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HETEROGENEOUS EFFECTS OF TEMPORARY EMPLOYMENT ON PRODUCTIVITY AND WAGES IN THE ITALIAN BUSINESS FIRMS

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Abstract

What is the link between flexible employment, labour productivity and wages? Taking advantage of an original firm level database combining information from *Rilevazione Imprese e Lavoro* (RIL) conducted by INAPP on a representative sample of Italian firms with the AIDA archive, we explore the nexus between temporary employment, labour productivity and wages along the distributions of labour productivity and wages. By applying conditional quantile technique with additive fixed effects, we detect a strong negative relationship between the use of fixed-term contracts and both labour productivity and wages. The effect of temporary employment on firms' labour productivity and wages is heterogeneous along the distributions. Low-productive firms - recurring more to temporary contracts - are also more affected by an incremental use of short-term work arrangements risking to be trapped in a vicious cycle of low-productivity and low-wages.

Keywords: Labour productivity, Wages, Temporary employment, Firm-level analysis

Jel Codes: J2, J24, J31, L25

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1. Introduction

Two major dynamics reshaped Italian labour markets over the last decades. On the one hand, the diffusion of flexibilisation through the increasing adoption of short-term work arrangements and, on the other hand, a stagnant trend of both labour productivity and wages. Indeed, the increasing adoption of short-term contracts has motivated a large concern about the effects of temporary employment on firms' performances. The diffusion of fixed-term contracts - from 7.2% of total employment in 1995 to 14% in 2016 – and the declining trend in labour productivity over the pre-crisis (1995-2007) and the crisis (2007-13) periods and the stagnation in real wages since 2010, re-opened the debate on the link between the use of temporary employment, labour productivity and wages. Recent reforms increasing the flexibility of the Italian labour market have been introduced with the aim of removing labour rigidities considered the major cause of stagnant labour market (OECD, 1999; 2003; IMF, 2007; Bugamelli et al., 2018). The claim for labour flexibility grounds on the hypothesis that more flexible labour markets - without affecting innovative capacity and productivity growth - influence firms' decisions in terms of new hirings impacting on firms' costs (Houseman, 2001). The use of temporary contracts might allow a more efficient screening of labour and thus, by selecting more productive workers, the overall productivity of the workforce should increase (Wang and Weiss, 1998; Autor, 2001). However, this view disregards the consequences of an increasing use of flexible work arrangements on firm-level knowledge accumulation that only long-lasting employment relationships might allow due to training opportunities and workers' specific job experience. An increasing use of short-term work arrangements might deeply affect firm performances avoiding the slow and intense process of knowledge accumulation (Dosi et al., 2018) and, therefore, it might deepen the divide between high-productive and low-productive firms and high-paying and low-paying firms.

What is the link between flexible employment, labour productivity and wages? Does it vary among firms?

This work builds on these considerations to explore how and to which extent an increasing use of temporary employment by firms might affect firms' labour productivity and firms' wages by emphasizing the heterogeneity of effects along the distributions of labour productivity and wages. We acknowledge a high degree of heterogeneity in the Italian business firms along many dimensions of performance including labour productivity (Bottazzi et al., 2007). Such heterogeneity also affects firms within the same sector and relates to so-called "state-variables" for the firm (Winter, 1987; Dosi et al. 2008: Dosi et al. 2012), namely those features identifying sources of differentiation across firms entailing specific organizational forms and capabilities not easy to acquire in the short-term, such as innovation, engagement in international transactions or both exporting and patenting activities. The relationship between labour flexibilisation – in the form of external numerical flexibility (temporary employment) – and labour productivity and wages has not been studied so far emphasizing the role of firms' heterogeneity in terms of productivity and wages.

In order to study these relationships, we take advantage of the information drawn from the *Rilevazione Imprese e Lavoro* (RIL) conducted by INAPP for 2007, 2010 and 2015 on a representative sample of partnerships and limited liability firms matched with the AIDA archive.

The effect of an incremental use of temporary employment on labour productivity and wages might not be homogeneous among enterprises especially if we recognize a high-persistence in performance dynamics. Furthermore, the composition of the Italian business firms in relation to small and micro enterprises needs to be taken into account. Therefore, a special focus we deserve to small firms – with less than 50 employees – that cover more than 90% of the Italian business firms and almost 80% of the RIL sample.

In what follows, we discuss previous evidences on temporary employment, wages and labour productivity emphasizing those studies that explicitly consider in some way the role of firms' heterogeneity (Section 2) stating our research questions in relation to the existent literature. In Section 3, we present data and some descriptive statistics of temporary employment along the distributions of productivity and wages. Section 4 introduces the empirical strategy; Section 5 the main results and Section 6 concludes.

2. Temporary employment, productivity and wages: the role of heterogeneity in the Italian business firms

Over the last decade the implementation of labour market reforms was aimed at relaxing the so-called labour market rigidities – such as reducing firing and hiring costs - and making employment more flexible to allow firms to adjust to the needs of the markets and sustain competitiveness even during downturns. This process of flexibilisation has led to lower employment protection (EPL) even for regular workers and to a larger use of atypical contracts for new entrants (Lucidi and Kleinknecht, 2010; Walwei, 2014; Eichhorst et al., 2015; ILO, 2016; Polavieja, 2005). Labour flexibilisation can be implemented both as "numerical flexibility" addressing the variation of the quantity of labour input taking place within the firm and using external labour market flexibility such as fixed-term contracts aiming at reducing firm costs. The relationship between the use of "numerical flexibility" and firm's performances has been at the centre of a long-lasting debate often blind to firms' heterogeneity which overlooked the structural features of the Italian business firms. Indeed, from a theoretical point of view, three main arguments dominate the labour economic literature explaining the relationship between temporary employment and labour productivity. The first one relies on the use of temporary employment to adjust workforce to product demand fluctuations. According to Bentolila and Saint-Paul (1992), Nunziata and Staffolani (2007), volatile product demand and, more generally, fluctuations in product demand lead firms to increase the use of flexible forms of employment in order to adjust firm production to markets' needs without facing high dismissal costs. Houseman (2001) empirically tests the relationship between demand fluctuations

and the use of temporary employment finding a significant relationship between industry seasonality and the probability of employing temporary workers. On the same line, Vidal and Tigges (2009) and Hagen (2003) show that the use of fixed-term contracts is a tool to deal with changes in product demand which has a positive effect on labour productivity.

