considered to be invariant and represent appropriate criteria with which to build cohorts of firms.

To transform the original data into a pseudo-panel, the following steps are performed. First, extreme and unreliable values are cleaned from the dataset through a trimming procedure which excludes observations falling outside the first and last 0.1 percentiles. Moreover, firms with no employees are excluded from the dataset. Then, to trace individual firms and to account for dependency of observations over time, a synthetic identity number is generated using firm characteristics that are time invariant (economic business sector and region). The next step involves the calculation of the pseudo-firm means of all the relevant variables according to the identification number and year. Finally, we build an unbalanced pseudo-panel selecting cohorts which are in the dataset for at least three years in the period considered. Through this procedure, the large quantity of original data are reduced to a total of about 15,000 cohorts of large enterprises and more than 45,000 cohorts of SMEs. These cohorts are followed for the period 2003-2008.[19]

Table 3 summarizes the main differences between the pseudo-panel and the original data. As the pseudo-data consist of averages of the firm-level data for each cohort, variability between observations is reduced. However, if one compares the mean values of the original and of the pseudo data in the table, one can see that there are no large differences in the mean values of the variables considered in our analysis, especially as far as large enterprises are concerned, because each cell of the new data is quite close to the original dataset. Therefore, the large number of cohorts – which represent the 'observations' for our empirical analysis – still preserve the informative content of the original data and allow our investigation to be grounded on a very wide and interesting set of information.

4. Specification and econometric approach

We are interested in assessing the effects of short-term contracts on the labour productivity of Italian firms of different sizes and operating in different sectors of activity. Our approach aims to empirically test whether temporary employment is a costly option for firms in terms of labour productivity, and to verify the trade-off between potential benefits and costs identified by the theoretical literature. A similar empirical approach is adopted by Hirsch and Mueller (2012), where a productivity regression is estimated to investigate the effect of temporary agency work in Germany. Likewise, Lotti and Viviano (2011) study the impact of temporary workers on firm productivity, and Cappellari *et al.* (2012) assess the impact of two temporary employment reforms on several variables (including labour productivity).

[19] The yearly numbers of firms and cohorts after each step of the above procedure are reported in Table A.2 of the Technical Appendix.

Our baseline productivity equation is the following:

$$\ln y\_gr_{it} = \alpha_i + \gamma_1 \ln etw_{it} + \gamma_2 \ln dtw_{it} + \beta' X_{it} + \varepsilon_i, \qquad (1)$$

where we regress the log of growth of real value added per hour worked on two key independent variables: the share of hours worked by external atypical workers (*etw*) and the share of hours worked by employed atypical workers (*dtw*) out of the total number of hours worked. As explained in the previous sections, with these two flexibility indicators we distinguish atypical workers between external staff (agency and employer-coordinated freelance) and employed (apprentices and fixed-term workers). We expect that these two categories of temps might have specific effects on labour productivity: on the one hand, employed atypical workers could have a positive effect on labour productivity if they feel that their temporary position is a stepping stone to a permanent job. Therefore, they can increase their effort to increase the probability of a transition. On the other hand, external temporary staff may be less motivated because of a lack of future career within the firm. However, both categories of workers could produce a positive contribution to labour productivity by means of their innovative ideas and skills. Unlike the studies cited above, in this specification variables are standardized in terms of hours worked instead of in terms of workers, as this information better reflects the contribution of atypical workers – measured as hours they effectively work – to labour productivity in a contractual framework with increasing numbers of flexible working-hour arrangements.

In equation (1), X_{it} include several control variables.[20] A measure of the external temporary labour cost relative to the standard labour cost is used to control for the effect on productivity of substitution between different contract types due to their relative price. The log of investment expenditure on equipment per hour worked is included in the equation to control for a positive effect of new technology on labour productivity, while the log of firm expenditure on training per hour worked captures the effect of increasing the firm's human capital (a positive sign is expected for both).[21] As is usual in survey data on firms, capital stock is not available. Therefore, we use investments as a proxy of capital stock so that we arrive at a Cobb-Douglas production function specification in terms of hours worked.[22] Finally, year dummies are introduced to control for productivity shocks common to all firms, and size dummies capture specific effects of firm size on labour productivity within the two categories of enterprises for which we run our model.

