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Within-firm inequality in workdays and labour productivity: Evidence from linked employer-employee Italian data

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ABSTRACT

Within-firm inequality in workdays and labour productivity: Evidence from linked employer-employee Italian data

Using a longitudinal dataset built by merging survey and administrative datasets on Italian firms, we investigate the association between productivity growth and labour flexibility by focusing on the role of inequality of yearly workdays within firms. In addition to a negative association between productivity and the share of fixed-term employment, we find a further negative association between this type of within-firm inequality and productivity. This finding suggests that higher inequality in workdays may weaken cooperation among workers, affecting labour productivity.

KEYWORDS: labor productivity, firms, flexibility, employer-employee data

JEL CODES: J24, J41, L25

1. Introduction

In the last decades, most developed countries have experienced a serious decrease in the growth rate of labour productivity (OECD 2015). Despite this stylised fact, no consensus has emerged on the drivers of the decrease in productivity growth (Syverson 2011). Some authors have pointed out mechanisms related to the mismeasurement of productivity in ICT industries and to the characteristics of new technologies (e.g. Baily and Montalbano 2016; OECD 2015). Others authors, instead, have stressed the existence of a negative effect of supply-side reforms which have increased labour market flexibility in many countries (Kleinknecht 2020), introducing a set of measures that strengthen wage bargaining decentralisation and, mostly, weaken the employment protection, easing firing and hiring and favouring the spread of several non-standard contractual arrangements (OECD 2003; Turrini *et al.* 2014; Damiani *et al.* 2016; European Commission 2017).

Notably, labour market flexibility might, on the one hand, cause an increase in productivity, mostly by favouring the matching process between employer and employees and allowing for more efficient screening of better workers (Houseman 2001; Wang and Weiss 1998; Autor 2001), and, on the other hand, might hamper productivity growth through several possible mechanisms, also depending on the specific content of a flexibilisation reform. The latter mechanisms can be related to (i) reduced incentives to introduce labour-saving technologies and innovations because of the reduction in wage growth associated with labour market flexibilisation (Kleinknecht 2020); (ii) smaller incentives to invest in workers' human capital and training when job relationships become more unstable (Ricci and Waldmann 2015; Arulampalam *et al.* 2004; Booth *et al.* 2002;); (iii) lower organisational capabilities, nested in the procedural knowledge of organisations and affecting innovative competencies based on the long-run accumulation of firm-specific and tacit knowledge, due to the shorter duration of job relationships within a firm (Dosi *et al.* 2001; 2008); and (iv) a slackening of imitating behaviours by laggard firms when wage bargaining is decentralised (Andrews *et al.* 2015; Damiani *et al.* 2020).

Italy, the country this article focuses on, has been characterised, since the middle of the last decade of the 20th century, by a large decrease in the rate of growth of labour productivity and by the introduction of a series of reforms which, by following suggestions of the OECD (1994), have greatly increased labour market 'external' flexibility, introducing various types of non-standard atypical contracts and largely easing opportunities to hire temporary employees, and, more recently, with the 2015 reform, reducing the employment protection of standard employees¹. Therefore, the flexibilisation process lowered the employment protection legislation (EPL) for standard workers and promoted a larger use of atypical contracts for new entrants (ILO 2016). Furthermore, a reform in the bargaining procedures among social partners introduced in 1993 – aimed at curbing the inflation rate and favouring second-level decentralised bargaining – contributed to freezing the wage dynamics in the following years (Lucidi and Kleinknecht 2010; Franzini and Raitano 2019).

¹ For a description of the Italian labour market reform process, see Cirillo *et al.* (2017) and Struffolino and Raitano (2020).

These trends are clearly confirmed by available data. Regarding productivity, the OECD data show that the mean annual growth rate of real GDP per worked hour reduced from 1.89% in the 1980s to 1.42% in the 1990s and to 0.05% and 0.34% from 2000 to 2009 and 2010 to 2019, respectively. Regarding indicators of labour market flexibility, in the 1990–2018 period, the OECD EPL index for regular and for temporary workers decreased from 3.02 to 2.56 and from 4.88 to 1.63, respectively, and the share of individuals working through atypical arrangements increased impressively: according to Eurostat figures, the share of employees on fixed-term and part-time arrangements increased in the 1995–2019 period from 7.2% to 17.1% and from 6.4% to 18.7%, respectively. Furthermore, Italy was characterised during that period by a high increase in the use of the so-called ‘parasubordinate collaborations’, referring to individuals who are legally self-employed but are often ‘economically dependent’ on an employer because, in most cases, their activity is reliant upon one client or a few clients. The widespread use of parasubordinate arrangements, especially until the mid-2000s, was mainly because their cost was lower than employees’ cost, especially because of the much lower social contribution rates levied on these arrangements (a gradual increase in contribution rates on parasubordinate contracts was established starting from 2007). Accordingly, the number of parasubordinate atypical workers increased by 129% between 1996 and 2007, when approximately 1.67 million were employed as a parasubordinate collaborator (Raitano 2018).

As a consequence of the labour market reform process, the Italian labour market is characterised by a strong segmentation among workers (Eichhorst *et al.* 2017), namely a gap in wage, workdays, and employment conditions that penalises less advantaged individuals, where the dimension to assess segmentation varies according to researchers’ focus: it can refer to employment status, gender or age divides (Liotti 2020), and, in most of cases, to the type of contract (permanent versus temporary; Boeri 2011).

Relying on the case study of Italy, in this article we focus on a peculiar type of labour segmentation associated with the usage of atypical contracts, that is, experienced at the firm level and refers to the employment structure within the firm (Osterman 1994). In deregulated labour markets, firms are characterised by an unequal distribution of workdays among those employed in the firm, due to the coexistence of standard employees and workers hired through a plethora of atypical arrangements who are employed for a largely different number of hours/days per year. In this article, we define this type of segmentation emerging among workers of the same firm as ‘within-firm segmentation’ or ‘within-firm workdays inequality’ (henceforth, we use both terms as synonyms).

Building on dual labour market theories (Doeringer and Piore 1971), several authors have highlighted that within firms, different employment regimes coexist. Firms offer both stable jobs with career prospects and well-developed rules with respect to promotion – so-called primary jobs – and frequently hire temporary workers and offer them virtually no prospects for contract renewal and upward mobility. An evident manifestation of this internal labour market segmentation corresponds to a significant increase in the within-firm inequality of days and hours worked by the employees, which increases annual earnings inequality within a firm because some employees work full-time year-round and others are employed for a few hours per day (in most cases involuntarily) or a few weeks per year (Checchi *et al.* 2016). Therefore, inequality of workdays/hours within a firm in one year reflects the segmentation of internal markets between groups of individuals with different contractual arrangements engendered by the process of labour market deregulation and flexibilisation.

As mentioned, and extensively reviewed in Kleinknecht (2020), a growing strand of the economic literature has pinpointed the existence of a negative association between labour market flexibility and productivity growth, proposing, on the theoretical side, various mechanisms to explain this association and testing, on the empirical side, the link between productivity and labour market flexibilization – usually proxied by the share of temporary employees – and the plausibility of the various theoretical mechanisms by considering countries, industries, or firms as the unit of analysis.