A second argument suggested states that the use of short-term work arrangements is related to the screening for new productive workers. Firms cannot observe the productivity of new employees before hiring them, therefore they are likely to use fixed-term contracts to screen new employees for a certain period (Wang and Weiss, 1998). This mechanism implies that during the probation period, the employee has an incentive to increase his/her effort to get an open-ended contract; firms offering permanent contracts only to more productive workers have the chance to increase the overall productivity (Engellandt and Riphahn, 2005; Gerfin et al., 2005; Addison and Surfield, 2009; Boockmann and Hagen, 2008; Gash, 2008; McGinnity et al., 2005; Mertens and McGinnity, 2004; Amuedo-Dorantes, 2000). However, fixed-term employees used to substitute core workforce can negatively impact on workers' motivation resulting in lower labour productivity (Brown and Sessions, 2005). The conclusion reached by this literature states that a moderate use of fixed-term contracts should increase labour productivity due to screening and positive motivational aspects; on the contrary, an excessive adoption of such contracts can be detrimental affecting workers motivation.

A third explanation of the link between fixed-term contracts and productivity relies on the "human capital" theoretical framework. In case of short term contracts, firms have little incentive to invest in human capital leading to decrease investments in specific human capital and therefore in labour productivity (Arulampalam et al., 2004; Booth et al., 2002; Zwick, 2006). The same argument holds for workers who are induced to invest in firm-specific skills when the employment relationship is expected to last; conversely, workers tend to invest in general skills when they perceive a high risk of losing their job (Wasmer, 2006). Another set of theories focusing on "high-trust" human resource management practices states that long-lasting working relations imply a commitment between employees and employers boosting productivity (Lorenz, 1999; Buchele and Christiansen, 1999; Naastepad and Storm, 2006).

Indeed, also empirical evidences are quite heterogeneous leading to different results. At the firm level, Arvanitis (2005) using data for Swiss firms, estimates the relationship between the importance of temporary work and average labour productivity, measured as logarithm of sales per employee, without finding any statistically significant relationship. Arvanitis (2005) introduces a first element of heterogeneity across firms distinguishing firms along human capital intensity and detecting a positive relationship between temporary work and labour productivity only in firms with a high human capital intensity. Conversely, flexible work arrangements correlate negatively with labour productivity in firms with low human capital intensity.

On German manufacturing firms, Nielen and Schiersch (2016) find no effects of temporary employment on labour productivity controlling explicitly for the selection problem of using fixed-term contracts. Perotin and Robinson (2000)

estimate the relationship between the percentage of part-time workers and productivity without finding a significant relationship, while on UK firm level data, Michie and Sheehan (1999; 2001) find a positive correlation for measures of numerical flexibility and productivity.

Conversely, Cappellari et al. (2012) on Italian firm level data between 2004 and 2007 detect a small negative effect of reforms on fixed-term contracts on labour productivity rejecting the hypothesis that reforms in the legislation of fixed-term increase labour productivity. Kleinknecht et al. (2006) on Dutch firm observations estimate the relationship between fixed-term contracts and sales growth finding overall no significant effect.

Few studies have explicitly considered the role of heterogeneity across firms. Some of them focuses on heterogeneity in terms of technological opportunities. Indeed, major differences arise when looking at innovative and non-innovative firms: while among firms with high R&D expenditure temporary employment does not seem to affect labour productivity growth, among non-innovating firms lower labour productivity is shown when employing a higher rate of workers under short-term contracts. Focusing on the Italian firm level data, Boeri and Garibaldi (2007) detect a negative effect of the share of fixed-term contracts on labour productivity growth in a sample of manufacturing firms. A negative relationship also emerges in Lucidi and Kleinknecht (2010) highlighting that high shares of flexible workers can negatively affect labour productivity growth.

Analogously to productivity, the relationship between fixed-term contracts and wages has been deeply studied in theoretical and empirical literature mainly from a micro perspective and without emphasizing the role of wage heterogeneity among firms, which in turn corresponds to a variety of technological patterns and firms' opportunities. Indeed, more productive firms are also the ones paying higher wages.

The way in which the adoption of short-term contractual arrangements is likely to affect labour productivity and wages is the aim of this research. As said, the explanations linking workers' contractual arrangements to wages are mainly micro-based and rely on different arguments without providing a structural interpretation of the underpinning mechanisms possibly connecting flexible work with both labour productivity and wages.

Focusing on firms' strategies, flexible work arrangements might allow firms to pursue strategies of cost compressions. An intensive use of temporary work might proxy firm specificities even in terms of different innovation strategies such as in the neo-Schumpeterian approach introducing the distinction between new products and new processes. From this point of view, following a Post-Keynesian interpretation, Pianta and Tancioni (2008) argue that, in those industries where product innovations are prevalent, a strategy of technological competitiveness can be identified; firm growth is related to innovation and monopoly rents, possibly associated with wage growth. Conversely, in those sectors where new processes prevail, a strategy of price competitiveness emerges. In addition, in these industries and firms, profits increase but with contrasting consequences for wages. In high-productive firms, innovation creates new

added value (when adequate demand exists), while in the low-productive firms, the introduction of innovation corresponding to a cost-compression strategy can even increase productivity and profits but at the expense of employment and wages. Post-Keynesian perspectives, building on Kaldor (1956) and Robinson (1960), analyse the dynamics of wages and their relations to the demand and supply conditions for continuing accumulation and growth. Focusing on the supply side, temporary employment can influence production capabilities shaped by the patterns of capital investment, changes in techniques and by different types of oligopoly power affecting wage setting as well as distributional dynamics (Sylos Labini, 1967; 1979). Wages tend to be higher and grow faster in those industries where higher technological opportunities are available (Acemoglu, 2002; Chennells and Van Reenen, 2002; Pianta and Vaona, 2007). If this is the case, we expect that high-paying firms mostly corresponding to high-productive firms are the ones where flexible employment is not always used to pursue some forms of wage compression. Indeed, flexible employment impedes knowledge accumulation and we hypothesize that this effect is more relevant among low-productive firms whose use of temporary work responds to strategies of cost compression.

