

Improving the school-to-work transition for young people by closing the digital divide. Evidence from the EU regions

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Purpose

The purpose of this paper is to provide comparative empirical evidence on the young people neither in employment nor in education and training (NEET-youth) under the influence of digital divide, education and sectoral growth across the EU regions, with a focus on the transition patterns followed over time by EU regions in bridging digital divide and their specific implications on school-to-work transition (STWT).

Design/methodology/approach

First, five variables on Internet usage activities are aggregated into an index of E-skills. In the second step, linear dynamic panel data regression models are used to explain the influence of various factors on regional rates of NEET-youth, with or without grouping regions upon the digital divide in relative terms.

Findings

Advanced digital literary skills are found to have a stronger effect on the STWT than the basic ones. The growth of employment in specific economic activities like “Information and Communication” enhances STWT, but only when considering the regional differences in the digital divide and E-skills as well. However, the negative effect of deprivation and low educational attainments on STWT are both offset by a low level of regional digital divide. In addition, more R&D expenditure in higher education are necessary to compensate the effect of the digital divide on the STWT.

Policy implications

On brief, the policy implications are twofold. First, regions will need to focus more on improving the people’s E-skills, because this regional level achievement will not only generate positive effects for STWT, but will also enhance the positive impact of education and sectoral growth on STWT, or even compensate their low progress. Second, in the context of the EU single market, to better address the situation of young people, regions should monitor the relative progress in bridging digital divide and improving E-skills, with respect to the other EU regions. Improving the relative position on the EU map of E-skills increases the effectiveness of regional policies targeting the STWT.

Originality/value

Upon our knowledge, this is the first paper framing in a regional setting the analysis of the relationship between the STWT and the regional digital divide, which could reveal common policy goals for the EU regions. Besides, the innovative contribution relies in the identification of (1) transition patterns that regions follow over time in improving the STWT while bridging the digital divide, and (2) policy measures addressing the NEET-youth in the context of the regional digital divide.

Paper type: research paper

1. Introduction

Young people who are not in education, employment or training (NEETs) are at the core of the EU-policy agenda since 2010, when they were officially addressed, for the first time in European policy debates, through the “Youth on the move” initiative. The NEETs youth unveils a particular type of vulnerability that exceeds the borders of unemployment. While being stuck in this situation, the NEET young people are not accumulating standard human capital through work, education and training, so this situation can be described as a state of deprivation upon a set of initial endowments which could negatively impact the onward participation in the labour market.

In recent years, a large body of literature on NEET young people and STWT has emerged, but most of them provide country case studies and formulate specific policy measures. Behind the national peculiarities lying in the persistence of the young NEET situation, common approaches conducted at the EU level could reveal common aspects, causes, and policies.

The process of digital transformation has recently opened new challenges for the labour market, which might turn into long-term solutions for all NEET youth subcategories. Equipped with (advanced) digital skills, the NEETs could get easier access to better, new and/or flexible jobs, contributing therefore to the development and growth of the digital economy which itself creates various opportunities for NEETs in present, and in the future as well. Moreover, bridging the digital gaps ensures the equality of opportunity in terms of equal access to human rights, education and jobs, fostering the process of digital inclusion. Closing all forms of digital divide at national, regional and EU level is therefore needed not only for the sustainable development of digital economy in the EU, but especially for the social and digital inclusion of vulnerable groups, such as NEET youth.

Our focus here are the regional NEET rates of youth aged 15–24 of the EU-NUTS2 regions. Young people are natively the most active users of ICT's, but mostly for entertainment, so that sometimes they represent a particular group of digitally excluded persons (Serrano-Cinca et al., 2018). This paper actually looks to determine whether digitally inclusive regions manage better to facilitate the STWT by: (1) examining the impact of the regional digital divide on the young NEET, (2) analysing whether the impact of education and sectoral growth rates are enhanced by the regional progress on the digital divide and E-skills, (3) constructing an index of E-skills, and (4) checking whether the regions experiencing similar transitions over time across the quartiles of the digital divide index also share similarities in the relationship between NEET youth, digital divide, education and sectoral growth rates.

The paper is structured in four sections, of which the first is the Introduction, the second synthesises the literature review, the third presents the data and methods, the fourth is the empirical analysis, and the fifth concludes and advances policy recommendations.