However, among these mechanisms, scant attention has been paid to the role played by the aforementioned within-firm workforce segmentation. In addition to possible effects of large use of atypical arrangements on labour productivity growth due to reduced incentives to innovate and invest in human capital, another relevant mechanism should be considered instead. That is, the higher fragmentation of job relationships within a firm related to the coexistence of workers employed a largely different number of hours/days per year might hamper productivity because changes interactions, fairness, trust, cooperation, and propensity to share knowledge and information among co-workers (Osterman 2011).

Consistent with the theoretical literature, we consider labour market flexibility a broad phenomenon that might engender various consequences on productivity and argue that, from the empirical side, these consequences cannot be wholly captured by a single indicator of flexibility (e.g. the share of temporary workers employed by a firm). Notably, being constant the share of temporary workers, the heterogeneity in days worked within a firm may largely differ, engendering dissimilar consequences on co-workers' interactions.

Thus, in this article, we aim to contribute to the literature on the link between labour market flexibilisation and firms' productivity by empirically investigating the possible link between within-firm workdays' inequality and productivity growth, in addition to the association that has been demonstrated in some studies between the share of workers employed through fixed-term arrangements and firms' productivity (e.g. Michie and Sheenan 1999; Cappellari *et al.* 2012; Devicienti *et al.* 2018; Cirillo and Ricci 2020). To the best of our knowledge, no studies have investigated the link between firms' internal segmentation and productivity, by using a firm-level database.

To answer this research question, we exploit an innovative longitudinal employer–employee linked database built by merging a representative survey on Italian firms (RIL - *Rilevazione Imprese e Lavoro*) with information at the worker and the firm level provided by various administrative sources: (i) the administrative dataset on workers' job relationships (COB), which records in detail worked days and contractual arrangements of all workers hired or fired by each firm since 2009; (ii) the AIDA (*Analisi Informatizzata delle Aziende Italiane*) archive, provided by Bureau van Dijk, which contains information on balance sheets of private corporations; and (iii) the archives of Italian firms and their employees (*Archivio Statistico delle Imprese Attive – ASIA-Imprese and ASIA-Occupazione*), which allow us to compute the characteristics of the entire stock of employees within a firm in a given year, adding information on those individuals not tracked by COB data. Excluding firms that had job relationships with fewer than five workers per year, our final dataset includes approximately 20,000 firms per year observed over the 2009-2016 period.

Taking advantage of this unique employer-employee linked data, controlling for various proxies of industries' business cycle, and using various econometric techniques (OLS, FE and IV), we find various original results. First, the within-firm segmentation – proxied with the standard deviation of 'full-time

equivalent' workdays within the firm per year – is negatively associated with labour productivity growth, and this effect is larger in medium-large firms and the services sector. Second, such a negative association is additional to that associated with the usual indicator of external flexibility, that is, the share of fixed-term employment in a firm. Third, the within-firm workdays' inequality is also negatively associated with labour costs per worker. Thus, our findings suggest that higher inequality in days worked may weaken cooperation and the sharing of information among co-workers, negatively affecting labour productivity.

The remainder of the paper is structured as follows. section 2 discusses the background of the link between flexibility, within-firm segmentation, and firms' performance. sections 3 and 4 present the data and the empirical strategy, respectively. The main findings are shown in section 5, and section 6 presents results obtained by distinguishing firms by sector and size. section 7 concludes and discusses possible mechanisms which may be drivers of our findings.

2. Flexibility, segmentation, and labour productivity: a background discussion

As briefly mentioned in 'Introduction', several arguments have advocated or denied the existence of a relationship between supply-side labour market reforms and labour productivity. In this section, we refer to possible effects on productivity due to the reduction in the EPL and the increase in the number of non-standard workers, that is, workers (usually involuntarily) working under short-term and atypical contractual arrangements.

Among the pro flexibilisation arguments are three main theses. The first thesis argues that strong firing protection prevents labour reallocation from inefficient to more efficient firms and industries (Bartelsman *et al.* 2016), inhibits the introduction of labour-saving innovations (Scarpetta and Tresselt 2004), and prevents firms from adjusting employment to fluctuations in demand (Bentolila and Saint-Paul 1992; Nunziata and Staffolani 2007). A second thesis states that labour market deregulation promotes job matches, increasing opportunities that individuals are employed where they are more productive (Pissarides 2000). A third thesis advocates that, in presence of labour market imperfections and asymmetric information, temporary contracts may help firms screen new workers for a certain period, to subsequently hire the most productive workers through an open-ended arrangement (Engellandt and Riphahn 2005; Boockmann and Hagen 2008; Gash 2008; Amuedo-Dorantes 2000).

Against these arguments are at least four theses arguing that an increase in the number of non-standard workers might negatively affect productivity (see Kleinknecht 2020 for a detailed discussion). First, high turnover reduces employers' incentive to sponsor training initiatives; hence, employees are more interested in general training than in firm-specific training that does not improve their employability (Bassanini and Ernst 2002; Belot *et al.* 2007). Second, short-term contracts weaken a firm's organisational capabilities, that is, how complex organisations may learn from past experiences by avoiding mistakes and quickly solving problems (Teece 2019). This argument is linked to a third channel through which flexible employment may affect productivity by mostly weakening innovation activities. Firms may rely on generally available knowledge or firm-specific knowledge accumulated over longer periods (Breschi *et al.* 2000). As stated in Polanyi (1966), such accumulated knowledge is

often tacit, not codified, and difficult to quickly transfer between workers; it is embodied in workers and is based on personal experiences (Kleinknecht 2020). The more job relationships are stable, the more workers are willing to be enrolled in high specialised and more productive tasks because they are not afraid to be fired, and the more workers have opportunities to improve their performed tasks, contributing to production processes, protecting and managing the knowledge base of a firm. Finally, flexible work arrangements may reduce loyalty and trust towards employers and require more monitoring and control (Kleinknecht *et al.* 2016), whereas labour market rigidities increase mutual trust, commitment, and loyalty between employers and employees, thus making the mobilisation of tacit knowledge accumulation easier (Breschi *et al.* 2000; Kleinknecht 2020).

On empirical grounds, the evidence from studies based on firm-level data has been heterogeneous. Arvanitis (2005), using data for Swiss firms, estimates the relationship between the spread of temporary workers and labour productivity and does not find, on average, any statistically significant relationship but shows that this relationship changes according to a firm's human capital intensity (it is positive in firms with high human capital intensity and vice versa). Nielen and Schiersch (2016) find no effects of temporary employment on labour productivity in German manufacturing firms, and Perotin and Robinson (2000) find no significant relationship between the share of part-timers and productivity in the United Kingdom. Conversely, Kleinknecht *et al.* (2006) and Zhou *et al.* (2011), for the Dutch case, and Michie and Sheenan (1999), for the United Kingdom, have demonstrated a negative association between the share of fixed-term employees and productivity and innovation. Hirsch and Mueller (2012) focus on temporary agency workers (TAW; a type of atypical arrangement) and find that the association between the share of atypical workers and productivity is not linear, depending on the size of the share of flexible workers: a moderate use of fixed-term contracts should increase labour productivity due to screening and positive motivational aspects, and an excessive adoption of such contracts can be detrimental for productivity because it affects workers motivation. As regards Italy, clearer results emerge from studies which have used firm-level data (Boeri and Garibaldi 2007; Cappellari *et al.* 2012; Lucidi and Kleinknecht 2010; Cirillo and Ricci 2020), because, independent of the data and methodology used, they all find a negative association between productivity and the share of fixed-term contracts or other indicators of external flexibility (e.g. job turnover in firms). Therefore, the negative association between the share of fixed-term workers, the standard indicator of external labour market flexibility, and the productivity in Italy may be considered as a stylised fact.