The labour productivity regression as specified in equation (1) is in static form. Following this equation, a pooled and a fixed-effect model are estimated on our pseudo-panel data; in the latter, fixed effects are

[20] All monetary variables are deflated by the appropriate price deflators.

[21] As the apprenticeship contract requires a compulsory training period inside the firm, correlation between training expenses and the use of apprenticeship contracts has been tested. The correlation index for SMEs is -0.0045 and for large enterprises is -0.0074, although neither value is statistically significant.

[22] The use of pseudo-panel data does not allow the perpetual inventory approach to be adopted to provide a measure of capital stock.

included to capture unobserved time-invariant variables at the cohort level, such as differences in the level of technological development and in management ability. However, the fixed-effects model does not take into account time-varying unobserved heterogeneity within cohorts, such as productivity shocks, which affect the idiosyncratic error, making it correlated to covariates and producing biased coefficients. Moreover, a fixed-effects model does not prevent the occurrence of endogeneity and reverse causality problems. For example, a productivity shock may affect the composition of the workforce, instead of the other way round.

To address the problem of both time-invariant and time-varying unobserved heterogeneity, we estimate a dynamic model with the system GMM estimator (GMM-SYS), which uses time differencing of the model and instruments endogenous covariates with both lagged levels and lagged differences of the same (Blundell and Bond, 1998). To take account of productivity catch-up processes among cohorts and to control for state dependency during the period,[23] we include the lagged dependent variable among the regressors. This should not be correlated with the idiosyncratic error thanks to the use of the system GMM estimator. The dynamic equation is specified as follows:

$$\Delta \ln y\_gr_{it} = \alpha_i + \delta \Delta \ln y\_gr_{i,t-1} + \gamma_1 \Delta \ln etw_{it} + \gamma_2 \Delta \ln dtw_{it} + \beta' \Delta X_{it} + \Delta \varepsilon_i , \qquad (2)$$

where the right-hand side variables include the lagged level of the dependent variable and Δ is the differencing operator. Since a fist-differences transformation tends to magnify gaps in an unbalanced panel, a second transformation is needed, called 'forward orthogonal deviations' (Roodman, 2009). In fact, forward orthogonal deviations – subtracting the average of all available future observations from each observation – expunge fixed effects (as does the first differences transformation) but minimize data loss due to gaps in the unbalanced panel. With regard to instruments, the usual rule in GMM estimation is to start from the first lag for pre-determined variables, and from the second for endogenous variables (Roodman, 2009). However, the standard approach to validate the choice of instruments is to look at the Hansen test for over-identifying restrictions and at the difference-in-Hansen test, which allows the validity of the instrument subsets to be tested. Pursuant to these observations, we decide to include instruments starting from (t-1) for pre-determined variables and from (t-2) for endogenous variables and, in order to limit the number of instruments we choose to stop at (t-3).[24]

[23] According to Lucidi (2012), the inclusion of lagged productivity growth allows for variations in the utilisation of productive capacity over the period, so that a firm which had an abnormally low productivity growth at the beginning of the period for transitory reasons and then returns to its 'normal' level is not considered a fast-growing firm.

[24] The Hansen test is weakened by the inclusion of an excessively high number of instruments compared to the number of observations.

