



Drivers of Youth Labour Market Integration Across European Regions

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Abstract

Territorial disparities and youth labour markets have been often considered as separated themes, due to challenges in data availability. Comparative regional or sub-regional research on youth labour market integration (YLMI) have been therefore scarce. In this article, we address this gap by presenting a composite measure of YLMI that covers a wide range of indicators and sheds light on the EU territorial divide of young peoples' opportunities at regional level. In order to build the YLMI index, we use benefit-of-the-doubt-weighting, a seminal methodology on composite indicators (CI) that combines sequence with conditional weights based on the range of each sub-indicator. To proof the usefulness of YLMI, we analyze the evolution of regional YLMI in the EU before and after the economic crisis; and the trends of homogenization or differentiation across EU territories. Furthermore, we investigate to what extent employment conditions, skills supply and technological resources explain cross-regional variations in YLMI.

Keywords Spatial inequality · Territorial cohesion · NEET · Unemployment · Structures of opportunities · Living conditions · Young people · Macro-dynamics · Indicator

1 Introduction

Empirical evidence shows worrisome trends in youth unemployment patterns (Eichhorst et al. 2013; Caroleo et al. 2017) and in young adults' living conditions (Scandurra et al. 2020b; Cefalo et al. 2020) in several EU countries. Recent policies initiatives of European Union, as the Juncker plan, the Youth Guarantee or the Smart Specialization, mirror as well the growing concern and the effort for improving skills, participation and

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mobility among youth. Despite common trends, countries show differences in labour market in patterns of youth labour market integration (YLMI). However, comparative studies on YLMI at the subnational level have been limited. Regional disparities and youth labour markets have been often considered as separated, mainly due to limited data availability (Perugini and Signorelli 2010). Recent exceptions mainly focused on single measures of exclusion and the lack of integration, i.e. youth unemployment (Marelli et al. 2012) and NEET rates (Bruno et al. 2014). This is especially striking, giving the increasing importance assumed by territorial cohesion and regional disparities in the international and European debate (Storper 2018; Dijkstra 2017). In 2020, more than 5.5 million youth in Europe were unemployed, with a huge variation among territories: in the Prague and North-East regions of the Czech Republic the youth unemployment rate was below 1.3%, while in Sicily and West Macedonia it was above 50%.

In this article, we address this gap by presenting a composite measure of YLMI that covers a wide range of indicators and considers regional differences at the European level. We interpret this indicator as a comprehensive measure of contextual fragilities (or strengths) of regional youth labour markets. Furthermore, we investigate to what extent macro and meso-characteristics like cyclical and structural factors explain cross-regional variations in YLMI. Quantifying such a multidimensional social phenomenon is rather complex. Doing so on a European scale with a consequent loss of background information across countries and regions, presents some methodological and practical difficulties. We use the conditional Benefit-of-the-Doubt (BoD) weighting methodology to construct the YLMI index. The BoD is considered to be coherent with the Open Method of Coordination (OMC), in the way it helps identifying benchmark regions and setting policy priorities, limiting disadvantages associated to the weighting of the sub-indicators in the process of index computation (Rogge and Self 2019). Based on the composite scores, leading and lagging regions in YLMI are identified and the impact of regional contextual characteristics are examined.

By developing this index and through the analysis of how it changed between 2004 and 2018, we would like to contribute to the literature in a threefold way. First, we focus on regional measures of integration: the scope of the analysis delves beyond national performance evaluation to account for territorial disparities in YLMI, with a specific interest in the NUTS-2 level. Second, we measure YLMI in the EU by using a wide range of indicators. In addition to labour market exclusion, we also consider access indicators and the importance of education in determining the outcomes of transitions (Müller 2005; Quintini et al. 2007). Third, we investigate to what extent regional contextual characteristics explain cross-regional variations in YLMI: we explore how regional outcomes of YLMI are explained by the duality of the labour market; the dynamic of educational qualifications and skills-supply; and the regional concentration of technological and innovation resources. Along with several contributions on school-to-work transitions (De Lange et al. 2014; Piopiunik and Ryan 2012; Caroleo et al. 2020), we consider youth integration in the labour market as the outcome of a complex mix of economic, labour market and institutional factors characterizing a specific context. This paper focuses on characteristics related to the economy and the labour market, while the stock of educational qualifications is considered as a partial proxy of the outcomes of the education system. On this point, we stress the lack or limited availability of comparable longitudinal and sub-national evidence on YLMI, especially when institutional differences are considered (Scandurra et al. 2020a, b). Our hope is that following research will focus also on the outcomes of existing complementarities between socio-economic structures and institutions, resulting in differentiated opportunity structures that youth experience entering the labour market.

The article also contributes to the policy debate on territorial cohesion and social inclusion in the EU. Its relevance is based on three key aspects. First, several EU policies and recommendations focus on youth as a key group to foster EU integration. Second, the construction of an up-to-date and territorially-sensitive indicator provides contextualized evidence for policy makers engaging with territorial unbalances of youth employment and integration at regional level. Third, the lack of (reliable) regional data has been a long-standing shortcoming of the EU reporting standards, which has been noted by several studies (Atkinson et al. 2002). From a territorial and cohesion policy perspective, our findings contribute to understand the interaction between local and general knowledge, as a crucial step in the design and delivery of place-sensitive public policies for regional development (Barca et al. 2012).

The article is structured as follows. In the first section, we discuss youth labour market dynamics. In the second section we construct a synthetic measure of YLMI using BoD methodology, discussing the distinctive advantages it provides over standard composite indicators (CI) used before. In the third section, we provide new descriptive evidence by analysing the level and change of YLMI across European regions in the last 15 years (2004–2018). In the fourth section, we test the effect of cyclical and structural drivers on the integration of young entrants, deriving our hypotheses from the literature on youth labour market, territorial cohesion and spatial disparities. The final section summarises the main results, reflecting also on the analytical consequences of the proposed methodological exercise.

