REGIONAL STUDIES
https://doi.org/10.1080/00343404.2023.2281428



# Productivity slowdown across European regions: does non-standard work matter?

Michele Capriati[a], Valeria Cirillo[a] and Marialuisa Divella[a]

**ABSTRACT**

In recent decades, Europe has experienced a significant slowdown in productivity, accompanied by rising regional inequalities. At the same time, the fragmentation of work and the rise of non-standard forms of employment have deeply reshaped labour markets. Through the analysis of an extensive database comprising data on regional labour markets and productivity trends, we investigate the relationship between non-standard work and labour productivity dynamics in European regions from 2004 to 2018. The findings highlight that increasing non-standard employment across regions is likely to negatively affect labour productivity growth. Moreover, to some extent, the spread of non-standard jobs, especially of permanent, yet involuntary, part-time positions, might contribute to the widening of regional disparities.

**KEYWORDS**

non-standard work; labour markets; labour productivity; European regions

**JEL** J40, O30, R10, R12

**HISTORY** Received 16 September 2022; in revised form 3 November 2023

## 1. INTRODUCTION

In recent decades, most advanced economies have experienced a considerable decline in productivity (Evenhuis et al., 2021). Especially in Europe, there has been a labour productivity slowdown (Decker et al., 2017; Rodríguez-Pose & Ganau, 2022), with rising inequalities between firms and economic sectors and, therefore, across territories (Marrocu et al., 2013; Gopinath et al., 2017; Rodríguez-Pose & Ganau, 2022). Such a negative trend cannot be solely attributed to the Great Recession that started in 2008. This is because a substantial disparity between the European Union (EU) and the United States (US) had already started to emerge in the mid-1990s. The productivity gap was subsequently exacerbated by the 2008–09 crisis and by the economic policies implemented within the EU not able to revert the state of depression of the European economy (Cette et al., 2016; Viesti, 2015): in fact, the growth in EU aggregate labour productivity has been even lower in the aftermath of the economic crisis (Bauer et al., 2020). The causes of such productivity slowdown, that is, the so-called 'productivity puzzle', as well as of rising productivity inequality across European countries and regions, have thus gained increasing importance in the economic literature (Van Ark et al., 2008; Bauer et al., 2020).

Traditional analyses have focused on the basic factors behind productivity, that is, physical/human capital and innovation. A special attention is paid to capital investments in information and communication technologies (ICTs) (Van Ark et al., 2008; Iammarino & Jona-Lasinio, 2015), education and skills (Inklaar et al., 2008; Benos & Karagiannis, 2016), and institutional factors such as governance quality (Rodríguez-Pose & Di Cataldo, 2015; Lasagni et al., 2015; Agostino et al., 2020; Higón et al., 2022). A growing body of literature, inspired by the Keynesian tradition (Verdoorn, 1949; Kaldor, 1975), has furnished both empirical validation and theoretical insights for the influence regarding the impact of demand-side factors on labour productivity dynamics. As a result, the growth of labour productivity is considered to be endogenously determined by the growth of output, which, in turn, relies on the dynamics of aggregate demand (McCombie et al., 2002; Castiglione, 2011; Deleidi et al., 2020). Another factor that contributes to stagnating labour productivity is structural change, especially the process of tertiarisation and the challenges associated with reallocating resources across firms and geographical areas (Fagerberg, 2000; Storm, 2017).

All these explanations tend to overlook the role of labour markets in shaping labour productivity dynamics. A new line of research has therefore emerged, with a particular emphasis on labour markets, particularly examining factors such as real wage decline, issues associated with wage moderation, labour market flexibility and productive

**CONTACT** Marialuisa Divella marialuisa.divella@uniba.it
Department of Political Sciences, University of Bari Aldo Moro, Bari, Italy

Supplemental data for this article can be accessed online at https://doi.org/10.1080/00343404.2023.2281428

capabilities (Naastepad, 2006; Lucidi & Kleinknecht, 2010; Pessoa & Van Reenen, 2014; Kleinknecht, 2020; Pariboni & Tridico, 2020; Celi et al., 2018).

Over the past three decades there have been substantial transformations in the nature of work and labour markets, and these changes are expected to have profound implications for labour productivity dynamics. Among these changes, the most significant is the growing fragmentation, marked by the rapid diffusion of non-standard forms of employment, especially temporary and part-time jobs (International Labour Organization (ILO), 2016; Organisation for Economic Co-operation and Development (OECD), 2018). To some extent, the rise of non-standard work (NSW) can be attributed to how firms are capitalising on the new opportunities presented by technological advancements: a noteworthy example is the proliferation of digital labour-platforms that have dramatically widened opportunities for firms to enhance their competitiveness by increasing labour flexibility and task outsourcing (Katz & Krueger, 2019; Tubaro & Casilli, 2019), though bringing about income vulnerability and social exclusion at the same time (Cirillo et al., 2023). In Europe, however, the diffusion of NSW has also been the result of specific reforms meant, at least in principle, at favouring the labour market participation of specific groups (especially young people and women) by increasing labour market flexibility (Cirillo et al., 2017; Green & Livanos, 2017). Indeed, after the 2008 downturn, labour flexibility has been on top of the EU's reforms agenda to promote employment and economic growth.

In standard neoclassical frameworks, labour flexibility is viewed as an opportunity for firms to enhance resource utilisation and efficiency. It grants them greater freedom in managing their workforce, allowing for more responsive adjustments to fluctuations in demand (Nunziata & Staffolani, 2007). Consequently, the increased use of NSW contracts by firms is expected to boost labour productivity by improving overall efficiency, particularly in the short term (Tressel & Scarpetta, 2004; Autor et al., 2007; Okudaira et al., 2013; Garnero et al., 2014; Bartelsman et al., 2016; Bjuggren, 2018). Nevertheless, taking an evolutionary perspective, this study argues that the extensive utilisation of NSW can have detrimental effects on firms and long-term economic growth. This is especially true because it may lower labour quality in various aspects, leading to negative consequences for the virtuous dynamics of knowledge generation and accumulation that are only possible through enduring job relationships, and which are vital for fostering innovation and productivity in the long-run (Zhou et al., 2011; Kleinknecht et al., 2014; Cetrulo et al., 2019; Cirillo & Ricci, 2020; Kleinknecht, 2020; Reljic et al., 2023; Pianta & Reljic, 2022).

So far, most empirical studies on the relation between NSW and labour productivity have been conducted at the firm level or have relied on aggregate industry level-data based on single or multiple countries. These studies have yielded somewhat mixed results (Lucidi & Kleinknecht, 2010; Okudaira et al., 2013; Garnero et al., 2014; Bardazzi & Duranti, 2016; Nielen & Schiersch, 2016; Lisi & Malo, 2017; Bjuggren, 2018). Despite evidence of huge regional differences in both the distribution of non-standard workers (OECD, 2018) and labour productivity growth rates (Rodríguez-Pose & Ganau, 2022), even within individual countries, the geographical dimension of the relation between NSW and labour productivity dynamics remains largely unexplored.[1] Therefore, very little is known regarding whether, and how, an increasing prevalence of non-standard employment affects the growth of labour productivity at the regional level. Specifically, we lack knowledge about whether an uneven distribution of non-standard workers among regions indeed contributes to the widening gap between rapidly growing regions and others, potentially reinforcing polarisation dynamics across Europe.[2] In this paper we thus aim to answer these two research questions by empirically investigating the relation between the share of non-standard workers, specifically meant as employees with temporary and/or part-time contracts, and the dynamics of labour productivity in the EU regions (NUTS-2) over the long 2004–18 time span.

Compared with previous literature, we contend that a change in the level of analysis is useful for two main reasons. First, it enables the consideration of various patterns that may not be discernible at the firm or industry level. These patterns are often influenced by numerous confounding factors stemming from disparities in the economic activities and labour markets across regions, and which are likely to play a role in shaping the relationship under study. Second, the regional level of analysis allows one to capture those relevant effects related to the exchange of tacit knowledge and spillovers, which are pivotal in driving productivity growth through innovation.

The rest of the paper is organised as follows. Section 2 reviews the relevant literature and formulates specific hypotheses for subsequent empirical analysis. Section 3 describes the model and data used, providing insights into the data source and sample, and some descriptive evidence concerning the main variables. Moreover, we delve into the empirical strategy employed. Section 4 presents and discusses the results, including the provision of some robustness checks. Section 5 concludes.

## 2. BACKGROUND LITERATURE AND HYPOTHESES

### 2.1. Non-standard work: an 'umbrella' concept

The label 'non-standard work' (NSW) is commonly used in the literature to encompass all forms of employment that differ from traditional open-ended, full-time, positions. These NSW arrangements are typically associated with limited access to employment protection and workers' rights. In fact, the terms 'flexible', 'atypical', 'unstable' or 'precarious' work are often used interchangeably to refer to such employment arrangements (Reljic et al., 2023).

In more detail, NSW is conventionally defined as including temporary workers (i.e., with fixed-term contracts), part-time workers (i.e., working fewer than 30 hours per

week), and self-employed with no employees, such as disguised employed workers, dependent self-employed workers, sham or misclassified self-employed workers (OECD, 2018). NSW is, thus, by definition an 'umbrella' concept comprising four main distinct employment arrangements deviating from the standard employment relationship. The latter is characterised by full-time work, indefinite job tenure and the presence of a subordinate relationship between an employee and an employer (ILO, 2007) (see Table A1 in Appendix A in the supplemental data online for a general overview of standard/non-standard forms of employment).

Given that the work arrangements included in the conventional definition of non-standard employment represent very different categories, it can be misleading considering them all together. Therefore, in our specific definition of NSW, we exclude the category of self-employment, which is more extensive and substantially different.

Self-employment includes all forms of independent work, such as individuals who have chosen to establish their own business or work independently. According to Carrasco and Hernanz (2022), self-employment encompasses a diverse range of workers, some of whom occupy a 'grey area' between traditional employment and fully fledged entrepreneurship. This group of individuals, often referred to as 'false' self-employed, has experienced rapid growth, largely driven by the rise in outsourcing and cost reduction practices by firms. In fact, employers find it more financially advantageous to hire self-employed workers rather than traditional employees. Notwithstanding this, self-employment still constitutes a relatively small proportion of the overall NSW observed in European labour markets. Additionally, accurately measuring the labour contribution of independent contract workers and freelancers at the regional level presents challenges. This paper thus focuses only on the dependent workers with temporary and/or part-time job contracts, which are specifically considered as 'non-standard' or 'flexible' workers for the scope of this study.

However, it is important to acknowledge that also the nature of temporary and part-time work can vary significantly and exhibit huge heterogeneity across countries and regions. Indeed, temporary jobs are often linked to businesses' need for labour flexibility, while part-time job positions may in principle align with workers' preferences for flexible work arrangements. Nevertheless, recent evidence highlights a few key patterns related to part-time work that bring it closer to non-standard forms of work. For instance, the growing prevalence of involuntary part-time, which corresponds to situations where individuals lack a genuine choice regarding their employment (Anxo & O'Reilly, 2000; Fagan & O'Reilly, 1998; Tijdens, 2002): they want to work full-time, though are currently employed part-time, because they cannot find a full-time job or face slack work conditions in their current job. In such circumstances, part-time work arrangements are the outcome of demand-side dynamics in the labour market, that, as emphasised by Barbieri et al. (2019), promote marginal forms of employment within the peripheral labour force. This situation is particularly pronounced in Southern European countries such as Italy, Spain and Greece, where the percentage of involuntary part-time overcomes 50% of total part-time jobs. In the Euro area as a whole, the share of involuntary part-time has exceeded 20% over the past 15 years. These statistics align with the data from the European Labour Force Survey, which indicates that over 25% of European part-time workers report being unable to find a full-time job. Given this, part-time can also be considered as a major component of NSW: as in the case of temporary work, its increasing prevalence in the economy is often driven by firms' growing need for organisational flexibility (Euwals & Hogerbrugge, 2006). As stressed by the labour market segmentation perspective (Rubery, 1998; Hipp et al., 2015), employers use non-standard employment as a cheap and easily available buffer to counter the volatility of markets and accommodate customers' requirements, such as in the case of service industries (Allaart & Bellmann, 2007).

In the light of this background, this article examines both temporary and part-time employment as the two primary components of non-standard employment. Nevertheless, it is important to also emphasise that the concept of NSW is dynamic and should be adaptable to encompass emerging employment relationships, which may include those facilitated by digital labour platforms and remote work arrangements. To comprehensively capture these new forms of employment, following the evolution of labour markets, it will be essential to have access to representative and high-quality micro-data in the future. Such data will enable us to effectively map and comprehend the evolving nature of work and labour markets.

## 2.2. On NSW and labour productivity

From a theoretical perspective, the relation between NSW and labour productivity remains an open issue. Likewise, the findings from existing empirical research are inconclusive.