The evidence on the Italian business firms supports the thesis of a jeopardized production structure characterized by the coexistence of high-productive and low productive firms and high-paying and low-paying firms. A high degree of heterogeneity characterizes the Italian business firms, and such heterogeneity is an intrinsic property of industries (Dunne et al., 1989; Haltiwanger et al., 1999; Bartelsman and Doms, 2000).

In this panorama of heterogeneous firms, labour productivity slowdown and wage stagnation, we focus on short term working arrangements to detect how their use is associated to wages and labour productivity at the firm level, answering to the following research questions:

R1- Is there a link between the use of temporary employment by firms and labour productivity and wages across heterogeneous firms?

Furthermore, we aim to understand to which extent the use of temporary employment might reduce the dualism of the Italian business firms or it might deepen the Italian jeopardized production structure:

R2- Does the use of temporary employment diverge among high-paying and high-productive firms and low-paying and low-productive firms?

A group of empirical and theoretical contributions analyses labour flexibility accounting for differences in production structures, technological regimes and macroeconomic conditions (Cirillo and Guarascio, 2015; Dosi et al., 2016; Cetrulo et al., 2019); these studies highlight that in presence of structural weaknesses such as prevalence of low-tech sectors and weak aggregate demand, an intense use of temporary employment can even negatively affect productivity dynamics.

3. Data and descriptive statistics

The empirical analysis is based on three waves of the *Rilevazione Imprese e Lavoro* (RIL) conducted by INAPP during 2007, 2010 and 2015 on a representative sample of partnerships and limited liability firms[1]. Each wave of the survey covers over 25000 firms operating in non-agricultural private sector. A subsample of the included firms (around 35%) is followed over time, making the RIL dataset partially panel over the period under study.

Each wave of the RIL questionnaire provides a rich set of information about the employment composition and personnel organization (type of contracts, training activities, etc.), industrial relations and other workplace and firms productive characteristics.[2] The RIL survey contains, however, incomplete information on financial and accounting variables, which had to be recovered from another source. For this purpose, we use the national tax number to merge RIL data with AIDA archive provided by the Bureau Van Dijk for the period 2005-2014. The AIDA data offers comprehensive information on the balance sheets of almost all the Italian corporations operating in the private sector, except for the agricultural and financial industries. In particular, this dataset contains yearly values of such variables as revenues, added value, net profits, book value of physical capital, total wage bill and raw-material expenditures. Consequently, we are able to use indicators of labour productivity (value added per employee), wages (total labour cost per employee), fixed capital (the total amount of physical asset per employees) and other balance sheet variables (raw material expenditures, net profits, etc.)[3].

The resulting "RIL-AIDA" merged sample was then restricted to limited liability firms that disclose detailed accounts in accordance with the scheme of the 4th Directive CEE. As for sample selection, we excluded firms with no employees. After excluding also firms with missing information for the key variables, the longitudinal RIL-AIDA sample is made up of approximately 2600 firm-year observations analysed over the period 2007-2015.

Table 1 shows the descriptive statistics for labour productivity and labour costs distributions in each sample year. Both high-productive and low-productive firms have registered a decline of labour productivity over time and over the crisis (2007-2010). Over the whole period, labour productivity declines by 0.32 log points in low-productive firms and by 0.21 log points in high-productive firms. Such decline was faster in low-productive firms both during the crisis (2007-2010) than in the post-crisis period (2010-2015); indeed, high-productive firms faced a contraction of labour productivity during the crisis (-0.09) and even in the post-crisis (-0.12).

[1]For more details on sample design, methodological issues and procedures for requesting data related to RIL, see: http://www.inapp.org/it/ril

[2] The detailed list of variables included in the analysis is shown in the Appendix – table A1.

[3] These financial variables have been deflated according to specific deflators provided by the national statistics institute (ISTAT).

The evolution of the labour costs reflects that of the productivity: labour costs decrease below the median while they are stable or even they increase at last decile (0.09), mostly over the last two years (0.06). To the extent that the labour productivity distribution mimics the labour costs' distribution, it emerges that low-productive firms reacted to the crisis compressing wages from 2010 onwards, while high-productive firms did not compress wages both during the crisis (2007-2010) and the post-crisis period (2010-2015). Wage stagnation emerges over the period, however low-paying firms decrease wages more than high-paying firms where wages remain almost stable[4].

Table 1: Distribution of productivity and wages. **Whole sample**

	Mean	q10	q25	q50	q75	q90
Panel A: Productivity						
2007	10.81	10.17	10.48	10.81	11.15	11.52
2010	10.72	10.04	10.40	10.71	11.00	11.43
2015	10.56	9.85	10.22	10.60	10.95	11.31
Total	10.69	9.95	10.33	10.70	11.03	11.44
Panel B: Wages						
2007	10.27	9.71	10.06	10.32	10.55	10.74
2010	10.28	9.67	10.07	10.33	10.56	10.77
2015	10.16	9.48	9.97	10.33	10.58	10.83
Total	10.23	9.63	10.04	10.33	10.57	10.78

Source RIL-INAPP 2007-2010-2015. Sampling weights applied.

Small firms deserve a peculiar attention due to the composition of the sample and the numerosity of small firms in the Italian production structure. Table 2 shows descriptive statistics for the sub-sample of small firms. Both productivity and wage dynamics are confirmed in the sub-sample with a declining trend in labour productivity over time which is sharper in the lowest part of the labour productivity distribution (-0.3). Wages declined over time in low-paying firms (-0.21), while they even increased in the upper part of the distribution (0.1), as for medium and medium-large firms.