To test for the validity of the instruments, we run the Hansen test for over-identifying restrictions, which tests the null hypothesis that the additional moment conditions are met and the subset instruments are jointly exogenous. Under the null hypothesis that all the instruments are valid, the test statistics have an asymptotic chi-squared distribution with degrees of freedom equal to the number of over-identifying restrictions. Moreover, we verify the absence of second-order autocorrelation in the transformed idiosyncratic errors by means of the Arellano–Bond test, which tests the null hypothesis of absence of second-order serial correlation.[25]

In order to assess the different impact that atypical labour has on SMEs and LEs, models (1) and (2) are estimated separately for the two groups. This distinction appears to be particularly relevant in a country where the economy is based mainly on micro enterprises. Moreover, in view of the different uses of atypical work in the secondary and tertiary sectors, equations are estimated separately for industry and service firms. Both distinctions are rare in the literature and the results appear to be interesting and deserve attention.

5. Estimation results

Our first estimation is based on a pooled OLS of model (1), and provides some preliminary evidence on the impact of atypical labour and labour productivity at the firm level, highlighting the importance of distinguishing different types of atypical workers.[26] The results for the total economy, presented in Table 4, highlight the importance of distinguishing different types of atypical workers, and show a negative relationship (in both SMEs and LEs) between the use of non-standard external workers and growth in labour productivity, and a positive relationship, although not statistically significant, for atypical employees.[27] In order to correct for bias caused by unobserved heterogeneity, we also estimate equation (1) using the fixed effects within estimator, the results of which, presented in Tables 5 and 6, are in line with the OLS estimations. The fixed effects estimates confirm the negative effect of the use of external workers on labour productivity growth, especially in manufacturing firms and in LEs. Conversely, the coefficient on the share of employed atypical workers appears to be less statistically significant, highlighting once again the relevance of a distinction between different types of atypical workers.

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[25] On the contrary, since the model is estimated on first differences, the equation will show first-order serial correlation.

[26] All the estimates are carried out for the total economy and according to business sector (manufacturing and service sectors). The complete sets of results are available from the authors upon request.

[27] These results appear different from those obtained in Lucidi's OLS estimate, which point to a positive relationship between contract workers and productivity growth and to a negative relationship for fixed-term and on-the-job training employees (Lucidi, 2012). The difference in the results may be explained in part by the different methodology used in the estimation but, above all, by the fact that we use a wider definition of atypical workers (divided into only two broad categories) and we measure their shares by relying on hours actually worked instead of workers. According to our data, shares of external staff out of total workers as opposed to hours worked overestimate the contribution of these atypical workers, in particular for SMEs, while this effect is more limited in the case of apprentices and fixed-term employees.

Since the fixed effects results may still suffer from simultaneity bias because plants may choose their inputs in response to time-varying unobserved heterogeneity (such as productivity shocks), we estimate the productivity equation in a dynamic form as represented by equation (2) in Section 4, applying the GMM-SYS estimator discussed there. This is our final and preferred specification, and the rest of this section comments on its results. The p-values of the Hansen test reveal that the results are statistically valid for SMEs (Table 7) and for the LE manufacturing sector (Table 8). The lagged dependent variable has a negative coefficient, suggesting that firms with poor productivity performance at the beginning of the period tend to grow faster, thanks to a process of catching up with best-practice firms (Lucidi and Kleinknecht, 2010). The inclusion of the lagged productivity growth rate also allows us to control for fluctuation in the utilisation of productive capacity for transitory reasons (e.g. restructuring, temporary difficulties, etc.) in order to avoid inferring that a firm returning to its 'normal' level after a period of abnormally low (or high) productivity growth is a fast/slow-growing firm. The coefficients show that the productivity dynamic is path-dependent for those among both groups of enterprises which exhibit productivity growth persistence. Regarding the relative cost of external workers, this does not appear to be relevant in explaining the dynamics of productivity, given its low level of significance. However, when it is statistically significant the sign of the coefficient is mostly negative, indicating that an increase in the cost of standard workers relative to that of external temporary labour leads to productivity gains, which is in line with an efficiency wage argument as firms are prone to pay higher wages to more productive workers. As for training expenses, the estimation results show a positive and statistically significant sign and the coefficient appears to be larger for the manufacturing sector, suggesting a higher return on investment in human capital compared to services, the coefficient for which is not statistically significant for LEs. As expected, the investment variable shows a positive and statistically significant coefficient, which is higher for the tertiary sector than for the secondary sector for SMEs while the converse is true for LEs.

