What drives employment growth and social inclusion in the regions of the European Union?

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by

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Abstract

The European Union promotes development strategies aimed at producing growth with "a strong emphasis on job creation and poverty reduction". However, whether the economic conditions in place in EU regions are ideal for the generation of high- and low-skilled employment and labour market inclusion is unclear. This paper assesses how the key factors behind EU growth strategies – infrastructure, human capital, innovation, quality of government – condition employment generation and labour market exclusion in European regions. The findings indicate that the dynamics of employment and social exclusion vary depending on the conditions in place in a region. While higher innovation and education contribute to overall employment generation in some regional contexts, low-skilled employment grows the most in regions with a better quality of government. Regional public institutions, together with the endowment of human capital, emerge as the main factors for the reduction of labour market exclusion – particularly in the less developed regions – and the promotion of inclusive employment growth across Europe.

Keywords: social exclusion, employment, skills, regions, Europe.

JEL Classification: R23, J64, O52.

Introduction

The European Union is undertaking an effort to counterbalance the effect of the crisis on unemployment by trying to get people back into work. The Juncker Commission has set up a plan of investments of (estimated) €315 billion over 2015-2017, expected to bring significant support to the areas of Europe with the highest job losses. Employment generation is further targeted by other strategies, such as Europe 2020, aimed at producing inclusive economic growth with "a strong emphasis on job creation and poverty reduction" (European Commission, 2010). However, concerns remain about the 'inclusiveness' of these measures.

The challenge for the promotion of 'inclusive' or 'equitable' growth and cohesion in EU labour markets is double: (a) competition from emerging markets and (b) skilled-biased technological development. These challenges, it is claimed, raise the demand for skilled workers, while threatening the wages and jobs of the unskilled (Atkinson, 2009; 2013) and pose a serious risk for the creation of a more inclusive society. The situation has worsened with the current economic and financial crisis, which has fundamentally hit workers with few formal qualifications and reverted a two-decade-long decline in people at risk of poverty or social exclusion[1] in the EU (European Commission, 2013). According to recent estimates, in 2013 more than 120 million people (1 out of every 4 EU inhabitants) were at risk of poverty and social exclusion (European Commission, 2014).

Strategies such as the Juncker Plan and Europe 2020 have been designed to counter these trends and promote employment by focusing in particular on those in highest need. However, how these policies can lead to inclusive labour markets is still unclear (Bilbao-Osorio et al., 2014). It is uncertain what types of jobs will be generated, what are the optimal conditions for creating more jobs, and who will benefit or lose out from any potential job creation.

The aim of this paper is to investigate the relationship between structural economic factors and regional labour market outcomes by assessing how the elements on which the EU has invested – and plans to invest – the most affect employment generation and social inclusion in European

regions. We focus on the four different axes regarded as key constituents of economic growth: the stock of human capital, research and innovation, infrastructure endowment, and the quality of public institutions.[2]

Each of these axes represents a basic component of the framework in which labour investments take place. A growing body of literature has studied their potential impact on labour market outcomes, yet much less research has concentrated on their contribution to employment generation by skill-type and to social inclusion in the EU regional context. This paper tests the extent to which each development axis has been associated to employment generation and social inclusion in EU regions between 1999 and 2010. The analysis distinguishes employment by skill level, sub-dividing regions by level of economic development. The aim is to identify the conditions that exacerbate or reduce labour market disparities in different economic contexts. Additional light is shed on the dynamics of social exclusion by using long-term unemployment as a proxy for labour market marginalisation while testing for the presence of a long-run effect of economic endowments on labour conditions.

The findings of the analysis stress that the economic factors behind employment growth are not always the same as those conditioning the evolution of social exclusion. As a consequence, targeting job creation and social inclusion goals requires different policy options depending on the specific needs of regions. While in the better-off EU regions innovation capacity contributes to employment growth, the presence of a highly-educated population drives employment in the less developed areas. Quality of regional government also emerges as a fundamental element for the creation of employment for workers with limited skills, particularly in the periphery of Europe. Both human capital and government quality facilitate labour market inclusion: regions with a more qualified workforce and better public institutions have significantly reduced the share of long-term unemployment. The endowment of transport infrastructure is, at best, insignificant for generating regional employment and reducing labour market disparities.

Growth endowments, employment, and social exclusion

What determines employment generation and social exclusion in a region? The factors behind employment and social exclusion are generally the same as those affecting economic growth. In particular, four factors – transport infrastructure, innovation, human capital, and government quality – are regarded as essential for both economic growth and employment. As mentioned earlier, this paper focuses on these four factors over the 1999-2010 period. The link between each of these factors and employment generation and social exclusion, as referred to by the theoretical and empirical literature, is presented below.

Transport infrastructure

There is a growing body of literature making the connection between transport accessibility and changes in the labour pool and in the demand for labour (Seitz and Licht, 1995; Dalenberg and Partridge, 1995; Cohen and Paul, 2004; Jiwattanakulpaisarn et al., 2010). The construction, operation and maintenance of transport infrastructure is also used as a means to create employment (OECD, 2002). Transport infrastructure is considered capable of attracting private investment and generating jobs, through increases in the demand for labour. However, private investment may take place even in absence of transport improvements and higher transport accessibility may displace other economic activities (Venables et al., 2014). Moreover, if improved transport conditions determine increases in firm output in unchanged market-demand conditions, cheaper transport inputs may lead firms to a substitution effect away from the use of labour (Lakshmanan et al., 2001; Vickerman, 2007). Therefore, the evidence on the link between infrastructure and employment remains ambiguous.

Transport is also seen as essential in determining social outcomes (Banister and Hall, 1981). Individuals facing transport-related constraints, such as limited mobility, inaccessibility to goods and services and 'lock-out' from planning and decision-making processes may end up socially

excluded (Lucas, 2012). However, transport disadvantage does not always lead to social solution and areas with good transport have pockets of socially excluded individuals (Kenyon et al., 2002; Currie and Delbosc, 2010; Lucas, 2012). Similarly, low levels of accessibility may correspond to high social inclusion (Preston and Raje, 2007). Whether improvements in transport increase or reduce social exclusion depends on how changes in the system affect the generalised costs of travel for those at risk. In general, if transport services are far away from where the socially excluded live, the costs (i.e. the psychologically weighted sum of travel times) increase and the probability of participation in society of vulnerable groups is reduced (Schönfelder and Axhausen, 2003).

Innovation

The effect of technological development on employment growth and social inclusion is equally controversial. A long-standing debate has addressed the labour implications of innovation. Economic theory generally predicts that the short-term effect of new technologies is a reduction of employment. In the medium/long-run, however, the market would counterbalance the effect, producing increases in labour demand. This mechanism of compensation, however, is subject to a set of conditions that must be in place for it to work (e.g. Vivarelli, 2014). The picture is further complicated by the 'skill-biased technological change' hypothesis (Griliches, 1979), which stresses that the introduction of new technologies favour the creation of high-skilled employment. Hence, in presence of skill-biased innovation, unskilled unemployment increases.

The empirical evidence on the link between innovation and employment is mixed. Most analyses support a positive impact of innovation on employment generation (e.g. Van Reenen, 1997; Greenan and Guellec, 2000; Bogliacino et al., 2011). The skill-biased technological change concept also goes in this direction (Berman et al., 1994; Machin and Van Reenen, 1998), although some research suggests a more complex relationship, depending on the level of skills available in a territory (e.g. Piva and Vivarelli, 2002; Autor et al., 2003). Evidence from developing countries

indicates that the presence of institutional barriers makes employment creation from technological development less likely to occur (Vivarelli, 2014).

Technological development and innovation can also solve social problems and favour pro-poor employment, but this link is far from automatic (Cozzens et al., 2007; Alzugaray et al., 2012). The development of knowledge economies has at times implied income and social inequalities, with more technologically advanced regions and more qualified workers advantaged at the expense of poorer areas and less skilled individuals. Lee and Rodríguez-Pose (2013), for instance, find that innovation capacity leads to higher labour market inequalities. Only if research and innovation are adequately tailored to the needs of end-users, such as disadvantaged local communities and marginalised workers, their impact on social cohesion can become positive (Cozzens et al., 2007).