Table 2: Distribution of productivity and wages. **Small firms**

	Mean	q10	q25	q50	q75	q90
Panel A: Productivity						
2007	10.79	10.15	10.47	10.79	11.14	11.52
2010	10.71	10.02	10.39	10.70	10.99	11.43
2015	10.55	9.85	10.21	10.60	10.94	11.30
Total	10.68	9.95	10.32	10.69	11.03	11.43
Panel B: Wages						
2007	10.25	9.69	10.03	10.30	10.53	10.72
2010	10.26	9.67	10.06	10.32	10.55	10.75
2015	10.15	9.48	9.97	10.33	10.57	10.82
Total	10.22	9.62	10.03	10.32	10.55	10.77

Source RIL-INAPP 2007-2010-2015. Sampling weights applied.

[4] Figure A1 in the Appendix shows the distributions of both labour productivity and wages by year.

Focusing on the intensity of temporary jobs along the productivity and wages distributions, table 3 displays mean and standard deviation of the share of employees under fixed-term contracts (FT) across different quantiles of the productivity and the labour cost distributions. Two major patterns emerge. Firstly, the share of FT contracts is higher in low quantiles of both labour productivity (13.9%) and labour costs (15.9%) distributions. Low-paying and low-productive firms are the ones recurring to temporary employment more often than the others, and registering both higher shares of temporary employees and higher volatility in employing under short-term work arrangements. Secondly, the share of FT contracts has increased over time – at least till 2010 – for low and medium productive firms, while it has constantly decreased over the entire period (2007 – 2015) for high productive firms from 7% to 4%. The average share of temporary employment for the most productive firms at the top of the distribution (IV quantile) is about 5% over the entire time span. Third, our sample registers a falling trend of temporary employment from 2007 to 2015 both in high and low-productive firms and in high and low-paying firms. However, such decline in temporary jobs is faster in low-productive firms (-0.038 percentage points) than in high-productive ones (-0.005), probably due to job destruction experienced by low-productive firms over the period which has mostly hit workers covered by short-term work arrangements.

Overall, the share of FT contracts is significantly higher among low-productive and low-paying firms rather than among high-productive and high-paying firms suggesting a tendency toward "neo-dualism" of the Italian business firms (Dosi et al., 2018). Does an increase in the proportion of temporary employees at the workplace level equally affect both high productive and low productive firms? Does it have an equal effect on the firm-level wage paid to workers among high-paying and low-paying firms? We try to answer to these questions in the following paragraphs.

Table 3: Share of temporary employment by quantile

	2007		2010		2015	
	mean	sd	mean	sd	mean	sd
Labor productivity						
1 quantile	0.139	0.215	0.155	0.206	0.101	0.198
2 quantile	0.083	0.132	0.099	0.131	0.051	0.115
3 quantile	0.077	0.127	0.083	0.150	0.042	0.087
4 quantile	0.059	0.105	0.056	0.100	0.054	0.116
Labour costs						
1 quantile	0.159	0.229	0.196	0.224	0.116	0.204
2 quantile	0.079	0.118	0.083	0.108	0.067	0.131
3 quantile	0.066	0.109	0.067	0.122	0.032	0.078
4 quantile	0.054	0.097	0.046	0.082	0.034	0.078

Source RIL-INAPP 2007-2010-2015. Sampling weights applied.

4. Econometric strategy

Given the wide dispersion both in productivity and wages among firms, we resort to a quantile regression approach. Quantile regression originally developed in Koenker and Bassett (1978) allows to understand the relationship between fixed term contracts and firms' performances along the entire distributions of productivity and wages. Then we explore the following econometric specifications:

$$ln(lab\ prod)_{i,t} = \alpha_\theta \cdot FT_{i,t} + \beta_\theta \cdot X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (1)$$

$$ln(wage\ )_{i,t} = \alpha_\theta \cdot FT_{i,t} + \beta_\theta \cdot X_{i,t} + \eta_i + \varepsilon_{i,t} \quad (2)$$

where $ln(lab\ prod)_{i,t}$ and $ln(wage\ )_{i,t}$ are the (log of) value added per employee and the (log) of labour cost per employee, respectively; $FT_{i,t}$ is the share of fixed term contracts while the vector $X_{i,t}$ controls for a wide set of firms' characteristics (physical capital, age, sector of activity, size, macro-region, etc.) and employment composition (gender, education, age, contractual arrangement, professions, etc.). The parameter η_i denotes the firms' time-invariant unobserved heterogeneity and ε_{it} is an error term capturing the idiosyncratic component of labour productivity in (1) and wages in (2). Finally the vector of the coefficients α_θ, β_θ, are estimated at each of chosen quantiles $\theta = 0.1, 0.25, 0.5, 0.75$ and 0.9 of the outcome variable.

Within this econometric framework, we start performing quantile regression with robust and clustered standard errors controlling for heteroscedasticity and autocorrelation within firms across the distribution (Machado and Santos Silva, 2000; Parente and Santos-Silva, 2016). Then, we rely on the simple two-step procedure proposed by Canay (2011) in order to control for time-invariant firm-specific unobserved heterogeneity. Following this procedure, the estimation is carried out controlling for fixed effects under the assumption that these effects are pure location shifters across the productivity (wage) distribution. In our case, the first step is needed to estimate the unobserved fixed effect using a standard within FE estimators of equations (1) and (2). In the second step, the consistently estimated FE are used to demean the (log of) labour productivity (or alternatively the log of wages) and this transformed (adjusted) measure is taken as dependent variable to conduct a standard conditional quantile regression of equations (1) and (2)[5].