2. Theoretical background

The STWT is placed at the centre of the debate related to high levels of youth unemployment in the EU countries and the necessity to adapt educational programs and institutions to the challenges of digital economy. In this framework, a particular attention should be given to NEET youth since their unemployment and lack of inclusion in education make them more vulnerable to new labour market requests in the context of digital transformation.

The EU labor market is itself vulnerable, in the sense that there is a large share of labor resources employed temporarily, occasionally and part-time. Many of these employees are young and find it difficult to enter the workforce because of the lack of experience. However, there are many young people with a high level of education, who have failed to get a job, often because of mismatches. During the global economic crisis started in 2008, higher education graduates also found it difficult to find a job, some of them being forced to accept jobs for which they were overqualified and some chose to go into unemployment.

A large number of studies showed that the recent global economic crisis has generated significant increases in the values of NEET rates (Ruesga-Benito et al., 2018), these young people being more affected by economic decline compared to other categories of unemployed people. Therefore, the reduction of NEET rates has become one of the main objectives of the 2030 United Nations Agenda for Sustainable Development Goals (Oliveira et al., 2019). The COVID-19 pandemic that is expected to determine another world economic crisis will enhance the issue of NEETs, but in the context of digital economy.

The STWT could be facilitated by specific government policies and national institutions that prevent long-run youth unemployment and enhance social cohesion and labour productivity (Zimmermann et al., 2013). For example in Italy, passive and active labour market policies supporting NEET-youth, higher education spending and trade unions enhanced the STWT (Pastore et al., 2020). Formal training and firms' implication in educational programs to provide the suitable feedback might help NEET-youth to make a faster transition to a job (Eichhorst et al., 2015). Recently, Pastore, Quintano and Rocca (2021) examine the duration of the STWT in 14 European countries and find that increasing the flexibility of education and introducing more widely the dual principle in every branch of the education system are key to increasing young people's hazard rate.

Youth employment policy should be based on a combination of tools: efficient education, labour flexicurity, and suitable transition regimes in the youth insertion into labour market (Pastore, 2018). The role of transition regimes is to minimize the gap of job experience between adults and young people (Pastore and Zimmermann, 2019). Speckesser et al. (2019) showed that work experience could be gained outside business environment or regular employment and has positive effects on youth transition to job. Five European models of STWT resulting in lower youth unemployment have been identified: higher output and economic growth, high education attainment and flexible labour market, dual educational system, active labour market policies for NEETs, and youth unemployment costs, not supported only by households (Pastore, 2014).

The most studied factors that influence STWT are represented by a set of micro- and macroeconomic variables, such as gender, characteristics related to migration, economic growth, educational variables and labour market indicators (Bacher et al., 2017). As the

variables used to explain in our empirical section the regional NEET rates are grounded in the literature, some relevant papers and findings, will be briefly referred to as below.

The economic situation of region is essential in understanding the evolution of NEET rate. Dietrich (2012) and Bell and Blanchflower (2011) showed that business fluctuations influence the young unemployed. The periods of economic crisis contribute to NEET rate increase, while periods of economic growth create more jobs and reduce the NEET rate. Moreover, Scarpetta et al. (2012) showed that NEET rate is more sensitive to economic growth compared to the unemployment rate. Alternatively, the risk of poverty and social exclusion for NEETs are obstacles for economic growth and a competitive economy (Ruesga-Benito et al., 2018).

A period of economic growth is beneficial for unemployed youth due to more available jobs. However, the economic crisis brings fewer jobs for which unskilled and unemployed young people are less eligible. Job shortage is actually the main cause for unemployment among young people (de Lange et al., 2014).

Economic growth and the structure of economy suggest the patterns of labour demand which are necessary in evaluating the differences in youth integration in the labour market, in different countries (Zimmermann et al., 2013). Slow economic growth associated with weak organization of educational system explain the increasing youth unemployment in Italy rather than less flexible labour market (Pastore, 2019). In turn, higher levels of GDP contribute to NEET youth insertion on labour market (Pastore et al., 2020).