2 Regional Differentiation of YLMI

In the literature on labour market participation, young people are often considered as outsiders and as a vulnerable group (Lindbeck and Snower 2001), being characterized by conditions of structural disadvantage and fewer opportunities *vis-à-vis* insiders like for instance middle-aged males with a permanent working position (Ryan 2008; Pastore 2015). As pointed out by Möller (2017), youth unemployment is particularly sensitive to economic fluctuation, due to insider/outsider and last-in/first-out dynamics. They are exposed to higher unemployment risks than prime-age workers, above-average turnover rates between jobs, and are overrepresented among those in precarious and atypical forms of employment (Piopiunik and Ryan 2012). As a consequence, permanent positions are quite hard to reach for young labour market entrants, having also to face an increased competition on global scale for attractive and well-paid jobs (Brown et al. 2011). It also comes with little surprise that the onset of the economic crisis generally had strong adverse effects on the outcomes of youth school-to-work transitions (Scandurra et al. 2020a), with sharp increases of youth unemployment and precarisation (Botrić and Tomić 2017). This also raised concerns on the shadows cast by “scarring effects” on employment careers, and on the existence of a “lost generation” of young people with extremely poor employment perspectives (Eichhorst et al. 2013; Buchholz et al. 2009). A crucial role in shaping their patterns of integration in the labour market is played by the transition from education to employment, intended as the life span between the end of individuals’ enrolment in initial education and their settlement in the labour market (Wolbers 2014). Qualifications gains during training represent an important criterion in the allocation of school-leavers to jobs, as they provide signals and information used by employers when making hiring decisions. Moreover,

the accumulation of knowledge and skills acquired become the basis for career advancement and professional development, although these do not constitute entirely exclusive factors (Kramarz and Skans 2014).

Comparative literature and research mainly focused on differences across European countries, stressing the role of varying institutional arrangements as well as of contextual cyclical and structural factors shaping the transitions from education to the labour market (Smyth et al. 2001; Ryan 2008; Caroleo et al. 2017). However, several contributions on regional labour market and regional economy, as well as on the processes of subsidiarization and rescaling of social policies, have variously emphasized the impact of subnational differences on inequalities and cohesion. The polarization of economic growth and employment opportunities among regions have revealed the existence of different ecosystems of EU territories which have shown very different performances in the last decade (Iammarino et al. 2018; Fratesi and Rodríguez-Pose 2016). Per capita income, labour force participation, returns to education, the distribution and matching of skills are some of the main dimensions of differentiation (Storper 2018; Dijkstra 2017). As Storper (2018, p. 248) puts it, “the divergent new geography of employment and incomes [...] seems to correspond to a divergent new geography of opportunities”. Ignoring territorial differences and their specific interactions with socio-economic trends and institutional features, may even contribute to produce new social inequalities or to aggravate existing ones. Along this line, Atkinson et al. (2002), Ranci (2010) stress the importance of regional and place-based indicators in comparative research, since regional contextual conditions have a crucial impact in shaping transitions and subsequently individual life chances (Glaser and Becker 2016).

Recent evidence also emphasizes intra-national variations as an under-estimated issue in research on school-to-work transitions (Bacher et al. 2017; Raffe 2014), calling for the adoption of a territorialized perspective in research on transitions from education to employment (Scandurra et al. 2020a). Nonetheless, to date, the two subjects of regional and youth labour markets have been often considered as separated, due to fragmentation and limited availability of comparable information (Perugini and Signorelli 2010). Recent exceptions provided empirical evidence showing significant differences across regions, mainly focusing on measures of exclusion, i.e. unemployment and NEET rates (Bruno et al. 2014; Möller 2017; Bradley et al. 2020). In previous contributions (Scandurra et al. 2020a; Cefalo et al. 2020), we explored how variation at regional level pertains different dimensions of school-to-work transition outcomes, as well as of young adults' living conditions. In this contribution, we progress along this research strand, building our analysis on a new measure of YLMI, developed using a seminal methodology on CI (Cefalo et al. 2020). We investigate the evolution of YLMI at regional level in the EU between 2004 and 2018 as well as the existence of homogenization or differentiation trends across EU territories. Further, we draw on literature on youth labour market and territorial disparities to investigate the main contextual drivers of YLMI. On the one hand, research addresses the different dimensions through which youth participation in the labour market might be affected, by considering the impact of various cyclical and structural factors at national level (see for instance De Lange et al. 2014). On the other hand, contributions on employment growth in European regions state that, since nations are not homogeneous, dynamics of regional employment vary depending on the conditions in place in a region (Di Cataldo and Rodríguez-Pose 2017). Deriving our research hypothesis from these literatures, we explore how regional contextual factors related to cyclical and structural characteristics of the economy, of the labour market and of the outcomes of the education system, affect our measure of YLMI.

To start with, the economic and labour market situation are seen as major structural factors impacting on young entrants on the labour market. Therefore, we expect them to have an important role in explaining country differences in YLMI. Young people are strongly affected by economic downturns as outsiders with scarce work experience, skills related to job-specific tasks and networks (Pastore 2015; ILO 2013). Differently to the employment of the central age active population, that usually displays a quite stable trend, youth employment is strongly pro-cyclical (De Freitas 2008). Möller (2017) finds out that, in Europe, youth unemployment rates are twice as sensitive to cyclical shocks as non-youth unemployment rates and this is mainly related to insiders–outsiders' mechanisms. According to dualization and insider–outsider theories (Lindbeck and Snower 2001; Emmenegger et al. 2012), incumbent workers enjoy more favourable conditions on the labour market than disadvantaged outsiders. This distinction can be applied to a wide number of divides, including the one between established senior workforce and new labour market entrants. The latter, like in the case of young people in transition from education to employment, are regarded as a specific group of outsiders: they lack working experience and they also have to compete for available jobs with the insiders, i.e. with the established workforce, whose interests are represented by labour unions in negotiating wages, working conditions and employment protection. Outsiders groups are more likely to have higher probabilities of being trapped in unstable and non-standard labour market position or being excluded (e.g. unemployment). During economic downturn young people, who are generally employed in temporary and non-standard positions, have been highly affected by last-in/first-out dynamics of workforce adjustments (Möller 2017). As a consequence, we expect that a higher overall employment rate would have a positive effect on YLMI (H1). Moreover, relying on the analysis of De Lange et al. (2014) on youth integration at the national level, we expect that when the employment rate of insiders (e.g. 55–64 years employed) is higher, also as a result of legislation that protect employment of incumbent workers, regional youth integration is likely to be more difficult (H2).