[5] We also estimate equations (1) and (2) by performing quantile regression estimator for panel data (QRPD) with non-additive fixed effects, i.e. assuming the non-separable disturbance term associated with quantile estimation (Powell, 2016). Although QRPD is straightforward to implement, this approach is computationally burden and shows problems of convergence in our data. For this reason we use conditional quantile models with additive fixed effects (Canay, 2011; Koenker, 2004) rather than the unconditional one with non-additive fixed effects (Powell 2016).

We acknowledge that there might be a selection of firms into an intensive use of flexible contractual arrangements which is likely to be affected by firms' productive and behavioural characteristics (size, sectoral specialization, type of corporate governance, etc.). Further economic uncertainty and/or shock in wages and productivity levels might generate changes in the share of fixed-term employees who are the first to be affected by firings in case of a negative productivity shock. This avenue of selection at firm level represents potential biases for our estimates. We decided to address these endogeneity issues by: i) including a wide set of observed explanatory variables and ii) controlling for firm specific time invariant unobserved heterogeneity through the implementation of Canay (2011)'s technique.

5. Main Results

Table 4 reports the pooled quantile regression results for equations (1) and (2).

In particular, Panel A of Table 4 shows the quantile estimates across the labour productivity distribution. Here we find that a higher share of short-term contracts is negatively associated with labour productivity along the productivity distribution. In detail, we observe that the share of fixed-term employees is significantly and negatively related to labour productivity at the 10^{th}, 25^{th}, 50^{th} and 75^{th} quantiles of the productivity distribution by respectively -0.59, -0.41, -0.28 and -0.12 meaning that a one percentage point increase in the share of temporary employment is associated with a decrease of about 0.4% of labour productivity. No significant effect emerges for the upper tail of the labour productivity distribution, namely at the 90^{th} quantile suggesting a non-uniform relationship along the whole distribution. For less productive firms – at the 10^{th} quantile – an increase by one percentage point of the share of fixed-term contracts reduces firm labour productivity by almost 0.6%. The same increase by one percentage point in the share of fixed-term contracts would decrease firm productivity by 0.41% for those firms in the 25^{th} quantile. Firms at the median of the productivity distribution – 50^{th} quantile – are also characterized by a negative relationship between an increase in the share of temporary employees and labour productivity; specifically an increase by one percentage point in the share of fixed-term employees decreases productivity by 0.28%. Conversely, at the top of the productivity distribution – among more productive firms - the relationship between fixed-term contracts and labour productivity does not hold anymore, meaning that more productive firms are not affected by an incremental use of short-term employment while a potential *vicious cycle* between the use of fixed-term contracts and low productivity emerges for low productive firms[6].

Panel B of Table 4 displays the pooled quantile estimates for the labour cost distribution (wages).

[6]In our exercise we do not test explicitly for the *vicious cycle* hypothesis, but we use this argument to interpret our results. Indeed, considering the distribution of fixed-term workers among firms and the magnitude of the FT coefficient varying substantially, we argue that those firms employing a higher share of temporary jobs – being also the less productive ones – are exposed to a higher negative effect than high-productive firms.

Here we observe a negative correlation between the share of fixed term employees and labour costs paid by firms in each quantile. In detail, the negative relationship between the share of fixed term contracts and wages is decreasing along the distribution and in relation to productivity analysis, it shows mirror-image values: being equal to -0.7 at 10^{th} , -0.57 at 25^{th} quantile, -0.45 at the median, -0.33 at the 75^{th} quantile and -0.19 at the 90^{th} quantile. Low-paying firms are those where an incremental use of fixed-term contracts is strongly and negatively associated to firm average wage, while high-paying firms – at the 90^{th} quantile - show a weaker relationship between the use of fixed-term contracts and average wages. Indeed, these results are consistent with previous empirical evidences on the existence of wage differentials between permanent and fixed-term workers having detrimental conditions for workers covered by short-term contracts. Therefore, firms registering a higher share of fixed-term employees show on average lower average wages, and this hold mostly for low-paying firms.

Combining results from Panel A and B of Table 4, to the extent that the distribution of labour productivity mimics the one of the labour costs[7], it emerges that a higher share of fixed-term employees in high productive firms does not decrease labour productivity and reduces firm average wage by less than 0.2%. Conversely, in low productive firms a higher percentage of fixed-term workers is associated to a sharp decrease of labour productivity and compresses the average firm wage by almost 0.7%. In high productive firms, an incremental use of short-term work arrangements is not associated with labour productivity. Short-term workers are paid more in high-productive firms which is in line with previous empirical studies showing a smaller wage gap between high skilled permanent and fixed term workers compared to low-skilled ones.[8] Our estimates might support the thesis of a strategic use of flexible staff arrangements by firms to sustain profitability even when labour productivity strongly declines. An intensive use of temporary work allows low-productive firms to survive in the market pursuing a strategy of cost-competitiveness based on wage compression.

[7] In table A3 in the Appendix we show the cross tabulations of firms by quantiles of labour productivity and labour costs' distributions. More than 60% of firms in the lowest quantile of the labour productivity distribution are also located in the first quantile of the labour costs' distribution.

[8] Results displayed in Table 4 are obtained by including in equations (1) and (2) a rich set of explanatory variables. For example we find that firm size is positively related with productivity in the lower part of the corresponding distribution. In high productive firms, size is not associated with labour productivity highlighting that firm dimension is a crucial feature for low productive firms. As expected, physical assets by employee are positively related to labour productivity both for high and low productive firms. We also include a set of controls related to workers' characteristics such as share of female workers, share of executives, white and blue collar. We also consider a set of controls related to firm features – firms' age, sector of activity, location, being part of a multinational – and firms' performance in terms of introduction of both product/process innovations. The estimates related to these controls are available upon request.