Empirical findings suggest the positive impact of unemployment on NEET rate. Adult unemployment in Italy, Spain and UK in the period 1993–2018 determined NEET rate growth (Bradley, Migali and Paniagua, 2020). NEET phenomenon in Italy is considered as an issue related to overall unemployment, almost half of the Italian young people being declared NEET for at least 13 months in the period 2008–2011 (Contini et al., 2019). One explanation is that the skill depreciation determines long-run unemployment and the creation of a group called “discouraged workers” (Nichols et al., 2013). The older youth is more affected by skill depreciation compared to teenagers (Bradley, Migali and Paniagua, 2020).

Education is the most powerful tool for reducing unemployment (Kromydas, 2017). Therefore, the role of education in reducing NEET rate is discussed next. Empirical evidence states that a higher level of education is associated with a higher probability of being hired. This connection is most significant in case of young people (Vancea and Utzet, 2014). NEET people do not accumulate human capital using formal education channels and present a higher risk of social exclusion, poverty and deprivation (Alfieri et al., 2015).

The role of education in liberal economies is to ensure skills to facilitate innovation, mostly in IT sector, and labor mobility. Cataldo and Rodríguez-Pose (2017) showed that education and innovation in the EU regions contributed to the decrease of long-run unemployment, with positive effects on NEET rate reduction. There is a strong relationship between employment and education, but countries focused on general education rather than vocational one are more affected by unemployment (Wolbers, 2007).

NEET rates are lower for young people with higher education than those with a lower level of education. Caroleo et al. (2020) showed that the phenomenon of young NEETs has a structural nature in Greece and Italy, being generated by the propensity of NEETs to transition from school to work, but also by long-term unemployment. In Greece, this phenomenon has become a national labor market issue, increasing its insecurity (Papadopoulou, 2020). The low NEET rates for Sweden and the Netherlands are due to the direct system of transition from school to work. In addition, the Nordic countries have labor market regulations and social security networks (parental insurance for children, unemployment security, etc.) that facilitate the insertion of young people into employment (Lorentzen et al., 2019).

Previous studies for the US, UK and France (Ryan et al., 2019) and for nine European countries (Russell and O'Connell, 2001) have shown that young vocational education graduates are more likely to be hired than higher education graduates. For ensuring highly skilled labor supply at the EU level, which would stimulate economic growth, the European Commission has set the goal of increasing the level of inclusion in higher education (Yagci, 2015).

According to Pastore (2018), skills mismatch or lack of job competences is the main cause for youth unemployment despite high level of education. Higher educated Italian young people find faster a job compared to less educated ones (Pastore et al., 2020). The sequential education systems promote work after education, but Youth Guarantee is implemented as an active labour policy to reduce this shortage in the EU countries (Pastore, 2014).

The technological unemployment caused by the 4th Industrial Revolution could act like a stimulus for NEETs to improve their level of education to face the new labour market challenges. Gomez (2018) showed that there are differences between young people in Madrid regarding the three levels of digital divide. These asymmetries are explained by social and cultural characteristics and the degree of technological socialization and influence the younger's insertion in the labour market. Serrano-Cinca et al. (2018) showed that Spanish NEETs mostly uses Internet for entertainment and could be considered digitally excluded.

Gross domestic expenditure on R&D (GERD) enhances the economic growth as Keskin (2011) showed for 177 states of the United Nations. The economic development ensures more jobs for young people, but these benefits are enhanced more in countries supporting the digital transformation. Appropriate strategies based on research and communication between NEET youth, workers', and employers' organizations must better integrate labour resources in the labour market of the digital economy (Oliveira et al., 2019). Loughlin (2018) showed that NEETs should be digitalized to increase their opportunities to integrate on the labour market. The author indicated few directions to achieve this goal: the creation of volunteer communities to promote digital work among young people, partnership with universities and technical expertise, mentorship and training programs. The lack of adaptation to the digital transformation will enhance social exclusion of NEETs. (Ziemann, 2017).

The youth unemployment at the sectoral level received little attention in literature, being focused on situation in a single country, especially in terms of labour market policies (Mascherini, 2019). There is an uneven repartition of employed youth across sectors (Blanchflower and Freeman, 2000). Moreover, gender differences are also present. Construction sector is dominated by men, while health sector receives more support from young females.