In a standard neoclassical perspective, the rise of NSW, considered as proxy of higher labour market flexibility, can be expected to enhance labour productivity through several channels. One of the most important refers to the use of temporary and part-time contracts by firms as a tool to adjust their workforce to product demand fluctuations (Boeri & Garibaldi, 2007; Nunziata & Staffolani, 2007; Bjuggren, 2018; Devicienti et al., 2018; Garcia-Vega et al., 2021), which indeed could exert a positive effect on labour productivity dynamics, at least in the short-run. Other channels refer to the use of fixed-term contracts as means for screening most productive workers for permanent positions, or to more easily replace less productive workers with more productive ones (Ghignoni, 2009; Portugal & Varejao, 2022). In the same vein, it is also stressed that the use of non-standard contracts would reduce chances that workers entrenched in safe jobs gradually lose their motivation and put less effort in work (Ichino & Riphahn, 2005; Ghignoni, 2009). Other

scholars posit that flexible labour markets lead to more intense factor mobility that, in turn, increases efficiency of workers reallocation across sectors (i.e., from old declining sectors to new dynamic ones). This should improve the quality of matching between labour demand and supply, and raise opportunities for workers to find a job in which they are more productive (Bartelsman et al., 2016). Bjuggren (2018) shows that labour market flexibility contributes significantly to increased labour productivity, primarily driven by enhanced efficiency. Further arguments stress that a positive relation between NSW and labour productivity can be mediated by the innovative strategies and activity of firms, which indeed have an impact on labour productivity dynamics. For instance, it is argued that labour flexibility increases incentives for firms to engage in risky innovation investments as they could more easily fire redundant personnel in case of failure (Bartelsman et al., 2016; Bjuggren, 2018; Garcia-Vega et al., 2021). High labour turnover can also be advantageous for firms in terms of innovation and productivity. This is because it can lead to an influx of individuals with fresh ideas and networks, which potentially increase knowledge spillovers across firms. This idea is supported by studies such as those by Bassanini and Ernst (2002), Altuzarra and Serrano (2010) and Parrotta and Pozzoli (2012), as well as by the parallel concept of productivity enhancing knowledge exchange that occurs through business visits across industries (Piva et al., 2020).

In this paper, however, we refer to alternative strands of literature that challenge the aforementioned presented in these works, offering alternative arguments and presenting contrasting empirical evidence. In this framework, a central idea is that an excessive reliance on NSW contracts by firms can have detrimental effects on labour productivity dynamics over time. This is primarily due to the reduction in labour quality across various dimensions, which, in turn, disrupts the generation, and long-run accumulation, of firm-specific tacit knowledge embedded in the workforce and organisational learning processes (Kleinknecht, 2020; Pianta & Reljic, 2022; Reljic et al., 2023). Indeed, the accumulation of firm-specific tacit knowledge is considered instrumental in fostering local conditions conducive to achieving innovation and productivity growth (Lundvall, 1992; Dosi & Grazzi, 2010; Capriati & Divella, 2019, 2022). For instance, research has pointed out that job insecurity and frequent job turnover within firms that heavily rely on NSW can lead to a decrease in social capital. This decrease in social capital can result in reduced levels of trust and cooperation among employees, which, in turn, have a negative impact on the sharing of tacit knowledge. This latter is indeed highly dependent on social interactions and collaborative relationships within the workplace (Kleinknecht et al., 2006, 2016; Bloise et al., 2022). Moreover, as suggested by theoretical and empirical analyses adopting an evolutionary perspective (Nelson, 1985; Dosi et al., 2008), this is particularly detrimental to the growth of firms and industries characterised by a 'Schumpeter Mark II' technological regime (Schumpeter, 1943), as they are more reliant on historically accumulated knowledge for innovation (Kleinknecht, 2020). Likewise, studies within the endogenous growth framework (Acemoglu, 1997) stress that excessive job turnover makes firm-specific human capital accumulation difficult, especially because of lower incentives, for both workers and employers, to invest in education and on-the-job training (Booth et al., 2002; Belot et al., 2007; Grinza & Quatraro, 2019; Dughera et al., 2022). Indeed, by creating strong incentives for firms to exploit labour costs savings for improving their competitive advantage (Lucidi & Kleinknecht, 2010; Kleinknecht & Naastepad, 2005; Kleinknecht et al., 2014; Cirillo & Guarascio, 2015; Cetrulo et al., 2019), the use of NSW contracts favours the employment of the less skilled and productive workers, as well as of non-productive managerial personnel needed to compensate the lack of trust among employees with greater levels of control (Kleinknecht et al., 2016). All these factors are likely to hinder the positive cycle of productivity growth driven by knowledge and innovation.

Hence, a substantial body of research also supports the existence of a negative relationship between NSW and productivity dynamics. As already stressed (section 1), these results are mostly based on firm/industry-level analyses regarding single or multiple countries (Kleinknecht, 2020; Pianta & Reljic, 2022; Reljic et al., 2023) (Table A2 in Appendix A in the supplemental data online provides a short summary of the relevant literature on this topic). Considering the increasing territorial disparities in both the distribution of non-standard employment and labour productivity growth rates across the EU, and even within individual countries, in this work we argue that a regional analysis of this relationship becomes essential.

### 2.3. The need of a regional perspective

Despite the increasing prevalence of NSW arrangements in nearly every European country over the past few decades, its diffusion is far from uniform across regions, and this disparity exists even within individual countries (Green & Livanos, 2017; OECD, 2018). Indeed, national regulations and institutions establish the overarching framework that influences labour relationships and, more specifically, the use of temporary and part-time contracts by firms. However, the regional distribution of non-standard workers varies significantly due to various factors that operate at the local level and affect employers' actual choices when it comes to the use of NSW. These factors ultimately influence the actual 'degree of flexibility' that employers have in terms of hiring and firing (Eichhorst & Marx, 2015). Among them, for instance, one could consider the local availability of a pool of workers with the necessary qualifications, skills and competencies, as well as the associated cost of replacing one or more employees. The presence of labour unions and the quality of industrial relations, which likely differ across industries, occupations and, thus, regions, also play a crucial role.

At the same time, the slowdown of aggregate labour productivity has also been accompanied by increasing inequalities across European countries and regions

(Rodríguez-Pose & Ganau, 2022). A growing gap has become apparent, on the one hand, between the post-2004 new member states in Central and Eastern Europe – displaying relatively faster productivity growth rates – and the members of the former EU-15 – with productivity growth barely above zero (Marrocu et al., 2013); and, on the other, between the more productive and competitive countries in the north and those more stagnant in the south (Gopinath et al., 2017). Furthermore, due to the increasing concentration of advanced economic activities, especially frontier firms (Andrews & Criscuolo, 2019; Veugelers, 2018), in a limited number of economically dynamic areas, productivity growth rates have started to significantly diverge across regions, even within individual countries (Rodríguez-Pose & Ganau, 2022). In response to these challenges, the EU has launched an integrated framework programme aimed at encouraging regions to formulate their Smart Specialisation Strategies, with a dual aim of promoting economic growth and fostering European cohesion. Nevertheless, as noted (McCann & Ortega-Argilés, 2015; Foray, 2018), this programme has achieved somewhat unsatisfactory results thus far (De Noni et al., 2021).

Given such a context, in this paper we argue that not only do regions exhibit different shares of non-standard employment, but also the diffusion of NSW is also likely to affect regions in different ways. In other words, the relation between NSW and labour productivity dynamics arguably has a profound geographical dimension, neglected by most previous research.

Therefore, by linking the distribution of NSW to labour productivity dynamics at the regional level, we aim to reveal unique patterns and trends that may not be discerned by exclusively concentrating on individual firms and industries. Indeed, diverse productivity outcomes are likely affected by factors that extend beyond these levels of analysis. Such factors are closely linked to the structure of economic activities, such as the co-localisation of firms and their positions within the global production hierarchies. Additionally, they are related to the composition of labour markets in the regions, for example, to the local availability of pools of highly qualified and trained workers.

Building upon the evolutionary framework (section 2.2), we anticipate that the extensive use of NSW contracts by firms can have detrimental effects on regional labour productivity growth. Indeed, while firms may experience potential short-term benefits from flexible work arrangements, these advantages are likely to be outweighed by the long-term adverse effects on innovation and productivity. This is particularly concerning because a higher prevalence of non-standard employment within a local area, coupled with the associated high turnover of workers, should severely undermine the positive processes of knowledge generation and accumulation that only enduring labour relationships can foster (Zhou et al., 2011; Kleinknecht et al., 2014; Cetrulo et al., 2019; Cirillo & Ricci, 2020; Kleinknecht, 2020; Reljic et al., 2023; Pianta & Reljic, 2022). In fact, a large part of the knowledge critical for firms' and regions' competitive advantage is of tacit nature, that is, mostly made of skills, techniques, know-how, and routines developed through practice and experience which are, thus, highly specialised, embodied in workers and difficult to transfer (Nelson, 1985; Lundvall, 1992). Long-lasting job relationships are, therefore, of paramount importance in driving innovation and productivity in the long run. Based on these arguments, our first hypothesis is:

> *Hypothesis 1: Higher shares of NSW across regions are associated with decreasing labour productivity growth at the regional level.*

We also argue that the expected negative relationship between NSW and labour productivity growth may not be uniform across regions. Indeed, it is conceivable that various confounding factors, which differ depending on the specific industrial and employment characteristics of each region, may exert an influence on this relationship.

Taking regional heterogeneity into account is crucial because certain firms or industries may be better positioned to capitalise on the advantages of their specific regional environment. For instance, high-tech manufacturing companies situated in knowledge hub regions may leverage the concentration of knowledge and innovation resources. As emphasised by Prenzel et al. (2018), the elasticity of labour productivity in relation to research and development (R&D) tends to be higher in regions known for their superior innovation performance. This relationship can, in turn, be influenced by the quality of the labour force.

Hence, we hypothesise that the negative relationship between NSW and labour productivity dynamics is contingent on the distribution of the labour productivity growth rates, and much stronger in those regions characterised by lower labour productivity growth. Indeed, in such regions, the prevalence of firms or sectors that prioritise cost-cutting measures over innovation-based strategies to enhance their competitiveness may contribute to the weaker labour productivity performance. In this scenario, NSW would likely be used by located firms as a structurally cheaper form of labour. Consequently, the long-term negative effects on regions' innovation and productivity, particularly via the loss of workers' embodied tacit knowledge and valuable expertise, may be even more pronounced.[3] Accordingly, we state our second hypothesis:

> *Hypothesis 2: The negative relationship between NSW and labour productivity dynamics at the regional level varies across the distribution of labour productivity growth rates, and is more pronounced in regions characterised by lower labour productivity growth.*

## 3. EMPIRICAL ANALYSIS

### 3.1. Modelling and data

Given the framework widely discussed, to investigate the relationship between the spread of non-standard employment and the growth of labour productivity at the regional

level, we rely on the Neo-Schumpeterian 'technology-gap' model originally developed by Fagerberg (1988, p. 439) to assess the relation between innovation and countries' economic growth. This model has then inspired further empirical studies conducted across various regions, with a particular focus on the EU (e.g., Crescenzi, 2005; Sterlacchini, 2008).

If the literature has traditionally analysed the differences in national economic growth in terms of convergence towards one or more steady-state equilibrium (Gregory Mankiw et al., 1992),[4] the Schumpeterian approach takes growth to be a process of disequilibrium created by the interaction of two forces: innovation, which tends to increase technological differences among countries; and imitation/diffusion, which tends to decrease them (Fagerberg, 1988). It follows that the positive relationship between knowledge/innovation and economic growth cannot be taken for granted, but rather can result in either convergent or divergent paths depending on the local availability of human capital/absorptive capacities as well as the local institutional and social conditions.

According to Fagerberg (1988), this model can be specified as:

$$Y = ZD^{\alpha}N^{\beta}C^{\gamma} \tag{1}$$

where the labour productivity of a country/region ($Y$) is assumed to be a function of knowledge originating outside the country/region ($D$), knowledge originating inside the country/region ($N$), country/regions' ability to take advantage of (external and internal) knowledge ($C$), and a constant ($Z$).

By taking logarithms and differentiating equation (1) with respect to time, we have:

$$y = \alpha d + \beta n + \gamma c \tag{2}$$

where lower case letters signal growth rates.

As a further step, Fagerberg (1988, p. 439) assumes that:

> the contribution of the diffusion of internationally available knowledge to economic growth ($d$) is an increasing function of the distance ($T/T_f$) between the level of knowledge appropriated in the country/region ($T$) and that of the country/region on the technological frontier ($T_f$).

Accordingly, we obtain the final specification of the technology gap model:

$$y = \alpha(T/T_f) + \beta n + \gamma c \tag{3}$$

where $T$ denotes the total amount of knowledge and the suffix $f$ identifies the frontier country/region. As we shall see, equation (3) is a point of departure for the specification of our empirical model, which partially follows Fagerberg' s specification.

The knowledge stock available in a given territory cannot be directly measured, but it can be approximated by the level of productivity, assuming a strong correlation between the two. The influence of differences in technological endowment ($T/T_f$) can, thus, be approximated by the prior year's productivity level. The growth of the internal knowledge ($n$) can be measured by the innovative efforts, such as R&D or patent activities. Measuring changes in the utilisation of both internal and external knowledge ($c$) is challenging due to its dependence on institutional, social and cultural factors within different regions. Typically, this is proxied by the percentage of the population with a high-school qualification. However, in this paper, we move beyond evaluating skills solely based on educational attainment and also consider the composition of the local labour markets in terms of standard and non-standard job contracts. Within the extensively discussed framework (section 2), we emphasise the significance of higher employment quality characterised by a reduced prevalence of NSW. This factor is likely to be critical because it greatly affects the accumulation of knowledge and the development of firms' innovative capabilities. These capabilities entail integrating both internal and external resources to generate new knowledge and technologies, rather than merely relying on their adoption from external sources. Ultimately, this employment quality factor is expected to have long-term effects on productivity dynamics.