Table 4: Pooled quantile estimates (santos Silva technique). Whole sample

	q10	q25	q50	q75	q90
Panel A: Lab productivity					
share of FT contracts	-0.590***	-0.419***	-0.282***	-0.125***	-0.107
	[0.109]	[0.072]	[0.042]	[0.047]	[0.078]
other controls	yes	yes	yes	yes	yes
constant	9.352***	9.511***	9.531***	9.691***	10.732***
	[0.113]	[0.142]	[0.140]	[0.316]	[0.151]
N of Obs	8228	8228	8228	8228	8228
R2	0.231	0.259	0.274	0.255	0.229
Panel B: Wages					
share of FT contracts	-0.695***	-0.577***	-0.457***	-0.338***	-0.196***
	[0.094]	[0.044]	[0.036]	[0.034]	[0.064]
other controls	yes	yes	yes	yes	yes
constant	9.525***	9.800***	10.120***	10.654***	11.425***
	[0.124	[0.108	[0.088	[0.083	[0.308
N of Obs	8278	8278	8278	8278	8278
R2	0.271	0.3	0.307	0.274	0.212

Source: RIL-INAPP 2010-2015. Note: Other control variables: employment composition (gender, executives, blue collar, white collar, trained, hirings, immigrants), vacancy, product innovation, process innovation, mergers & acquisitions, firms' age, sector of activity, macro-region, ecc), employers' membership, performance related pay. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

5.1 Fixed effects

Table 5 shows the quantile fixed effect estimates of the equations (1) and (2) obtained with the two-step procedure proposed by Canay (2011).

To begin with, Panel A of Table 5 clearly indicates that the magnitude of the estimated coefficients decreases across the distribution of the labour productivity confirming the pattern already found in Table 4: the negative sign associated with the share of FT is equal to -0.38 at 10^{th}, -0.28 at 25^{th}, -0.21 at the median and -0.14 at 75^{th} quantile of the labour productivity distribution, while a non-significant correlation is detected at the 90^{th} quantile[9]. That is, in high-productive firms (at the 90^{th} quantile), the detrimental effect of temporary employment on labour productivity does not emerge. This result can be partly explained by the composition of the workforce in high-productive firms. Even controlling for occupations, it is likely to expect that high-productive firms employ high-productive workers and temporary employees are highly qualified. A further explanation concerns the kind of short-term contracts applied in high-productive firms, more similar to "port of entry" of temporary employees into permanent employment positions (Berton et al., 2011). If this is the case, on the one hand a short-term contract does not affect workers' motivation lowering labour productivity and on the other hand it does not affect firms' training programs nor the accumulation of capabilities at the firm level.

[9] The fact that the pooled results are (in absolute terms) larger than the FE results might indicate the existence of a selection of firms into short-term work utilization making FE estimates more reliable than the pooled ones.

Similarly, Panel B of Table 5 shows that the effect of fixed term contracts reduces the (log of) labour cost with decreasing magnitudes across the distribution. More specifically, it emerges that the share of fixed-term employees reduces firms' average wage by almost 0.5% in low-paying firms and by 0.13% in high-paying ones. In low-paying firms, an increasing share of short-term employees lowers firms' average wages more than in high-paying firms.

Therefore, our results allow to positively answer to *R1- Is there a link between the use of temporary employment by firms and labour productivity and wages across heterogeneous firms?* and to *R2- Does the use of temporary employment diverge among high-paying and high-productive firms and low-paying and low-productive firms?*

Table 5: FE quantile estimates (Canay technique). Whole sample

	q10	q25	q50	q75	q90
Panel A: Lab productivity					
share of FT contracts	-0.386***	-0.284***	-0.217***	-0.149***	-0.068
	[0.037]	[0.023]	[0.012]	[0.023]	[0.043]
other controls	yes	yes	yes	yes	yes
constant	-0.403	-0.381***	-0.366***	-0.260*	-0.387
	[0.293]	[0.141]	[0.093]	[0.152]	[0.249]
N of Obs	8228	8228	8228	8228	8228
R2	0.809	0.817	0.818	0.816	0.810
Panel B: Wages					
share of FT contracts	-0.482***	-0.371***	-0.306***	-0.219***	-0.138***
	[0.038]	[0.019]	[0.008]	[0.017]	[0.025]
other controls	yes	yes	yes	yes	yes
constant	10.741***	10.884***	10.958***	11.180***	11.381***
	[0.046]	[0.033]	[0.056]	[0.034]	[0.166]
N of Obs	8278	8278	8278	8278	8278
R2	0.876	0.884	0.885	0.882	0.876

Source: RIL-INAPP 2010-2015. Note: Other control variables: employment composition (gender, executives, blue collar, white collar, trained, hirings, immigrants), vacancy, product innovation, process innovation, mergers & acquisitions, firms' age, sector of activity, macro-region, ecc), employers' memebrship, performance related pay. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

To sum up, the empirical analysis seems to describe the existence of a dualism in the Italian production structure with a coexistence of low-paying/low-productive firms with high-productive/high-paying firms whose use of short-term work arrangements is differently associated to labour productivity and wages. An additional source of heterogeneity potentially affecting the temporary employment-productivity and wage relationship might relate to structural and organizational differences among small, medium and medium-large firms as already detected for the RIL-sample on training and labour productivity in Dosi et al. (2018). Below we focus on small firms.

5.2 Small firms

In this section we replicate previous analysis for the subsample of small firms with less than 50 employees which, being characterized by specific features, deserve a special focus.

Table 6 reports the pooled quantile estimates for equation (1) and (2).