The level of education plays a major role in shaping youth access to the labour market as claimed by theories on human capital (Becker 1964), signalling (Spence 1973) and credentialism (Collins 1979). Education qualifications provide differential returns on the labour market, in terms of risk of unemployment, earnings, training opportunities on the job. Even during economic recessions, education can act as a protective factor against unemployment and precarisation. As argued by Dalziel (2015), skills in the local labour force are a critical factor of regions' development, touching upon the issue of coordination in skills formation and utilisation, as well as the perspectives of employers and young people making life career-related decisions. Due to the complex characteristic of highly skilled jobs, it is more profitable for employers to hire higher educated people for a longer period. Moreover, higher educated can choose to take on less qualified jobs, thus crowding-out lower educated people, especially for new entrants (Gesthuizen and Wolbers 2010). First, education qualifications serve as a signal for the employer which place them at the beginning of the job cue (Müller 2005). Additionally, once employed more educated people acquire knowledge and skills more tightly connected to their job (Becker 1964). Along this line, we consider the impact of differences in educational qualifications on the relationship between education and labour market outcomes. Therefore, we expect that higher educational levels and skills supply in the territory may increase the opportunities of young people on the labour market (H3).

Research on regional disparities emphasizes territorial and regional dynamics as structural characteristics resulting in diverging real incomes and rates of labour force participation (Dijkstra et al. 2015). We want to test the effect of such characteristics on regional

youth integration: we consider the role of brain–drain processes and the existence of barriers to innovation resulting in long-term decline in employment and competitiveness in many industrially declining and/or peripheral regions; the consequences of technological change in local demand of high and low skills. The role of knowledge and learning relate to the innovation process and innovation systems, defining the characteristic of a learning economy where the capacity and opportunity to learn and knowledge-intensive work is crucial for economic performance (Lundvall 2016). Competitiveness has also a spatial dimension, due to interdependencies that develop and consolidate in regional innovation systems where organizations cluster together in territorial proximity (Storper 1997). This brings on the forefront also the characteristics of the job demand and of the regional productive system. This spatial element can be applied to NEET and youth unemployment, as regions where young people experience more difficulties in entering the labour market tend to cluster close to each other (Bruno et al. 2014). All in all, more dynamic and fast-growing regions are more adaptable to changes and better equipped for generating youth employment opportunities. This is also connected to technological advancements (Kalleberg 2009), leading to a growing need for higher skilled workers, according to the theory of skill-biased technological change (Berman et al. 1998). Innovation in Europe is still concentrating in a limited number of north-western regions. Here, as stated by Dijkstra (2017), good interregional connections, a highly skilled labour force and an attractive business environment have allowed neighbouring regions to benefit from their proximity to the regions concerned. In southern and eastern Member States, the innovation performance is weaker and regions close to centres of innovation—mainly the capitals—do not benefit from their proximity. Accordingly, we expect that regions where the agglomeration of innovation and technological resources is high, favour YLMI. However, this might vary depending on the level of openness and dynamism of the regions and the level of qualification of labour supply (H4).

Hence, we explore the following four hypotheses on the drivers affecting YLMI:

- H1. Well-functioning and stable regional economies have a positive effect on YLMI, because youth “pay less” in terms of labour market chances for being outsiders?
- H2. There is a trade-off between the level of employment of the insiders (55–64 years) and YLMI, because of the availability of jobs.
- H3. The skills supply at regional level has a positive effect on YLMI because higher education qualifications generate higher labour opportunities for youth.
- H4. Territories where the agglomeration of technological resources is high, favour YLMI, however this might vary depending on the level of technology openness of the regions.

3 Data and Descriptive Statistics

We have constructed a macro-panel dataset based on EUROSTAT online publicly available data, that collects information at regional level for a range of labour market and socio-economic indicators. The data have information for 283 regions at NUTS-2-level. We have considered the regions which pertains to EU-27 together with Norway, Switzerland and the United Kingdom. The time span considered in our analysis ranges from 2004 to 2018. This encompasses more than a decade during which labour market in Europe underwent

important changes. The indicators used for constructing YLMI are retrieved from the Labour Force Surveys (EU-LFS) that give information about labour market dynamics in the EU.

Building on previous work on youth transitions and regional outcomes on the labour market (Scandurra et al. 2020a; Cefalo et al. 2020), we constructed and refined the YLMI index using six indicators: the share of employed population which have attained ISCED¹ 3–4 and ISCED 5–8, the share of employed population after 3 years of having attained, respectively, ISCED 3–4 and ISCED 5–8, the NEET rate for youth aged 18–24 and the unemployment ratio of people aged 15–24. The denominator for each of these indicators is the population in the region in the corresponding age interval. Both the NEET and unemployment ratio variables are switched in their sign in order to have all the component of YLMI with a positive sign.

The main benefit of the YLMI is that it can be computed for most EU regions, allowing for cross-regional comparison. Moreover, covering several indicators related to youth integration in the labour market, YLMI represents a good proxy of the dynamics of spatial inequality in the opportunity structures of youth for EU territories. It is a regional indicator that can be thought as a combination of three underlying factors: (i) access to employment (youth employment rate, considering differences in educational qualifications of young workers) (ii) speed of integration through jobs access; (iii) and exclusion from labour market (NEET and unemployment). The first dimension of indicators (Access) covers the match between education and employment: looking at the highest level of education attained, we distinguish a group of highly qualified, tertiary educated (ISCED 5–8) and a group of medium qualified, with upper secondary education (ISCED 3–4). The second dimension (Time-to-job) represents the time needed for the matching between education and employment. We used the employment rate after 3 years of educational completion for tertiary and upper secondary educated: this is the rate of people who after 3 years from the achievement of their educational qualification are employed. As for the third dimension (Exclusion), the NEET rate is an indicator of inactivity and ‘joblessness’ (Quintini et al. 2007; Caroleo et al. 2020) grouping together young people being not employed, but also out of formal education and training. This group is larger than the unemployed, as composed by people who are experiencing different degrees of exclusion from the labour market. It is computed dividing by total youth population rather than youth labour force. Thus, it discounts for differences in education systems that may have major impact on the employment of young people. The shortcomings of the NEET indicator, are related to the fact that it groups heterogeneous categories (Vancea and Utzet 2018) such as unemployed, disabled, mono-parental mothers, etc. (Furlong 2006). Therefore, we included in the analysis the youth unemployment ratio as an indicator of exclusion from the labour market. We opted for the unemployment ratio instead of the unemployment rate, which is not considered a good proxy in comparative research on youth, due to the cross-national differences in the educational programs (i.e. TVET) and in the extent of compulsory schooling (Tamesberger and Bacher 2014).