Coming to the core variables of our model, the results confirm the existence of a relationship between the use of atypical work and labour productivity growth, with noticeable differences between the types of non-standard contract.

Regarding external staff, our estimates support the arguments in the literature discussed above that they have a negative impact on firm productivity due to a combination of lower worker effort, lower human capital investment and accumulation by firms. This negative relationship appears to be confirmed for both manufacturing and services in large firms, and only in manufacturing for small firms while the negative coefficient for services is not statistically significant.

On the other hand, the evidence on the effect of atypical employment is less clear-cut. Indeed, the existence of a relationship between the use of atypical employees and the dynamic of labour productivity is confirmed by the statistical significance of most of the coefficients. However, the strength and sign of

this relationship differs according to firm size and sector of activity. In the case of small and medium firms, the sign of the relationship is negative, pointing to a probability that small and medium manufacturing enterprises are more inclined to use flexible employees as part of a cost-cutting strategy. In line with Ghignoni (2009), this result can be interpreted as the effect of reduced employee effort in a context where conversion of atypical contracts into permanent contracts is perceived as rather infrequent. The opposite explanation applies to large firms, where the lower incidence of temporary employees among the total makes conversion more likely, with a positive influence on worker motivation, and also on the firm's propensity to invest in training, thus stimulating labour productivity.

However, within the size classes, some differences appear to exist between manufacturing and service firms. Indeed, for small service firms the sign of the atypical employment coefficient is not statistically significant, while for large service firms the positive coefficient has statistical significance, contrary to what happens for manufacturing firms, which show a negative coefficient. In other words, in the case of service firms the use of atypical employment by small ones does not have a significant negative impact, and it even has a positive impact when used by large ones. Referring to the existing literature, this may be explained by flexible contracts allowing firms to adapt more rapidly to fluctuations in demand, potentially determining productivity gains through a reduction in labour hoarding (Malgarini et al., 2013). Indeed, this is particularly true for service firms, which are more exposed to volatility of demand and seasonality.[28] Another reason may relate to the innovation policy of a firm, which may be stimulated by a large inflow of workers hired with temporary contracts. Again, this is particularly true for service firms, some of which have a high innovative and technological content.[29]

Finally, we test the possibility that the effect of temps on firm productivity may be non-linear, as Hirsch and Mueller (2012) find for temporary agency workers in Germany. In particular, we use a set of dummy variables to represent the intensity of atypical work utilisation. Each share of atypical work is transformed into a categorical variable whose value represents one of four quantiles: no, low, average or high utilisation. In an additional specification, the shares of the two temporary worker categories enter quadratically rather than as dummies. Both equations are estimated with GMM-SYS and the results for SMEs and LEs are presented in the Appendix (Table A.3). In general, the dummy variables specification does not produce reliable results with this estimation method because of the poor informative content of these dummies when used as instruments, as shown by the Hansen test, which rejects the null hypothesis, particularly for LEs. If we focus on the quadratic specification, the results are not significant for the effect of external staff on productivity, while for temporary employees the sign of the coefficients

[28] More than a third of our panel of service firms belong to trade, hotel or restaurant activities, which are characterized by a high volatility and seasonality of demand.

[29] Sectors with a high innovative content or based on high-level professions, such as information and communication services, professional, scientific and technical activities and health, represent around 30% of the total service panel.

differs by firm size, similar to what happens with the basic specification. However, given the poor performance of the Hansen test and also of the Arellano-Bond statistics for SMEs we cannot consider these results to be robust, and on this basis we conclude that there is not a hump-shaped productivity effect of Italian firms using temporary workers.