3. Data and method

The empirical analysis uses Eurostat data aggregated at the regional NUTS2 level, running from 2011 to 2019. The main variables of interest are in the field of the NEET youth, digital divide, education and sectoral growth:

- NEETs aged 15-24 and NEETs 15-28
- Individuals who ordered goods or services over the internet for private use (abb. E-commerce)
- Individuals who used the internet for interaction with public authorities (abb. E_government)
- Individuals who used the internet for submitting completed forms to public authorities (abb. E_gov_forms)
- Individuals who used the internet for participating in social networks (abb. Internet_networks)
- Individuals who used the internet for internet banking (abb. E_banking)

- The proportion of the region's population that had never used the internet (abb. Never_internet)
- R&D expenditure performed by the higher education sector (abb. GERD_HigherEd)
- R&D expenditure performed by the business enterprise sector (abb. GERD_Business)
- R&D expenditure performed by the government sector (abb. GERD_Gov)
- Population aged 25-64 by educational attainment level: ISCED 0-2 (abb. Primary education) and ISCED 5-8 (abb. Tertiary education)
- Growth rate of employment in: Manufacturing, Construction, Information and Communication (abb. Information), Administrative and support service activities (abb. Administration), Real Estate activities (abb. Real estate) and Wholesale and retail trade, repair of motor vehicles and motorcycles (abb. Trade).
- Average number of usual weekly hours of work in main job (abb. Weekly hours)
- Long term unemployment for the total population aged 15-65 (abb. Unemployment)
- Economic growth
- People at risk of poverty or social exclusion (abb. Poverty) and Severe material deprivation (abb. Deprivation)

The first method applied in the empirical analysis concerns the aggregation of a set of Internet usage variables into a summative index by the Principal Components Analysis (PCA). The PCA method is a multivariate exploratory technique which allows reducing a set of correlated variables to fewer ones, and constructing summative indexes (Abeyasekera, 2005).

The influence of different variables on NEET rate is analysed using linear dynamic panel data regression models and Eurostat data. The main advantage of panel data approach is the control for individual heterogeneity, but it also ensures less collinearity and more variability, improving the coefficient efficiency (Baltagi et al., 2014).

The methodology supposes the verification of regression assumptions before the regression analysis. First, error heteroskedasticity is checked using likelihood ratio tests. In case of heteroscedastic disturbances, pooled OLS estimator is less efficient even if it remains consistent and unbiased. Second, error autocorrelation is checked using specific tests for errors serial correlation like Wooldridge test. The presence of autocorrelation makes pooled OLS estimators without asymptotically efficiency. This issue could be solved by considering robust estimators of variances or efficient estimators based on data re-weighting to consider heteroskedasticity/ autocorrelation. In case of endogeneity, OLS and GLS provide biased and inconsistent estimators. Here, consistency could be ensured even for short periods if instrumental variable estimators (IV) are used.

The endogeneity within the observed variables could be controlled using dynamic or system generalized method of moments (system GMM) (Teixeira and Queirós, 2016). Compared to GMM approach that provides less accurate estimation in case of a short time and high persistence (Blundell and Bond, 1998), the system GMM developed by Arellano and Bover (1995) and Blundell and Bond (1998) overcomes this issue. In case of homoskedasticity, standard IV is selected with relevant instruments that should be correlated with endogenous variables and orthogonal to errors. The validity of the chosen instruments could be checked using the Sargan test. This test is employed under the null hypothesis that all instruments are correctly specified. Another type of test refers to serial correlations in errors (first-order and second-order serial correlation). The first-order autocorrelation does not imply inconsistent estimates (Arellano and Bond, 1991). However, the second-order autocorrelation in errors supposes inconsistent estimates.

The preliminary tests applied to our data confirm the fulfillment of conditions for using the system GMM method: (1) short period of analysis and a large number of cross-sections

(T=9 years and N=138 regions), (2) existence of heteroskedasticity, endogeneity and serial correlation within cross-sections.

The endogeneity was confirmed in all regression models, being also supported by the economic theory and previous studies, with regard to Education, Economic growth and Unemployment.

In this paper, we employed linear dynamic panel-data models based on Arellano–Bover/Blundell–Bond system estimator using GMM as an estimation method, since this type of estimator is recommended for panel data based on short period of analysis and large number of cross-sections. It is an extension of Arellano–Bond estimator for large autoregressive coefficients and a larger variance of the panel effect compared to the dispersion of idiosyncratic error. This consistent GMM estimator is based on few assumptions: independent idiosyncratic errors and no correlation between panel-level effects and the first difference associated with the first observation of the regressand (Blundell et al., 2001). Compared to Arellano–Bond estimator, Arellano–Bover/Blundell–Bond system estimator considers additional moment conditions, the first differences of instrument variables being independent of fixed effects. This allows the use of more instruments that could improve estimation efficiency (Engblom et al., 2015). Even if GMM is used as the estimation method in most of the studies employing dynamic panel data, the method presents few limits related to poor accuracy in simulations and large bias in finite samples. These limits could be overcome by the maximum likelihood estimation method of structural equation models (Williams et al., 2018).