Our choice in the selection of the indicators is theoretically driven, as a way to overcome data constraints. A drawback of YLMI is that, being a comprehensive CI, it doesn’t reveal its internal differentiation for each region, whether by social origin, nature of education level, type of jobs and precarity or migration status. Therefore, an implicit assumption

¹ ISCED stands for International Standard Classification of Education. Levels 3–4 correspond to upper secondary education, while levels 5–8 correspond to university to Ph.D. education qualification.

in our analysis is that YLMI can be taken as a proxy for the overall level of YLMI. When aggregated across a large number of different variables (e.g. inclusion vs exclusion to the labour market) the indicator is more likely to capture other related factors of youth regional labour market specificities such as the degree of youth precarization which was not taken as a component of the YLMI.

The YLMI indicator was constructed using different methods. First, we performed confirmatory factor analysis and Cronbach alpha test. Factor analysis shows that the loadings of each variable were superior of 0.787 and one factor solution accounts for 85% of the overall variance. Moreover, the Cronbach alpha test (0.927) reveals that the items were internally reliable. Second, we use a geometric mean index number, which is a multiplicative aggregation of ratios, with their importance exponents. We then generate the indicator using linear BoD. This latter methodology, proposed by Cherchye et al. (2007), is a weighted geometric average and it has the advantage to compare each sub-indicator relative to a baseline (e.g. in our case the reference was the Netherlands²). In addition, it combines sequence with conditional weights based on minimum and maximum distribution. In our results, the BoD method gives slightly higher importance to the item employment rate after 3 year of youth with ISCED 3–4. On the contrary BoD weights are lower for the NEET rate. We report BoD weights mean figures in Table 1, the regions weights are available upon request to the authors. It is important to point out that the results in YLMI scores proved to be very similar through the different methods, showing the consistency of the index. The composite measure of YLMI ranges between 0 and 1. Table 1 provides summary statistics of key variables.

As can be gauged from Fig. 1, which shows the average over the period 2004 and 2018, the YLMI varies widely across EU territories. Over the period from 2004 (0.73), the average value of YLMI raised until reaching its peak in 2008 (0.76), then it dropped greatly in 2009 (0.71), reaching its minimum in 2013 (0.67). From 2014 onwards YLMI experienced a remarkable increase reaching 0.74 in 2018. However, the level of YLMI is still generally lower than it was in 2004 (the initial year). The dispersion of YLMI increased being the standard deviation 0.12 in 2004 compared to 0.15 in 2018, showing a stronger differentiation in trajectories across European regions. Over the last 15 years, the median region scored 0.81, whilst for the top 10% of regions this is above 0.90. The highest values are observed in Zeeland (NL), Gelderland (NL), Noord-Brabant (NL), Utrecht (NL), Oberbayern (DE), Trøndelag (NO), Oberösterreich (AT), Tirol (AT), Oslo (NO), Noord-Holland (NL), where the YLMI scored above 0.94, whilst the low performer regions were Severozapaden (BG), Puglia (IT), Campania (IT), Calabria (IT) and Sicily (IT) together with the French overseas territories with an YLMI below 0.59.

Our descriptive results show a combination of cross-country and cross-regional variations below the country average. Research on regimes of youth transitions (Walther 2017) can help us to interpret the differences in YLMI scores among EU countries. Higher scores of YLMI are observed in Central-Northern European regions (especially in the Netherlands, Germany, Austria, Switzerland, Sweden, Norway, Denmark). Central European countries, like Germany, Austria, the Netherlands and Switzerland have a strong corporatist tradition and focus on vocational training as central labour market integration tool (Busemeyer and Trampusch 2012). Northern countries, such as Sweden, Norway, Denmark, are characterised by more universalistic institutions, as they combine

² We picked the Netherlands because this country shows relative stable YLMIs over time and very low variation across its territories.

Table 1 Summary statistics of observed variables of YLMI and BoD weights

Indicators	Age reference (years)	Dimension	Mean	SD	Min	Max	BoD weights mean	BoD weights SD
Employment rate ISCED 3–4	20–34	Access	77.04	9.45	32	100	0.0010	0.0016
Employment rate ISCED 5–8	20–34	Access	84.98	8.90	39	100	0.0027	0.0025
Employment rate after 3 years ISCED 3–4	20–34	Time-to-job	68.03	16.44	15	100	0.0014	0.0022
Employment rate after 3 years ISCED 5–8	20–34	Time-to-job	79.91	13.42	25	100	0.0034	0.0033
Youth unemployment ratio	15–24	Exclusion	21.73	12.15	3.4	79.2	0.0019	0.0031
NEET rate	18–24	Exclusion	12.06	5.69	2	42.6	0.0016	0.0037

Source: Authors' own calculations on Eurostat data (LFS)