Human capital

Different views also exist on whether employment and social exclusion are influenced by human capital and education. The dominant view is that the stock of human capital has both direct and indirect effects on employment. The direct effects stem from the greater employability of workers with higher human capital in markets that demand skills, as in the European case. The indirect effects are related to the positive externalities human capital generates. Highly-educated individuals attract other human capital (Berry and Glaeser, 2005) and this external effect produces an increase in employment, especially in areas endowed with higher shares of highly-skilled (Glaeser et al., 1995; Simon, 1998).

Education also fosters participation in the labour market and social mobility for the poorest in society. Winters (2013) finds that human capital concentration determines higher employment, through increases in labour market participation. This is particularly true for less-skilled workers. Additional external effects of higher education rates are decreases in criminal activity (Lochner and

Moretti, 2004) and increases in civic participation (Milligan et al., 2004) and quality of life (Shapiro, 2006). All of these externalities facilitate labour market inclusion.

By contrast, opponents of the human capital model believe that labour market participation and individual earnings depend more on the personal ability and less on educational attainments (see Sparkes, 1999).

Government quality

Finally, social exclusion and employment outcomes are influenced by institutional quality. Strengthening institutional and administrative capacity, reducing the administrative burden, and improving the quality of legislation can have beneficial effects on labour demand, wages, and employment (Knack, 1999).

Well-functioning institutions are regarded as a precondition for the promotion of effective social development policies, in line with Europe 2020 goals (European Commission, 2015). Lack of accountability and corruption distort resource allocation, incentivising investment in capital-intensive projects at the expense of social expenditure (Gupta et al., 2002). Good governance additionally contributes to social welfare in cases where governments are more trustworthy, impartial, and less corrupt (Rothstein et al., 2012). Government quality is also positively related to welfare spending (Rothstein et al., 2012) and helps reduce income inequalities (Knack, 1999). While most empirical analyses on the role of institutions are performed at the national level, social spending increasingly depends on regional governments and their quality (Deacon et al., 2007). Government quality may also indirectly affect labour market participation through access to sanitation and health care or schooling. The socially excluded have less access to public services and good government may facilitate a more equal delivery of such services (Lewis, 2006).

Research on employment generation in EU regions

The dynamics of employment and unemployment in Europe have been analysed in a large number of studies. Less research, however, has been carried out at the regional level. Regions are nevertheless important, both because in the multi-level governance framework of the EU labour market policy has traditionally been decentralised (Scarpetta, 1996) and because an increasing share of economic resources are devoted generating employment in regions of Europe, through cohesion intervention, European and national employment schemes, and other European, national, and local policies.

The main interest of research on employment in EU regions has been to test convergence theories and assess how change in economic structure and sectoral specialisation affects regional employment (e.g. Martin and Tyler, 2000; Marelli, 2004), or to link unemployment to increasing regional polarisation (Martin and Tyler, 2000; Overman and Puga, 2002; Cosci and Sabato, 2007). The determinants of long-term unemployment in European regions have, by contrast, attracted much less attention (e.g. Bornhorst and Commander, 2006; Perugini and Signorelli, 2007). There is no research making a connection between unemployment and existing economic development conditions of the kind analysed in this paper. Similarly, there is no evidence about how labour market determinants affect employment at different levels of skill composition: high-skilled vs. low-skilled employment. Consequently, we know little about how vulnerable workers with low levels of education and training are conditioned by structural economic and labour market factors. Despite a growing interest on the study of social cohesion in the EU (e.g. Atkinson et al., 2002; Atkinson, 2009), the analysis of which policy measures are more effective for the promotion of inclusive regional employment remains underexplored.

Our work examines how the four different development axes associated with European regional intervention affect employment promotion in EU regions and contribute to social inclusion/exclusion, long-term unemployment, and to change in labour market disparities. In order

to test the effect of growth determinants on labour market outcomes, we develop empirical models of employment and long-term unemployment change, including traditional labour market determinants as controls. The most often used set of explanatory factors for explaining change in employment concerns regional industrial structure (e.g. Martin and Tyler, 2000). Other works have explained differences in employment growth intensity by looking at labour market governance and institutions (Dunford, 1995; Nickell and Layard, 1999; Perugini and Signorelli, 2007; Huber, 2013), such as differences in unionisation rates and unemployment benefits. These factors are however generally set nationally (Nickell et al., 2005). The existing literature has also devoted great attention to Okun's (1970) law: i.e. the relationship between the change in employment/unemployment and GDP growth. Okun considered the direction of causality as running from (un)employment to economic growth, however most estimates of the Okun coefficient look at the inverse relationship (Prachowny 1993). Finally, some empirical models (e.g. Perugini and Signorelli, 2007) are completed by other variables describing the structure of the regional labour market (labour market flexibility, the proportion of self-employed or of employees).

Employment, unemployment, and social exclusion: key facts

Over the past 15 years the composition of EU employment has changed significantly. One of the most striking changes has occurred in the share of employed people with high- versus low-skills. As shown in the left-hand graph of Figure 1, in 1999 less than two in ten workers held a higher education degree. By 2012 the proportion had increased by 50%, to about three in ten.[3] Low-skilled employment has followed an opposing trend: starting from a relatively high value in 1999 (over 30% of the total workforce holding less than primary/lower secondary level of education degree), in 2012 only 20% of those in employment had left school without formal qualifications. Overall, employment in the EU has followed a strong upskilling process.

However, the change in the composition of employment has been associated with an important variation in unemployment by skills-type (European Commission, 2013). Unemployment for medium-skilled and high-skilled changed only marginally from 1999 onwards. Jobs for the low-skilled, by contrast, have declined, causing unemployment rates for this group to shoot up from 12% (2001) to 18% (2012) (right-hand graph, Figure 1). Simultaneously, the percentage of long-term unemployed as share of total unemployment remained stable until 2006, dropped to its lowest level in 2009[4] and then started to rise until 2012 (Figure A1 in the Appendix).

[Figure 1]

Figure 2 illustrates the geographical distribution of long-term unemployment[5] in EU regions. The highest long-term unemployment is found in Southern Italy, Eastern Germany, and Eastern Europe, particularly in Slovakia. While all regions of the Mezzogiorno (Southern Italy) and many regions of Germany managed to reduce the proportion of long-term unemployed between 1999 and 2012, in Eastern Europe only some regions of Poland, Romania, and Hungary, have seen long-term unemployment decrease. The share of the long-term unemployed has risen in Northern Italy, Northeastern France, Ireland, Central and Eastern Spain, and the UK. The crisis has aggravated the long-lasting skills mismatch by expanding the pool of highly educated workers driven towards less skilled jobs, consequently displacing the low-skilled into long-term unemployment (Livanos and Núñez, 2012).

[Figure 2]

Long-term and low-skilled unemployed represent those at a higher risk of marginalisation and persistent exclusion. Low-skilled workers are more likely to become long-term unemployed when losing their jobs (European Commission, 2013) and long periods of inactivity lead to skill loss (Pissarides, 1992; Ljungqvist and Sargent, 1998). Therefore, the recent growth in long-term unemployment is related to the increase in low-skilled unemployment. Especially since the beginning of the crisis, the share of people at risk of poverty and social exclusion has continued to

rise, making European targets on poverty and social exclusion difficult to meet (European Commission, 2013; Frazier and Marlier, 2013). Similar trajectories are visible in other areas, such as jobless households and the proportion of people facing material deprivation (Social Protection Committee, 2013). Put together, these trends suggest increases in the number of people requiring welfare support. The challenge for the EU thus goes beyond bringing unemployment back to the pre-crisis levels, and includes unwinding the cumulative social effects determined by the rise in long-term unemployment. In order to identify what policies are needed to revert these trends and to recognise the areas at a higher risk, it is necessary to first understand what are the factors behind change in social exclusion in Europe.

A first descriptive picture is derived from plotting the regional data on people at risk of poverty or social exclusion from Eurostat Regio, available from 2005 to 2012 for a limited number of EU regions.[6] The top quadrants of Figure 3 show that economic growth and employment creation are associated with a reduction in social exclusion during this period. De-composing employment growth into high-skilled and low-skilled adds nuance to the social exclusion picture. The relationship between changes in low-skilled employment and in social exclusion is negative and significant, suggesting that employment conditions for the poorest have improved in regions witnessing the lowest reduction in low-skilled employment (Figure 3, bottom left quadrant). Increases in high-skilled employment, instead, are not associated with a reduction in people at risk of poverty or social exclusion (Figure 3, bottom right quadrant). We investigate more thoroughly the determinants of change in social exclusion in the next section.