The empirical analysis carried out relies on an original database created by combining data from various sources on European regions at the NUTS-2 level. These sources include the EU's Labour Force Survey (EU-LFS), Eurostat's Regional Economic Accounts and Annual Regional Database of the European Commission (ARDECO). Such a database has been constructed with the aim of tracking EU regions over an extended period, preserving comprehensive data on regional labour productivity and employment by job contract type (i.e., open-ended/fixed-term and full-time/part-time). Additionally, the database contains information on various other aspects, including gross fixed capital, R&D investments, the local presence of firms by size and sector, and the composition of employment in terms of education, gender and age. The final sample (a balanced panel of 2640 observations) covers 176 regions in 20 different EU countries over the long period between 2004 and 2018 (15 years).

The regions included in the final sample deviate to some extent from the NUTS-2 aggregations. In some cases, two or more NUTS-2 regions are combined and treated as a single, larger territorial unit of observation. This adjustment is necessary to account for changes in the NUTS classification over time, which could potentially affect data integrity. Indeed, these changes can go beyond mere modifications of regions' names or codes, and may involve situations where regions are merged, split, or undergo boundary modifications. Further details about the structure of the sample and the regions considered for estimations are reported in Table A3 in Appendix A in the supplemental data online.

### 3.2. Descriptive evidence

For the scope of this study, labour productivity is defined as the logarithm of value added per hour worked.

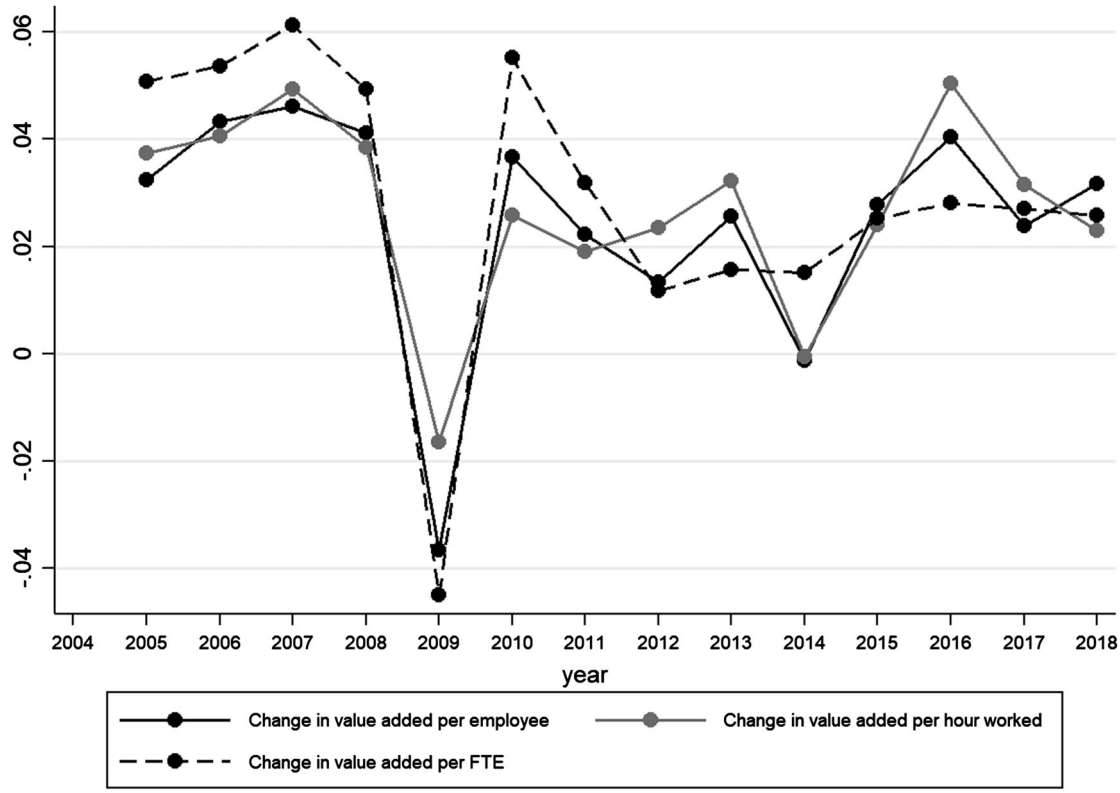


**Figure 1.** Labour productivity growth in European Union regions.
Sources: Eurostat; authors' own calculations.

Figure 1 illustrates the average annual labour productivity growth rates for EU regions over the period 2004–18 that is being considered.

For the sake of comparison, labour productivity is measured in two ways: as value added per hour worked and as value added per employee, including full-time equivalent (FTE). In summary, changes in valued added per employee closely mirror changes in value added per hour worked and FTE. All these indicators consistently hover around zero, although they exhibit a sharp decline between 2008 and 2009, which can be attributed to the economic downturn following the global financial crisis of 2008. Subsequently, there was a phase of recovery between 2014 and 2015. On average, EU regions show a decrease in labour productivity, which is particularly evident when considering the change in value added per hour worked. In fact, the value reached in 2018 is noticeably lower than the corresponding figure registered at the beginning of the period. The space between the two black lines (i.e., standing for change in value added per employee and change in value added per FTE) is due to the presence of non-full-time jobs.

While Figure 1 offers an overview of labour productivity dynamics in Europe, it hides the existence of heterogeneity in labour productivity trends across European regions. These regions have, in fact, experienced varying growth patterns over time, establishing trajectories of divergence, even within individual countries. As highlighted by the European Commission's *Eighth Report on Economic, Social and Territorial Cohesion* (2022), before the 2007–08 crisis, disparities in gross domestic product (GDP) per capita within the EU were diminishing. This was largely attributed to regions with the lower levels of labour productivity growing at a faster rate than the average during the period from 2001 to 2008. However, after that point, regional disparities have started to slightly widen. This is more evident by examining the data in Figure 2, which complements Figure 1 by more accurately illustrating the overlapping distributions of labour productivity by year.

Based on kernel densities,[5] Figure 2 clearly indicates a sinusoidal shape in the distribution of labour productivity across regions, with a concentration of regions around two main levels of labour productivity.

Two main patterns emerge: (1) a persistent wide dispersion in productivity across European regions, as evidenced by the large tails and the bimodal shape of the statistical distributions; and (2) a growing dispersion over time, as indicated by the emergence of two distinct peaks in labour productivity levels. This overall suggests that that European regions have increasingly polarised and segmented in high and low productivity clusters.

By relating the value added per hour worked (on the *x*-axis) with the rate of change in labour productivity (*y*-axis), Figure 3 enables the identification of European regions that have undergone either positive or negative changes in labour productivity over time. Three distinct clusters of regions can be identified: (1) low-productive regions that have experienced only modest increases in labour productivity over the period 2004–18 – these regions are typically connected to the manufacturing core of Europe, including Eastern European regions where

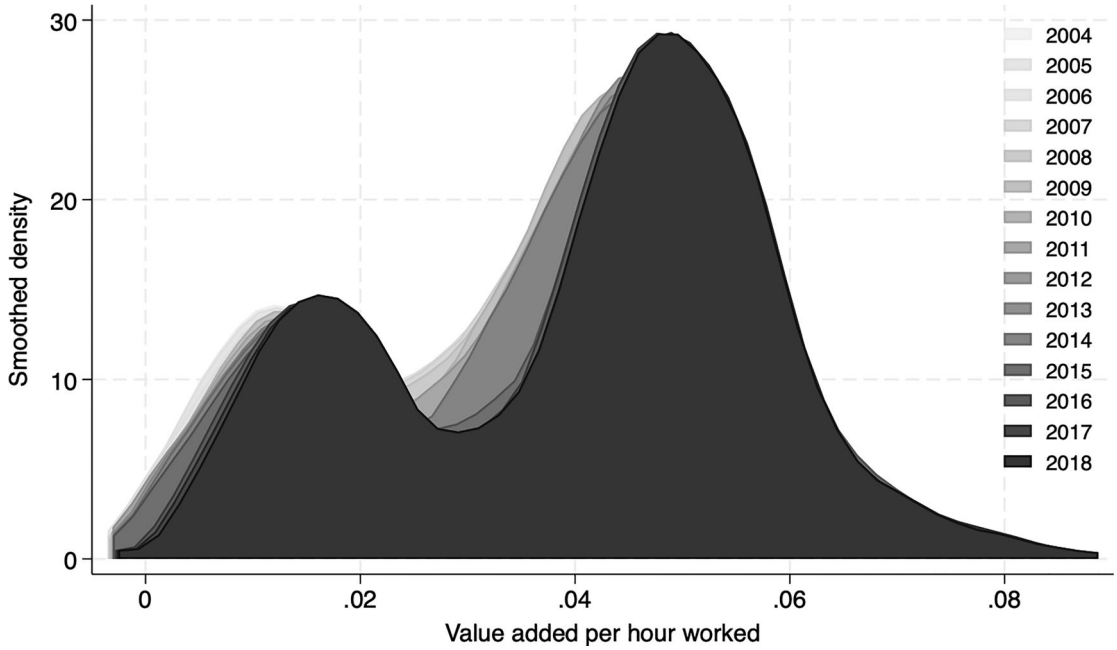


**Figure 2.** Kernel distributions of labour productivity by year.
Sources: Eurostat; authors' own calculations.

manufacturing firms have been relocated and deeply integrated into global production networks; (2) fast-growing regions, which already had relatively high labour productivity levels in 2004, including some regions in France, Germany, Austria, Sweden and Belgium; and (3) a sizable group of regions in Spain, France, Austria, Italy, Germany, Belgium and Sweden, which despite beginning with relatively high levels of labour productivity, have experienced minimal growth or, in some cases, have fallen behind, registering negative rates of change in labour productivity during the considered period.

How can these trends in value added per hour worked be linked to regional labour markets? Figure 4 maps and contrasts the spatial distribution of NSW across EU regions in 2004 (Figure 4a) and 2018 (Figure 4b), with darker shades representing areas characterised by higher shares of non-standard employment. For the purpose of this study, the NSW for each region is computed as the

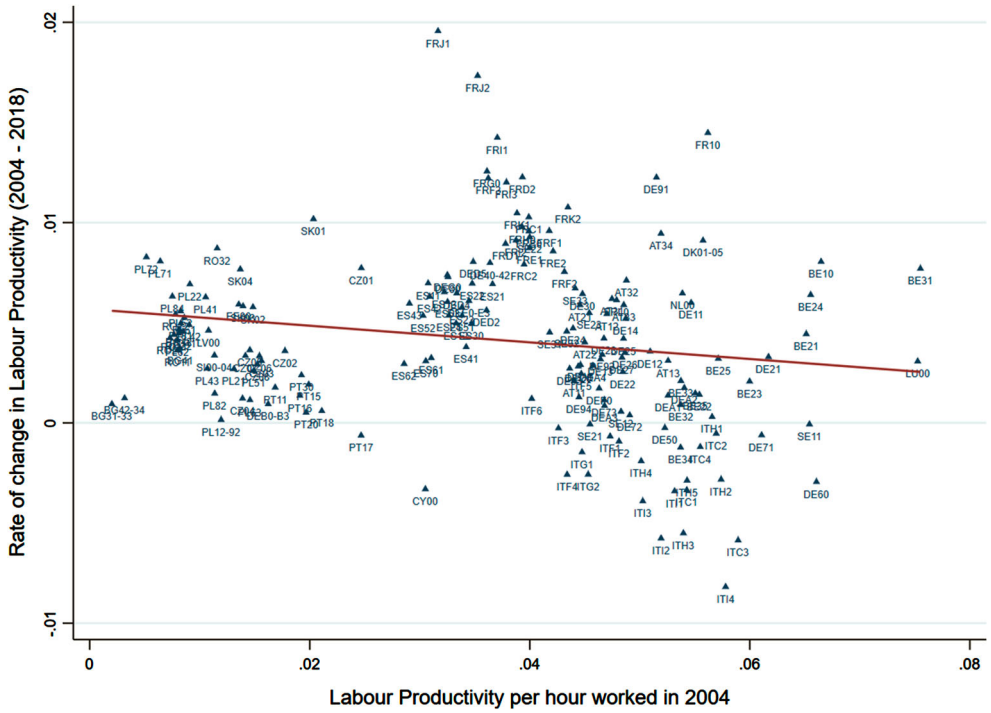


**Figure 3.** Labour productivity growth by region.
Sources: Eurostat; authors' own calculations.

number of employees with temporary and/or part-time work contracts over total employment.[6] As can be noticed, the use of NSW has increased over time across the majority of European regions, particularly in Italy, France and Southern Spain. In contrast, in North- and South-Eastern regions the prevalence of NSW seems less widespread and relatively stable over time. The Netherlands stands out as a region characterised by a structurally higher incidence of non-standard employment, largely related to the extensive diffusion of part-time jobs.

The spatial distribution of NSW appears to have some correlation with the observed dynamics of labour productivity (Figure 3). By the end of the period, NSW seems more prevalent in some Spanish, French, Austrian, Italian, German, Belgian and Swedish regions. Interestingly, these are the same regions that have shown only modest or negative performances in terms of labour productivity growth.