In equation (1), the NEET-youth rate is explained upon endogenous and exogenous variables related to economic and social indicators, education, digital divide and sectoral dynamics:

$$y_{it} = \alpha y_{i,t-1} + \beta X_{it} + \delta Z_{it} + \varepsilon_{it} \quad (1)$$

$$\varepsilon_{it} = u_i + v_{it} \quad (2)$$

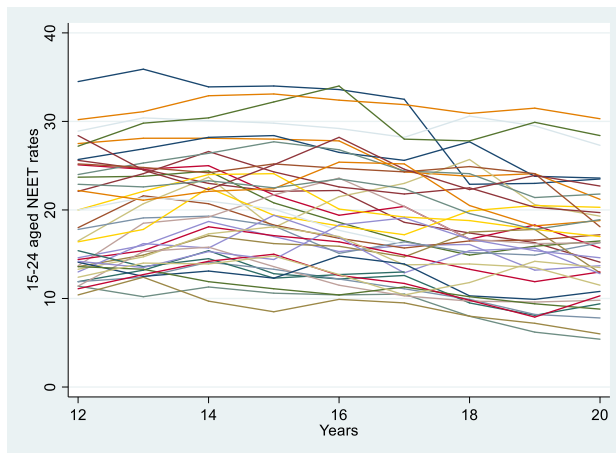
y_{it} , ε_{it} -random variables, X_{it} -vector for exogenous variables, Z_{it} -vector of endogenous variables that is correlated with u_i , β , δ - vectors of coefficients.: u_i fixed effects orthogonal component, v_{it} - idiosyncratic errors.

4. The empirical analysis

The empirical analysis is intended to examine the dynamics of the regional NEET youth rates upon the progress done by regions in closing the digital divide, sectoral evolutions and educational achievements. This approach could shed some light on the role played, at the EU regional level, by digital divide in the improvement of NEETs situation. The digital divide is operationalized here by the Internet usage and Internet usage activities.

The analysis develops into two steps. In the first step, an index of the Internet usage activities, called E-skills index is derived from a set of five indicators. This index allows us, in the second step, to systematically analyse how the digital divide impede the NEET youth (re)integration into labour or education, and how it enhances the effect of other NEETs drivers. The E-skills index is also used to create categories of regions upon their transitions across the index quartiles. This way we can check whether the role played by digital divide in the NEET youth reintegration is influenced by the type of transition (i.e. progress, regress or persistent in lower categories) experienced by regions over time.

In the first part, we derive an index of the internet usage activities using the PCA. The variables entering the model are the Eurostat NUTS2 variables on five Internet activities: submission of completed forms to public authorities, interaction with public authorities, Internet banking, participation in social networks and E-commerce. The measurement scale



In the second step of the empirical analysis, a number of 6 panel regression models are comparatively examined. First, two NEETs indicators are analysed, with and without the impact of digital achievements, and then the analysis is separately undertaken for three relevant transition categories.

All models (1)-(6) in Tab.1-2 have two common findings: the significant autoregressive term and the negative impact of long term unemployment. The positive influence of unemployment on NEETs is well documented in the literature. Bradley, Migali and Paniagua (2020) recently found that adult unemployment is correlated with the NEET rates in Italy, Spain and UK. They explain it by the presence of a discouraged worker effect, which is more pronounced for older youths than it is for teenagers, the latter seeing further education as a more desirable option than dropping out of the labour market. As Bradley, Migali and Paniagua (2020) found in the case of adult unemployment, in our study as well, the effect is stronger for older youths than for teenagers. In addition to unemployment, we find that a higher average number of weekly hours of work is associated with a higher rate of NEET.