6. Conclusions

The Italian labour market has undergone significant reforms since the mid-nineties. The aim has been to liberalise atypical work in order to ease hirings and firings by reducing the costs to firms of adjusting employment. These reforms have radically changed the Italian labour market, which has become cleanly segmented into two groups: well-protected employees with open-ended contracts on one side, and atypical workers with unstable careers and wages on the other. The implications of this phenomenon are manifold, not only for workers' careers but also for the performance of firms. In particular, the slowdown in labour productivity experienced in Italy since the end of the nineties may be one of the results of the rise in atypical employment.

The empirical analysis presented in this paper has contributed to the investigation of this issue by analysing the relationship between the utilization of different types of flexible labour and firm productivity growth. Is temporary employment a boon or a bane for firms?[30] The use of temporary contracts as buffer stocks facilitates labour adjustments, reduces labour hoarding and therefore enhances productivity. Their use as a screening device has the same effect because better information improves matching between worker characteristics and the firm. Conversely, the dim prospects of a secure working position and the weakening of incentives for both firms and employees to invest in human capital development might have adverse effects on productivity. Thanks to the distinction between external workers and temporary employees, our results highlight that the use of atypical contracts is not always bad for firm productivity. Indeed, our estimates provide evidence of a trade-off between the utilisation of external flexible contracts and labour productivity growth, due to the fact that external staff are frequently used as part of a 'low road' to competitiveness based on cost-cutting as opposed to investment in human resources and innovation.

These results are only obtained for atypical employment in the case of small and medium firms, which are more inclined to also use this type of contract as part of a cost-cutting strategy, thus reducing investment in training and worker motivation. On the contrary, in the case of large firms, a lower proportion of temporary employees among the total workforce makes conversion more likely, which has a positive influence on worker motivation and also on the firm's propensity to invest in training, thus stimulating labour productivity. The positive effects of the use of atypical employees on productivity

[30] This question was the title of an international workshop held in 2011, contributions to which are summarized by Jahn et al. (2012).

growth are especially clear for service firms, which are more exposed to demand volatility and seasonality, and are thus more sensitive to the need to limit labour hoarding.

In the light of these results, the recent reforms of the Italian labour market (Fornero Law, 2012; Jobs Act, 2015) are to be appreciated. The attempt to reduce the improper use of external staff by abolishing employer-coordinated freelance contracts, the reduction of the cost of apprenticeships and the increase in the flexibility of fixed-term contracts (by allowing more extensions) are all interventions aimed at favouring a proper use of atypical work, shifting firm choices from 'bad' to 'good' atypical contracts. Moreover, recent changes in the field of dismissals from open-ended contracts may reduce the overall amount of atypical work, inducing firms to only hire on a temporary basis when it is strictly necessary to deal with a volatility of demand and production peaks or to screen potential candidates. On the basis of our empirical results, the implications of these recent policy changes in the regulation of the use of atypical work should only benefit firm productivity.

Technical Appendix

Table A.1 Reasons for Atypical Worker Use, 2010. (%)

REASON	Apprentices	
	Large Firms	Small and Medium Firms
To train candidates for permanent jobs	88.6	81.7
Lower labour cost	9.6	15.7
To save on separation time and costs	0.4	0.6
Other reasons	0.0	0.4
No answer	1.4	1.6
	Temporary agency contracts	
	Large Firms	Small and Medium Firms
Seasonal needs	22.1	13.2
To save on screening time and costs	5.8	5.8
To screen candidates for permanent jobs	9.3	15.9
Temporary requirement (special projects)	45.6	36.9
Fewer constraints about separation	1.7	8.4
For activities outside of the firm's core business	1.9	3.1
Substitution of workers on leave	11.4	9.6
Other reasons	0.7	1.3
No answer	1.5	5.9