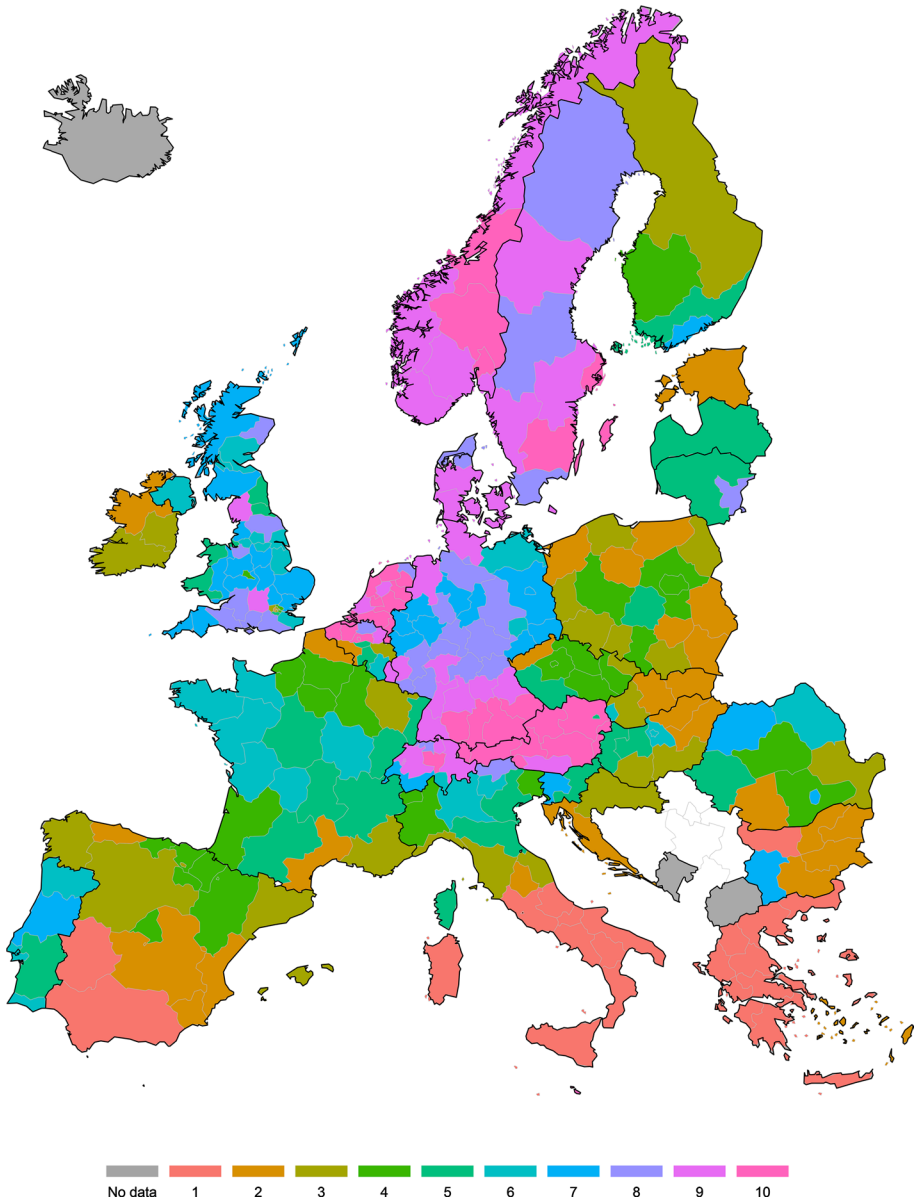


Fig. 1 YLMI composite index score, average over the period 2004–2018 in deciles, NUTS-2 regions

inclusive education systems with supportive active labour market policies and strength of social partners. UK displays values of YLMI well above the average, also some Eastern countries, namely Poland, Slovenia, Lithuania, Czech Republic and Hungary. However, in the UK and Ireland, school-to-work transitions are mainly shaped by the predominance of general education and flexible labour market arrangements, with minimal social protection. Eastern countries are said to present a wide array of institutional

arrangements that express varying mixes of liberal and collective skill formation policies, due to the different trajectories of transition to a market economy. At the bottom of the distribution of YLMI regional scores, we mostly find regions from Southern Europe (Greece, Italy, Spain). In these countries the linkages between education and the labour market are weak and fragmented. Comprehensive education systems but low take-up of VET, under-developed active policies and labour market services, going together with disadvantaged socio-economic conditions, especially worsened after 2008. Our findings confirm that typologies and cross-country differences can explain a relevant but not exhaustive share of the variance associated with outcomes of school-to-work transitions (Scandurra et al. 2020a). In order to build a comprehensive picture of youth employment, cross-regional differentiations below the country level must be addressed as well. Southern European countries, namely Italy and Spain, display sharp territorial divides between northern and southern regions. However, remarkable regional differences are also observable, for instance, in France and in the U.K., as well as in Poland, Romania, Bulgaria, and Hungary (Fig. 1). Even in Germany, although comparatively high values of YLMI are generally observable, southern regions display the highest scores of YLMI over the period considered, while the Eastern regions show lower values, especially in the early 2000s.

Figure 2 shows the growth rate of the YLMI in percentage terms, i.e. $\partial y = (y_{2018} - y_{2004})/y_{2004}$, from the beginning to the end of the period for each region. Focusing on the variation over time, we can clearly observe the strong differentiation of regional trajectories. Most of the regions in Central and Northern Europe have stable or growing YLMI, showing that the integration of young people in the labour market remained constant or even improved after 2004. This is mostly the case for the regions in Germany, Austria, Netherlands, Switzerland, Sweden and Norway. In Germany, relative improvements in the integration of young people between 2004 and 2018 are more observable in the Eastern regions, that started from lower values of YLMI at the beginning of the period. The impact of the economic crisis of 2008 was especially detrimental in Southern European regions such as Greece, Spain and Italy. The darkest areas correspond to Sicily, Calabria, Campania and Northern Greece that report a -35% change in YLMI over the analysed period, showing a strong deterioration of the labour market conditions for young people. This pattern of change marks a long-term lack of opportunities for young people. However, struggling in YLMI is not to be considered only a Mediterranean or South European issue. Some UK, French, Danish and Finnish regions experienced a decrease in the YLMI scores in the last 15 years.

Conversely, several regions from Eastern European countries (Hungary, Poland, Czech Republic, Slovakia and Bulgaria) display moderate to strong improvements in YLMI over the period considered (Fig. 2). These regions show somehow different trajectories but an overall improvement of conditions in 2018 with respect to the early 2000s, as well as minor impact or a faster recovery from the Great Recession (Próchniak 2011). These improvements of the YLMI index could be related to a combination of several factors occurring in Eastern European countries, such as favourable economic circumstances related to the European integration (Székely 2016) or migration outflows of young people. However, economic growth in newer EU member states goes with rising internal polarization, highly affecting disadvantaged peripheries in the western parts (Andor 2019). Labour mobility from East to West and brain-drain outflows of qualified young people may also reduce job competition among local youths (O'Reilly et al. 2015), contributing to relative improvements of YLMI scores for some regions in Eastern Europe.