Poverty and long term deprivation are found to generate significant but different effects on NEETs. Poor regions have higher rates of 15-24 aged NEETs, while regions characterised by persistent deprivation rates have higher NEETs rates for both 15-24 and 15-29 aged youth. Interestingly, the negative deprivation effect prevails only when omitting the digital divide differences in impact digital across regions, which suggests that bridging the digital divide may act as a barrier against the NEETs increase, even in regions with high rates of chronic deprivation.

In Tab 1, beside unemployment, the impact of educational achievement, digital divide and the most important sectoral growth rates on the two categories of NEETs are comparatively examined, with a focus on the changes induced by the digital divide across models. When comparing Models 2 and 3 we get several interesting differences, such as that the impact of unemployment on NEETs is double for youth aged 15-29 compared with the NEETs aged 15-24. As previously referred to as, this finding is in line with the literature (Bradley, Migali and Paniagua, 2020).

Education and NEETs

According to our expectations, the R&D performed by higher education is found to generate a stronger positive effect for the 15-24 NEETs than for the 15-29 NEETs, because for the former, reintegration in education is easier for younger ages. Although this indicator generally gives insights into the R&D, innovation, ICT and growth, we place it here in the category of education indicators. At regional level, a higher R&D level of expenditure performed by higher education are also indicative of advanced higher education institutions, which are acknowledged as facilitators of regional development widening access to education,

human capital development, and highly skilled labour (OECD, 2007). In this light, the knowledge-intensive regions are able to better address the NEETs problems.

Educational attainments are also examined in relation to NEET-youth. Regions with higher proportions of people graduated from tertiary education tend to have lower rates of both 15-24 and 15-29 aged NEETs. This result is confirmed by the micro level analysis conducted by Bradley, Migali and Paniagua, 2020, who explains it by the greater demand for this category of employees, especially during downturns, and by foreign investors. The same result is confirmed by Orellana et al. (2016) in the case of Ecuador. In addition, we advance another explanation grounded in the literature, i.e. education is an effective tool for protecting people from unemployment. An extensive literature review on this topic is provided by Kromydas (2017) and Pastore, Quintano and Rocca (2021). Cataldo and Rodríguez-Pose (2017) also found that education and innovation contribute to overall employment generation in EU regions. In line with the literature, our study also finds that a higher proportion of people with lower educational attainments (ISCED 0-2) is not significantly related to the NEETs reintegration in labour or education (Models 2 and 3).

Sectoral growth and NEETs

In line with the literature (Blanchflower and Freeman, 2000), the empirical results indicate that the growth rates of employment in certain sectors have the potential to facilitate the labour market integration of NEETs. The positive influence of growth in “Manufacturing” on NEETs is conditioned upon the depth of digital divide (see models 2 and 3, compared to 1 and 4), in contrast with the growth of employment in “Real estate”, which is positive and constant across all models. The “Information” growth is beneficial only for the 15-29 aged NEETs (Model 3), and only when taking into account the digital divide. In turn, the growth of employment in “Administration” has positive implications only for the 15-24 aged NEETs (Models 1 and 2).

Digital divide and NEETs

Digital divide is operationalized here by two indicators of the second order digital divide (Never_internet and E-skills index). Both indicators are found to be significant and to produce positive effects across all models, i.e. while bridging the digital divide, regions are more effective in improving the situation of NEETs youth. This is unsurprising since digital inequality and social inequality reinforce each other, so that policies successfully closing digital divide will also contribute to the decrease of social inequalities and NEETs (Răileanu Szeles and Simionescu, 2020). In our analysis, the E-skills index has a more powerful influence on the NEET rates than the indicator Never_internet, showing that the internet usage activities facilitate to a higher extent the decrease of NEET rates than the basic digital literacy.

The differences between the models encompassing the impact of digital divide and the rest of them (Models (2) and (3) compared to (1) and (4)) reveal new insights about the NEETs determinants. The NEET rates are higher in regions with a higher proportion of the population who have completed primary education (ISED 0-2), but only when also considering the impact of the digital divide. The improvement of E-skills can therefore offset the negative influence of low education. Still in the area of education, the impact of R&D performed by higher education is more significant and stronger when omitting the digital divide (Models (1) and (4)), which could indicate that the regions’ progress toward digitalisation could successfully substitute the R&D performed by higher education in the process of NEETs reintegration. As regards the potential of certain economic activities to absorb a part of NEETs, “Manufacturing” and “Administration” are found to generate a larger impact when not considering the regional differences in the impact of digital divide. The explanation could be that these activities are not so attractive or generous for NEETs in digitally developed regions as they are in lesser developed ones, where, for instance, “Information” provides better opportunities.