Source: Rlil

Table A.2 Firms and cohorts in the pseudo-panel

	Small-Medium Enterprises			Large Enterprises		
	number of firms	number of cohorts	cohorts without outliers	number of firms	number of cohorts	cohorts without outliers
2003	39311	8636	8413	10016	2905	2836
2004	36170	8590	8311	10299	2899	2737
2005	33701	8467	8231	10495	2954	2848
2006	32202	8291	8081	10787	3000	2887
2007	29552	8003	7764	11149	3069	2989
2008	53943	8952	8796	11246	2787	2720
TOTAL			49596			17017
Total cohorts with at least 3 observations in the period considered			45281			15512

Table A3. System-GMM productivity regression – alternative specifications – SMEs and LEs

	SMEs	SMEs	LEs	LEs
	Dummies	*Quadratic*	*Dummies*	*Quadratic*
Labour productivity growth (t-1)	-0.374***	-0.362***	-0.309***	0.434***
	(0.016)	*(0.018)*	*(0.044)*	*(0.048)*
External temporary labour cost / standard labour cost	0.223	0.0315	0.043	0.102
	(0.025)	*(0.027)*	*(0.070)*	*(0.057)*
Share of external temporary hours worked 1	-0.0619	-	-0.895*	-
	(0.044)		*(0.048)*	
Share of external temporary hours worked 2	-0.0532	-	0	-
	(0.034)		-	
Share of external temporary hours worked 3	-0.109***	-	-1.31**	-
	(0.031)		*(0.523)*	
Share of temporary employee hours worked 1	0.0418	-	0.629	-
	(0.045)		*(0.439)*	
Share of temporary employee hours worked 2	0.0121	-	-0.629	-
	(0.045)		*(0.404)*	
Share of temporary employee hours worked 3	-0.0209	-	0.547	-
	(0.046)		*(0.361)*	
Share of external temporary hours worked squared	-	-0.032	-	-0.028
		(0.005)		*(0.029)*
Share of temporary employee hours worked squared	-	-0.011**	-	0.027**
		(0.004)		*(0.013)*
Training expenses per hour worked	0.0191***	0.0157***	0.060**	0.053***
	(0.003)	*(0.004)*	*(0.024)*	*(0.019)*
Investment per hour worked	0.0561***	0.0598***	0.239***	0.255***
	(0.006)	*(0.008)*	*(0.064)*	*(0.060)*

Constant term	-0.0179	0.18***	0	0
	(0.048)	*(0.043)*	-	-
Time dummies	Yes	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes	Yes
Number of observations	6532	6569	4019	4003
Number of instruments	64	77	64	77
Hansen (p-value)	56.98 (0.401)	86.70 (0.053)	127.3 (0.0)	33.81 (0.013)
AR(1) (p-value)	-8.07 (0.000)	-8.94 (0.000)	-3.50 (0.000)	-5.74 (0.000)
AR(2) (p-value)	-0.57 (0.571)	-2.34 (0.019)	0.89 (0.373)	1.26 (0.209)

Notes: Standard errors are given in parentheses. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

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Table 1 – Firms using atypical contracts, divided according to size, geographical area and economic activity, 2010. (%)

	Apprenticeship	*Fixed term contract*	***Atypical employment contracts***	*Employer-coordinated freelance contracts*	*Temporary agency contracts*	***Atypical external contracts***
1-15 workers	11.4	15.2	**24.5**	38.8	1.0	**39.3**
16-50 workers	26.9	48.7	**62.4**	61.8	10.6	**64.8**
51-100 workers	30.4	65.9	**73.7**	71.7	25.5	**78.7**
More than 100 workers	30.0	78.2	**82.6**	74.6	38.8	**83.2**
North-west	11.7	16.6	**25.5**	41.5	3.6	**43.0**
North-east	17.5	22.0	**34.7**	42.2	3.2	**43.2**
Centre	15.8	21.9	**33.0**	45.7	1.8	**46.3**
South and islands	7.7	16.8	**22.6**	36.1	0.5	**36.3**
Secondary sector	16.0	20.0	**31.0**	40.0	5.0	**42.0**
Tertiary sector	12.0	18.0	**27.0**	42.0	1.0	**42.0**
Total	13.0	19.1	**28.7**	41.3	2.4	**42.2**