### 3.3. Empirical model and estimation strategy

To explore the relationship between the prevalence of NSW and the growth of regional labour productivity, we have tested the following empirical specification. This model has been adapted and expanded from the technology-gap model described in the previous section (equation 3):

$$\Delta LProd_{i,t} = \alpha + \beta log(LProd_{i,t-1}) + \gamma log(NSWsh_{i,t-1}) + \delta log(' X_{i,t-1}) + \zeta_i + t + \epsilon_{i,t} \quad (4)$$

where $\Delta LProd_{i,t}$ indicates the annual regional labour productivity growth, computed as the logarithmic difference between value added per hour worked in region $i$ at time $t$ and the corresponding value at time $t-1$ (i.e., $\Delta LProd_{i,t} = logLProd_{i,t} - logLProd_{i,t-1}$); while $LProd_{i,t-1}$ denotes the logarithmic value of labour productivity of region $i$ at time $t-1$. The initial level of the logarithm of value added per hour worked aims to capture the potential for catching up by the less developed regions, which are characterised by a lower labour productivity. Consequently, the expected sign of the coefficient ($\beta$) for $LProd_{i,t-1}$ is negative.

The variable $NSWsh_{i,t-1}$ is of main interest; it measures the share of non-standard workers (i.e., employees with temporary and/or part-time work contracts over total employment) in region $i$ at time $t-1$. Next, $'X_{i,t-1}$ is the vector of covariates that comprises additional important determinants of productivity growth as identified based on prior literature (section 1), namely: gross fixed capital investments ($GFC_{i,t-1}$) and R&D expenditure ($RD_{i,t-1}$) per employee, inserted to account for the regional investments in fixed capital and R&D; the shares of workers employed in micro- (with up to 10 employees) and small size firms (11–49 employees), namely respectively $SIZE\_MICROsh_{i,t-1}$ and $SIZE\_SMALLsh_{i,t-1}$, included to capture potential effects of local firms scale; the shares of workers in high-tech manufacturing industries ($IND\_HTsh_{i,t-1}$) and knowledge-intensive services ($IND\_KISsh_{i,t-1}$), considered to control for effects related to local firms sector and technological intensity.[7]

Further controls account for the regional employment composition in terms of education, gender and age. As we claim that the NSW has a role in determining the regional trend of labour productivity, these latter are inserted to ensure that we are not capturing other features of local labour force that could be competing determinants of regional labour productivity. Especially, we consider: the share of workers educated to tertiary and upper-secondary levels ($EDUC\_TERTIARYsh_{i,t-1}$ and $EDUC\_UPPERSECsh_{i,t-1}$);[8] the share of female and that of young employees (15–34 years) over total employment ($GEND\_FEMALEsh_{i,t-1}$ and $AGE\_YOUNGsh_{i,t-1}$). Lastly, $\zeta_i$ and $t$ indicate unobserved regional and year fixed effects, whilst $\epsilon_{i,t}$ is the idiosyncratic error term.

Table 1 reports some descriptive statistics (computed before log transformation) for the variables employed (correlations are shown in Appendix A in the supplemental data online). As expected, the between-standard deviation

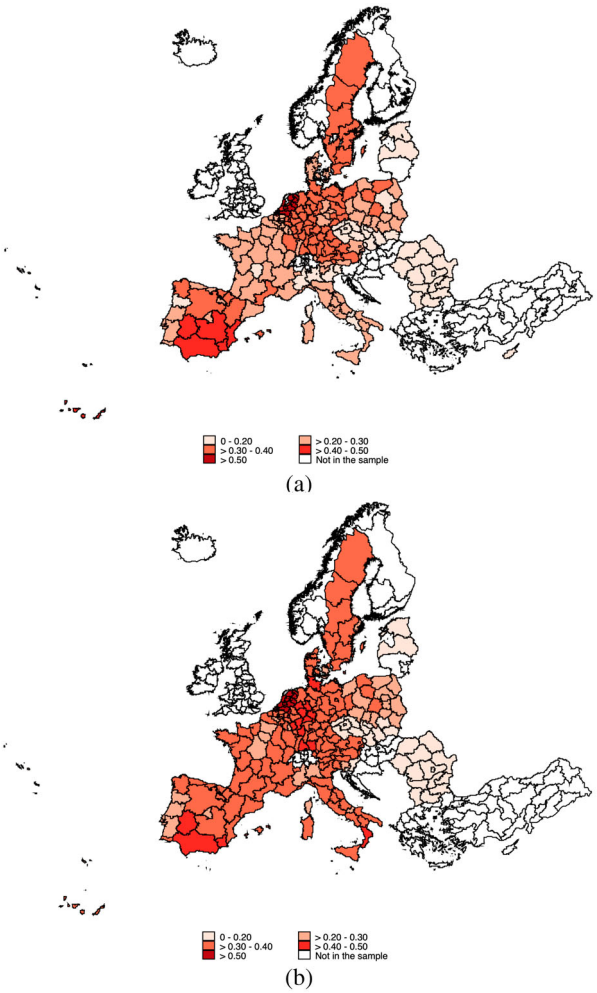


**Figure 4.** Non-standard work across European Union regions in (a) 2004 and (b) 2018.
Sources: European Union's Labour Force Survey (EU-LFS); authors' own calculations.

**Table 1.** Descriptive statistics.

| Variables | Mean | Total | SD | | Observations |
|---|---|---|---|---|---|
| | | | Between | Within | |
| *LPROD* | 0.0377 | 0.0172 | 0.0167 | 0.0041 | 2640 |
| *NSWsh* | 0.2889 | 0.1031 | 0.1013 | 0.0206 | 2640 |
| *GFC* | 14.2450 | 6.5320 | 6.2417 | 1.9787 | 2640 |
| *R&D* | 1.0010 | 0.9537 | 0.9421 | 0.1632 | 2640 |
| *SIZE_MICROsh* | 0.1932 | 0.0764 | 0.0621 | 0.0447 | 2640 |
| *SIZE_SMALLsh* | 0.2666 | 0.0675 | 0.0543 | 0.0403 | 2640 |
| *IND_HTsh* | 0.0749 | 0.0532 | 0.0515 | 0.0139 | 2640 |
| *IND_KISsh* | 0.4321 | 0.0984 | 0.0858 | 0.0486 | 2640 |
| *EDUC_TERTIARYsh* | 0.2737 | 0.0946 | 0.0863 | 0.0393 | 2640 |
| *EDUC_UPPERSECsh* | 0.5125 | 0.1532 | 0.1513 | 0.0262 | 2640 |
| *GEND_FEMALEsh* | 0.4514 | 0.0295 | 0.0271 | 0.0120 | 2640 |
| *AGE_YOUNGsh* | 0.3194 | 0.0434 | 0.0307 | 0.0308 | 2640 |

Note: Statistics were computed before log transformation.

(SD) exceeds the within component, indicating the extent to which a variable exhibits variation within units. In our case, labour productivity and the other covariates show more variability across regions than over time within each region, with the exception of the share of young workers: indeed, the variation in the share of young workers across European regions is almost equal to that observed within a single region over time.

It needs to be stressed that given the substantial regional disparities in labour productivity levels across the EU (section 3.1), and our primary interest in assessing the role of NSW in relation to these differences, particularly in amplifying the distance between regions, we have considered the rate of change of labour productivity, instead of the mere level of labour productivity, as the dependent variable in our estimations. Furthermore, the measurement of labour productivity is based on the actual hours worked rather than on the workers employed. This allows us to capture more accurately the real amount of work employed in the regional economies, especially considering the increasing entry of part-time workers in recent years, as well as the reduction in hours worked due to the onset of the financial crisis.

Similarly to other studies (Rodríguez-Pose & Ganau, 2022), equation (4) is first estimated through a two-way fixed-effects estimator, which permits one to adjust for unobserved unit- and time-specific confounding factors at the same time. Given the wide dispersion in labour productivity growth across regions, following Cirillo and Ricci (2020), we also resort to a quantile regression approach (Koenker & Bassett, 1978). In more detail, we employ the method proposed by Machado and Santos Silva (2019), which allows us to examine the relation between the share of non-standard employment in each region and the associated changes in productivity at different quantiles of the productivity distribution function (e.g., 0.25, 0.50, 0.75), while also accounting for the presence of fixed effects. This method is particularly useful for the scope of this study, since it permits one to account for the presence of the heterogeneous effects of NSW across different quantiles of the conditional growth distribution and, thus, to assess whether it affects regions according to their positions on the latter. In other words, we can check whether the expected negative association between NSW and labour productivity growth is robust at all quantiles, or significant at specific quantiles only; moreover, even in the presence of a robust relation across quantiles, it could be the case that the coefficients of the variable of interest differ across quantiles. Hence, in accordance with our second hypothesis, from this second estimation we expect to find some evidence that the strength of the negative relation between NSW and labour productivity growth is higher in underperforming regions, those recording lower labour productivity growth.

Finally, we have to acknowledge a potential threat to the consistency of our estimates that might arise from reverse causality, particularly from the circumstance that less productive firms, which are more likely to be concentrated in underperforming regions, should be also those more committed to the use of NSW contracts. If so, the relation under study could also run in the opposite direction, with regional labour productivity affecting the territorial diffusion of NSW. To limit issues of reverse causality and partially tackle problems of omitted variables leading to biased estimates, we have included a wide set of predetermined (lagged) explanatory variables in all the estimates. Moreover, we have controlled for regions' specific time-invariant unobserved heterogeneity through the implementation of a two-step procedure proposed by Canay (2011).[9]

## 4. RESULTS AND DISCUSSION

This section presents the results obtained from the estimation of equation (4) through a two-way fixed-effects estimator (Tables 2 and 3) and by applying the quantile fixed-effects approach (Table 4). We use annual data for

**Table 2.** Non-standard work (NSW) and regional labour productivity: two-way fixed-effects estimates.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | **(I)** | **(II)** | **(III)** | **(IV)** | **(V)** | **(VI)** |
| $LPROD_{i,t-1}$ | −0.5105*** | −0.5122*** | −0.5138*** | −0.5385*** | −0.5442*** | −0.5609*** |
| | (0.0458) | (0.0462) | (0.0468) | (0.0440) | (0.0428) | (0.0421) |
| $NSWsh_{i,t-1}$ | −0.9449*** | −0.9903*** | −0.9843*** | −0.9415*** | −0.9392*** | −0.9343*** |
| | (0.1890) | (0.1947) | (0.1931) | (0.1815) | (0.1781) | (0.1683) |
| $GFC_{i,t-1}$ | | | | 0.1043*** | 0.0957*** | 0.0870*** |
| | | | | (0.0148) | (0.0151) | (0.0178) |
| $R\&D_{i,t-1}$ | | | | | 0.0258** | 0.0180* |
| | | | | | (0.0100) | (0.0109) |
| $SIZE\_MICROsh_{i,t-1}$ | | 0.3077*** | 0.3054*** | 0.2514*** | 0.2690*** | 0.2469*** |
| | | (0.0824) | (0.0829) | (0.0828) | (0.0835) | (0.0881) |
| $SIZE\_MICROsh^2_{i,t-1}$ | | −0.7808*** | −0.7731*** | −0.4073* | −0.4911** | −0.3464 |
| | | (0.2221) | (0.2238) | (0.2395) | (0.2417) | (0.2696) |
| $SIZE\_SMALLsh_{i,t-1}$ | | −0.0260 | −0.0254 | 0.0505 | 0.0437 | 0.0508 |
| | | (0.0475) | (0.0475) | (0.0509) | (0.0507) | (0.0508) |
| $IND\_HTsh_{i,t-1}$ | | | 0.1221 | 0.1259 | 0.0908 | 0.1094 |
| | | | (0.1721) | (0.1680) | (0.1690) | (0.1647) |
| $IND\_KISsh_{i,t-1}$ | | | 0.0622 | 0.1283* | 0.1245* | 0.1668** |
| | | | (0.0824) | (0.0721) | (0.0706) | (0.0677) |
| $EDUC\_TERTIARYsh_{i,t-1}$ | | | | | | −0.0425 |
| | | | | | | (0.1145) |
| $EDUC\_UPPERSECsh_{i,t-1}$ | | | | | | −0.1227 |
| | | | | | | (0.1296) |
| $GEND\_FEMALEsh_{i,t-1}$ | | | | | | −1.0814*** |
| | | | | | | (0.2721) |
| $AGE\_YOUNGsh_{i,t-1}$ | | | | | | −0.2615** |
| | | | | | | (0.1228) |

(*Continued*)

**Table 2.** Continued.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | **(I)** | **(II)** | **(III)** | **(IV)** | **(V)** | **(VI)** |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *CONSTANT* | −1.6264*** | −1.6400*** | −1.6754*** | −2.0812*** | −2.0588*** | −1.5781*** |
| | (0.1447) | (0.1480) | (0.1643) | (0.1694) | (0.1657) | (0.1771) |
| Observations | 2640 | 2640 | 2640 | 2640 | 2640 | 2640 |
| Regions | 176 | 176 | 176 | 176 | 176 | 176 |
| Wald test statistic (*F*-form) | 20.65 | 22.45 | 19.79 | 23.52 | 22.96 | 20.05 |
| ($H_0$: no time-related dummies) | | | | | | |
| Wald test *p*-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. (Fixed effects estimates controlled for time dummies. The Wald test on the set of time dummies supports that they are jointly significant at 1%.) ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