As clarified in the 'Introduction', in this paper, we do not intend to merely propose a further estimate of such association, even if based on innovative data and indicators, because we aim at highlighting a further, usually overlooked, mechanism that may explain why the increase in labour market flexibility may hamper labour productivity. We point at testing whether – in addition to the effect related to the increase in the number of temporary workers – the increase in the fragmentation of job relationships and in the heterogeneity of work intensity within a firm due to the process of deregulation of contractual arrangements – what we call within-firm segmentation or inequality in days worked – might further affect productivity growth. The within-firm segmentation – i.e. the heterogeneity of worked hours/days in the firm by permanent and full-time workers and short-term and part-time workers – might indeed further hamper productivity by weakening interactions, cooperation, and

trust among co-workers, which, in a high segmented work environment, often have divergent interests, motivations, and fairness perceptions (Osterman 2011; 2018)².

3. Data

3.1 Dataset development

We use an original longitudinal dataset on a representative sample of Italian firms for the period 2009-2016 and developed thanks to the integration – using firms’ fiscal codes as the matching code – of the 2011 and 2015 waves of the dataset on firms sampled in the RIL survey (*Rilevazione Imprese e Lavoro*), periodically conducted by Inapp (*Istituto nazionale per l’analisi delle politiche pubbliche*), with three longitudinal administrative datasets: the AIDA (*Analisi Informatizzata delle Aziende Italiane*) archive on firms’ balance sheets, the Compulsory Communications System (*Sistema delle Comunicazioni Obbligatorie*; COB) about workers’ job relationships, and the ASIA (*Archivio Statistico delle Imprese Attive*) archives on firms’ characteristics. The steps followed for building this innovative dataset – which we name AD-RIL (administrative RIL) – are summarised in figure 1.

In the scope of this article, the RIL survey has been used to select a representative sample of firms whose longitudinal characteristics were extracted from the various administrative sources³.

The AIDA archive, managed by the Bureau van Dijk, provides comprehensive balance sheet information for private sector corporations, except those active in agricultural and financial sectors. In line with the scope of our analysis, we extracted from this archive the yearly values of a firm’s value added, value of physical capital, and total labour costs.

The COB archive records from 2009 each job relationship that started or ended (for firing, dismissal, retirement, or transformation of the contractual arrangement within the same firm, e.g. from a fixed-term to an open-ended arrangement) for all individuals working in Italy as an employee or through apprenticeship, temporary agency work arrangements, and parasubordinate collaborations. Crucial to our scopes, for each job relationship, the COB archive records the fiscal code of the firm, allowing us to merge a firm’s features with the characteristics of each worker who had a job relationship with a firm in a given year⁴. For each job relationship experienced by the individuals from 2009, the COB archive records, in addition to several individual characteristics, the contractual arrangement (i.e. open-ended employment, fixed-term employment, apprenticeship, temporary agency work,

² Consistent with our statement, analysing 15 developed countries, Buchele and Christiansen (1999) focus on interactions among workers and detect that employment and income security encourage cooperative labour relations, which increases the productivity level and long-run productivity growth.

³ Even if the matching procedure we use may regard the universe of firms registered in Italian administrative archives, we had at our disposal only the compulsory communications of the workers employed in the firms sampled in RIL waves. This is the reason why – even if we do not use the many cross-sectional variables surveyed in RIL because we are mostly interested at carrying out fixed effects panel estimates – our dataset is built by selecting the firms interviewed in the RIL waves.

⁴ Regarding temporary agency workers, the COB archive records the code of the firm where the individual is working (the code that we use in this article) and the code of the temporary employment agency.

parasubordinate collaboration), the part-time versus full-time dichotomy and the date of activation and termination of the relationship, thus allowing us to compute the number of days an individual worked in a given firm per year. However, as mentioned, the COB archive only tracks workers who changed their job relationship or contractual arrangement starting from 2009. Henceforth, the individuals who spent the whole 2009-2016 period in the same firm where they were employed before 2009 are not observed in the COB archive. Note that the individuals missed in the COB archive have been employed in an open-ended arrangement for the whole observed period, because no other contracts may last in Italy for an eight-year period without interruptions or change in the contract type.

However, the number and some characteristics of the individuals not observed in the COB archive can be obtained by using a further administrative dataset – named ASIA-Employment (*ASIA-Occupazione*) – which records those working in 2015 under an open-ended contract in each firm, some of their broad characteristics (gender, age class, citizenship), and whether they are part-time or full-time employees. Therefore, subtracting the information provided in ASIA-Employment on the open-ended employees tracked in the COB archive, we obtained, for each firm, the number and the broad characteristics of those workers continuously employed by one firm during the 2009-2016 period and not observed in the COB archive. Adding the records of these missed individuals to the workers' records available in the COB archive, we obtain an employer-employee linked database which provides records for all workers employed by a firm per year plus dozens of firm features collected by the various administrative archives. Therefore, this dataset allows us to compute the number, the contractual arrangement, the broad characteristics, and the number of workdays of all individuals employed by each sampled firm in 2009-2016⁵.

Once we developed this employer-employee linked database, we collapsed individual records by firms and year to compute for each firm the total number of individuals who had a job relationship with the firm in each year and the distribution of workers employed each year by the firm by contractual arrangement, gender, age class (aged younger than 30 years, 30-49 years, and over 50 years), and citizenship (Italian, European Union, and extra-European Union). Mostly, individual records were built by integrating COB with the ASIA-Employment archives, allowing us to compute the distribution of yearly workdays in a firm by all individuals employed by the firm in a given year.