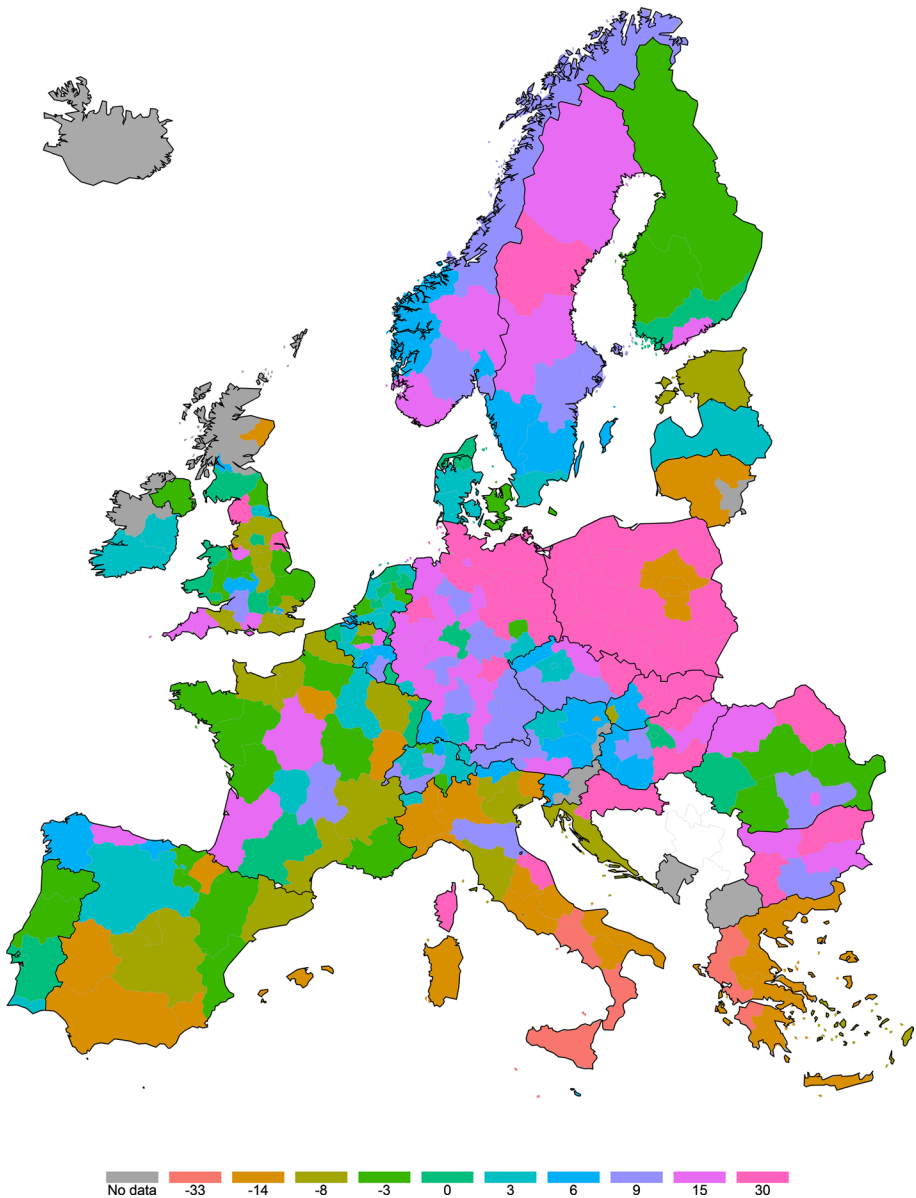


Fig. 2 YLMI composite index score, growth rate between 2004 and 2018 in percentage, NUTS-2 regions

3.1 Empirical Analysis

From a regional perspective, it is relevant to try to understand the drivers of change underlying the development of the YLMI index. In fact, this is potentially influenced by various contextual elements and policies such as the level of regional development, the structure of educational supply and demand, the regional innovation level, the labour market legislation

and protection, the grade of retention in the labour market of older workers that in turn reduces the stock of available jobs for youth.

In order to assess to what extent these factors shape the change in the YLMI index, we estimate a series of panel fixed effect regression models with first-order autoregressive disturbance term (Baltagi and Wu 1999). These models exploit the longitudinal relationship of the YLMI index with the regional drivers mentioned above by examining the within-region variation over time. We also add the squared terms of every factor included in the model to capture non-linear effects. By applying fixed effects, we control for unobserved time-invariant regional characteristics that reduces the risk of omitted-variable bias, at least as far as time-invariant characteristics are concerned. Since there could be external shocks affecting both the endogenous and exogenous variables, we do not claim causality. We test the adequacy of the fixed approach using the Durbin–Wu–Hausman test, which reported a systematic difference with random effect estimates and shows that fixed effects were preferred. Given the presence of heteroskedasticity and serial correlation (confirmed through the Wooldridge test), we apply a two-step Cochrane–Orcutt procedure that is an iterative process to correct for serial correlation in the error term. Our sample is composed by 283 European regions and it is strongly balanced covering the years between 2004 and 2018. The model can be written as:

$$(YLMI_{it}) = \beta_0 + \beta_1 GDP_{it} + \beta_2 EMPG_{it} + \beta_3 EMP_{it} + \beta_4 EDTG_{it} + \beta_5 EDT_{it} + \beta_6 INN_{it} + \eta_i + \mu_{it} \quad (1)$$

where;

- $(YLMI_{it})$ is the YLMI of region i in time t
- $\beta_1 GDP_{it}$ is GDP in PPS of region i in time t . This is the percent ratio between the per capita GDP of the region and the EU average at time t
- $\beta_2 EMPG_{it}$ is the employment rate of population between 55 and 64 years of region i in time t
- $\beta_3 EMP_{it}$ is the employment rate of population between 20 and 64 years of region i in time t
- $\beta_4 EDTG_{it}$ is the tertiary educated rate of population between 25 and 64 years of region i in time t
- $\beta_5 EDT_{it}$ is the tertiary educated rate of population between 30 and 34 years of region i in time t
- $\beta_6 INN_{it}$ is the share of employed in science and technology sector of region i in time t
- η_i are regional fixed effects
- μ_{it} is the first-order autocorrelated error term, where $\mu_{it} = \rho\mu_{i, t-1} + \eta_{it}$ and where ρ is bounded $[1, -1]$ and η is independent and identically distributed with mean 0 and variance σ_η^2
- the model includes the quadratic terms for each exogenous variable.

The aim is to analyse to what extent structural and cyclical factors influence the change of labour market integration of young people over time. We analyse how YLMI is affected by the labour market access, the participation of the older workers and by the supply of high-qualified people operationalized as the rate of tertiary educated people of 25–64 years and the rate of tertiary educated people of 30–34 years. Moreover, the analysis explores how the change in science and technology sector characteristics of the European regions influence YLMI. To capture the innovation capacity of the regions we use the rate of

people employed in science and technology sector.³ Both measures are calculated as ratio of the active population in the regions. Further, we include in the model, the regional GDP as a control variable.

All variables included in the model should be interpreted summing up their corresponding squared term which accounts for the non-linear effect. The size of the squared term indicates the steepness of the curvature while its sign indicates the direction, being upward if positive or downward if negative. The only squared terms that are not statistically significant are those associated with the GDP, the tertiary educated people of 30–34 years and the last two variables referring to the regional scientific and technological sector. The relevance of non-linear effects shows the complexity of the relationship between youth integration and the macro-factors considered, as it signals the existence of differences between groups of regions and their characteristics in terms of employment participation, skills supply and technological resources, and resulting index scores.