Source: Rlil

Table 2 – Reasons for Atypical Worker Use, 2010. (%)

REASON	Fixed Term contracts	
	Large Firms	Small and Medium Firms
Seasonal needs	26.1	36.1
Unexpected peaks in demand	35.9	23.0
To screen candidates for permanent jobs	14.1	23.7
Substitution of workers on leave	20.0	7.0
To save on separation time and costs	0.7	3.5
Other reasons	1.6	3.2
No answer	1.6	3.5
	Employer coordinated freelance contracts	
	Large Firms	Small and Medium Firms
Screen candidates for permanent jobs	3.9	7.1
Lower labour cost	2.6	7.2
For activities outside of the firm's core business	37.0	19.6
To keep skilled former employees	14.3	6.3
Temporary requirement (special projects)	36.1	43.0
Substitution of workers on leave	0.4	0.3
To save on separation time and costs	0.0	0.5
Required by the worker	2.0	7.4
Other reasons	2.0	4.4
No answer	1.7	4.3

Source: Rlil

Table 3 – Descriptive statistics of firm level and cohort data

	SME			LE		
	Original	Pseudo		Original	Pseudo	
	Mean	Mean	Sd	Mean	Mean	Sd
Labour productivity	43.20	35.11	48.97	35.53	39.37	79.76
External temporary / employee labour cost	1.58	1.48	2.08	1.33	1.08	2.03
Share of external temporary hours worked	0.03	0.03	0.09	0.04	0.05	0.11
Share of temporary employee hours worked	0.15	0.13	0.34	0.02	0.02	0.08
Training expenses per hour worked	0.05	0.04	0.40	0.06	0.06	0.45
Investment per hour worked	8.33	6.18	31.30	41.07	43.89	511.37

Table 4. Pooled OLS productivity regression – total economy

	SME	**LE**
External temporary labour cost relative to standard labour cost	-0.008	-0.001
	(0.007)	*(0.008)*
Share of external temporary hours worked	-0.006*	-0.022***
	(0.004)	*(0.009)*
Share of temporary employee hours worked	0.007	0.002
	(0.005)	*(0.005)*
Training expenses per hour worked	0.005*	0.009
	(0.004)	*(0.006)*
Investment per hour worked	0.003	0.022**
	(0.004)	*(0.009)*
Constant term	-0.016	-0.186
	(0.039)	*(0.127)*
Time dummies	Yes	Yes
Size dummies	Yes	Yes
Number of observations	2927	1497

Notes: Standard errors are given in parentheses. *** indicates statistical significance at the 1% level, **at the 5% level, and * at the 10% level.

Table 5. Fixed effects productivity regression – small and medium firms

	Total	Manufacturing	Services
External temporary labour cost relative to standard labour cost	-0.022**	-0.021**	-0.029**
	(0.009)	*(0.012)*	*(0.013)*
Share of external temporary hours worked	-0.022***	-0.025***	-0.007
	(0.006)	*(0.007)*	*(0.010)*
Share of temporary employee hours worked	-0.009	-0.013*	-0.004
	(0.008)	*(0.009)*	*(0.013)*
Training expenses per hour worked	0.010***	0.013***	0.010
	(0.004)	*(0.004)*	*(0.007)*
Investment per hour worked	0.044***	0.030***	0.052***
	(0.008)	*(0.010)*	*(0.012)*
Constant term	-0.101	-0.193***	0.053
	(0.063)	*(0.163)*	*(0.073)*
Time dummies	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes
Number of observations	8286	4643	3643
R-sqr within	0.029	0.033	0.035
R-sqr between	0.015	0.021	0.013
R-sqr overall	0.017	0.023	0.018

Notes: Standard errors are given in parentheses. ***indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. Fixed effects productivity regression – large firms