Tab1. Explaining the NEETs rates by digital divide, education and sectoral dynamics

Explanatory variables	Model 1 (15-24 ani)	Model 2 (15-24 ani)	Model 3 (15-29 ani)	Model 4 (15-29 ani)
NEETs (Lag)	.51*** (.05)	.46*** (.05)	.40*** (.05)	.46*** (.06)
Economic growth	-.07*** (.03)	-.11** (.4)	-.12*** (.03)	-.09*** (.03)
Unemployment	.15*** (.05)	.25*** (.05)	.48*** (.06)	.32*** (.06)
Weekly hours	.28** (.13)	-.06 (.14)	-.26* (.16)	.18 (.13)
Poverty	.07* (.04)	.07* (.04)	.02 (.04)	.03 (.03)
Deprivation	.04** (.02)	-.01 (.02)	.004 (.02)	.05** (.02)
Education				
Primary Education	.08*** (.01)	-.006 (.02)	-.02 (.02)	.08*** (.01)
Tertiary Education	-.14*** (.02)	-.09*** (.03)	-.11*** (.03)	-.16*** (.02)
GERD_HigherEd	2.95*** (.85)	2.16** (.94)	1.39 (1.11)	1.65** (.86)
Digital divide				
Never_Internet_usage	X	.06*** (.02)	.06*** (.02)	X
E-skills index	X	-.50*** (.16)	-.83*** (.20)	X
Sectoral growth				
Information	.003 (.01)	.01 (.01)	.01*** (.007)	.01 (.01)
Administration	-.02*** (.01)	-.01** (.007)	-.001 (.009)	-.01 (.01)
Constructions	-.007 (.007)	-.01** (.007)	-.02** (.009)	-.01 (.009)
Manufacturing	-.02 (0.2)	-.02** (.01)	-.02*** (.009)	-.03** (.01)
Real estate	-.01*** (.006)	-.01*** (.004)	-.01*** (.005)	-.01** (.005)
Trade	.02 (.02)	.01 (.02)	.01 (.01)	.01 (.02)

Notes. (1) One-step Arellano-Bond robust VCE estimator (system dynamic panel data estimation), (2) The standard errors are reported in brackets; (4) *** p<0.01, ** p<0.05, * p<0.1; (3) 169 regions, 9 years.

Tab.2 summarizes the estimates of three panel regression models, where the 15-24 aged NEET rates are explained upon mostly the same explanatory variables as in Tab1. In contrast with Tab.1, the regression models are separately conducted for three quartiles of the E-skills index. Only the negative (downward) and positive (upward) transitions, as well as the group of regions persisting in the lowest quartile, are selected to be compared.

In the case of positive transition regions, a lower proportion of population who never used the Internet, the R&D activities performed by the business sector, and a lower rate of poverty, along with a lower unemployment (whose impact is positive across all models) and the growth of employment in “Information”, explain together a lower NEET rate. In negative transition regions, the impact of education, the average weekly hours of work, and especially the Internet usage activities add explanatory power over unemployment, sectoral employment growth and the basic digital literacy (Never_internet). Less explanations are associated with Model 6 where economic growth, the employment growth in “Manufacturing”, and GERD_business are the only significant drivers of the NEET reduction.

According to our expectations, the employment growth in “Information” contributes to the reduction of NEET rates in regions experiencing positive transitions over time, while the growth of “Manufacturing” provides opportunities for NEETs only in regions with negative transitions or in those constantly low digital performers.