The results are reported in Table 2. Model (1), our baseline model, accounts for regional GDP level and its squared term. In subsequent specifications of the model we add a range of covariates. The predictions of model (6) are simulated in Fig. 3. The figure shows the findings of model 6 providing a graph of the average marginal effects of each variable included in the model. The height of the confidence interval bars shows the precision of the model estimates: not surprisingly they are wider at the extreme of the response surface, where the sample is reduced. The figure eases the interpretation of the results providing an intuitive representation of the change in YLMI at a given point in the covariate space calculated using the delta method. Thus, it provides a visual representation of significant differences between groups of regions, going beyond the average effect calculated in Table 2. This figure reveals a sort of bifurcating effect of the covariates on YLMI, meaning that regional contexts are crucial in shaping youth labour market opportunities.

Model (1) suggests that a higher GDP corresponds to an increasing level of YLMI. However, the effect of GDP is reduced by almost seven times its size when we account for regional labour market, education and skills supply (Model 6). This means that these variables moderate and reduce the effect of GDP on YLMI. Model (2) suggests that a higher share of population employed has a positive effect on YLMI, confirming that high employment levels are positively correlated with YLMI and provide a more equal access to opportunities. The variables related to regional employment capture most of the overall variance in the dependent variable, with an increase of the Adjusted R-squared from the baseline model (1), when the only covariate included in the model is the regional GDP, that goes from 0.187 to 0.45 in model (2). Once we include all co-variates in model (6) this goes up to 0.630. This highlights the importance of the structure of the labour market, as national and regional context specificity, in configuring youth opportunities. The result is in line with previous research and it is similar to patterns observed in recent findings on income dynamics and youth labour market (Milanovic 2013; Alvaredo et al. 2018; De Lange et al. 2014). Additionally, we find evidence confirming the hypothesis of an insiders–outsiders divide between those workers passing the peak of their career and approaching retirement and young people. Results show a negative effect (Model 3) of the share of older workers on youth integration (population employed aged between 55 and 64 years).

³ We have also used in other specifications of the model, the share of scientist and engineers employed in the region, however when including this proxy, it was collinear with the other variable used to capture the innovation capacity of the region.

Table 2 Drivers of YLMI in European regions: two-step Cochrane–Orcutt estimation

Variables	(1)	(2)	(3)	(4)	(5)	(6)
GDP in PPS, % of EU	0.00504*** (0.000163)	0.000906*** (0.000198)	0.000797*** (0.000160)	0.000704*** (0.000149)	0.000703*** (0.000149)	0.000699*** (0.000148)
GDP in PPS, % of EU (squared)	-4.48e-06*** (3.68e-07)	-4.49e-07 (3.73e-07)	-5.57e-07* (3.12e-07)	-4.35e-07 (2.88e-07)	-4.30e-07 (2.87e-07)	-3.92e-07 (2.86e-07)
Share of employed pop, 20–64 years		0.00319*** (0.000874)	0.00823*** (0.00115)	0.0110*** (0.00115)	0.0104*** (0.00116)	0.00879*** (0.00129)
Share of employed pop, 20–64 years (squared)		8.60e-05*** (8.01e-06)	0.000112*** (9.76e-06)	9.09e-05*** (9.74e-06)	9.72e-05*** (9.87e-06)	0.000106*** (1.05e-05)
Employment rate, 55–64 years			-0.0111*** (0.000833)	-0.00828*** (0.000818)	-0.00860*** (0.000815)	-0.00792*** (0.000820)
Employment rate, 55–64 years (squared)			4.91e-05*** (8.40e-06)	3.69e-05*** (8.11e-06)	3.89e-05*** (8.08e-06)	3.28e-05*** (8.13e-06)
Share of 25–64 years with tertiary education (ISCED 5–8)				-0.00914*** (0.000940)	-0.00491*** (0.00142)	-0.00658*** (0.00152)
Share of 25–64 years with tertiary education (ISCED 5–8) (squared)				9.27e-05*** (1.47e-05)	4.14e-05** (2.10e-05)	4.50e-05** (2.25e-05)
Pop ratio of 30–34 years with tertiary education (ISCED 5–8)					-0.00267*** (0.000828)	-0.00231*** (0.000827)
Pop ratio of 30–34 years with tertiary education (ISCED 5–8) (squared)					2.47e-05** (1.06e-05)	2.17e-05** (1.06e-05)
Employed in science and tech., ratio of active pop.						0.00378** (0.00166)
Employed in science and tech., ratio of active pop. (squared)						-2.61e-05 (2.73e-05)

Table 2 (continued)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	0.289*** (0.00550)	-0.0233** (0.0106)	-0.0616*** (0.0174)	-0.0852*** (0.0205)	-0.0763*** (0.0209)	-0.0746*** (0.0213)
Observations	3614	3526	3523	3311	3304	3304
Number of regions	283	283	283	280	279	279
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared within	0.251	0.495	0.598	0.656	0.659	0.662
R-squared between	0.218	0.692	0.814	0.792	0.801	0.785
R-squared overall	0.190	0.636	0.774	0.768	0.775	0.761
Adj. R-squared	0.187	0.450	0.562	0.623	0.627	0.630
AIC	-11,689	-12,500	-13,009	-12,564	-12,538	-12,559
BIC	-11,670	-12,469	-12,966	-12,509	-12,471	-12,480
RMSE	0.0476	0.0415	0.0385	0.0364	0.0363	0.0362

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

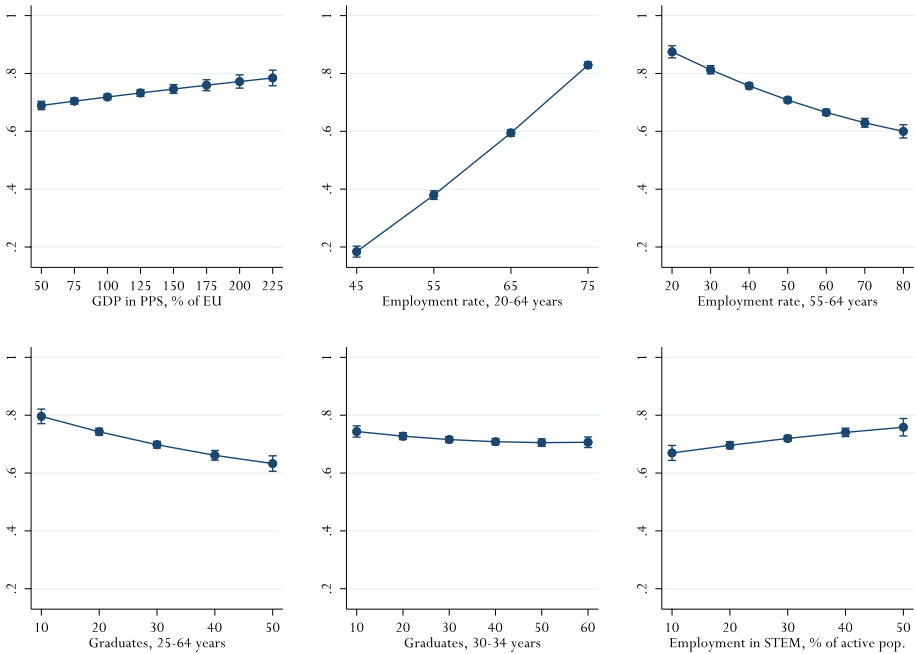


Fig. 3 Marginal effects of the drivers of YLMI. Source: Authors' own calculations on Eurostat data (LFS)