Table 6: Pooled quantile estimates. Firms with less than 50 employees

	q10	q25	q50	q75	q90
Panel A: Lab productivity					
share of FT contracts	-0.695***	-0.512***	-0.346***	-0.238***	-0.163*
	[0.104]	[0.083]	[0.043]	[0.059]	[0.086]
other controls	yes	yes	yes	yes	yes
constant	9.495***	9.458***	9.673***	9.947***	10.707***
	[0.174]	[0.114]	[0.392]	[0.308]	[0.121]
N of Obs	6443	6443	6443	6443	6443
R2	0.16	0.215	0.236	0.221	0.191
Panel B: Wages					
share of FT contracts	-0.812***	-0.650***	-0.512***	-0.400***	-0.248***
	[0.095]	[0.049]	[0.037]	[0.042]	[0.049]
other controls	yes	yes	yes	yes	yes
constant	8.733***	9.551***	9.882***	10.188***	10.482***
	[2.689]	[0.165]	[0.129]	[0.336]	[0.080]
N of Obs	6487	6487	6487	6487	6487
R2	0.208	0.241	0.255	0.227	0.16

Source: RIL-INAPP 2010-2015. Note: Other control variables: employment composition (gender, executives, blue collar, white collar, trained, hirings, immigrants), vacancy, product innovation, process innovation, mergers & aquisitions, firms' age, sector of activity, macro-region, ecc), employers' association, performance related pay. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Panel A of Table 6 shows that an increasing share of fixed-term employment is associated to lower firm average productivity along the whole distribution, even in high-productive firms – differently from what emerges from table 4 at the 90th quantile. However, in small firms the negative effect associated with the share of temporary contracts is stronger in low-productive firms than in high-productive ones.

Similarly, Panel B of Table 6 indicates that an increasing use of fixed-term employment reduces firm average wage mostly in low paying firms confirming the general pattern detected in the whole sample. These findings are substantially confirmed if quantile FE estimates are performed, as it emerges from Table7.

Table 7: FE quantile estimates. Firms with less than 50 employees

	q10	q25	q50	q75	q90
Panel A: Lab productivity					
share of FT contracts	-0.372***	-0.269***	-0.195***	-0.133***	-0.051*
	[0.040]	[0.023]	[0.015]	[0.021]	[0.031]
other controls	yes	yes	yes	yes	yes
constant	10.569***	10.781***	10.893***	11.129***	11.174***
	[0.064]	[0.323]	[0.085]	[0.156]	[0.269]
N of Obs	6443	6443	6443	6443	6443
R2	0.647	0.664	0.666	0.661	0.654
Panel B: Wages					
share of FT contracts	-0.482***	-0.368***	-0.297***	-0.203***	-0.135***
	[0.047]	[0.036]	[0.009]	[0.022]	[0.022]
other controls	yes	yes	yes	yes	yes
constant	10.542***	10.698***	10.737***	10.905***	11.416***
	[0.050]	[0.074]	[0.031]	[0.209]	[0.548]
N of Obs	6487	6487	6487	6487	6487
R2	0.756	0.776	0.779	0.773	0.762

Source: RIL-INAPP 2010-2015. Note: Other control variables: employment composition (gender, executives, blue collar, white collar, trained, hirings, immigrants), vacancy, product innovation, process innovation, mergers & acquisitions, firms' age, sector of activity, macro-region, ecc), employers' membership, performance related pay. Robust (boostrapped) standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Apparently the main dynamics detected for the whole sample of firms emerge also in small firms with the exception of the highest-productive firms whose productivity is negatively related to an incremental use of short-term work arrangements which is not verified in case of high-productive medium-large firms. Also for this subsample, R1 and R2 are verified.

7. Conclusions

In the last decade the implementation of labour market reforms in the Italian labour market was aimed to increase labour flexibility to spur labour productivity and to facilitate allocative efficiency (Scarpetta and Martin, 2012). On this line, Bugamelli et al. (2018) highlight that the two recent Italian reforms have significantly changed the functioning of labour market increasing its allocative efficiency. However, a detrimental effect stemming from the diffusion of fixed-term contracts on productivity can emerge due to weaker incentives to invest in firm-specific skills by both the employer and the employee (Lotti and Viviano, 2012). Few studies have explicitly taken into account firms' heterogeneity. Indeed, the Italian business firms are characterized by strong differences in terms of structural conditions

strongly related to the capability accumulation, technologies, positioning in the global value chains, internal hierarchical structures and work organizations. These features strongly affect firms' labour productivity and wages paid to workers. In this work, we shed lights on the links between firms' use of labour flexibility, labour productivity and wages emphasizing the existence of heterogeneity among firms.

We estimate the effect of temporary employment on productivity and wages contributing to the existent literature in different ways. Firstly, we examine how an increasing use of short-term contracts is associated to high and low productive firms and high and low paying firms. Secondly, we investigate this relationship across both small and medium-large firms shedding lights on different dynamics between temporary employment and productivity that can coexist across different groups of firms. Thirdly, we explicitly consider firms' heterogeneity in terms of both productivity and labour costs though a quantile regression approach.

Using both the pooled quantile technique (Santos Sileva technique) and the quantile fixed effect approach (Canay technique), we find a strong and negative relationship between the share of temporary employees at the firm level and both labour productivity and wages. It emerges that the lower productivity of temporary employment is compensated by lower labour costs. This general relationship changes according to average firm productivity and average firm costs. Indeed, an increasing share of temporary employment is more detrimental on labour productivity in low productive firms than in high-productive ones. In the most productive firms – at the 90^{th} quantile -, an increase in the share of temporary employment does not reduce the average labour productivity, while at the 10^{th} and 25^{th} quantiles, a small increase of temporary employment in the workforce is associated to the firm productivity compression. Focusing on wages, we show that temporary employment is associated with lower labour costs, and this is stronger in low-paying firms than in high-paying ones. Finally, we focused on small firms – with less than 50 employees – where most relationships are confirmed. A variation in the workforce composition toward temporary employment affects labour productivity even in the most productive small firms, reducing labour productivity. From this point of view, comparing small and medium-large high productive firms, it emerges that the use of temporary employment compresses labour productivity only in small firms.

Some messages can be drawn from this analysis. An intensive use of short-term work arrangements weakens labour productivity mainly in low productive firms and might enforce a *vicious cycle* of low-productivity among low productive firms and deepening the dualism of the Italian productive structure towards a small cluster of high productive firms coexisting with a major group of low-productive/low-paying firms. Indeed, in the most productive firms, flexible work is not associated to labour productivity contraction and wages are on average higher. Last but not least, the common mantra of a one-fits-all-policy fuelling labour flexibilization might weaken the Italian business firms

enforcing a neo-dualist tendency among firms and potentially reinforcing a vicious-cycle of low-productivity-low-wages with possible distributional consequences.