[Figure 3]

Empirical analysis – models and data

This section aims to identify the local endowments (human capital, innovation, infrastructure, quality of government) contributing to the generation of employment, high-skilled employment, low-skilled employment, and to the reduction of long-term unemployment. The models are based

on dynamic responses of labour market variables to static economic conditions. They allow assessing the employment/unemployment long-term performance of different EU regions on the basis of their specific structural characteristics.

Two versions of the models are estimated. The first employs classic panel techniques – fixed effects and random effects – while the second is structured as a dynamic panel AR(1) model, minimising endogeneity issues by employing Generalised Method of Moments (GMM) techniques.

The models, for region *i* at time *t*, are as follows:

$$\Delta L_{i,t} = \beta\ growth\ factors_{i,t} + \gamma\ \Delta \log GDP\ p/c_{\ i,t} + \ \delta\ X_{i,t} + \varphi_i + \tau_t\ +\ \varepsilon_{i,t} \quad (1)$$

$$\Delta LTU_{i,t} = \beta\ growth\ factors_{i,t} + \gamma\ \Delta \log GDP\ p/c_{\ i,t} + \ \delta\ X_{i,t} + \varphi_i + \tau_t\ +\ \varepsilon_{i,t} \quad (2)$$

And:

$$\Delta L_{i,t} = \alpha\ L_{i,t-1} + \beta\ growth\ factors_{i,t} + \gamma\ \Delta \log GDP\ p/c_{\ i,t} + \ \delta\ X_{i,t} + \varphi_i + \tau_t\ +\ \varepsilon_{i,t} \quad (3)$$

$$\Delta LTU_{i,t} = \alpha\ LTU_{i,t-1} + \beta\ growth\ factors_{i,t} + \gamma\ \Delta \log GDP\ p/c_{\ i,t} + \ \delta\ X_{i,t} + \varphi_i + \tau_t\ +\ \varepsilon_{i,t} \quad (4)$$

Where $\Delta L_{i,t}$ is divided into $\Delta tL_{i,t}$, $\Delta hsL_{i,t}$ and $\Delta lsL_{i,t}$, meaning that, in total, four dependent variables are considered.

$\Delta tL_{i,t}$ is the annual change in employment as a share of regional population, a proxy for total employment generation.

$\Delta hsL_{i,t}$ and $\Delta lsL_{i,t}$ are respectively: the annual change of those in employment with tertiary level of education (ISCED 5-6) as a share of the regional population, a proxy for the generation of jobs for workers with high qualifications; and the annual change of those employed with less than primary/lower secondary level of education (ISCED 0-2), as a share of the regional population, a proxy for the variation low-skilled employment. An increase in low-skilled employment is assumed

to correspond to a more inclusive labour market and to a decrease in the proportion of the regional population facing poverty or social exclusion;

$\Delta\, LTU_{i,t}$ is the annual change of long-term unemployment. As discussed above, a long period of unemployment often results in the marginalisation of workers and in skills loss and demotivation. The longer the duration of unemployment, the greater the risk of social exclusion, understood as the inability to afford material goods, services and housing, combined with the reduction of social contacts (European Commission, 2010). Long-term unemployment is used by the EU as one of its basic indicator of labour market exclusion (Atkinson et al., 2002). However, this indicator suffers a profound one-off shock in 2009 as a result of the crisis which is likely to affect the viability of the econometric analysis. We therefore resort to the use of long-term unemployment as a percentage of total unemployment – the 'incidence' of long-term unemployment, according to the European Commission (2014) – as our main long-term unemployment proxy. We test the robustness of the results by using the long-term unemployment rate as an alternative dependent variable in the GMM models.

$L_{i,t-1}$ and $LTU_{i,t-1}$ are the lagged levels of employment and long-term unemployment, respectively.

The four growth determinants are measured as follows:

Human capital stock: percentage of total students in higher education (ISCED levels 5-6). This variable differs from the usual educational attainment proxy for human capital – the proportion of employed people holding university degrees (Nehru et al., 1993) – which cannot be used, as it is the dependent variable in one of the models. The drawback of using university students is that not all graduates will contribute to increase the stock of highly-qualified employable individuals in a region, as graduates are highly mobile (Docquier and Marfouk, 2006). Human capital proxies based on school enrolment (ratio between individuals of school age and students enrolled in educational institutions) are widely used in national level analyses (e.g. Barro, 1991). We therefore assume that

a strong correlation exists between the capacity of a region to attract university students and the accumulation of talented individuals.

Innovation capacity: patent applications per million inhabitants in the region, available until 2010. Patents are an imperfect proxy for innovative performance (Griliches, 1990), as not all inventions are patented and patenting propensity differs across sectors. Nonetheless, for want of better alternatives, this is the most frequently used variable (Acs et al., 2002), including the majority of studies assessing innovation performance at the regional level in the EU (e.g. Bottazzi and Peri, 2003).

Transport infrastructure stock: kilometres of roads per squared kilometre. This is a widespread measure of transport infrastructure density[7] (e.g. Crescenzi and Rodríguez-Pose, 2012; Del Bo and Florio, 2012). This variable is chosen over other available transport proxies (km of motorways only or of railways) because it gives a better representation of the transport network in a region.

Quality of government institutions: EU Quality of Government (QoG) Index, calculated as a combination of the Regional QoG (RQoG) index developed by the QoG Institute of the University of Gothenburg and the World Bank Global Governance Indicators (WBGI). This variable was produced by Charron et al. (2014) by extending the 2010 RQoG over time using the national variation of the WBGI.[8] The index has already been widely employed as a proxy for regional institutions (e.g. Rodríguez-Pose and Di Cataldo, 2015; Rodríguez-Pose and Garcilazo, 2015).

The model is completed by a set of control variables selected on the basis of existing empirical works analysing employment and unemployment determinants.

First, following Perugini and Signorelli (2007), we account for Okun's law and for the economic cycle by controlling for the natural logarithm of the annual change of regional per capita GDP. A positive correlation with employment generation and a negative association with long-term unemployment change are expected.

$X_{i,t}$ represents a vector of 7 labour market variables. To control for labour market institutions, the model includes union density, available at the national level. While there are a variety of views about how unions shape labour market outcomes, the dominant position suggests that unions increase the wages of the unskilled (Faini, 1999; Koeniger et al., 2007), but are associated with higher unemployment (Nickell, 1997). Following the majority of analyses looking at the evolution of employment in EU regions, the models control for industrial structure (e.g. Martin and Tyler, 2000; Marelli et al., 2012), by including the share of employment in agriculture and fisheries and industry.[9] Finally, models on regional unemployment normally consider a number of characteristics of the labour force structure. Perugini and Signorelli (2007) include the share of employees and part-time workers – the latter as a proxy for labour flexibility. Our initial full specification also counted the share of self-employed; however, the Variance Inflation Factor (VIF) test indicated that this variable is collinear with the share of employees, leading to its removal[10] (see Appendix A4). The percentage of unemployed in long-term unemployment is included in models 1 and 3. $\Delta\, hsL_{i,t}$ and $\Delta\, lsL_{i,t}$, are used as additional control variables. φ_i and τ_t represent region and time dummies, respectively.

All dependent and independent variables and their sources are presented in Table A1 in the appendix. Table A2 reports the variables' descriptive statistics and Table A3 displays the correlation among the variables of interest.

The analysis considers all EU regions for which data are available and comprises a panel of 168 NUTS1 and NUTS2 regions[11] from 18 countries for the 1999-2010 period.

For all regressions, standard errors are clustered at NUTS level (NUTS1 or NUTS2 depending on the geographical level at which variables are measured).

Empirical analysis – results

Employment generation

The first three models focus on employment generation. In these models the four growth determinants – human capital, innovation, infrastructure, and government quality – are linked to annual change in employment to identify what drives job creation in EU regions. The increase of high-skilled employment has different social implications with respect to changes in low-skilled employment. While the former is a process following the structural transformation of the EU labour market, the latter is closely connected with social inclusion trends. For this reason, the results of the model assessing the effect of growth factors on low-skilled employment are interpreted as an indication of how labour market inclusion may be affected by the specific conditions of a region.