**Table 3.** Temporary work (full-time/part-time) and regional labour productivity: two-way fixed-effects estimates.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | **(I)** | **(II)** | **(III)** | **(IV)** | **(V)** | **(VI)** |
| $LPROD_{i,t-1}$ | −0.4906*** | −0.4927*** | −0.4945*** | −0.5292*** | −0.5369*** | −0.5558*** |
| | (0.0472) | (0.0472) | (0.0478) | (0.0456) | (0.0445) | (0.0428) |
| $TEMP\_WORKsh_{i,t-1}$ | −0.4801*** | −0.4856*** | −0.4820*** | −0.6404*** | −0.6695*** | −0.7568*** |
| | (0.1697) | (0.1693) | (0.1666) | (0.1771) | (0.1738) | (0.1671) |
| $GFC_{i,t-1}$ | | | | 0.1216*** | 0.1118*** | 0.0966*** |
| | | | | (0.0163) | (0.0162) | (0.0184) |
| $R\&D_{i,t-1}$ | | | | | 0.0309*** | 0.0227** |
| | | | | | (0.0100) | (0.0109) |
| $SIZE\_MICROsh_{i,t-1}$ | | 0.2701*** | 0.2670*** | 0.2175** | 0.2403*** | 0.2271** |
| | | (0.0862) | (0.0872) | (0.0851) | (0.0860) | (0.0901) |
| $SIZE\_MICROsh^2_{i,t-1}$ | | −0.8818*** | −0.8656*** | −0.4777* | −0.5831** | −0.4378 |
| | | (0.2427) | (0.2463) | (0.2490) | (0.2510) | (0.2754) |
| $SIZE\_SMALLsh_{i,t-1}$ | | 0.0155 | 0.0182 | 0.0912* | 0.0812 | 0.0840 |
| | | (0.0488) | (0.0490) | (0.0527) | (0.0526) | (0.0527) |
| $IND\_HTsh_{i,t-1}$ | | | 0.1659 | 0.1687 | 0.1266 | 0.1371 |
| | | | (0.1770) | (0.1717) | (0.1733) | (0.1659) |
| $IND\_KISsh_{i,t-1}$ | | | 0.0611 | 0.1316* | 0.1264* | 0.1701** |
| | | | (0.0753) | (0.0689) | (0.0673) | (0.0663) |
| $EDUCsh\_TERTIARYsh_{i,t-1}$ | | | | | | 0.1024 |
| | | | | | | (0.1107) |
| $EDUC\_UPPERSECsh_{i,t-1}$ | | | | | | −0.0556 |
| | | | | | | (0.1292) |
| $GEND\_FEMALEsh_{i,t-1}$ | | | | | | −1.3812*** |
| | | | | | | (0.2867) |
| $AGE\_YOUNGsh_{i,t-1}$ | | | | | | −0.2140* |
| | | | | | | (0.1207) |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *CONSTANT* | −1.6984*** | −1.7242*** | −1.7627*** | −2.2212*** | −2.1945*** | −1.6564*** |
| | (0.1577) | (0.1599) | (0.1755) | (0.1872) | (0.1809) | (0.1862) |
| Observations | 2640 | 2640 | 2640 | 2640 | 2640 | 2640 |
| Regions | 176 | 176 | 176 | 176 | 176 | 176 |
| Wald test statistic (*F*-form) | 25.56 | 27.65 | 21.56 | 25.41 | 24.72 | 20.04 |
| ($H_0$: no time-related dummies) | | | | | | |
| Wald test *p*-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. (Fixed effects estimates controlled for time dummies. The Wald test on the set of time dummies supports that they are jointly significant at 1%.) ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

the 2004–18 period and for all 176 EU regions in our sample. All estimates include regional and year fixed effects in order to capture time-invariant unobserved regional heterogeneity and cycle conditions that may influence the outcome of interest.[10] We also cluster standard errors at the regional level to account for any within-group correlation in the error terms.

As can be seen from Table 2, which displays the results achieved through the step-wise addition of the complete set of control variables (from columns I to VI), a process of regional convergence in labour productivity growth is taking place across Europe. This is suggested by the negative and statistically significant coefficients linked to the initial level of labour productivity in all the tests. Therefore, over the period under examination, the gap in labour productivity between regions that performed well and those that lagged behind has decreased, although substantial disparities still persist.[11] This aligns with previous studies that have also shown a long trend of convergence in labour productivity growth (Rodríguez-Pose & Ganau, 2022).

**Table 4.** Non-standard work (NSW)/temporary work and regional labour productivity: quantile fixed effects with Canay correction.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | (I) | | | (II) | | |
| | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| $LPROD_{i,t-1}$ | −0.2501*** | −0.2915*** | −0.3816*** | −0.2681*** | −0.3258*** | −0.3992*** |
| | (0.0390) | (0.0193) | (0.0540) | (0.0200) | (0.0276) | (0.0783) |
| $NSWsh_{i,t-1}$ | −0.3762*** | −0.2993*** | −0.2935*** | −0.4135*** | −0.3721*** | −0.3811*** |
| | (0.0981) | (0.0610) | (0.0573) | (0.0624) | (0.0634) | (0.0774) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2640 | 2640 | 2640 | 2640 | 2640 | 2640 |
| Regions | 176 | 176 | 176 | 176 | 176 | 176 |
| | $\Delta LPROD_{i,t}$ | | | | | |
| | (III) | | | (IV) | | |
| | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| $LPROD_{i,t-1}$ | −0.2310*** | −0.2835*** | −0.3884*** | −0.2628*** | −0.3235*** | −0.4049*** |
| | (0.0613) | (0.0219) | (0.0628) | (0.0258) | (0.0260) | (0.0735) |
| $TEMP\_WORKsh_{i,t-1}$ | −0.1335* | −0.1721*** | −0.2976*** | −0.3103*** | −0.3218*** | −0.3758*** |
| | (0.0741) | (0.0470) | (0.0690) | (0.0654) | (0.0639) | (0.0828) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2640 | 2640 | 2640 | 2640 | 2640 | 2640 |
| Regions | 176 | 176 | 176 | 176 | 176 | 176 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. Specifications I and III includes firms' size and sector–technological intensity indicators as standard controls, while in specifications II and IV, fixed capital investments, research and development (R&D) expenditure, and indicators of regional labour markets composition are added. ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

As clearly depicted in Table 2, European regions characterised by higher shares of employees with non-standard contractual arrangements exhibit lower labour productivity growth over time. In fact, the results in column I show a significant negative value on the estimated coefficient of the lagged share of NSW. This result holds when we add in sequence the full set of controls, that is, by controlling for effects of the local firms' scale (column II) and sector–technological intensity (column III), for the regional share of fixed capital investments (column IV), R&D expenditure (column V), and for the regional labour markets composition in terms of skills education, gender and age (column VI). In detail, a 1 percentage point increase in non-standard employment seems to be associated, on average, with a 0.9 percentage point contraction in labour productivity, therefore confirming the first hypothesis of this study (section 2.3). Hence, our findings from these estimates fully corroborate that higher shares of non-standard employment are linked to unfavourable labour productivity dynamics. This evidence is not only consistent at the firm level, as documented by earlier research (Bloise et al., 2022; Cirillo & Ricci, 2020), but also notably evident at the regional level.

Turning to controls, both their sign and significance are as expected. Specifically, regarding firm size effects, the presence of micro-firms (i.e., with up to 10 employees) – $SIZE\_MICRO_{i,t-1}$ – shows an inverted 'U'-shaped relationship. This indicates that an increasing presence of micro-sized companies is positively associated with labour productivity growth only up to a certain point. In fact, the coefficient of the squared term turns out to be negative, implying a negative relationship. Hence, micro-firms are not inherently detrimental to productivity growth. This finding is not surprising, considering that innovative start-ups and university spin-offs often represent examples of dynamic entrepreneurial models, particularly in high-tech sectors, where micro-firms can make a positive contribution to productivity growth. Nonetheless, it should be acknowledged that this does

**Table 5.** Two-way fixed-effects estimates: economic cycles.

| | $\Delta LPROD_{i,t}$ | | | |
|---|---|---|---|---|
| | **2004–07** | **2008–11** | **2012–15** | **2016–18** |
| $LPROD_{i,t-1}$ | −0.8184*** | −1.2109*** | −1.1354*** | −0.8275*** |
| | (0.1078) | (0.0731) | (0.0650) | (0.0277) |
| $NSWsh_{i,t-1}$ | −1.5712*** | 0.0302 | −0.0753 | −0.5831** |
| | (0.4848) | (0.3689) | (0.4178) | (0.2397) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes |
| Observations | 704 | 704 | 704 | 528 |
| Regions | 176 | 176 | 176 | 176 |
| Wald test statistic (*F*-form) | 14.78 | 1.41 | 27.45 | 56.58 |
| ($H_0$: no time-related dummies) | | | | |
| Wald test *p*-value | 0.0000 | 0.2417 | 0.0000 | 0.0000 |

| | $\Delta LPROD_{i,t}$ | | | |
|---|---|---|---|---|
| | **2004–07** | **2008–11** | **2012–15** | **2016–18** |
| $LPROD_{i,t-1}$ | −0.8023*** | −1.2108*** | −1.1354*** | −0.8324*** |
| | (0.1085) | (0.0731) | (0.0644) | (0.0271) |
| $TEMP\_WORKsh_{i,t-1}$ | −1.2969** | 0.0539 | −0.0941 | −0.6332*** |
| | (0.5417) | (0.3339) | (0.4464) | (0.1989) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes |
| Observations | 704 | 704 | 704 | 528 |
| Regions | 176 | 176 | 176 | 176 |
| Wald test statistic (*F*-form) | 12.03 | 1.49 | 26.30 | 59.22 |
| ($H_0$: no time-related dummies) | | | | |
| Wald test *p*-value | 0.0000 | 0.2191 | 0.0000 | 0.0000 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. All specifications include the full set of controls, that is, firms' size and sector–technological intensity, fixed capital investments, research and development (R&D) expenditure, and indicators of regional labour market composition. (Fixed effects estimates controlled for time dummies. The Wald test on the set of time dummies supports that they are jointly significant at 1%, with the exception of time dummies in 2008–11.) ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

not apply to micro-businesses operating in low-value-added sectors, where their impact on productivity growth may be limited. Hence, the emerged positive relationship between $SIZE\_MICRO_{i,t-1}$ and labour productivity should not be generalised too broadly as it holds only up to a certain threshold, which could be explained by the positive dynamics associated with new business formation and the presence of innovative start-ups (Fritsch, 2008).

The coefficient related to industry and technology effects, specifically pertaining to the local presence of high-tech manufacturing, is not statistically significant. However, the share of knowledge-intensive services exhibits a positive and slightly significant association with labour productivity growth. This positive relationship persists even when we introduce the variable $R\&D_{i,t-1}$, which measures regional expenditure in R&D per employee. As expected, this variable is positively linked to labour productivity growth. Indeed, the role of R&D and high-skilled/knowledge-intensive sectors in determining labour productivity growth is well-established in the literature (Castellani et al., 2019; Lisi & Malo, 2017).

The share of fixed capital investments is also positively and significantly correlated with the growth of regional productivity, which supports the positive role of the local endowments in physical capital (Van Ark et al., 2008; Iammarino & Jona-Lasinio, 2015).

Regarding labour markets indicators, both shares of female and young workers are negatively associated with

**Table 6.** Two-way fixed-effects estimates: regions in Eastern Europe selected out.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | **(I)** | **(II)** | **(III)** | **(IV)** | **(V)** | **(VI)** |
| $LPROD_{i,t-1}$ | −0.5367*** | −0.5613*** | −0.5681*** | −0.5795*** | −0.5849*** | −0.5929*** |
| | (0.0332) | (0.0343) | (0.0350) | (0.0346) | (0.0345) | (0.0372) |
| $NSWsh_{i,t-1}$ | −0.3457*** | −0.4139*** | −0.4065*** | −0.4016*** | −0.3969*** | −0.3916*** |
| | (0.0672) | (0.0702) | (0.0683) | (0.0690) | (0.0686) | (0.0724) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 |
| Regions | 133 | 133 | 133 | 133 | 133 | 133 |
| Wald test statistic (*F*-form) | 41.84 | 44.32 | 37.15 | 41.45 | 43.10 | 25.06 |
| ($H_0$: no time-related dummies) | | | | | | |
| Wald test *p*-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | $\Delta LPROD_{i,t}$ | | | | | |
| | **(I)** | **(II)** | **(III)** | **(IV)** | **(V)** | **(VI)** |
| $LPROD_{i,t-1}$ | −0.5472*** | −0.5688*** | −0.5758*** | −0.5919*** | −0.5978*** | −0.6048*** |
| | (0.0353) | (0.0359) | (0.0364) | (0.0357) | (0.0353) | (0.0370) |
| $TEMP\_WORKsh_{i,t-1}$ | −0.3349*** | −0.3590*** | −0.3562*** | −0.3967*** | −0.3958*** | −0.4508*** |
| | (0.0746) | (0.0760) | (0.0738) | (0.0787) | (0.0777) | (0.0808) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 |
| Regions | 133 | 133 | 133 | 133 | 133 | 133 |
| Wald test statistic (*F*-form) | 33.24 | 39.55 | 33.61 | 37.44 | 39.17 | 25.88 |
| ($H_0$: no time-related dummies) | | | | | | |
| Wald test *p*-value | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. All the specifications include the full set of controls, that is, firms' size and sector–technological intensity, fixed capital investments, research and development (R&D) expenditure and indicators of regional labour markets composition. (Fixed effects estimates are controlled for time dummies. The Wald test on the set of time dummies supports that they are jointly significant at 1%.) ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

labour productivity dynamics. This outcome can be explained by phenomena of gender-based labour segregation in low-value-added sectors, which are increasingly involving also young workers. These latter are indeed often hired through short-term contracts in low-knowledge-intensive services, which certainly contributes to the observed negative association with productivity growth.