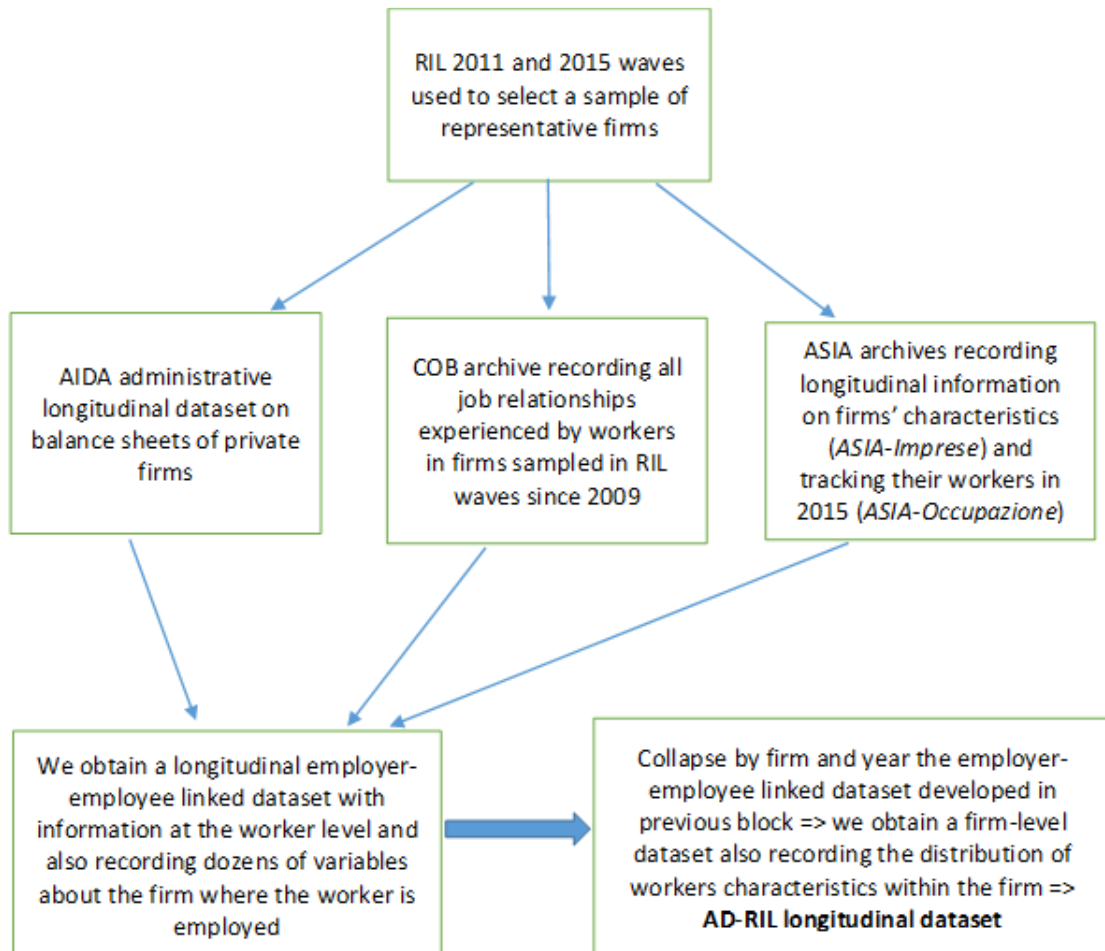
Also note that, by exploiting the information on part-time and full-time contracts, we computed the within-firm distributions of workers' characteristics, contractual arrangements, and workdays considering 'equivalised' workdays, that is, attributing a half-day to workdays spent as part-timers (administrative archives do not collect information on the number of worked hours).

In a further step, to add more variables at the firm level, we merged our dataset with the ASIA-Firms (*ASIA-Imprese*) archive, which provides information on the industry (coded at 3 digit NACE Rev. 2) and the region where the firm is active. Finally, we added to our dataset the information, provided at the 3-digit NACE Rev. 2 level by the *Istituto Nazionale della Previdenza Sociale* (Inps), on the total number of hours authorised to firms for replacing, for every reason (e.g. demand fluctuation, firm temporary crisis), working hours with the job suspension allowance (called *Cassa Integrazione Guadagni* - CIG),

⁵ Open-ended employees observed in the ASIA-Employment dataset and not in the COB archive yearly work, by definition, 365 days into the firm in the whole observed period.

which is paid by the Inps to workers whose job relationship is temporarily suspended (without a firing) by a firm. The number of CIG hours authorised to each 3-digit NACE industry is a good indicator of the industry business cycle.

Figure 1. Building blocks of the AD-RIL longitudinal dataset



Therefore, the complex matching procedure of the various sources described above allowed us to create an employer-employee longitudinal dataset and, then, by collapsing the information at the firm level, the panel dataset AD-RIL which records several firm characteristics and various variables summarising the distribution of all firm workers according to their characteristics.

Because of our interest in inquiring about the effect of the heterogeneity of the work intensity among the individuals employed by a firm, we exclude from our sample those firms that had in a given year a job relationship (independent of the type of contractual arrangement) with fewer than five individuals⁶.

⁶ Our findings are however robust when we include firms employing fewer than five individuals (results are available upon request).

By completing the various aforementioned steps, we obtained a final dataset where 23,256 firms are followed in the 2009-2016 period. Because firms sampled in the two RIL waves differ by their date of birth and (eventually) death, the panel is slightly unbalanced: 80.2% of firms are followed for the whole eight-year period and 91.9% have at least five annual observations. On average, we observe approximately 20,000 firms per year. In what follows we make use of the unbalanced dataset; however, our findings are robust if we use the balanced subsample composed of 18,648 firms continuously followed for the whole 2009-2016 period⁷.

3.2 Main variables

As mentioned in the 'Introduction', by using firm-level data, we aim to assess the association between the rate of growth of labour productivity growth and the inequality of workdays within a firm, controlling for the share of workers with a temporary contract and a set of firm characteristics.

Not having at disposal the information on worked hours, we measure labour productivity as the ratio between yearly value added and the total number of equivalised workdays used by a firm per year, that is, as the value added per full-time equivalent workday.

We measure within-firm inequality in workdays – that captures within-firm segmentation – through the standard deviation of the distribution of the number of equivalised days worked over the year by each worker within a firm, while the share of temporary workers in the firm is measured by the ratio between total equivalised days worked per year by fixed-term employees and the total number of equivalised workdays as an open-ended or a fixed-term employee. Other major variables used in our empirical analyses are the value of physical capital per equivalised workday, the 'per capita labour cost', computed dividing total firm's labour cost by the total number of equivalised workdays used by the firm per year, and the total number of individuals who had a job relationship with a firm in a given year (henceforth, firm size)⁸.

Note also that in our empirical analysis, we take natural logarithms of the variables of productivity, within-firm segmentation, value of physical capital per equivalised workday, labour costs per equivalised workday, firm size, and the number of hours authorised for the CIG allowance to the industry per year.

Before presenting sample characteristics, it has to be remarked that our concept of within-firm segmentation should capture the fragmentation of the work intensity in a firm. For example, highly segmented firms are those for which two clusters of workers employed for a heterogeneous number of workdays coexist: a first cluster of workers with high work intensity in the firm over the year, that

⁷ Estimates conducted by using the balanced subsample are available upon request by the authors.