The results of model (1) are displayed in Tables 1, 2, 3. We begin with a parsimonious specification including change in per capita GDP as the only control variable and excluding region dummies in a random effects (RE) model (columns 1, 6, 11). The fixed effects (FE) version of this specification is shown in columns 2, 7, 12, where we test for systematic differences between the two models with a Hausman test. Columns 3, 8, 13 report the results with labour market controls, while columns 4, 9, 14 add change in high- and low-skilled employment as additional controls. In all of these cases, the Hausman test reports a systematic difference in the variables' coefficients and we only report the preferred fixed effects results. Finally, the results of the GMM[12] version of the model are depicted in columns 5, 10, 15. In all GMM estimations, first-order lags are excluded as instruments. The Hansen test for over-identifying restrictions reports a p-value indicating that instruments as a group are exogenous.

In the case of change in total employment, the first specification – without region dummies – shows that employment rose in regions with a higher stock of human capital and good government institutions. Transport infrastructure endowment is negatively and marginally significantly correlated with employment growth. The inclusion of fixed effects does not alter the significance of

human capital, while innovative capacity becomes positive and significant, and government quality is no longer significant. These results remain unchanged when labour market controls are included. However, the coefficient of innovation is again insignificant when endogeneity is addressed in the GMM-sys model. Therefore, the main finding of this model is that a larger share of highly-educated population has favoured employment generation in EU regions, a result that can be explained by the upskilling process in the composition of employment. The coefficient of human capital in FE and GMM models corresponds to the effect of a 1% increase in the percentage of tertiary educated individuals on employment growth – ranging from 0.06 to 0.1 percentage points. These figures are high, as the average employment growth over the period has been 0.002 (see Table A2), i.e. 0.2% per year.

Regarding our control variables, an increase in per capita GDP is positively correlated with employment generation, in line with Okun's law. The only significant labour market variables are the share of people in manufacturing (positively associated with employment creation in the GMM estimate) and the share of unemployed being long-term unemployed, taking the expected negative coefficient in the GMM model.[13] Both high-skilled and low-skilled employment generation are positively associated with employment growth, with low-skilled employment displaying a slightly larger coefficient. In sum, the more successful regions in job generation are those with more talented individuals. This result is consistent with the fact that in the European 'knowledge economy' the 'winners' have been regions investing in skills and making a better use of the available human resources to maintain the competitiveness of their local labour market.

[Table 1]

Switching to the variation of those in employment holding higher education degrees as the dependent variable, the first specification (column 6) indicates that high-skilled employment has grown more in regions with a skilled workforce and with more efficient public institutions. However, government quality is no longer significant in the fixed effects estimation. The sign and

significance of human capital is, by contrast, robust to the inclusion of fixed effects and of other controls. High-skilled employment increased more in regions with a highly-educated population. The coefficients, although lower than those in Table 1, remain within the range 0.04 to 0.06 percentage points increases of the annual high-skilled employment growth rate. This provides evidence that EU regions feature self-reinforcing spatial concentrations of human capital, i.e. high-skilled jobs increase where skills are already clustered. The inclusion of region dummies uncovers a negative effect on high-skilled employment growth in regions where transport infrastructure is more developed. However, the coefficient is insignificant in the GMM model. Innovation capacity, marginally significant in the RE model, turns positive but insignificant with region fixed effects. Regarding the controls, a larger share of long-term unemployed has a negative effect on high-skilled jobs creation (column 10), while the only labour market variable remaining significant across specifications is manufacturing employment. A further indication that low-skilled and high-skilled employment are following opposing trends: EU regions where the former has grown the most are those where the latter has increased the least.

[Table 2]

In the third version of model (1) the dependent variable is change in low-skilled employment. Regions experiencing more significant increases (or less pronounced decreases) in employment of less-qualified workers are those with poverty and social exclusion problems.

The relationship between local factors and low-skilled employment generation differs from the specifications describing the dynamics of total employment and high-skilled employment. Unlike in previous versions of the model, the positive and significant coefficient of government quality is robust to the inclusion of all control variables and to changes in estimation method. Regions with higher government quality have more successfully tackled declines in employment for the low-skilled. The coefficients, when controls are included, indicate that a one point increase in the QoG Index is associated with a 0.13 to 0.15 percent increase in low-skilled employment. To put these

figures in perspective, between 1999 and 2010 EU regions experienced an average 0.3% annual decrease in low-skilled jobs (Table A2). However, increasing the regional QoG Index by one point is far from easy, as government institutions evolve slowly over time.

Of the other economic growth determinants, only human capital displays a significant coefficient, which becomes insignificant in the GMM model. Of the control variables, regional GDP growth is positive and significant in all specifications, while a higher share of workers is negatively associated with low-skilled employment generation. New jobs for the low-skilled have been created in regions with higher shares of industrial employment, indicating that the association between manufacturing employment and job creation of column 5 mainly relates to low-skilled jobs. Agricultural employment is associated with lower high-skilled employment change in the GMM estimation. The coefficient of union density is negative and significant in column 15, meaning that a strong presence of trade unions is not enough to stem the low-skilled job haemorrhage. An increase in high-skilled employment is connected with a decrease in low-skilled employment. The labour market upskilling process works at the expense of individuals with fewer opportunities to adapt to new professions, who are pushed out of employment by overqualified workers.

The results of the analysis also confirm a strong relationship linking government quality and corruption with social spending, inequality, and poverty (Mauro, 1998; Gupta et al., 2002; Rothstein, 2011). Hence, efficient public institutions provide greater support for disadvantaged workers, by, for example, setting up effective labour market re-insertion schemes targeting those in highest need, delivering effective public policies, or curbing corruption.

[Table 3]

Do these results vary depending on the level of development of EU regions? To address this question, we sub-divide the full sample into core and peripheral regions according to the European Commission classification for the 2007-2013 programming period. Peripheral regions are those with a per capita GDP below 75% of the EU average and receiving larger shares of Structural

Funds. Core regions are all remaining regions. The three versions of models (1) and (3) are estimated for the sub-samples of core and peripheral regions both with FE and GMM methods.[14]

The results are presented in Table A5 in the Appendix. Columns 16 to 19 refer to the model analysing the determinants of total employment generation. The estimates indicate that the key finding of Table 1 – human capital endowment as a driver of employment growth – applies particularly to less developed regions, while in richer regions employment has grown the most in more technologically advanced and innovative areas. The positive correlation between the stock of highly qualified individuals and high-skilled employment generation of Table 2 is principally driven by the most developed regions (Table A5). The human capital coefficient in columns 20 and 21 (core regions) is positive and significant and displays a larger magnitude relative to columns 22 and 23 (peripheral regions). Government quality also has a different effect on low-skilled employment generation in core and less developed regions. The positive effect of government institutions on the creation of jobs for the less skilled is mainly driven by the less developed subset (columns 26 and 27), rather than by core regions (columns 24 and 25). While the coefficient of government institutions is positive across all specifications, its magnitude and significance are higher in less developed regions. Hence, higher regional government quality makes a difference for the promotion of labour market inclusion particularly in poorer areas, where the welfare system and social infrastructures are less developed and efficient. Boosting employment of different skill-types in peripheral regions also has beneficial effects for job creation across the entire labour pool, as low-skilled employment change is associated with high-skilled employment increase, and vice versa (columns 23 and 27).

Social exclusion

Models (2) and (4) describe the relationship between different growth determinants and the evolution of long-term unemployment over the 1999-2010 period. Long-term unemployment is

recognised by the European Commission as an indicator of labour market exclusion. Some countries have even set long-term unemployment targets in order to comply with the Europe 2020 social inclusion objective.[15] Therefore, the results of these models can be seen as a description of the dynamics of social exclusion in EU regions.

The results are shown in Table 4. The model is estimated with the change in the share of unemployed being long-term unemployed as dependent variables and RE, FE and GMM methodologies (columns 28-32). To test the robustness of the results, the GMM model is replicated with the change in the long-term unemployment rate as dependent variable (column 33).