Delving deeper into the analysis, we break down the results on NSW and labour productivity, with a specific focus on temporary jobs, a significant component of non-standard employment that is strongly linked to knowledge accumulation. Table 3 presents the estimates of the relation between share of temporary workers in the region – *TEMP_WORKsh* – and the dynamics of labour productivity. Even in this case, a strong negative relation has emerged: the coefficient associated with temporary work varies from 0.4 to 0.7 percentage points, highlighting the adverse effects of an increasing diffusion of temporary jobs on productivity outcomes. This finding further corroborates the first hypothesis of this study. The coefficients of the main control variables remain consistent and align with the signs and significance outlined in Table 2. For instance, expenditure per employee in gross fixed capital investments and R&D are both positively associated with labour productivity growth, as is the share of employees involved in knowledge-intensive services. It is also confirmed that regions with higher shares of female and young workers display lower productivity growth, possibly due to the concentration of such workers in low-value-added sectors and firms.[12]

**Table 7.** Quantile fixed effects with Canay correction: regions in Eastern Europe selected out.

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | (I) | | | (II) | | |
| | *Q25* | *Q50* | *Q75* | *Q25* | *Q50* | *Q75* |
| $LPROD_{i,t-1}$ | −0.2723*** | −0.3020*** | −0.3988*** | −0.2594*** | −0.3222*** | −0.4162*** |
| | (0.0457) | (0.0317) | (0.0539) | (0.0384) | (0.0302) | (0.0444) |
| $NSWsh_{i,t-1}$ | −0.3203*** | −0.1889*** | −0.1942*** | −0.3395*** | −0.2497*** | −0.2591*** |
| | (0.0750) | (0.0537) | (0.0637) | (0.0652) | (0.0461) | (0.0591) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 |
| Regions | 133 | 133 | 133 | 133 | 133 | 133 ** |

| | $\Delta LPROD_{i,t}$ | | | | | |
|---|---|---|---|---|---|---|
| | (III) | | | (IV) | | |
| | *Q25* | *Q50* | *Q75* | *Q25* | *Q50* | *Q75* |
| $LPROD_{i,t-1}$ | −0.2627*** | −0.3025*** | −0.4095*** | −0.0919*** | −0.1173*** | −0.1684*** |
| | (0.0391) | (0.0306) | (0.0558) | (0.0284) | (0.0271) | (0.0316) |
| $TEMP\_WORKsh_{i,t-1}$ | −0.1743*** | −0.1656*** | −0.2535*** | −0.0601 | −0.0459 | −0.0705 |
| | (0.0562) | (0.0586) | (0.0725) | (0.0643) | (0.0482) | (0.0444) |
| $'X_{i,t-1}$ | Yes | Yes | Yes | Yes | Yes | Yes |
| *REGION_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *YEAR_FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1995 | 1995 | 1995 | 1995 | 1995 | 1995 |
| Regions | 133 | 133 | 133 | 133 | 133 | 133 |

Note: Robust standard errors clustered at the regional level are shown in parentheses. Specification I includes firms' size and sector–technological intensity indicators as standard controls, while in specification II fixed capital investments, research and development (R&D) expenditure and indicators of regional labour markets composition are added. ***$p$, 0.01; **$p$, 0.05; *$p$, 0.1.

Table 4 shows the results of the quantile fixed-effects estimates obtained by applying the Canay (2011) correction. One of the main advantages of the quantile technique is to allow for heterogeneity of coefficients along the distribution of the dependent variable, in our case at the 25th, 50th and 75th quantiles of the productivity growth. In detail, specification I shows the results obtained by considering the regional indicators of firms size and sector–technology intensity among the regressors, together with regional and annual fixed effects, while in specification II the full set of controls is considered. In specifications III and IV we isolate the temporary work component within NSW, to investigate how and to what extent the presence of temporary work contributes to reshaping the productivity growth distribution of regions. Even in this case, while specification III only includes a selected number of controls – the regional indicators of firms size and sector–technology intensity – besides the regional and annual fixed effects; specification IV takes into account the full set of controls.

We can observe that the share of non-standard workers is consistently and significantly negatively associated with the growth of labour productivity across all quantiles of the productivity growth distribution. However, the magnitude of the associated coefficient slightly varies among quantiles, with relatively higher values for the lowest quantile in all estimations. In particular, when examining the results in specification II, the size of the coefficient exhibits a small change from the first quantile (−0.41) to the last quantile (−0.38). Therefore, it appears to be somewhat larger at the lower end of the productivity growth distribution, although the observed difference between the 25th and the 75th quantiles is approximately 0.03 percentage points in both estimates. Based on these findings, our second hypothesis, which posits that the negative association between NSW and labour productivity dynamics is not uniform across regions and is stronger in regions with poor labour productivity growth performances (section 2.3), receives only weak support. Indeed, in our estimations, this conjecture can only be partially inferred from the small differences observed in the size of the estimated coefficients related to the variable measuring the regional prevalence of NSW. Nonetheless, we can conclude that, at least to some extent, the diffusion of NSW might

contribute to increasing regional disparities in terms of labour productivity.

Specifications III and IV of Table 4 shed light on the correlations between temporary work and labour productivity growth across the distribution. In this case, an opposite pattern emerges, as a higher share of temporary jobs appears to be more detrimental in fast growing regions compared to others. The coefficient of temporary work ranges from 0.13/0.31 percentage points in the lowest quantile to 0.29/0.37 in the upper part of the productivity growth distribution.

Considering the construction of our indicator of NSW as the share of temporary and part-time employment, the difference between the magnitude of the coefficients of NSW (specifications I and II) and temporary work (specifications III and IV) can be attributed to a higher concentration of permanent, and perhaps involuntary, part-time positions in regions with slower labour productivity growth. Indeed, in rapidly growing Northern European regions, for instance, part-time job contracts are more likely to be associated with voluntary flexible work arrangements, which typically do not negatively impact labour productivity. Conversely, in most Southern European regions characterised by lower productivity growth rates, part-time work is more likely to be involuntary, indicating that workers are compelled to accept part-time positions due to the lack of full-time job opportunities.[13] The involuntary nature of part-time work is more likely to have detrimental effects on labour productivity growth. This conjecture is further supported by the evidence that the gap between the coefficients of NSW and temporary work narrows at the 75th quantile of the productivity growth distribution.

### 4.1. Robustness checks

In this last section we perform several robustness checks in order to prove the soundness of estimates and, at the same time, shed light on peculiar aspects of the relation between non-standard work and labour productivity dynamics. First, we re-estimate equation (4) by sub-periods with the aim to explicitly take into account the role of economic cycles. How and to which extent do NSW and, specifically, temporary jobs have contributed to the productivity slowdown of the European regions during upswings and downswings? Previous evidence suggests that after a long period of convergence, since the crisis in 2008, regional disparities (specifically in GDP per head) have stopped shrinking. From 2013 they have started shrinking again, but remain significantly greater than in 2007 (European Commission, 2022).

As can be seen from Table 5, which reports the results obtained from conducting two-way fixed-effects estimates on shorter time periods, during phases of economic downturn (2008–11 and 2012–15), the relationship between labour productivity growth and the use of non-standard employment contracts turns out not significant during recessionary phases. This likely happens because during economic crises, the performance of productivity is negatively influenced by the stagnant or recessive trend of aggregate demand, as explained by the Kaldor–Verdoorn law (Kaldor & Kaldor, 1996). It is likely that during economic downturns, employment does not grow and NSW workers are the first to be expelled from the labour market. This would justify the absence of a significant relation during such phases.[14] Conversely, during upswings, when employment rises, NSW starts increasing again, manifesting its negative relation with labour productivity growth.

Next, Tables 6 and 7 display the results obtained after excluding regions in Eastern Europe from the sample. This exclusion is made because these regions belong to countries that have recently joined the EU, and their productivity growth might be higher due to this factor and to the integration in the German cluster of production, irrespective of the labour market conditions. Hence, after excluding regions in Eastern European countries from the analysis, we re-estimated the model by means of two-way fixed-effects and quantile fixed-effects methods, and the results remained consistent. Indeed, the apparent non-significant role of temporary work across quantiles, when all controls are inserted (specifications II and IV), is likely to be due to statistical reasons. It is interesting to note that the signs of the share of female and young employees are both positive and, thus, different from those in estimates based on the total sample of regions, therefore suggesting a positive relationship (rather than a negative one) with labour productivity growth. Only in this respect, these latter findings are different from the main ones and may indicate that the negative association observed in the analysis of the total sample could be mainly influenced by the inclusion of regions in Eastern European countries. This could be explained by the fact that women and young individuals in such countries probably enter the labour market with lower average levels and quality of education and skills, which likely has a negative influence on productivity.

## 5. CONCLUSIONS

Exploring factors determining labour productivity growth has always been central in economic research. Indeed, the positive relation between labour productivity and economic growth has long been acknowledged (Kaldor, 1961). The registered decline in labour productivity during the last decades, together with rising inequalities between countries and regions, have thus been major source of concern within the EU. In fact, the uneven growth of labour productivity across territories implies, in turn, inequality of incomes and wealth, with strong social and political repercussions in a context of low economic growth, especially after the outbreak of the COVID-19 pandemic.

As emphasised in the existing literature, labour quality and knowledge play pivotal roles in shaping the economic performance of both companies and regions, largely by enhancing labour productivity (Malerba & McKelvey, 2020; Kang et al., 2022). Nevertheless, relevant transformations in the nature of work and labour markets during the 2000s, characterised by a substantial surge in non-standard forms of employment, which also exhibit regional disparities, have precipitated a swift decline in labour quality on various fronts. This decline likely has adverse repercussions on

knowledge development, chiefly due to factors such as job insecurity and a high turnover rate in the labour force.

Given this background, in this paper we have explored the relation between NSW and regional labour productivity dynamics to inspect whether, and how, the spread of non-standard employment is somehow related to the growth of labour productivity at the regional level.

The evidence provided has fully confirmed that an increasing prevalence of NSW across regions is associated with a decline in labour productivity growth. Indeed, the coefficient of our simple indicator measuring the regional share of fixed-term and part-time workers over total employment has proved to be negative and highly significant in all estimations, notwithstanding the inclusion of several controls traditionally considered as strong predictors of labour productivity (e.g., fixed capital, R&D investments and human capital, among others). Hence, the raise of non-standard employment is likely to be detrimental to the dynamics of labour productivity at the regional level.

The emerged negative association between NSW and labour productivity growth has demonstrated consistency across different quantiles of the labour productivity growth distribution. Moreover, the comprehensive effect of NSW is slightly more pronounced, as reflected in the magnitude of the estimated coefficients, in regions that exhibit weaker performances in terms of labour productivity growth. As widely discussed, this finding can be primarily attributed to the negative effects exerted by higher prevalence of permanent, and potentially involuntary, part-time positions in those regions. Therefore, at least to some extent, the diffusion of NSW, especially of permanent though involuntary part-time jobs, might contribute to increasing regional disparities in terms of labour productivity, widening the gap between the growth rates of over- and underperforming regions.

From a policy perspective, these results suggest the need of drastically reducing the plethora of flexible work contracts that can be used by firms and have led to a dramatic spread of NSW. This not only to put an end to precariousness and improve the quality of labour, but also to reduce harmful consequences on productivity. To this aim, especially cases of systematic abuse – when, for example, employers fulfil permanent full-time roles with personnel on sequential temporary contracts and/or involuntary part-time work schemes – should be avoided. Most recent labour market reforms adopted by the Spanish government have taken decisive steps into this direction by making more difficult the use of flexible work contracts by firms. Following this example, especially in the current phase of investments planned through the Next Generation EU, specific measures aimed at promoting permanent full-time job positions as the standard ones should be implemented also in other countries. This, for instance, by making investments and fiscal incentives contingent upon the creation of 'high-quality' jobs by firms. In this respect, further research would thus be needed in the future to assess the effects of these reforms, in particular to more clearly disentangle the interrelations, at the territorial level, between the incidence of 'stable' jobs, knowledge accumulation, the introduction of innovations and the consequent changes in productivity.

## DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

## FUNDING

The authors acknowledge the support of the Italian National Research Project – PRIN 2017 'Regional Policies, Institutions and Cohesion in the South of Italy' [project code 2017-4BE543; www.prin2017-mezzogiorno.unirc.it], financed by the Italian Ministry of Education, University and Scientific Research from 2020 to 2023. Marialuisa Divella also acknowledges the support of the Research for Innovation - REFIN project 'Innovazione e cambiamento strutturale: politiche di sistema per le regioni a sviluppo intermedio alla luce dei rischi e delle opportunità all'interno dell'attuale quadro europeo' (project code REFIN - AFBB0ACE) financed by Puglia Region [grant number POR PUGLIA FESR-FSE 2014/2020].