The impact of skills supply and technological agglomeration on the YLMI index is not straightforward (models 4–6). To start with, both the share of the overall population and of those 30–34 years old with tertiary education have a negative effect on YLMI. However, the share of the tertiary educated population 25–64 years old has a significant squared term associated, showing a sort of deviation between those regions that have a higher share of tertiary educated population and the ones that have a poorer stock of tertiary educated and skilled population. This means that in some regions with a lower share of tertiary educated population, there is a higher YLMI which could be related to comparatively less job-competition than in regions with a higher stock of human capital. This could be due to an existing matching between intermediate/low qualifications and low qualified job demand, resulting in lower displacement effects for youth entering the labour market. In any case, the relationship between education and labour market integration for youth is complex, pointing to the need to consider the interaction of the contextual characteristics of a region.

The size of the science and technology labour market of territories has a moderate effect on YLMI (model 6). The effect of the share of employed in the science and technology sector on YLMI index is statistically positive and linear and shows a differentiation between low vs. high specialized regions. Figure 3 confirms that for high specialized technological regions there is a positive and slightly higher effect on YLMI compared to regions with low agglomeration of technological resources. All in all, Fig. 3 reveals a fragmented and divergent picture of regional change in YLMI. For most regions, the rate of change in YLMI grows for higher levels of employment rate, GDP and, slightly, for higher employment in the science and technological sector. Other factors being equal, the dynamics of changes in employment conditions and regional GDP are highly associated with YLMI. This former relationship is non-linear: starting from the point when the employment rate of the

population aged 20–64 reaches 60%, additional changes confer lower increases of YLMI. The effect of the employment rate of those aged 55–64 years reveals the dualisation experienced in several European labour markets (De Lange et al. 2014): the effect on YLMI is negative and the index decreases as the share of older workers in the region increases. As for the regional change in the share of tertiary educated population, the results show a weak and negative relationship with YLMI. Further, a higher concentration of tertiary educated people has a negative effect on YLMI. Once the share of tertiary educated graduates reaches 20%, each additional change produces higher and negative effects on YLMI. This finding may provide some support to the claim that exogeneous increases in the supply of tertiary educated graduates, as experienced in the last decades, could yield adverse effects in the access of jobs for youth, due to the possible reallocations of labour market opportunities (Oesch 2013; Salvatori 2018). The complex matching between education and employment in local skill ecosystems is surely a topic that deserves further investigation, given its relevant policy implications.

Summing up, we found evidence supporting hypothesis H1, H2 and H4, but not for H3. More than educational qualifications, labour demand and high-technology factors related to the general state of the regional economy and labour market seem to be relevant. The GDP, the employment rate of the active population and the share of employed in science and technology sector have a significant and positive effect on YLMI. More specifically, territories where the agglomeration of technological resources is very high favour YLMI, but the difference is statistically significant only when comparing regions with high agglomeration of technological resources and regions with low technological resources.

4 Conclusion

Territorial variation in the transition from education to employment mirrors the extension of differences in the structures of opportunities (Roberts 2009), with potential impact on the life course of young people. In more divided countries, regional disparities in integration are likely to re-produce and even increase inequalities. Subnational disparities in YLMI represent therefore one of the most urgent and relevant issues to be considered in EU cohesion policy.

The variation in YLMI is pronounced not only across countries but also across regions. Central and Northern European regions display more favourable conditions for labour market integration of youth, while sharp difficulties in integration mark the performance of Southern European regions. All in all, our results show that favourable economic conditions and a well-functioning local labour market positively affects YLMI, pointing out the relevance of contextual characteristics related to regional economies and their labour markets. This rather expected result, however, needs to be considered together with the relationship between education and YLMI. This is more complex, showing a slightly negative effect on YLMI and possibly pointing to regional dynamics of matching and job-competition. However, innovation and employment in knowledge-intensive sectors have a moderate positive effect on the labour market opportunities of young people, and this is more pronounced in regions with higher aggregation of technological resources. Results point out that in the latter, the presence of a high qualified job sector is associated with increased levels of youth integration in the labour market.

All in all, demand-side factors seem to be more important than the supply of skills and human capital, as far as YLMI is concerned. The impact of education on youth integration

is instead less straightforward than expected. This could be seen as a warning against focusing exclusively on supply-side policies targeting human educational qualifications and skills. A higher supply of tertiary educated graduates may have scarce or even slightly negative effects on regional job accessibility for young people, if disconnected from the contextual characteristics of the local economy and labour market. This points to the necessity of a more nuanced picture of the role of additional supply of tertiary graduates in European regions, as they may produce substantial reallocations of labour market opportunities, which could penalize youth (Oesch 2013). The connection between skill formation and contextual characteristic of the economy and labour market should be addressed as well as a strategic policy perspective. Targeted interventions aimed at a better matching between skills and employment could speed up the transitions to employment and improve the link between education and labour market. Place-sensitive policies as an EU long-term strategy aimed at fostering the economic eco-systems of deprived and more depressed regions, without damaging the dynamic drive of most developed regions, are therefore to be recommended. Following studies are however needed in order to clarify these relationships from a comparative and cross-regional perspective. What needs to be done is unpacking the combination of factors that relate to sectoral characteristics of the job-demand, as well as to the role of regional institutions and policy provision within local ecosystems. For these very reasons, we stress the importance of up-to-date evidence at sub-national level for informed policies on young people. The territorialisation of data collection is still limited and, especially as far institutions and policies are concerned, does not allow meaningful comparisons across European regions. Nevertheless, it proves to be paramount in order to further clarify the impact of contextual structural, cyclical and institutional factors on youth opportunities in the transition from education to employment.

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