In all different specifications and with both long-term unemployment proxies, human capital and government quality display significant and negative coefficients. Long-term unemployment is lower in regions with a more educated population, possibly because of the employability of skilled workers. The finding confirms that, as suggested by the European Commission (2013), education is a major factor for avoiding long-term unemployment and limiting social exclusion. A one percent increase in the proportion of those with tertiary education reduces the share of the unemployed being long-term unemployed by 0.7 percentage points (column 32). High government quality also reduces long-term unemployment, further supporting the main results of the model with low-skilled employment as dependent variable. Regions with effective and accountable governments, efficient rule of law, and low corruption have been more able to establish measures to control long-term unemployment and social exclusion than regions with a weaker government quality. The coefficients of the QoG index range from -0.8 to -1.2 in columns 30-32. Hence, a one-point increase in the index makes long-term unemployment decline by up to 1.2 percent per year. An extension of model (4) demonstrates that this effect is persistent and increases over time (Appendix A6). Consequently, while improving institutional conditions is a difficult task, it is highly rewarding in terms of reducing social exclusion.

Reverting the persistent unemployment trends in Europe thus requires targeted measures to reform local labour markets, developed by effective government institutions. These may include labour supply (i.e. improving the employability of those out of work; promoting the upward mobility for those in employment) and demand-side measures (e.g. equal opportunity policies; encouraging social integration) (Gordon, 2006). Long-term unemployment and social exclusion are not affected by the extensiveness of regional transport networks, while the GMM model with long-term unemployment rate as dependent variable displays a positive and significant association between innovation capacity and long-term unemployment change. Labour market exclusion has grown the most in regions with more developed innovation structures. The positive correlation between patents and social exclusion supports the idea that technological development affects most the less qualified workers, acting as a driver of labour market inequalities in Europe (Lee and Rodriguez-Pose, 2013).

Turning to the control variables, as predicted by Okun's law, there is a negative relationship between GDP growth and long-term unemployment. Long-term unemployment decreases as regional output increases and appears conditioned by the regional industrial structure. It has grown more in rural regions and less in manufacturing regions. However, the negative coefficient of industrial employment turns insignificant in the GMM models. Similarly, the positive link between the share of employees and long-term unemployment is no longer evident when endogeneity is minimised with the GMM. The specifications including change in high-skilled and low-skilled employment as regressors show that they both are connected with long-term unemployment reduction.

[Table 4]

Conclusions and policy implications

In the coming years the EU will spend vast resources to revamp its economy and generate job opportunities in its depressed labour market. The funds will be invested in the hope of developing

not just more competitive, but also more inclusive economies. In this paper we have examined the extent to which the pillars of the new growth strategies have indeed contributed to past employment generation and social inclusion in European regions. We identified four types of local economic factors (infrastructure, human capital, innovation, government quality) and tested whether these elements are linked to regional employment growth, labour market disparities, and social exclusion.

Over the past 15 years, the EU workforce has become both more specialised and more prone to risks of labour market exclusion. Our empirical findings suggest that the two elements that have been associated with faster employment growth are a relatively higher endowment of highly-skilled workers, mostly in less developed regions, and a stronger regional innovative performance, particularly in more advanced regions. Human capital has been at the heart of new job creation for the most skilled. A better capacity to absorb new workers, however, has not necessarily implied a decrease in the number of disadvantaged workers. The proportion of individuals in poverty or at risk of social exclusion has increased sharply since 2009. More inclusive societies will thus require the promotion of better opportunities for the low-skilled and the long-term unemployed.

In this respect, the results of the analysis indicate that regions with good and efficient governments have reduced labour market marginalisation and stemmed the loss of low-skilled jobs. This is particularly true for the less developed regions of Europe, generally characterised by lower economic capacity and government quality. Unlike short-term unemployed and highly educated workers, whose job opportunities are less affected by recessions (Oreopoulos et al., 2012), low-skilled workers face a strong risk of permanent exclusion. Other things equal, a more favourable institutional environment can make the difference in ensuring that public policies facilitate job-market re-entry.

The empirical analysis also demonstrates that a good human capital base is vital to reduce long-term unemployment. Upward mobility schemes or the matching of educational achievement to local job requirements can help in this respect (Nativel, 2002; Gordon, 2006). In order to better match labour

supply and demand, education and training programmes should reflect the need for skills to a greater extent than they do now (Cedefop, 2015). Strengthening networks between schools and universities, on the one hand, and the business environment, on the other, would contribute to addressing the skill mismatch. These interventions should be combined with measures targeting specifically those out of work (Gordon, 2006), such as employability programmes or policy initiatives generating new jobs for which the low-skilled have a comparative advantage.

More broadly, EU regions need to define comprehensive labour market strategies involving the largest possible number of stakeholders and dealing with wide-ranging issues, including the upskilling of the unemployed and socially excluded, the creation of vocational training programmes, and addressing skill mismatch problems (Cedefop, 2015). This general set of recommendations should be adapted to the needs and priorities of each specific context.

While some of these measures are already included in EU programmes targeting employment and social exclusion, the financial resources allocated to this target may require revision to tackle low-skilled unemployment and social exclusion more effectively (Frazier and Marlier, 2013). The €315 billion investment package approved by the Juncker Commission represents an important step in this direction, depending on how the allocation of funding addresses the roots of the problem.

This study has demonstrated that not all areas of regional intervention affect labour market conditions in the same way. The generation of employment and the process of labour upskilling depend on different economic factors than the dynamics of long-term unemployment and social inclusion. The regional endowment of human capital is a positive element for growth, employment promotion and social inclusion, but it is unlikely that education investments alone will suffice to fulfil the inclusion objectives of the Europe 2020 strategy. Especially in disadvantaged regions, characterised by weak governments and higher corruption, education policies should be coupled with institutional reforms, as good governance is essential to put the socially excluded back in the

employment track. The presence of adequate government institutions is a prerequisite for the success of any labour market policy.

Interventions in this direction may help the regions worst affected by the economic crisis to adapt to the changes underway in the European labour market. The EU is facing the complex challenges of recovering from the worst recession in almost a century, while reaffirming its pivotal position in the global economy. While the most qualified workers may be sufficiently equipped to compete globally, the low-skilled are those whose employment opportunities are most threatened. The formulation of policies sensitive to the needs of the weakest workers would help to ensure the participation in the labour market of those in the workforce facing the higher risk of marginalisation, lightening the burden on the European welfare systems, and reducing economic and social disparities in Europe.

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Endnotes

1. Social exclusion is a broad concept involving factors that may leave specific groups in society vulnerable. These include unemployment, lack of access to education, to childcare and to healthcare facilities, inadequate living conditions, and scarce social participation. In this study we focus particularly on labour market exclusion.

2. For each of these elements, a large body of empirical research has examined their effect on economic growth in the EU regional context. See e.g. Rodríguez-Pose and Vilalta-Bufí (2005), OECD (2009) for human capital; Fagerberg et al. (1997), Bottazzi and Peri (2003), Crescenzi and Rodríguez-Pose (2011) for innovation; Moreno et al. (1997), Crescenzi and Rodríguez-Pose (2012) for infrastructure; and Crescenzi et al. (2016) for institutions.

3. In this paper we use the definitions of levels of education adopted by the EU Labour Force Survey (LFS), which are based on UNESCO's International Standard Classification of Education (ISCED).

4. While the share of unemployed being long-term unemployed reached the lowest level in 2009, the long-term unemployment rate, as a result of the crisis, grew considerably in that very year. Hence, the long-term unemployment rate reflects to a greater extent the immediate shock of the crisis than the share of unemployed being long-term unemployed. Since 2009, however, both variables have co-evolved in a similar way, rising moderately between 2009-2012. Both indicators are correlated at 75% during the period of analysis, Because of the one-off shock provoked by the crisis in the long-term unemployment rate, we have preferred to use the share of unemployed being

long-term unemployed as an indicator that is less affected by the immediate short-term shock linked to the beginning of the crisis. In any case, in order to assess the robustness of the results, we resort to the long-term unemployment rate as an alternative to the share of unemployed being long-term unemployed in the GMM analysis presented in Table 4. The results of using either social exclusion variable in the dynamic panel analysis are virtually unchanged.

5. Long-term unemployed are defined by Eurostat as those individuals unemployed for 12 months or more. Unemployment refers to the population of jobseekers aged 15 to 74 who are available to start work within the next two weeks and who have actively sought employment at some time during the last four weeks.

6. The variable is available at the regional level only for Austria, Belgium, Czech Republic, Italy, Ireland, Spain, Romania, Sweden, and Slovakia.

7. Using a different normalisation, e.g. kilometres of roads divided by thousand inhabitants, leaves our econometric results essentially unaltered (regression results available upon request).