## NOTES

1. An exception is Calcagnini et al. (2021), who, by focusing on Italian regions, provide evidence for a non-linear relationship between temporary work and the growth of total factor productivity.
2. In line with the findings of the European Commission (2022), there has been convergence in Central and Eastern EU member states. However, the evidence indicates that a number of middle-income and less developed regions, especially in Southern Europe, have experienced economic stagnation and become trapped in a situation of limited development.
3. We recall that over the period 2001–19, many less developed regions, especially those located in the eastern member states, had above-average productivity growth, whereas in many regions of Italy and Greece productivity was falling (European Commission, 2022).
4. On the one hand, the neo-classical approach considers knowledge and technology spillovers as pure public goods, assuming that the growth rates converge in the long run: this happens because the countries initially behind grow faster than the leaders by making use of their knowledge stock which is, indeed, free and readily available. On the other hand, theorists of endogenous growth do not consider knowledge as freely available, but rather as the result of an internal process of accumulation. It follows that not just one, but different, steady states can be achieved from a given resource endowment. The relationship between knowledge/innovation and economic growth is also linear and deterministic, neglecting all that entrepreneurial, institutional or social mechanisms that actually affect the path of an economy, and that instead play a crucial role in the Schumpeterian approach.
5. Given a random sample from a population, a kernel density estimator estimates the density function of the population distribution.

6. As mentioned in section 2, we consider only dependent workers, since self-employed are excluded a priori.
7. In this respect, we have followed the standard sectorial classification proposed by Eurostat which differentiates between manufacturing and service sectors and classifies them according to their technological intensity, therefore allowing one to distinguish between high- and low-techs.
8. Education levels are defined according to the ISCED – International Standard Classification of Education
9. Appendix B in the supplemental data online in the supplemental data online also reports the results obtained from a dynamic panel generalised method of moments (GMM) system (Blundell & Bond, 1998), commonly used for models involving endogenous variables.
10. We employ a fixed-effects estimator, where the unobserved region-specific time-constant effect is removed through the within-transformation of the data, and also controls for time dummies.
11. According to the European Commission (2022, p. 18), 'GDP per head in the less developed regions is converging towards the EU average through both faster productivity growth and increased employment. This trend is primarily driven by developments in regions in the Eastern Member States, whereas many less developed regions in the Southern Member States are failing to catch up and are experiencing decline and divergence.'
12. The Wald test results for the set of time dummy variables (reported at the bottom of the tables) demonstrate that they are jointly significant at 1% in all the tests. This confirms the necessity of considering time-related fixed effects in addition to regional fixed effects. We have also conducted regression analyses using region-specific dummy variables which produced identical results. Subsequently, we performed a Wald test to assess the significance of the two separate sets of regional and year dummies, which turn out to be both jointly significant at 1%.
13. The share of involuntary part-time in total employment as a percentage of total part-time strongly differs across countries. Spain, Italy and Greece record the highest percentages of involuntary part-time compared with Belgium, Germany and even Portugal. Overall, as the OECD database highlights, the percentage of involuntary part-time is about 20% in the Euro area, ranging from 60% in Italy and Spain to 6% in Belgium.
14. Unsurprisingly, the Wald test on time dummies exhibit not significant results in the period 2008–11.

## ORCID

*Valeria Cirillo* http://orcid.org/0000-0003-4562-2359
*Marialuisa Divella* http://orcid.org/0000-0002-0830-1970

## REFERENCES

Acemoglu, D. (1997). Training and innovation in an imperfect labour market. *The Review of Economic Studies*, *64*(3), 445–464. https://doi.org/10.2307/2971723

Agostino, M., Di Tommaso, M. R., Nifo, A., Rubini, L., & Trivieri, F. (2020). Institutional quality and firms' productivity in European regions. *Regional Studies*, *54*(9), 1275–1288. https://doi.org/10.1080/00343404.2020.1712689

Allaart, P., & Bellmann, L. (2007). Reasons for part-time work: An empirical analysis for Germany and The Netherlands. *International Journal of Manpower*, *28*(7), 557–570. https://doi.org/10.1108/01437720710830052

Altuzarra, A., & Serrano, F. (2010). Firms' innovation activity and numerical flexibility. *ILR Review*, *63*(2), 327–339. https://doi.org/10.1177/001979391006300208

Andrews, D., Criscuolo, C., & Gal, P. N. (2019). *The best versus the rest: Divergence across firms during the global productivity slowdown* (Discussion Papers No. dp1645). Centre for Economic Performance (CEP), LSE.

Anxo, D., & O'Reilly, J. (2000). Working time regimes and transitions in comparative perspective. In J. O'Reilly, I. Cebrián & M. Lallement (Eds.), *Working-time changes: Social integration through transitional labour markets* (pp. 61–92). Edward Elgar.

Autor, D. H., Kerr, W. R., & Kugler, A. D. (2007). Does employment protection reduce productivity? Evidence from us states. *The Economic Journal*, *117*(521), F189–F217. https://doi.org/10.1111/j.1468-0297.2007.02055.x

Barbieri, P., Cutuli, G., Guetto, R., & Scherer, S. (2019). Part-time employment as a way to increase women's employment:(where) does it work? *International Journal of Comparative Sociology*, *60*(4), 249–268. https://doi.org/10.1177/0020715219849463

Bardazzi, R., & Duranti, S. (2016). Atypical work: A threat to labour productivity growth? Some evidence from Italy. *International Review of Applied Economics*, *30*(5), 620–643. https://doi.org/10.1080/02692171.2016.1165656

Bartelsman, E. J., Gautier, P. A., & De Wind, J. (2016). Employment protection, technology choice, and worker allocation. *International Economic Review*, *57*(3), 787–826. https://doi.org/10.1111/iere.12176

Bassanini, A., & Ernst, E. (2002). *Labour market institutions, product market regulation, and innovation: Cross-country evidence* (*OECD Economics Department Working Papers No. 316)*.

Bauer, P., Fedotenkov, I., Genty, A., Hallak, I., Harasztosi, P., Martinez Turegano, D., Nguyen, D., Preziosi, N., Rincon-Aznar, A., & Sanchez Martinez, M. (2020). *Productivity in Europe: Trends and drivers in a service-based economy* (EUR 30076 EN). Publications Office of the European Union. https://doi.org/10.2760/469079, JRC119785

Belot, M., Boone, J., & Van Ours, J. (2007). Welfare-improving employment protection. *Economica*, *74*(295), 381–396. https://doi.org/10.1111/j.1468-0335.2006.00576.x

Benos, N., & Karagiannis, S. (2016). Do education quality and spillovers matter? Evidence on human capital and productivity in Greece. *Economic Modelling*, *54*, 563–573. https://doi.org/10.1016/j.econmod.2016.01.015

Bjuggren, C. M. (2018). Employment protection and labor productivity. *Journal of Public Economics*, *157*, 138–157. https://doi.org/10.1016/j.jpubeco.2017.11.007

Bloise, F., Cirillo, V., Raitano, M., & Ricci, A. (2022). Within-firm inequality in workdays and labor productivity: Evidence from linked employer–employee Italian data. *Industrial and Corporate Change*, *31*(1), 39–61. https://doi.org/10.1093/icc/dtab069

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Boeri, T., & Garibaldi, P. (2007). Two tier reforms of employment protection: A honeymoon effect? *The Economic Journal*, *117*(521), F357–F385. https://doi.org/10.1111/j.1468-0297.2007.02060.x

Booth, A. L., Francesconi, M., & Frank, J. (2002). Temporary jobs: Stepping stones or dead ends? *The Economic Journal*, *112*(480), F189–F213. https://doi.org/10.1111/1468-0297.00043

Calcagnini, G., Marin, G., & Perugini, F. (2021). Labour flexibility, internal migration and productivity in Italian regions. *Structural Change and Economic Dynamics*, *57*, 308–320. https://doi.org/10.1016/j.strueco.2021.04.004

Canay, I. A. (2011). A simple approach to quantile regression for panel data. *The Econometrics Journal*, *14*(3), 368–386. https://doi.org/10.1111/j.1368-423X.2011.00349.x

Capriati, M., & Divella, M. (2019). Work organisation, employees' education, and innovation: A firm-level analysis for Italy. *L'industria*, *40*(3), 417–436.

Capriati, M., & Divella, M. (2022). Firms' organisational capabilities and innovation generation: The case of Italy. *Economics of Innovation and New Technology*, *31*(6), 447–466. https://doi.org/10.1080/10438599.2020.1823674

Carrasco, R., & Hernanz, V. (2022). Dependent self-employment across Europe: Involuntariness, country's wealth and labour market institutions. *Applied Economics*, *54*(14), 1568–1583. https://doi.org/10.1080/00036846.2021.1980200

Castellani, D., Piva, M., Schubert, T., & Vivarelli, M. (2019). R&D and productivity in the US and the EU: Sectoral specificities and differences in the crisis. *Technological Forecasting and Social Change*, *138*, 279–291. https://doi.org/10.1016/j.techfore.2018.10.001

Castiglione, C. (2011). Verdoorn–Kaldor's Law: An empirical analysis with time series data in the United States. *Advances in Management and Applied Economics*, *1*(3), 159.

Celi, G., Ginzburg, A., Guarascio, D., & Simonazzi, A. (2018). *Crisis in the European monetary union: A core–periphery perspective*. Routledge.

Cetrulo, A., Cirillo, V., & Guarascio, D. (2019). Weaker jobs, weaker innovation. Exploring the effects of temporary employment on new products. *Applied Economics*, *51*(59), 6350–6375. https://doi.org/10.1080/00036846.2019.1619015

Cette, G., Fernald, J., & Mojon, B. (2016). The pre-great recession slowdown in productivity. *European Economic Review*, *88*, 3–20. https://doi.org/10.1016/j.euroecorev.2016.03.012

Cirillo, V., Fana, M., & Guarascio, D. (2017). Labour market reforms in Italy: Evaluating the effects of the jobs Act. *Economia Politica*, *34*(2), 211–232. https://doi.org/10.1007/s40888-017-0058-2

Cirillo, V., & Guarascio, D. (2015). Jobs and competitiveness in a polarised Europe. *Intereconomics*, *50*(3), 156–160. https://doi.org/10.1007/s10272-015-0536-0

Cirillo, V., Guarascio, D., & Parolin, Z. (2023). Platform work and economic insecurity in Italy. *Structural Change and Economic Dynamics*, *65*, 126–138. https://doi.org/10.1016/j.strueco.2023.02.011

Cirillo, V., & Ricci, A. (2022). Heterogeneity matters: Temporary employment, productivity and wages in Italian firms. *Economia Politica*, *39*, 567–593. https://doi.org/10.1007/s40888-020-00197-2

Crescenzi, R. (2005). Innovation and regional growth in the enlarged Europe: The role of local innovative capabilities, peripherality, and education. *Growth and Change*, *36*(4), 471–507. https://doi.org/10.1111/j.1468-2257.2005.00291.x

De Noni, I., Ganzaroli, A., & Pilotti, L. (2021). Spawning exaptive opportunities in European regions: The missing link in the smart specialization framework. *Research Policy*, *50*(6), 104265. https://doi.org/10.1016/j.respol.2021.104265

Decker, R. A., Haltiwanger, J., Jarmin, R. S., & Miranda, J. (2017). Declining dynamism, allocative efficiency, and the productivity slowdown. *American Economic Review*, *107*(5), 322–326. https://doi.org/10.1257/aer.p20171020

Deleidi, M., Meloni, W. P., & Stirati, A. (2020). Tertiarization, productivity and aggregate demand: Evidence-based policies for European countries. *Journal of Evolutionary Economics*, *30*(5), 1429–1465. https://doi.org/10.1007/s00191-019-00647-6

Devicienti, F., Naticchioni, P., & Ricci, A. (2018). Temporary employment, demand volatility, and unions: Firm-level evidence. *ILR Review*, *71*(1), 174–207. https://doi.org/10.1177/0019793917697684

Dosi, G., Faillo, M., & Marengo, L. (2008). Organizational capabilities, patterns of knowledge accumulation and governance structures in business firms: An introduction. *Organization Studies*, *29*(8–9), 1165–1185. https://doi.org/10.1177/0170840608094775

Dosi, G., & Grazzi, M. (2010). On the nature of technologies: Knowledge, procedures, artifacts and production inputs. *Cambridge Journal of Economics*, *34*(1), 173–184. https://doi.org/10.1093/cje/bep041

Dughera, S., Quatraro, F., & Vittori, C. (2022). Innovation, on-the-job learning, and labor contracts: An organizational equilibria approach. *Journal of Institutional Economics*, *18*(4), 605–620. https://doi.org/10.1017/S1744137421000497

Eichhorst, W., & Marx, P. (2015). *Non-standard employment in post-industrial labour markets: An occupational perspective*. Edward Elgar.

European Commission. (2022). *Cohesion*[AQQ22] *in Europe towards 2050. Eighth report on economic, social and territorial cohesion*. European Commission. https://ec.europa.eu/regional_policy/en/information/publications/reports/2022/eighth-report-on-economic-social-and-territorial-cohesion#:~:text=The%20Report%20assesses%20economic%2C%20social,of%20region%20to%20catch%20up

Euwals, R., & Hogerbrugge, M. (2006). Explaining the growth of part-time employment: Factors of supply and demand. *Labour (Committee on Canadian Labour History)*, *20*(3), 533–557. https://doi.org/10.1111/j.1467-9914.2006.00352.x

Evenhuis, E., Lee, N., Martin, R., & Tyler, P. (2021). Rethinking the political economy of place: Challenges of productivity and inclusion. *Cambridge Journal of Regions, Economy and Society*, *14*(1), 3–24. https://doi.org/10.1093/cjres/rsaa043

Fagan, C., & O'Reilly, J. (Eds.). (1998). *Part-time prospects: An international comparison*. Routledge. https://doi.org/10.4324/9780203017623

Fagerberg, J. (1988). Why growth rates differ. In Dosi, G. et al. (Eds.), *Technical change and economic theory* (pp. 432–457). Pinter.