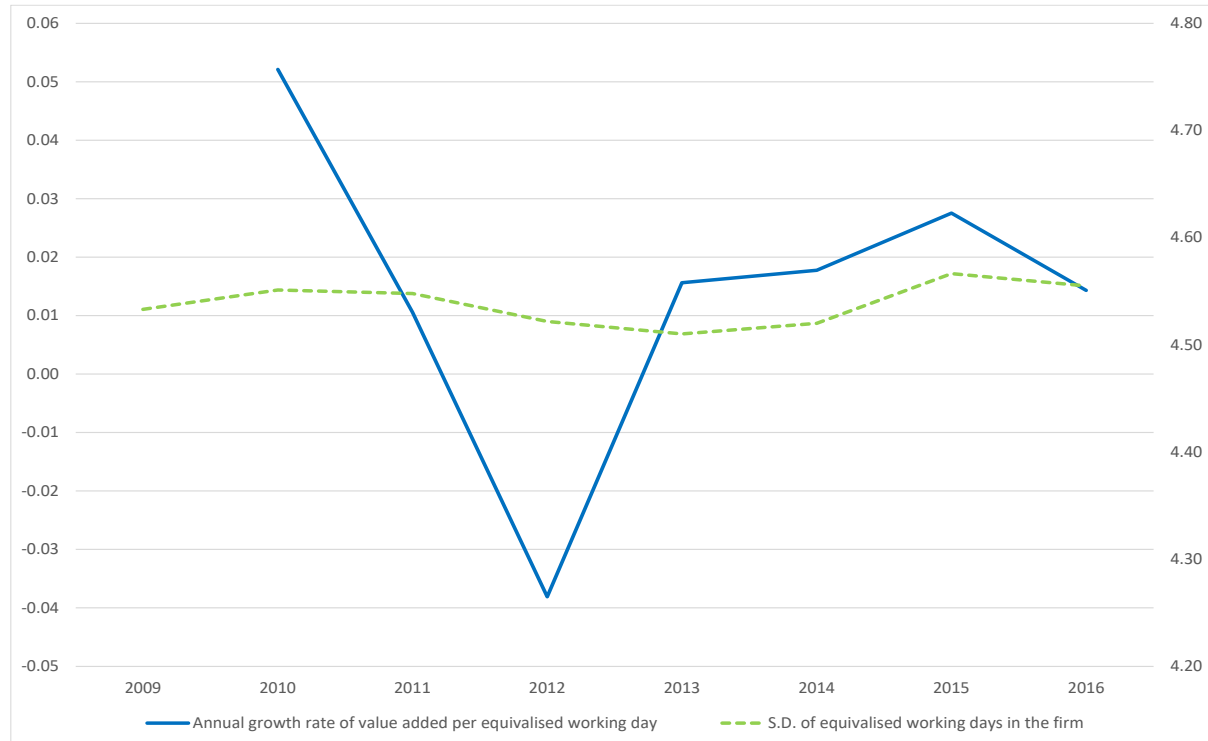
⁸ The total number of individuals with a job relationship within the firm in one year differs from the standard measure of firm size for two reasons: (i) we also include in our computations temporary agency workers and parasubordinate collaborators who are usually not considered when computing firm size; and (ii) firm size is measured usually in a point in time, whereas we sum all individuals who had at least one job relationship in one year, independent of the duration. Henceforth, our measure of the number of employed individuals is in many cases higher than the standard measure of firm size.

is, working the whole year as a full-timers, and a second cluster of workers with fragmented job relationships, for example, working a few days per year and/or as part-timers.

Therefore, conceptually, our measure of within-firm inequality in days worked is not strictly related to the share of non-standard workers in a firm. For instance, two firms that hire only open-ended employees or temporary workers, respectively, but employ them on a one-year contract, would have opposite values of the share of temporary workers on total employees but would be both characterised by zero inequality of days worked in the firm. Confirming the differences between the two variables capturing the extent of labour market flexibility, the size of the correlation between the share of temporary employees and the log standard deviation of workdays is low (+0.084).

Figure 2 shows the trend in the observed period of mean values of the yearly rate of growth of productivity and our measure of within-firm segmentation. On average, in our dataset, the rate of growth of labour productivity decreased until 2012, when negative growth occurred, and then remained rather constant until 2016. The size of within-firm inequality in days worked was instead characterised by very small changes in the 2009-2016 period. Furthermore, a clear link between the mean values of the two series does not emerge from figure 2, as also confirmed by the correlation between the two variables, that is, close to zero (-0.030). Finally, table 1 reports the mean and standard deviation in the observed period of the main variables.

Figure 2. Trend of the growth rate of productivity (left axis) and within-firm inequality in days worked (right axis)



Source: elaborations on AD-RIL data

Table 1. Mean and standard deviation (S.D.) of the main variables in the dataset

	Mean	S.D.
Log productivity per equivalised workday	5.029	0.657
Annual growth rate of productivity	0.014	0.356
Log S.D. of equivalised workdays	4.538	0.427
Share of equivalised workdays as a fixed-term employee	0.108	0.170
Log labour cost per equivalised workday	4.696	0.468
Annual growth rate of labour cost per equivalised workday	0.024	0.187
Log physical capital per equivalised workday	4.293	1.700
Log firm size	3.587	1.271
Share of female workers	0.336	0.266
Share of workers aged 15–29 years	0.215	0.174
Share of workers aged 30–49 years	0.527	0.170
Share of workers aged over 50 years	0.258	0.181
Share of workers with Italian citizenship	0.913	0.137
Share of workers with an EU country citizenship	0.033	0.078
Share of workers with an extra-EU country citizenship	0.055	0.102

Source: elaborations on AD-RIL data

4. Empirical strategy

The purpose of the econometric analysis is to estimate, at the firm level, the relationship between within-firm labour segmentation and the rate of growth of labour productivity, also including the usual indicator of labour market flexibility – namely, the share of equivalised days worked as a fixed-term employee – as a further independent variable and controlling for a set of characteristics of a firm and for the composition of its workforce.

In detail, we first estimate the following equation through pooled OLS⁹:

$$\Delta Prod_{i,t} = \alpha + \beta SD_WD_{i,t-1} + \gamma SH_FT_{i,t-1} + \vartheta X_{i,t-1} + \delta Z_{j,t-1} + \rho_j + \pi_r + \tau_{t-1} + \varepsilon_{i,t} \quad (1)$$

where $\Delta Prod_{i,t}$ is the difference in log labour productivity in firm i between year t and year $t-1$ (i.e. the annual growth rate of productivity); $SD_WD_{i,t-1}$ is our measure of within-firm segmentation; $SH_FT_{i,t-1}$ is the share of equivalised workdays as a fixed-term employee; $X_{i,t-1}$ is a vector of a firm's characteristics which includes the log physical capital per equivalised workday, the log firm size, and the composition of the workforce by gender, age classes, and groups of citizenship; Z_j is the number of yearly hours authorised for CIG in industry j ; ρ_j , π_r , and τ_{t-1} are, respectively, the industry, the region, and the year fixed effects; and $\varepsilon_{i,t-1}$ is the error term¹⁰.

⁹ Our estimated equation is consistent with the approach used in studies that have estimated the production function and wage function in a context with a heterogeneous workforce by using an employer-employee-linked dataset (Hellerstein *et al.* 1999; Akerberg *et al.* 2015).

¹⁰ In all estimates, we cluster the standard error by firm. Industry fixed effects are taken grouping sectors according to the 2-digit NACE Rev2 classification.

We also estimate equation (1) through fixed effect regressions, thus adding firm fixed effects μ_i ¹¹. To inquire into the possible heterogeneous effects, we also split our estimates by firm size – namely, distinguishing firms who, per year, have job relationships with fewer than or at least 50 individuals – and sector of activity, distinguishing manufacturing (also including construction) and services.

Furthermore, we estimate through pooled OLS and FE an equation similar to equation (1) but replace the dependent variable $\Delta Prod_{i,t}$ with $\Delta LC_{i,t}$, which measures the annual change in log labour costs per equivalised workday. This specification allows us to test whether a possible negative impact of our main independent variables on labour productivity growth is offset by a reduction in labour costs and, as a consequence, the increase in flexibility might be profitable for firms because of the labour cost reduction, despite the decrease in productivity.

Even when we conduct fixed effect estimates, the outlined empirical strategy does not guarantee that the estimated coefficients of interest are unaffected by reverse causality, that is a possible effect of productivity growth on a firm's decision on the use of flexible, short-term, and short-time arrangements. However, in our preferred specification, we control for a detailed proxy of industry business cycle, that is the number of hours of CIG allowance authorised in each 3-digit NACE Rev. 2 industry, which reduces a possible bias related to omitted variables jointly affecting productivity growth and firms' choices on contractual arrangements. Nevertheless, although we include a large set of control variables in our preferred specification together with fixed effects so that our estimated coefficients are not affected by potential endogeneity due to time-invariant unobservables, there might be other sources of endogeneity related to time-varying unobservables simultaneously correlated to our regressor of interest and the dependent variable. Therefore, we seriously consider the potential endogeneity in our estimates and, as a major robustness check, we re-estimate equation (1) by adopting an instrumental variable approach.