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Table A2: Sample characteristics by year. Longitudinal sample RIL-AIDA

	2007		2010		2015		whole period	
	Mean*	Std dev	Mean*	Std dev	Mean*	Std dev	Mean	Std dev
% FT contracts	10.5	0.21	10.6	0.20	0.07	0.18	9.2	0.20
% executives	3.6	0.11	3.3	0.10	0.05	0.15	4.1	0.12
%withe collar	44.1	0.37	44.8	0.37	0.54	0.37	47.7	0.37
% blue collar	52.1	0.37	51.9	0.38	0.41	0.38	48.2	0.38
% female	37.3	0.33	42.2	0.33	0.44	0.35	41.3	0.34
% trained	19.6	0.35	18.0	0.33	0.28	0.41	22.1	0.37
vacancy	15.4	0.36	6.8	0.25	0.05	0.22	8.9	0.28
ln(n of employees)	1.95	1.19	1.73	1.16	1.55	1.09	1.74	1.16
ln(physical capital pc)	9.82	1.50	9.96	1.73	9.80	1.97	9.86	1.75
process innovation	34.8	0.48	25.6	0.44	0.26	0.44	28.7	0.45
product innovation	54.5	0.50	37.3	0.48	0.33	0.47	41.3	0.49
employers' association	54.0	0.50	49.2	0.50	0.49	0.50	50.5	0.50
merger & acquistion	1.2	0.11	3.9	0.19	0.03	0.16	2.6	0.16
performance related pay	4.1	0.20	4.1	0.20	0.03	0.18	3.9	0.19
foreign ownership	1.0	0.10	0.8	0.09	0.01	0.09	0.9	0.09
North West	35.1	0.48	30.1	0.46	0.39	0.49	35.0	0.48
North East	23.0	0.42	25.7	0.44	0.26	0.44	25.0	0.43
Centre	22.4	0.42	26.3	0.44	0.19	0.39	22.5	0.42
South	19.4	0.40	17.9	0.38	0.16	0.36	17.6	0.38
N of Obs	2,668		2,824		2,697		8,189	

Source RIL-INAPP 2007-2010-2015. Sampling weights applied. * percent values

Figure A1: Distributions of labour productivity and wages over time (kernel densities)

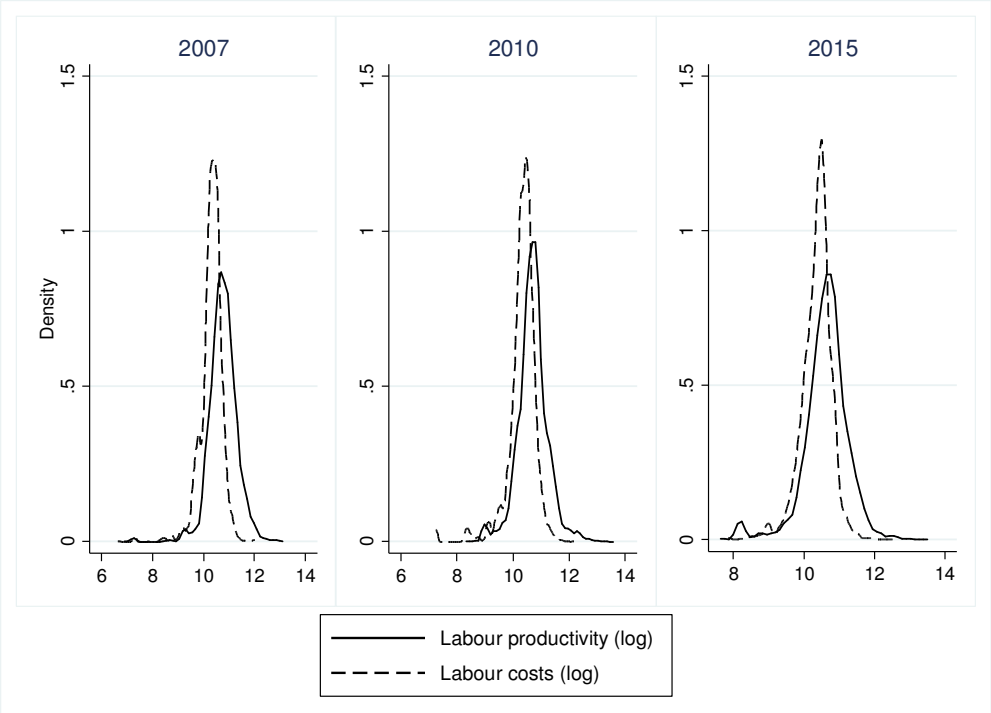

Table A3: Share of firms by quantiles of labour productivity and labour costs by year.

		Labour Cost				
	2007	**q10**	**q25**	**q50**	**q75**	**q90**
Labour Productivity	**q10**	**57.0%**	31.0%	7.0%	3.0%	2.0%
	q25	14.0%	**39.0%**	33.0%	13.0%	1.0%
	q50	4.0%	15.0%	**31.0%**	36.0%	14.0%
	q75	2.0%	7.0%	16.0%	**32.0%**	43.0%
	q90	1.0%	3.0%	8.0%	22.0%	**66.0%**
	2010	**q10**	**q25**	**q50**	**q75**	**q90**
	q10	**60.0%**	26.0%	10.0%	2.0%	2.0%
	q25	10.0%	**43.0%**	36.0%	9.0%	3.0%
	q50	4.0%	19.0%	**36.0%**	37.0%	4.0%
	q75	2.0%	9.0%	15.0%	**36.0%**	37.0%
	q90	1.0%	3.0%	9.0%	20.0%	**68.0%**
	2014	**q10**	**q25**	**q50**	**q75**	**q90**
	q10	**59%**	21%	10%	5%	6%
	q25	14%	**49%**	26%	8%	2%
	q50	3%	21%	**37%**	32%	7%
	q75	2%	8%	18%	**35%**	37%
	q90	0%	4%	10%	19%	**66%**