Fagerberg, J. (2000). Technological progress, structural change and productivity growth: A comparative study. *Structural Change and Economic Dynamics*, *11*(4), 393–411. https://doi.org/10.1016/S0954-349X(00)00025-4

Foray, D. (2018). Smart specialization strategies as a case of mission-oriented policy – A case study on the emergence of new policy practices. *Industrial and Corporate Change*, *27*(5), 817–832. https://doi.org/10.1093/icc/dty030

Fritsch, M. (2008). How does new business formation affect regional development? Introduction to the special issue. *Small Business Economics*, *30*(1), 1–14. https://doi.org/10.1007/s11187-007-9057-y

Garcia-Vega, M., Kneller, R., & Stiebale, J. (2021). Labor market reform and innovation: Evidence from Spain. *Research Policy*, *50*(5), 104213. https://doi.org/10.1016/j.respol.2021.104213

Garnero, A., Kampelmann, S., & Rycx, F. (2014). Part-time work, wages, and productivity: Evidence from Belgian matched panel data. *ILR Review*, *67*(3), 926–954. https://doi.org/10.1177/0019793914537456

Ghignoni, E. (2009). Temporary contracts, employees' effort and labour productivity: The evidence for Italy. *Economia politica*, *26*(2), 279–314.

Gopinath, G., Kalemli-Özcan, Ş., Karabarbounis, L., & Villegas-Sanchez, C. (2017). Capital allocation and productivity in

South Europe. *The Quarterly Journal of Economics*, *132*(4), 1915–1967. https://doi.org/10.1093/qje/qjx024

Green, A., & Livanos, I. (2017). Involuntary non-standard employment in Europe. *European Urban and Regional Studies*, *24*(2), 175–192. https://doi.org/10.1177/0969776415622257

Gregory Mankiw, N., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *The Quarterly Journal of Economics*, *107*(2), 407–437. https://doi.org/10.2307/2118477

Grinza, E., & Quatraro, F. (2019). Workers' replacements and firms' innovation dynamics: New evidence from Italian matched longitudinal data. *Research Policy*, *48*(9), 103804. https://doi.org/10.1016/j.respol.2019.05.013

Higón, D. A., Máñez, J. A., Rochina-Barrachina, M. E., Sanchis, A., & Sanchis, J. A. (2022). Firms' distance to the European productivity frontier. *Eurasian Business Review*, *12*(2), 197–228. https://doi.org/10.1007/s40821-022-00207-2

Hipp, L., Bernhardt, J., & Allmendinger, J. (2015). Institutions and the prevalence of nonstandard employment. *Socio-Economic Review*, *13*(2), 351–377. https://doi.org/10.1093/ser/mwv002

Iammarino, S., & Jona-Lasinio, C. (2015). ICT production and labour productivity in the Italian regions. *European Urban and Regional Studies*, *22*(2), 218–237. https://doi.org/10.1177/0969776412464504

Ichino, A., & Riphahn, R. T. (2005). The effect of employment protection on worker effort: Absenteeism during and after probation. *Journal of the European Economic Association*, *3*(1), 120–143. https://doi.org/10.1162/1542476053295296

International Labour Organization (ILO). (2007). *Conclusions concerning the promotion of sustainable enterprises*. International Labour Conference, 96th session, Geneva, June 2007. ILO.

International Labour Organization (ILO). (2016). *Non-standard employment around the world: Understanding challenges, shaping prospects*. ILO.

Inklaar, R., Timmer, M. P., & Van Ark, B. (2008). Market services productivity across Europe and the US. *Economic Policy*, *23*(53), 140–194.

Kaldor, N. (1961). Capital accumulation and economic growth. In Hague, D. C. (Ed.), *The theory of capital*. Palgrave Macmillan. https://doi.org/10.1007/978-1-349-08452-4_10

Kaldor, N. (1975). Economic growth and the Verdoorn Law–A comment on Mr Rowthorn's article. *The Economic Journal*, *85* (340), 891–896. https://doi.org/10.2307/2230633

Kaldor, N., & Kaldor, N. (1996). *Causes of growth and stagnation in the world economy*. Cambridge University Press.

Kang, T., Maliphol, S., Kogler, D. F., & Kim, K. (2022). Regional knowledge capabilities, entrepreneurial activity, and productivity growth: Evidence from Italian NUTS-3 regions. *International Regional Science Review*, *45*(3), 293–320. https://doi.org/10.1177/01600176211034134

Katz, L. F., & Krueger, A. B. (2019). The rise and nature of alternative work arrangements in the United States, 1995–2015. *ILR Review*, *72*(2), 382–416. https://doi.org/10.1177/0019793918820008

Kleinknecht, A. (2020). The (negative) impact of supply-side labour market reforms on productivity: An overview of the evidence. *Cambridge Journal of Economics*, *44*(2), 445–464. https://doi.org/10.1093/cje/bez068

Kleinknecht, A., Kwee, Z., & Budyanto, L. (2016). Rigidities through flexibility: Flexible labour and the rise of management bureaucracies. *Cambridge Journal of Economics*, *40*(4), 1137–1147. https://doi.org/10.1093/cje/bev056

Kleinknecht, A., & Naastepad, C. W. M. (2005). The Netherlands: Failure of a neo-classical policy agenda. *European Planning Studies*, *13*(8), 1193–1203. https://doi.org/10.1080/09654310500336550

Kleinknecht, A., Oostendorp, R. M., Pradhan, M. P., & Naastepad, C. W. M. (2006). Flexible labour, firm performance and the Dutch job creation miracle. *International Review of Applied Economics*, *20*(2), 171–187. https://doi.org/10.1080/02692170600581102

Kleinknecht, A., van Schaik, F. N., & Zhou, H. (2014). Is flexible labour good for innovation? Evidence from firm-level data. *Cambridge Journal of Economics*, *38*(5), 1207–1219. https://doi.org/10.1093/cje/bet077

Koenker, R., & Bassett, Jr, G. (1978). Regression quantiles. *Econometrica: Journal of the Econometric Society*, 33–50. https://doi.org/10.2307/1913643

Lasagni, A., Nifo, A., & Vecchione, G. (2015). Firm productivity and institutional quality: Evidence from Italian industry. *Journal of Regional Science*, *55*(5), 774–800. https://doi.org/10.1111/jors.12203

Lisi, D., & Malo, M. A. (2017). The impact of temporary employment on productivity. *Journal for Labour Market Research*, *50*(1), 91–112. https://doi.org/10.1007/s12651-017-0222-8

Lucidi, F., & Kleinknecht, A. (2010). Little innovation, many jobs: An econometric analysis of the Italian labour productivity crisis. *Cambridge Journal of Economics*, *34*(3), 525–546. https://doi.org/10.1093/cje/bep011

Lundvall, B.-A. (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*. Pinter.

Machado, J. A., & Santos Silva, J. M. C. (2019). Quantiles via moments. *Journal of Econometrics*, *213*(1), 145–173. https://doi.org/10.1016/j.jeconom.2019.04.009

Malerba, F., & McKelvey, M. (2020). Knowledge-intensive innovative entrepreneurship integrating Schumpeter, evolutionary economics, and innovation systems. *Small Business Economics*, *54*(2), 503–522. https://doi.org/10.1007/s11187-018-0060-2

Marrocu, E., Paci, R., & Usai, S. (2013). Productivity growth in the old and new Europe: The role of agglomeration externalities. *Journal of Regional Science*, *53*(3), 418–442. https://doi.org/10.1111/jors.12000

McCann, P., & Ortega-Argilés, R. (2015). Smart specialization, regional growth and applications to European Union cohesion policy. *Regional Studies*, *49*(8), 1291–1302. https://doi.org/10.1080/00343404.2013.799769

McCombie, J., Pugno, M., & Soro, B. (2002). *Productivity growth and economic performance: Essays on Verdoorn's law*. Springer.

Naastepad, C. W. M. (2006). Technology, demand and distribution: A cumulative growth model with an application to the Dutch productivity growth slowdown. *Cambridge Journal of Economics*, *30*(3), 403–434. https://doi.org/10.1093/cje/bei063

Nelson, R. R. (1985). *An Evolutionary Theory of Economic Change*. Harvard University Press.

Nielen, S., & Schiersch, A. (2016). Productivity in German manufacturing firms: Does fixed-term employment matter? *International Labour Review*, *155*(4), 535–561. https://doi.org/10.1111/ilr.12019

Nunziata, L., & Staffolani, S. (2007). Short-term contracts regulations and dynamic labour demand: Theory and evidence. *Scottish Journal of Political Economy*, *54*(1), 72–104. https://doi.org/10.1111/j.1467-9485.2007.00405.x

Okudaira, H., Takizawa, M., & Tsuru, K. (2013). Employment protection and productivity: Evidence from firm-level panel data in Japan. *Applied Economics*, *45*(15), 2091–2105. https://doi.org/10.1080/00036846.2012.654913

Organisation for Economic Co-operation and Development (OECD). (2018). *OECD Economic Outlook*, 2018(2). OECD Publ. https://doi.org/10.1787/eco_outlook-v2018-2-en

Pariboni, R., & Tridico, P. (2020). Structural change, institutions and the dynamics of labor productivity in Europe. *Journal of Evolutionary Economics*, *30*(5), 1275–1300. https://doi.org/10.1007/s00191-019-00641-y

Parrotta, P., & Pozzoli, D. (2012). The effect of learning by hiring on productivity. *The RAND Journal of Economics*, *43*(1), 167–185. https://doi.org/10.1111/j.1756-2171.2012.00161.x

Pessoa, J. P., & Van Reenen, J. (2014). The UK productivity and jobs puzzle: Does the answer lie in wage flexibility? *The Economic Journal*, *124*(576), 433–452. https://doi.org/10.1111/ecoj.12146

Pianta, M., & Reljic, J. (2022). The good jobs-high innovation virtuous circle. *Economia Politica*, *39*(3), 783–811. https://doi.org/10.1007/s40888-022-00268-6

Piva, M., Tani, M., & Vivarelli, M. (2020). *The productivity impact of business visits across industries* (*IZA Discussion Papers)*.

Portugal, P., & Varejao, J. (2022). Why do firms use fixed-term contracts? *Portuguese Economic Journal*, *21*(3), 401–421.

Prenzel, P., Ortega-Argilés, R., Cozza, C., & Piva, M. (2018). Interplay between regional and industrial aspects in the R&D–productivity link: Evidence from Europe. *Regional Studies*, *52*(5), 659–672. https://doi.org/10.1080/00343404.2017.1329586

Reljic, J., Cetrulo, A., Cirillo, V., & Coveri, A. (2023). Non-standard work and innovation: Evidence from European industries. *Economics of Innovation and New Technology*, *32*(1), 136–164. https://doi.org/10.1080/10438599.2021.1893139

Rodríguez-Pose, A., & Di Cataldo, M. (2015). Quality of government and innovative performance in the regions of Europe. *Journal of Economic Geography*, *15*(4), 673–706. https://doi.org/10.1093/jeg/lbu023

Rodríguez-Pose, A., & Ganau, R. (2022). Institutions and the productivity challenge for European regions. *Journal of Economic Geography*, *22*(1), 1–25. https://doi.org/10.1093/jeg/lbab003

Rubery, J. (1998). Part-time work: A threat to labour standards? In J. O'Reilly & C. Fagan (Eds.), *Part-time prospects: An international Comparison of part-time work in Europe, North America and the Pacific Rim* (pp. 137–155). Routledge.

Schumpeter, J. A. (1943). *Capitalism, socialism and democracy*. Routledge.

Sterlacchini, A. (2008). R&D, higher education and regional growth: Uneven linkages among European regions. *Research Policy*, *37*(6–7), 1096–1107. https://doi.org/10.1016/j.respol.2008.04.009

Storm, S. (2017). The new normal: Demand, secular stagnation, and the vanishing middle class. *International Journal of Political Economy*, *46*(4), 169–210. https://doi.org/10.1080/08911916.2017.1407742

Tijdens, K. G. (2002). Gender roles and labor use strategies: Women's part-time work in the European Union. *Feminist Economics*, *8*(1), 71–99. https://doi.org/10.1080/13545700210126553

Tressel, T., & Scarpetta, S. (2004). *Boosting productivity via innovation and adoption of new technologies: Any role for labor market institutions?* (*No. 3273)*. World Bank.

Tubaro, P., & Casilli, A. A. (2019). Micro-work, artificial intelligence and the automotive industry. *Journal of Industrial and Business Economics*, *46*(3), 333–345. https://doi.org/10.1007/s40812-019-00121-1

Van Ark, B., O'Mahoney, M., & Timmer, M. P. (2008). The productivity gap between Europe and the United States: Trends and causes. *Journal of Economic Perspectives*, *22*(1), 25–44. https://doi.org/10.1257/jep.22.1.25

Verdoorn, P. J. (1949). On the factors determining the growth of labour productivity. In L. Pasinetti (Ed.), *Italian economic papers* (vol. 2, pp. 59–68). Oxford University Press.

Veugelers, R. (2018). *Are European firms falling behind in the global corporate research race?* (Policy Contribution No. 18:06). Bruegel.

Viesti, G. (2015). Why Europe is in a trap. *Stato e mercato*, *35*(1), 53–84.

Zhou, H., Dekker, R., & Kleinknecht, A. (2011). Flexible labor and innovation performance: Evidence from longitudinal firm-level data. *Industrial and Corporate Change*, *20*(3), 941–968. https://doi.org/10.1093/icc/dtr013