Because of the difficulty in finding a convincing external instrument for which the basic exclusion restriction assumption holds, we instrument the standard deviation of the distribution of days worked days within the firm by exploiting its lagged values available in the dataset. By definition, the exclusion restriction assumption holds if the selected instrumental variable does not directly influence the dependent variable once all other control variables are considered. In other words, according to the exclusion restriction assumption, the selected instrument should be sufficiently correlated with the corresponding endogenous variable, but it must not be correlated with the generic error term ε_{it} . To a certain extent, an argument could be that firm staffing strategies are path-dependent and are related to firm positioning in national and international markets (Vidal and Tigges 2009), while labour productivity is influenced by several concurrent firm choices ranging from innovation to internationalisation and it is less likely to depend on old (more than five years) firm staffing strategies and, then, on old values of within-firm inequality in days worked.

Because we assume that our endogenous variable of interest may be contemporaneously correlated to the error term at any given time, we must use a lag order for which the lagged instrumental variable may be correlated to the contemporaneous error term but is uncorrelated to the error term observed

¹¹ Region and industry fixed effects cannot be estimated in FE models because they capture time-invariant firm characteristics. Further, because our dependent variable is productivity growth, our estimates refer to a seven-year period (2016 is only used to compute the dependent variable).

at time t . The latter assumption holds only if the error terms in equation (1) are not serially correlated or if we select a lag order that exceeds the order of the estimated serial correlation (Wooldridge 2010). Thus, to select the proper lagged instrumental variables for our main independent variable, we conducted two alternative tests of serial correlation (i.e. the Cumby-Huizinga test for autocorrelation and the Arellano-Bond test) useful in our fixed-T large-N panel data context.

5. Main results

5.1 Baseline estimates

In this section, we present the results of equation (1) estimated on the whole sample of AD-RIL through pooled OLS, fixed effects, and IV models¹².

Table 2 highlights that an increasing share of temporary employees at the firm level is negatively associated with productivity growth, confirming findings of previous empirical studies on Italian firms that have focused on the relationship between fixed-term employment and labour productivity in different periods of time and by using different data (Boeri and Garibaldi 2007; Lucidi and Kleinknecht 2010; Cappellari *at al.* 2012; Cirillo and Ricci 2020). Our estimates show that the size of the estimated coefficient is not negligible: on average, without controlling for within-firm segmentation (column 1), an increase of 10 percentage points in the share of equivalised workdays as a fixed term of employees is associated with a productivity slowdown ranging from 0.34 percentage points (pooled OLS) to 0.54 p.p. (fixed effects). Furthermore, when the proxy for within-firm segmentation (the log standard deviation of equivalised workdays) is explicitly considered both the sign and magnitude of the coefficient associated with our measure of use of temporary employment do not change (columns 2 and 3 of pooled OLS and fixed effects estimates).

More importantly, our findings show that the degree of within-firm inequality in days worked, our proxy of segmentation of the labour force in the firm, is negatively associated with a further productivity slowdown. The estimated coefficient of the log standard deviation of workdays is statistically highly significant and its size is rather large: a back-of-the-envelope computation shows that moving from the 25th to 75th percentile of the log standard deviation distribution results in a productivity growth rate reduction of 1.27 percentage points.

Notably, the sign and magnitude of the share of equivalised workdays as a fixed-term employee and of the log standard deviation of workdays do not change when we introduce the control for the business cycle, represented by the number of authorised CIG hours in the 3-digit NACE Rev. 2 industries (column 3 in pooled OLS and fixed effects).

¹² For brevity, in the tables, we synthesise the main independent variables as ‘share of fixed-term emp.’, instead of ‘share of equivalised workdays as a fixed-term employee used by the firm’, and ‘S.D. of workdays’, instead of ‘log standard deviation of equivalised workdays in the firm’.

Table 2. Main estimates. Dep var: yearly change of log labour productivity

	Pooled OLS			Fixed effects		
	[1]	[2]	[3]	[1]	[2]	[3]
Share of fixed-term emp.	-0.0337*** [0.0067]	-0.0327*** [0.0068]	-0.0312*** [0.0068]	-0.0542*** [0.0191]	-0.0586*** [0.0190]	-0.0582*** [0.0191]
S.D. of workdays		-0.0172*** [0.0031]	-0.0174*** [0.0031]		-0.0306*** [0.0048]	-0.0302*** [0.0048]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	No	No	No
Region fixed effects	Yes	Yes	Yes	No	No	No
CIG hours in the industry	No	No	Yes	No	Yes	Yes
N of obs.	120,430	120,430	120,310	120,430	120,430	120,310

Note: standard errors are in parenthesis. In all specifications, we control for log firm size, log capital per equivalised workday, and the shares of workers employed by the firms by gender, age class (15-29, 30-49, and over 50 years), and citizenship (Italian, EU, extra-EU). Standard errors clustered by firms. *** p<0.01, ** p<0.05, * p<0.10.

Source: elaborations on AD-RIL data

Overall, estimates in table 2 show that flexibility is a multifaced process affecting the number of workers employed under short-term work arrangements but also how work is organised within the firm. Therefore, in addition to the effect related to the increase in the number of temporary workers, the increase in the fragmentation of job relationships and in the heterogeneity of work intensity within a firm due to the process of deregulation of contractual arrangements further affect a firm's productivity growth.

We can interpret our results as the signal of the coexistence of two complementary effects of flexibilisation on firm performance related to two possible mechanisms. The first mechanism, already detected in the literature, highlights that increasing temporary work affects knowledge accumulation and weakens organisational capabilities of firms, resulting in lower productivity growth and a lower probability to innovate. The second mechanism is linked to work organisation and cooperation among co-workers: high turnover and weakened interactions among workers when many individuals work part-time hamper the creation of stable links among workers, restricts the disclosure of asymmetric information among workers and between them and the employer with negative effects on mutual trust, and inhibits the opportunities for cooperation and exchanging job-specific skills and knowledge. These two mechanisms coexist – capturing different mechanisms related to labour market flexibilization – and simultaneously affect firm performances, slowing down its productivity growth. However, as emphasised in section 4, estimates presented in table 2 do not allow us to infer causal effects: a firm's staffing decisions on contractual arrangements may be an endogenous variable because low-productive firms are more likely to use atypical contracts. Thus, regressions in table 2 should be interpreted as tests for correlation between labour productivity growth and our proxies of within-firm labour flexibility in a multivariate correlation setting. As mentioned, although equation (1) includes a large set of control variables and, when running fixed effects estimates, is not affected by potential endogeneity due to time-invariant unobservables, there might be other sources of endogeneity related to time-varying unobservables simultaneously correlated to our regressor of interest and the dependent variable. Therefore, as a further step in the empirical analysis we explicitly consider the potential endogeneity of our estimates and re-estimate equation (1) by adopting an

instrumental variable approach. Finding a convincing external instrument is not a trivial exercise, as explained in section 4. Therefore, we rely on lagged values of the log standard deviation of the distribution of individuals' workdays within a firm. A valid instrument should be highly correlated with the endogenous regressor and must not be correlated with the generic error term ε_{it} . In this context, a hypothesis might be that past values of within-firm segmentation are correlated with current work distribution but do not directly affect productivity growth.