8. More details on the methodology used to combine the Regional Quality of Government Index with the World Bank Governance Indicators can be found in Charron et al. (2014).

9. Eurostat provides data on regional employment in the primary, secondary, and tertiary sector. The three variables are collinear when included simultaneously in the model. We therefore choose primary and secondary sector employment (excluding services) for reasons of data availability.

10. The share of employees has been selected over the share of self-employed because the former variable has more observations.

11. In our choice of geographical level for regions, we follow Crescenzi and Rodriguez-Pose (2012) and Crescenzi et al. (2016) in selecting the regional units by country which are more meaningful in terms of institutional and governance features. This implies NUTS2 regions for Austria, Czech Republic, Finland, France, Hungary, Ireland, Italy, the Netherlands, Poland, Romania, Slovakia, Slovenia, Spain, and Sweden. NUTS1 are used for Belgium, Germany, and the UK.

12. We opt for GMM-system (Arellano and Bover, 1995; Blundell and Bond, 1998) over GMM-difference because the lagged levels of our variables are likely to be weak instruments for first-differences of endogenous variables. Instruments are collapsed in order to avoid issues of instrument 'proliferation' (Roodman, 2009). As the Arellano-Bond autoregressive test reports first-order lags as endogenous, they are excluded as instruments. Alternative versions of GMM estimations demonstrate that the results are not sensitive to the introduction of further restrictions on the set of instruments used, for example by excluding lower-order time lags (regression tables available upon request).

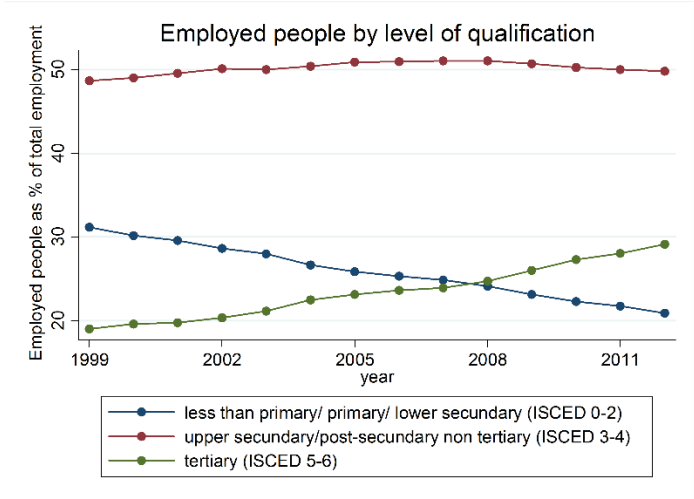
13. Models (1) and (3) are also estimated using the long-term unemployment rate as control variable instead of the share of unemployed being long-term unemployed. All the main results remain unchanged. The long-term unemployment rate is negative and significantly correlated with employment growth. These regression results are available upon request.

14. As this empirical test is performed on reduced samples, in order to keep the number of instruments in the GMM model close to the number of groups (Roodman, 2009), only second to

sixth-order lags in the estimations for core regions and second to fifth-order lags in the estimations for peripheral regions are considered.

15. Germany has committed to a reduction in long-term unemployment of 320,000 individuals; Sweden has pledged to reduce long-term unemployment and long-term sick leave by 14% (http://ec.europa.eu/europe2020/pdf/targets_en.pdf).

Figure 1


Employed people by level of qualification
Employed people as % of total employment
20
30
40
50
1999
2002
2005
2008
2011
year
less than primary/ primary/ lower secundary (ISCED 0-2)
upper secundary/post-secundary non tertiary (ISCED 3-4)
tertiary (ISCED 5-6)

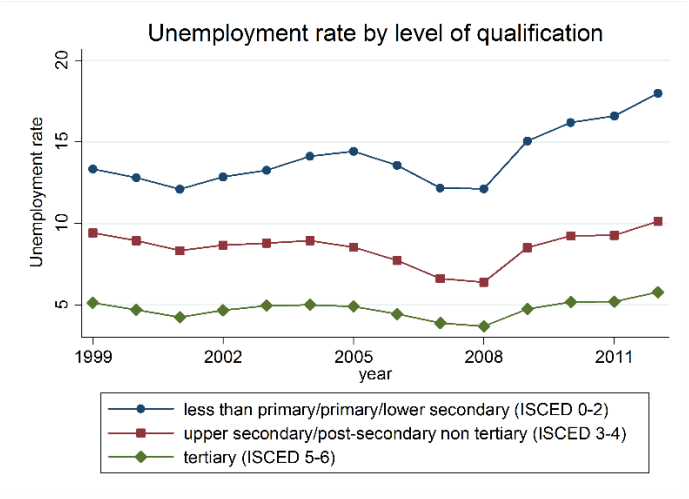
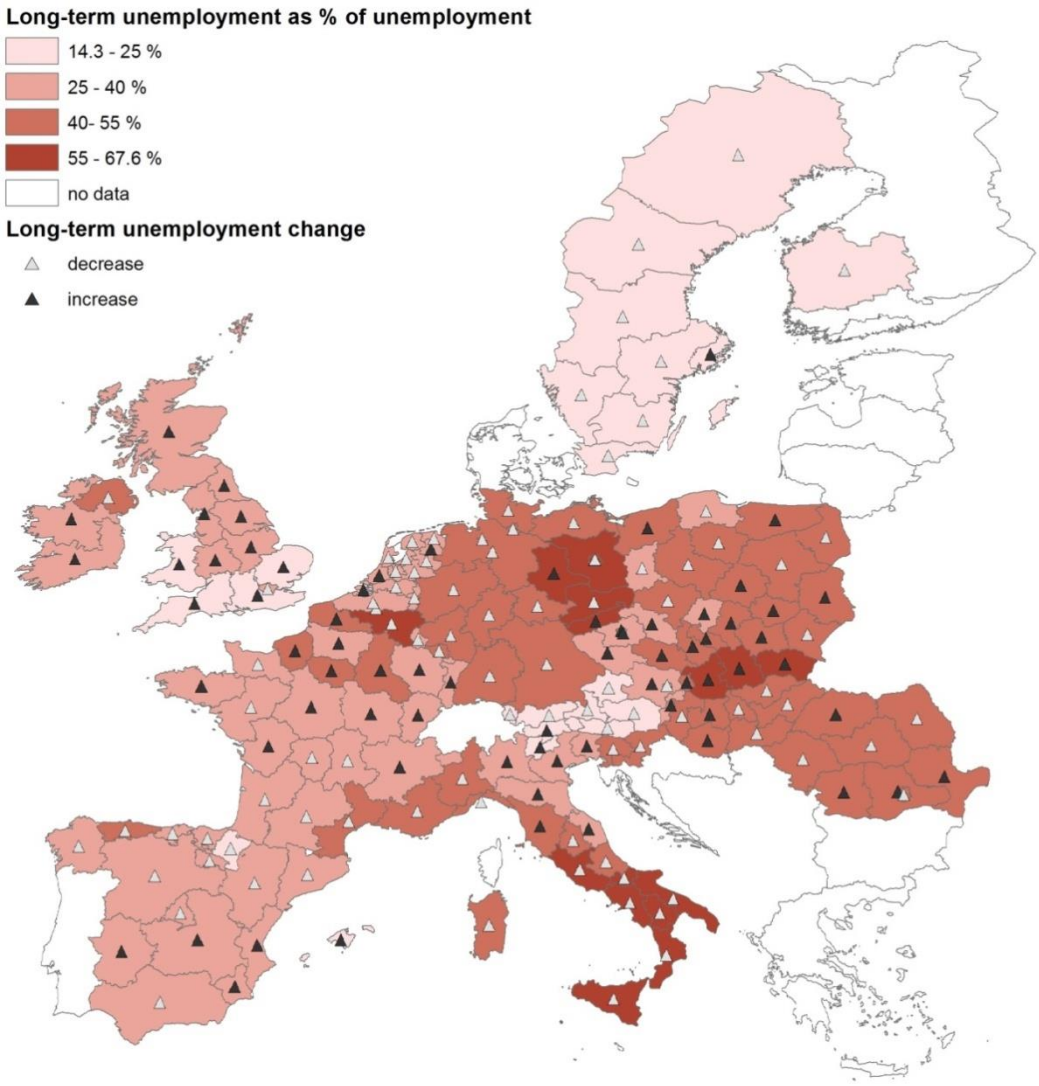
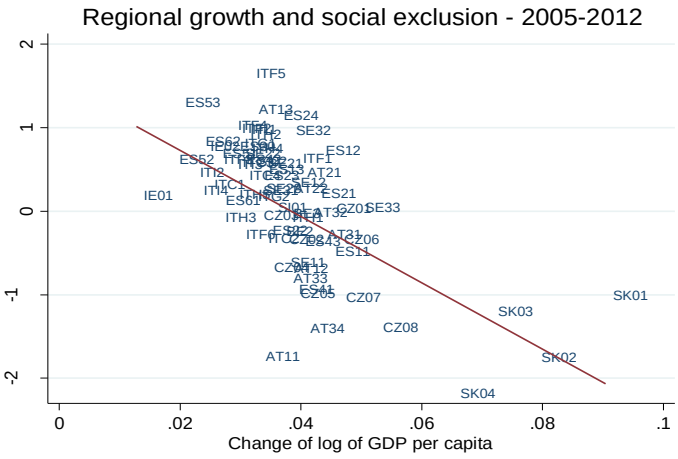