	Total	Manufacturing	Services
External temporary labour cost relative to standard labour cost	0.067**	0.012	0.091
	(0.028)	*(0.026)*	*(0.051)*
Share of external temporary hours worked	-0.043*	-0.054**	-0.011
	(0.022)	*(0.025)*	*(0.042)*
Share of temporary employee hours worked	0.038**	-0.004	0.072
	(0.019)	*(0.015)*	*(0.037)*
Training expenses per hour worked	0.025	0.003	0.046
	(0.016)	*(0.010)*	*(0.038)*
Investment per hour worked	0.313***	0.153**	0.414***
	(0.064)	*(0.059)*	*(0.101)*
Constant term	-3.23***	-1.88***	-3.73***
	(0.691)	*(0.630)*	*(1.145)*
Time dummies	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes
Number of observations	3151	1868	1283
R-sqr within	0.242	0.092	0.330
R-sqr between	0.031	0.015	0.064
R-sqr overall	0.056	0.027	0.096

Notes: Standard errors are given in parentheses. *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7 – System-GMM productivity regression – small and medium firms

	Total	**Manufacturing**	**Services**
Labour productivity growth (t-1)	-0.348***	-0.379***	-0.328***
	(0.019)	*(0.028)*	*(0.024)*
External temporary labour cost /standard labour cost	-0.057	-0.047	-0.115*
	(0.057)	*(0.061)*	*(0.062)*
Share of external temporary hours worked	-0.019*	-0.019*	-0.021
	(0.011)	*(0.011)*	*(0.017)*
Share of temporary employee hours worked	-0.021**	-0.028**	0.011
	(0.009)	*(0.011)*	*(0.016)*
Training expenses per hour worked	0.017***	0.018***	0.014*
	(0.005)	*(0.006)*	*(0.008)*
Investment per hour worked	0.063***	0.050***	0.073***
	(0.009)	*(0.013)*	*(0.012)*
Constant term	-0.202***	-0.214***	-0.200**
	(0.007)	*(0.072)*	*(0.100)*
Time dummies	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes
Number of observations	6272	3535	2737
Number of instruments	77	77	77
Hansen (p-value)	95.26 (0.013)	75.92 (0.213)	74.48 (0.248)
AR(1) (p-value)	-7.65 (0.000)	-5.41 (0.000)	-5.62 (0.000)
AR(2) (p-value)	-0.69 (0.488)	-2.31 (0.210)	1.36 (0.174)

Notes: Standard errors are given in parentheses. ***indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8 – System-GMM productivity regression – large firms

	Total	Manufacturing	Services
Labour productivity growth (t-1)	-0.375***	-0.535***	-0.335***
	(0.053)	*(0.111)*	*(0.045)*
External temporary labour cost /standard labour cost	-0.156*	0.020	-0.050
	(0.070)	*(0.063)*	*(0.077)*
Share of external temporary hours worked	-0.141***	-0.049*	-0.263***
	(0.040)	*(0.039)*	*(0.044)*
Share of temporary employee hours worked	0.057*	-0.047*	0.119***
	(0.029)	*(0.026)*	*(0.043)*
Training expenses per hour worked	0.063***	0.032**	0.052
	(0.021)	*(0.014)*	*(0.035)*
Investment per hour worked	0.300***	0.295***	0.184***
	(0.066)	*(0.106)*	*(0.046)*
Constant term	-0.241**	0.052	-0.100
	(0.120)	*(0.124)*	*(0.159)*
Time dummies	Yes	Yes	Yes
Size dummies	Yes	Yes	Yes
Number of observations	2497	1459	1038
Number of instruments	64	64	55
Hansen (p-value)	87.78 (0.030)	66.06 (0.146)	74.28 (0.050)
AR(1) (p-value)	-4.37 (0.000)	-3.10 (0.002)	-2.38 (0.017)
AR(2) (p-value)	-0.92 (0.326)	-0.74 (0.458)	-1.58 (0.115)

Notes: Standard errors are given in parentheses. ***indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.