The results of the two tests presented in table 3 show that, under the null hypothesis of no autocorrelation tested at any given lag, the error terms of equation (1) are serially correlated until the 4th lag. This reason is why we can instrument our endogenous regressor of interest by using lagged variables starting from the 5th lag.

Thus results of the IV estimate presented in table 4 confirm the negative sign of the standard deviation of the distribution of individuals' days worked within a firm¹³. Notably, the magnitude of the log standard deviation coefficient is higher in table 4 compared with that in table 2: moving from the 25th to 75th percentile of the log standard deviation distribution, the productivity growth rate decreases by 1.89 percentage points. Conversely, the share of fixed-term employees loses its significance, suggesting that firm internal segmentation emerges as the main driver of flexibilisation affecting labour productivity.

Table 3. Tests of residuals' autocorrelation

lag	Cumby-Huizinga test		Arellano-bond test		
	χ^2	p value		z statistic	Pr>z
1	5375.41	0.00	Test for AR (1)	-21.23	0.00
2	193.86	0.00	Test for AR (2)	-7.15	0.00
3	19.34	0.00	Test for AR (3)	-2.93	0.00
4	17.66	0.00	Test for AR (4)	-2.76	0.01
5	1.37	0.24	Test for AR (5)	-0.86	0.39
6	0.01	0.93	Test for AR (6)	-0.08	0.94

Source: elaborations on AD-RIL data

Table 4. IV estimate of the link between productivity growth and proxies of flexibility

Share of fixed-term emp.	0.009 [0.025]
S.D. of workdays	-0.045** [0.023]
Sample size	13,208
First-stage F statistic of excluded instruments:	200.17
Excluded instruments: S.D. of workdays (t-5) and S.D. of workdays (t-6)	

Note: standard errors are in parenthesis. Control variables: time and regional fixed effects, industry number of authorised CIG hours, log firm size, log capital per equivalised workday, and the shares of workers employed by the firms by gender, age class (15-29, 30-49, over 50 years), and citizenship (Italian, EU, extra-EU). Standard errors clustered by firms. *** p<0.01, ** p<0.05, * p<0.10.

Source: elaborations on AD-RIL data

¹³ The value of the first-stage F-test statistic is well above the critical minimum value of 10 suggested by, among others, Wooldridge (2010 - as the general rule of thumb to avoid the weak instrument problem.

However, we are aware that the use of lagged variables as instruments can totally circumvent all potential endogeneity only if they do not belong to the main estimating equation (Reed 2015). Unfortunately, although we perform two different tests of serial correlation to properly select the lag order of the instrumental variables, it is not possible to directly test the exclusion restriction hypothesis.

5.2 Further results: within-firm segmentation and labour costs growth

Thus far, estimates in tables 2 and 4 suggest that firms preferring non-standard staffing strategies will probably experience productivity slowdown linked to a twofold mechanism concerning (i) the number of temporary employees (external flexibility) and (ii) the within-firm segmentation. Once we control for endogeneity, the second mechanism prevails: more internally fragmented firms are experiencing worse productivity performances. If this is the case, we might wonder why firms use non-standard arrangements if temporary staffing policies compress labour productivity. Recent evidence on Italian labour markets has highlighted that the use of flexible work is significantly associated with labour cost compression (Damiani *et al.* 2018), mostly in low-productive firms (Cirillo and Ricci 2020). If a large use of short-term work arrangements simultaneously reduces labour productivity and labour costs, firms may still increase profits.

Therefore, we complement the estimates presented in table 2 by estimating an analogue specification of equation 1, having as a dependent variable the first difference of log firm labour costs per equivalised workday. We aim to verify if temporary employment and within-firm segmentation are associated with labour cost compression. If this is the case, we might argue that using flexible staff arrangements by firms is a rational choice that allows them to realise positive gains despite compressing firm productivity and placing firms on a “low road” strategy (Osterman 2018).

Estimates in table 5 highlight that both measures of flexibility – the share of equivalised workdays as a fixed-term employee and the log standard deviation of workdays – are associated with labour cost compression and that the sign and magnitude of coefficients are stable across specifications.

Table 5. Main estimates. Dep var: yearly change of log labour cost per equivalised workday

	Pooled OLS			Fixed effects		
	[1]	[2]	[3]	[1]	[2]	[3]
Share of fixed-term emp.	-0.0209*** [0.0045]	-0.0201*** [0.0045]	-0.0195*** [0.0045]	-0.0178 [0.0117]	-0.0213* [0.0117]	-0.0213* [0.0116]
S.D. of workdays		-0.0132*** [0.0015]	-0.0132*** [0.0014]		-0.0236*** [0.0024]	-0.0233*** [0.0024]
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector fixed effects	Yes	Yes	Yes	No	No	No
Region fixed effects	Yes	Yes	Yes	No	No	No
CIg hours in the industry	No	No	Yes	No	Yes	Yes
N of obs.	120,285	120,285	120,166	120,285	120,285	120,166

Note: standard errors are in parenthesis. In all specifications, we control for log firm size, log capital per equivalised workday, and the shares of workers employed by the firms by gender, age class (15–29, 30–49, over 50 years), and citizenship (Italian, EU, extra-EU). Standard errors clustered by firms. *** p<0.01, ** p<0.05, * p<0.10.

Source: elaborations on AD-RIL data

To be precise, a 10 percentage point increase in the share of equivalised workdays as a fixed-term worker is associated with a labour cost contraction (per equivalised workday) of approximately 0.2 percentage points, while moving from the 25th to 75th percentile of the log standard deviation distribution, the wage growth rate is decreased by 0.98 percentage points.

Increasing evidence has been reported on lower wages for temporary employees (Regoli *et al.* 2019) and flexibilisation policies leading to wage bargaining decentralisation and weakening of trade union power often associated with poorer wage prospects for atypical workers (Piasna and Myant 2017). From a theoretical perspective, the link between within-firm segmentation and labour cost compression is less straightforward; however, a negative link might emerge if workers in highly segmented firms are less exposed to wage increases due to the division among them and their incapacity to fully coordinate wage claims. In highly fragmented workplaces, rent sharing among employers and employees is less likely to occur and productivity gains are more often transferred to employers (Garnero *et al.* 2016).

Combining the evidence from tables 2 and 4, we observe that an increasing use of flexible staff arrangements leading to higher fragmentation within firms compresses both average firm productivity and labour costs per worker. Although a large use of flexible work might weaken firm labour productivity, it is also associated with wage contraction and therefore, to some extent, temporary staffing strategies may allow firms to pursue a business model grounded on cost competitiveness instead of technological competitiveness (Crespi and Pianta 2008; Bogliacino and Pianta 2011).

6. Heterogeneity by firm size and sector of activity

We now investigate whether the relationships we focus on vary by firm size and sector of activity.

Table 6 shows pooled OLS and fixed effects estimates on AD-RIL firms divided into two main groups according to the total number of workers employed by each firm over one year. Notably, external flexibility (number of temporary employees) mainly affects medium-small firms – those with less than 50 workers per year – and within-firm segmentation is likely to dominate in medium-large companies (50 and more than 50 employees).