Tab. 2 Explaining the regional NEET rates upon the quartiles of E-skills index

Explanatory variables	Model 4 - Q2 negative transition	Model 5 - Q3 positive transition	Model 6 - Q1 constantly poor
NEETs (Lag)	.34*** (.06)	.40*** (.16)	.55*** (.08)
GDP growth	.01 (.10)	-.0009 (.09)	-.12** (.06)
Unemployment	.21** (.10)	.27** (.14)	.49*** (.12)
Weekly hours	.46*** (.19)	.42 (.36)	.05 (.35)
Poverty	.08 (.07)	.08* (.04)	.003 (.05)
Education			
Primary Education	.12*** (.04)	.02 (.04)	-.006 (.02)
Tertiary Education	-.08** (.04)	-.03 (.05)	-.007 (.07)
GERD_HigherEd	3.40*** (.77)	-.62 (.91)	-1.24 (3.40)
GERD_Gov	.03 (.72)	.62 (1.26)	4.56 (3.32)
GERD_Business	2.40* (1.44)	-1.48*** (.63)	-3.18*** (1.17)
Digitalisation			
Never_internet	.09*** (.03)	.10** (.05)	.0007 (.03)
E-skills index	-.56* (.34)	-.17 (.38)	.02 (.43)
Sectoral growth			
Information	.005 (.006)	-.08*** (.02)	-.01 (.02)
Manufacturing	-.04** (.02)	.006 (.05)	-.11** (.05)

Notes. (1) One-step Arellano-Bond robust VCE estimator (system dynamic panel data estimation), (2) The standard errors are reported in brackets; (4) *** p<0.01, ** p<0.05, * p<0.1; 3) 169 regions, 9 years.

5. Conclusions

This paper was aimed to examine the role played by regions in the STWT, when the regional development is characterised by economic and social factors, including the educational attainment, digital divide and sectoral growth. The analysis mainly looks at the implications of digital divide on NEETs, by emphasizing different transitions patterns experienced by regions over time with regard to the progress done in bridging the digital divide and improving the E-skills, as well as at the changes in the impact of different other factors on STWT, under the influence of digital divide.

Compared to the existing strand of literature, the paper reveals new insights about the relationship between the region's digital divide and STWT. First, extending the usage of internet activities for more people results in lower NEET-youth rates in comparison with the proportion of population holding basic digital skills, although both are found to be significant drivers of NEETs reintegration. The growth of employment in certain economic activities (e.g. "Information") acts as a catalyst for the STWT and NEET youth reduction, but only when considering the regional differences in the digital divide effects as well. Moreover, at the regional level, the negative impact of a high level of chronic deprivation and of a high proportion of population with low educational attainments are both offset by a low level of regional digital divide. Similarly, higher R&D expenditure performed by higher education are necessary to compensate the effect of the digital divide on the regional NEET-youth rates.

The analysis of the NEET-youth drivers upon the type of transitions that regions experience over time in the process of closing the second order digital divide highlights new empirical evidence. Regions having negative transitions across the E-skills index quartiles, also

have distinct mechanisms and factors explaining the STWT. In their case, the educational attainments, the average number of weekly working hours and the digital divide have explained the NEET-youth reduction. Regions experiencing positive transitions have decreased the NEETs rates especially by the progress done over time in closing the second order digital divide, by increasing the R&D expenditure performed by higher education, and by facilitating the employment growth in “Information”. The lack of significance that most explanatory variables have in the case of regions characterized by persistent high levels of digital divide could be explained by the ineffectiveness of education policy in targeting the NEETs, and also by the lack of progress in improving the level of E-skills in the region. The only resort in their case is the R&D expenditure performed by the business sector.

The results revealed by the analysis conducted upon the transition categories unveil specific aspects. For instance, the R&D expenditure worsens the NEET-youth situation in the negative transition regions, and this apparently strange finding should be correlated to the strong relationship between digital divide and social inequality, whose victims are, *inter alia*, the NEET youth. In addition, the growth of employment in “Information” provides a strong support for the NEETs reduction, but only in regions facing positive transitions.

The policy implications are twofold. First, regions will need to focus more on improving the people’s E-skills, because this regional level achievement will not only generate positive effects for STWT, but will also enhance the positive impact of education and sectoral growth on NEET young people, or even compensate their low progress. Second, in the context of the EU single market, to better address the NEET youth, regions should monitor the relative progress in bridging digital divide and improving E-skills, with respect to the other EU regions. Improving the relative position on the EU map of E-skills increases the effectiveness of regional policies targeting the STWT.

To sum up, the regional digital divide is found to represent not only a significant driver of regional STWT, but also a versatile factor whose dynamic patterns influence the impact of other drivers, such as educational attainment and sectoral growth rates. In this light, closing the digital divide, which represents one of the most important pillars of the European structural and investment funds for the 2021-2027 programming period, should be also set up as priorities in all regional and national development strategies, to ensure a balanced regional development across the EU and to also result in the reintegration of NEET youth in labour and education.

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