Unemployment rate by level of qualification
Unemployment rate
5
10
15
20
1999
2002
2005
2008
2011
year
less than primary/primary/lower secondary (ISCED 0-2)
upper secondary/post-secondary non tertiary (ISCED 3-4)
tertiary (ISCED 5-6)

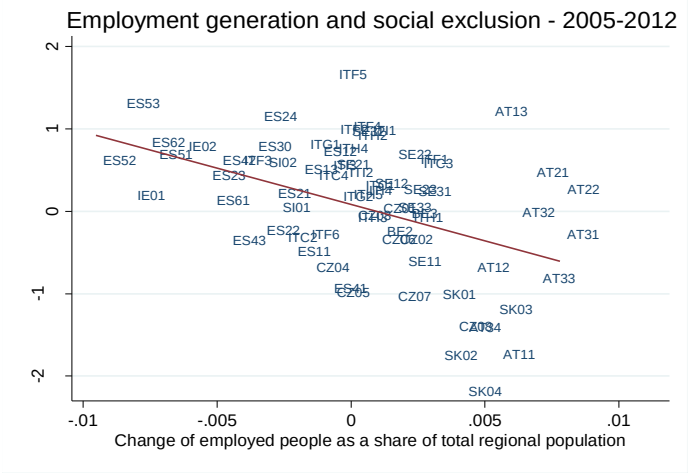
Figure 2
Long term-unemployment level and change in EU regions (1999-2012 average)

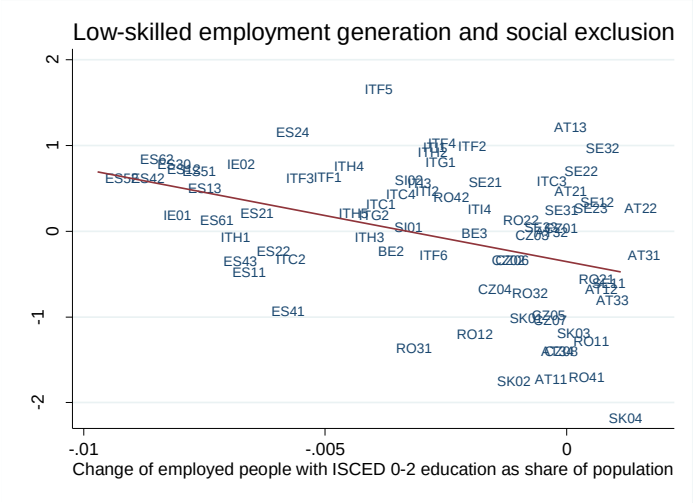


Source: own elaboration with Eurostat data.

Figure 3


Regional growth and social exclusion - 2005-2012
Change of log of GDP per capita


Employment generation and social exclusion - 2005-2012
Change of employed people as a share of total regional population


Low-skilled employment generation and social exclusion
Change of employed people with ISCED 0-2 education as share of population

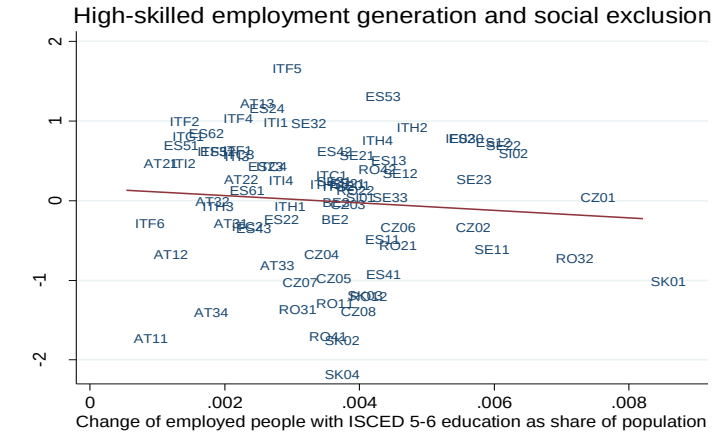

High-skilled employment generation and social exclusion
Change of employed people with ISCED 5-6 education as share of population

Table 1
Employment change and growth determinants

Dep. Variable:	Change in employment				
	RE	FE	FE	FE	GMM
	(1)	(2)	(3)	(4)	(5)
Human capital	0.000135***	0.000950***	0.00103***	0.000556***	0.000719**
	(4.44e-05)	(0.000233)	(0.000244)	(0.000188)	(0.000294)
Innovation	-2.97e-06	3.04e-05**	3.08e-05**	2.16e-05**	1.96e-05
	(2.29e-06)	(1.34e-05)	(1.24e-05)	(1.05e-05)	(1.51e-05)
Transport infrastructure	-0.000222*	-0.00278	-0.00308	-0.000916	-0.00144
	(0.000127)	(0.00190)	(0.00217)	(0.00182)	(0.00139)
Government quality	0.000772***	0.00206*	0.000539	-0.000708	0.000900
	(0.000177)	(0.00126)	(0.00132)	(0.00107)	(0.000892)
Change of log of per capita GDP	0.0218**	0.0425***	0.0775***	0.0367***	0.0179
	(0.0104)	(0.0109)	(0.0136)	(0.00982)	(0.0177)
Union density			2.83e-05	0.000117	0.000134
			(0.000248)	(0.000194)	(0.000124)
Share of employees			-0.00760	0.00834	0.0301
			(0.0244)	(0.0214)	(0.0242)
Share of part-time workers			-0.0165	-0.00906	0.0172
			(0.0252)	(0.0220)	(0.0211)
Share of unemployed people being long-term unemployed			8.26e-05*	9.49e-05**	-0.000140**
			(4.68e-05)	(4.28e-05)	(6.53e-05)
Share of people employed in the primary sector			-0.0189	-0.0335	-0.0243
			(0.0416)	(0.0322)	(0.0378)
Share of people employed in the industry sector			0.0186	0.0202	0.0553*
			(0.0261)	(0.0207)	(0.0317)
Change in high-skilled employment				0.635***	0.421***
				(0.0716)	(0.143)
Change in low-skilled employment				0.750***	0.646***
				(0.0644)	(0.102)
Lagged employment change					-0.152***
					(0.0372)
Year dummies	✓	✓	✓	✓	✓
Region dummies		✓	✓	✓	
Observations	1,742	1,742	1,593	1,593	1,593
R-squared	0.189	0.201	0.253	0.466	
EU regions	168	168	157	157	157
Hausman FE/RE ($p>\chi^2$)		55.1 (0.000)	38.7 (0.010)	34.4 (0.044)	
Instruments					151
AR(1) test (p-value)					-7.56 (0.000)
AR(2) test (p-value)					-1.19 (0.235)
AR(3) test (p-value)					-0.56 (0.575)
AR(4) test (p-value)					-0.05 (0.962)
Hansen test (p-value)					147.2 (0.096)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Table 2
High-skilled employment change and growth determinants