More precisely, when we focus on fixed effect estimates, it emerges that an increase by 10 percentage points in the share of equivalised workdays as a fixed-term worker is associated with a productivity slowdown of approximately 0.85 p.p. in medium-small and small firms, while the negative association disappears in medium-large and large companies. This result can be partly explained by the heterogeneous use of flexible work by firms: large and more productive firms are more likely to consider temporary contracts as steppingstones towards permanent jobs. If this is the case, the two mechanisms related to excessive use of short-term work arrangements – lower incentives to invest in firm-specific skills (Acemoglu and Pischke 1999) and weakening of firm organisational capabilities (Dosi *et al.* 2001; 2008) – are not at work. Conversely, small companies are more likely to offer temporary jobs to compress labour costs and pursue strategies of cost competitiveness (Vidal and Tiggas 2009; Vivarelli and Pianta 2000); in this case, an excessive workforce turnover is expected to affect knowledge accumulation and problem-solving capabilities that only long-lasting work relationships allow to ripen.

The focus on within-firm segmentation demonstrates that a significant negative relationship is detected in both small and medium-small firms, and large and medium-large companies. However, the magnitude of the coefficient is larger in companies with more than 50 employees, suggesting that cooperation and exchange of knowledge is crucial in large companies where workers with different skills and tasks are likely to work next to each other.

Table 6. Estimates by firm size. Dep var: yearly change of log labour productivity

	Pooled OLS		Fixed effects	
	<50	>=50	<50	>=50
Share of fixed-term emp.	-0.040*** [0.010]	-0.025** [0.010]	-0.085*** [0.023]	0.010 [0.033]
S.D. of workdays	-0.013*** [0.004]	-0.032*** [0.006]	-0.024*** [0.005]	-0.048*** [0.011]
N of obs.	74,795	45,515	74,795	45,515

Note: standard errors are in parenthesis. Control variables: time, sector and regional fixed effects, industry number of authorised CIG hours, log of firm size, log capital per equivalised workday, and the shares of workers employed by the firms by gender, age class (15-29, 30-49, over 50 years), and citizenship (Italian, EU, extra-EU). Standard errors clustered by firms. *** p<0.01, ** p<0.05, * p<0.10.

Source: elaborations on AD-RIL data

Next, we explore the relations between flexibilisation and labour productivity growth by focusing on manufacturing and services (table 7). Our estimates suggest that a higher share of equivalised workdays as a fixed-term employee is negatively related to labour productivity growth, but this effect prevails in manufacturing and construction firms. The nature of tasks and work activities performed in manufacturing industries – especially at the shop-floor level – requires stable work arrangements to develop a deep knowledge of production processes and problem-solving attitudes by workers. Conversely, internal firm segmentation is associated with labour productivity contraction in all industries, even if a slightly higher coefficient is detected for firms operating in services than for those in manufacturing and construction. To a certain extent, we might argue that cooperation and knowledge exchange are crucial in services where work processes are not always codified and that a certain degree of cooperation is required among workers to share successful strategies and problem-solving routines.

Table 7. Estimates by sector of activity. Dep var: yearly change of log labour productivity

	Pooled OLS		Fixed effects	
	Manufacturing & Construction	Services	Manufacturing & Construction	Services
Share of fixed-term emp.	-0.078*** [0.012]	-0.014 [0.008]	-0.148*** [0.029]	0.020 [0.026]
S.D. of workdays	-0.016*** [0.004]	-0.017*** [0.005]	-0.022*** [0.006]	-0.038*** [0.009]
N of obs.	62,043	53,342	62,043	53,342

Note: standard errors are in parenthesis. Control variables: time, sector and regional fixed effects, industry number of authorised CIG hours, log of firm size, log capital per equivalised workday, and the shares of workers employed by the firms by gender, age class (15-29, 30-49, over 50 years), and citizenship (Italian, EU, extra-EU). Standard errors clustered by firms. *** p<0.01, ** p<0.05, * p<0.10.

Source: elaborations on AD-RIL data

Overall, estimates in table 7 confirm the existence of two different mechanisms through which flexibilisation seems to affect labour productivity: although excessive job turnover related to a large use of temporary employment might prevail in manufacturing, in services, a different dynamic is detected and is related to how workers cooperate, because higher segmentation hampers productivity.

7. Conclusions

Since the last decade, Italy has experienced a large decrease in the growth rate of labour productivity, which has been almost flat over the last twenty years. Several arguments have attempted to explain the weak performance of the Italian economy, ranging from the shortage of skilled workers to the lack of investment in new technologies or inefficient management practices.

Following the suggestions of the OECD (1994), since the mid-1990s, Italy has introduced a series of reforms that have greatly increased labour market ‘external’ flexibility by opening to various types of non-standard atypical contracts and largely easing the opportunities to hire temporary employees. These measures were expected to increase employment and foster productivity by easing workers’ entry and exit and ensuring a better match between the demand for and supply of skills. As a consequence of the labour market reform process, the Italian labour market is now characterised by a strong segmentation among workers (Eichhorst *et al.* 2017) and by an increase in earnings inequality (Franzini and Raitano 2019). Workers having permanent contracts coexist, even in the same workplace, with workers hired on a short-time basis, leading to within-firm segmentation and inequality in annual worked days.

In this article, we explored how and to what extent flexibilisation is related to firm performances by focusing simultaneously on (i) the share of workers employed with a temporary contract, the standard measure for external flexibility, and (ii) within-firm segmentation, measured by the inequality of ‘full-time equivalent’ days worked over one year by each worker within a firm.

Two different mechanisms explaining a link between productivity growth and these two proxies of labour market flexibility might be at work: on the one hand, an excess of turnover strictly related to the large use of short-term contracts weakens organisational capabilities (Dosi *et al.* 2001; 2008) and affects innovative competencies based on the long-run accumulation of firm-specific and tacit knowledge (Kleinknecht 2020); and on the other hand, an increasing use of atypical contracts boosts within-firm segmentation and affects cooperation among co-workers (Osterman 2011). Higher segmentation leads to division among workers having divergent interests, motivations, and fairness perceptions, also reducing the capacity to disclose asymmetric information among workers and with the employer. Both mechanisms are hypothesised to jointly affect firm productivity performance, worsening knowledge accumulation or inhibiting the exchange of problem-solving practices among workers.

To achieve our objective, we exploited an original, innovative longitudinal employer–employee-linked database, built by merging the RIL survey on Italian firms with various administrative sources, that includes approximately 20,000 firms per year over the 2009-2016 period.

We applied both pooled OLS and fixed effects technique and found two main results. First, an increase in the share of flexible workers at the firm level is associated with slower productivity growth. Second, within-firm segmentation is negatively associated with labour productivity growth, and this negative association emerges independently of firm size or industry.

An increase in the dispersion of days worked within firms reflects, to some extent, the transition towards a new organisational model of businesses characterised by a high internal segmentation of work and a growing inequality in workers prospects. Hence, our empirical evidence suggests that companies characterised by high inequality in employment opportunities tend to produce less capacity for coordination and cooperation among individuals, with negative consequences for productive efficiency.

Overall, our findings suggest that labour market reforms that induce an increase in both internal and external numerical flexibility – through the spread of atypical contracts and the increasing use of part-time work – risk eroding margins of competitiveness, i.e. the dynamics of labour productivity, if not accompanied by public policy interventions that favour investment choices in innovation and specific human capital and that, therefore, reorient the staffing choices and the cost competitiveness model pursued by most Italian companies.

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