Dep. Variable:	Change in high-skilled employment				
	RE	FE	FE	FE	GMM
	(6)	(7)	(8)	(9)	(10)
Human capital	0.000118***	0.000347**	0.000567***	0.000592***	0.000503***
	(2.19e-05)	(0.000137)	(9.94e-05)	(9.93e-05)	(0.000175)
Innovation	-3.88e-06*	1.24e-05	6.39e-06	7.50e-06	1.80e-05*
	(1.98e-06)	(1.10e-05)	(8.34e-06)	(8.05e-06)	(1.01e-05)
Transport infrastructure	0.000135	-0.00321***	-0.00325***	-0.00327***	-0.00101
	(0.000111)	(0.000744)	(0.000993)	(0.00108)	(0.00120)
Government quality	0.000278***	0.000553	0.000173	0.000417	0.000389
	(7.47e-05)	(0.000404)	(0.000512)	(0.000515)	(0.000662)
Change of log of per capita GDP	0.0112***	0.00985**	0.0216***	0.0274***	0.0346***
	(0.00377)	(0.00458)	(0.00590)	(0.00607)	(0.0118)
Union density			-0.000119	-0.000122	-6.26e-05
			(9.29e-05)	(9.27e-05)	(8.80e-05)
Share of employees			0.0125	0.00739	0.00529
			(0.0132)	(0.0124)	(0.0204)
Share of part-time workers			0.00681	0.00429	-0.0143
			(0.0101)	(0.00964)	(0.0128)
Share of unemployed people being long-term unemployed			1.81e-05	1.30e-05	-0.000107**
			(2.44e-05)	(2.44e-05)	(4.29e-05)
Share of people employed in the primary sector			-0.0319**	-0.0244	-0.0169
			(0.0160)	(0.0155)	(0.0224)
Share of people employed in the industry sector			-0.0471***	-0.0410***	-0.0894***
			(0.0110)	(0.0109)	(0.0230)
Change in low-skilled employment				-0.161***	-0.0464
				(0.0305)	(0.0524)
Lagged high-skilled employment					-0.130***
					(0.0356)
Year dummies	✓	✓	✓	✓	✓
Region dummies		✓	✓	✓	
Observations	1,720	1,720	1,593	1,593	1,593
R-squared	0.037	0.044	0.074	0.103	
EU regions	166	166	157	157	157
Hausman FE/RE ($p>\chi^2$)		13.3 (0.582)	41.3 (0.005)	41.7 (0.007)	
Instruments					141
AR(1) test (p-value)					-7.51 (0.000)
AR(2) test (p-value)					-0.93 (0.352)
AR(3) test (p-value)					-0.67 (0.503)
AR(4) test (p-value)					-1.08 (0.281)
Hansen test (p-value)					129.2 (0.208)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Table 3
Low-skilled employment change and growth determinants

Dep. Variable:	Change in low-skilled employment				
	RE	FE	FE	FE	GMM
	(11)	(12)	(13)	(14)	(15)
Human capital	7.13e-05***	0.000350***	0.000154	0.000265**	4.86e-05
	(2.35e-05)	(0.000105)	(0.000113)	(0.000115)	(0.000132)
Innovation	1.37e-06	2.12e-06	6.90e-06	8.15e-06	1.03e-06
	(1.53e-06)	(8.66e-06)	(8.51e-06)	(8.17e-06)	(9.25e-06)
Transport infrastructure	2.50e-05	-3.60e-06	-0.000142	-0.000781	-0.000198
	(7.19e-05)	(0.00123)	(0.00113)	(0.00122)	(0.000712)
Government quality	0.000327***	0.00224***	0.00152**	0.00155***	0.00130**
	(0.000118)	(0.000517)	(0.000597)	(0.000592)	(0.000507)
Change of log of per capita GDP	0.00666	0.0166***	0.0360***	0.0403***	0.0608***
	(0.00619)	(0.00636)	(0.00694)	(0.00711)	(0.0129)
Union density			-1.73e-05	-4.08e-05	-0.000122*
			(9.90e-05)	(9.97e-05)	(6.50e-05)
Share of employees			-0.0318*	-0.0294*	-0.0637***
			(0.0170)	(0.0161)	(0.0154)
Share of part-time workers			-0.0157	-0.0143	0.0152
			(0.0121)	(0.0116)	(0.0110)
Share of unemployed people being long-term unemployed			-3.19e-05	-2.83e-05	4.27e-05
			(2.56e-05)	(2.58e-05)	(3.75e-05)
Share of people employed in the primary sector			0.0465**	0.0402*	-0.0598***
			(0.0221)	(0.0219)	(0.0204)
Share of people employed in the industry sector			0.0377***	0.0284**	0.00197
			(0.0137)	(0.0137)	(0.0167)
Change in high-skilled employment				-0.197***	-0.0199
				(0.0361)	(0.0819)
Lagged low-skilled employment					-0.0560***
					(0.0137)
Year dummies	✓	✓	✓	✓	✓
Region dummies		✓	✓	✓	
Observations	1,742	1,742	1,593	1,593	1,593
R-squared	0.072	0.083	0.129	0.156	
EU regions	168	168	157	157	157
Hausman FE/RE ($p>\chi^2$)		32.7 (0.005)	51.3 (0.000)	50.1 (0.000)	
Instruments					141
AR(1) test (p-value)					-7.59 (0.000)
AR(2) test (p-value)					-1.01 (0.312)
AR(3) test (p-value)					0.85 (0.395)
AR(4) test (p-value)					-0.07 (0.948)
Hansen test (p-value)					130.8 (0.181)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Table 4
Long-term unemployment change and growth determinants (1999-2010)

Dep. Variable:	Change in unemployed people being long-term unemployed					Change in long-term unemployment rate
	RE	FE	FE	FE	GMM	GMM
	(28)	(29)	(30)	(31)	(32)	(33)
Human capital	-0.0943***	-0.636***	-0.550***	-0.501***	-0.734***	-0.180***
	(0.0183)	(0.0800)	(0.0987)	(0.0972)	(0.188)	(0.0418)
Innovation	0.00130	0.00585	0.00106	0.00213	0.000318	0.00535**
	(0.000951)	(0.00507)	(0.00557)	(0.00527)	(0.0115)	(0.00228)
Transport infrastructure	0.0315	0.000802	0.379	0.169	0.393	0.155
	(0.0376)	(1.306)	(1.382)	(1.407)	(1.358)	(0.227)
Government quality	-0.116**	-1.497***	-0.933**	-0.817*	-1.175**	-0.264**
	(0.0587)	(0.391)	(0.444)	(0.432)	(0.618)	(0.126)
Change of log of per capita GDP	-13.70***	-14.84***	-17.28***	-13.22**	-30.44***	-4.597***
	(3.818)	(4.822)	(5.879)	(5.879)	(10.16)	(1.625)
Union density			-0.0159	-0.0225	0.0629	0.0134
			(0.0951)	(0.0939)	(0.0736)	(0.0132)
Share of employees			29.75**	27.97**	13.83	-2.705
			(13.76)	(13.60)	(27.07)	(4.184)
Share of part-time workers			7.430	6.414	32.95*	-0.443
			(9.636)	(9.271)	(17.50)	(3.596)
Share of people employed in the primary sector			75.44***	76.62***	80.78***	8.623**
			(18.71)	(18.47)	(25.30)	(4.272)
Share of people employed in the industry sector			-27.41**	-27.49**	17.21	-3.237
			(11.94)	(11.91)	(24.42)	(5.181)
Change in high-skilled employment				-62.34**	-110.8	-36.25***
				(27.23)	(71.36)	(12.31)
Change in low-skilled employment				-78.01***	-61.05	-10.81
				(23.71)	(44.22)	(7.062)
Lagged unemployed people being LTU					-0.188***	

					(0.0479)	
Lagged LTU rate						-0.192*** (0.0342)
Year dummies	✓	✓	✓	✓	✓	✓
Region dummies		✓	✓	✓		
Observations	1,686	1,686	1,588	1,588	1,588	1,538
R-squared	0.189	0.218	0.219	0.228		
EU regions	164	164	156	156	156	151
Hausman FE/RE ($p>\chi^2$)		65.6 (0.000)	83.2 (0.000)	75.1 (0.000)		
Instruments					140	140
AR(1) test (p-value)					-8.28 (0.000)	-5.70 (0.000)
AR(2) test (p-value)					3.16 (0.002)	1.02 (0.309)
AR(3) test (p-value)					-1.06 (0.287)	-0.53 (0.594)
AR(4) test (p-value)					0.44 (0.658)	-0.64 (0.524)
Hansen test (p-value)					130.2 (0.174)	132.5 (0.141)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second-order and higher order lags used as instruments.

Figure A1

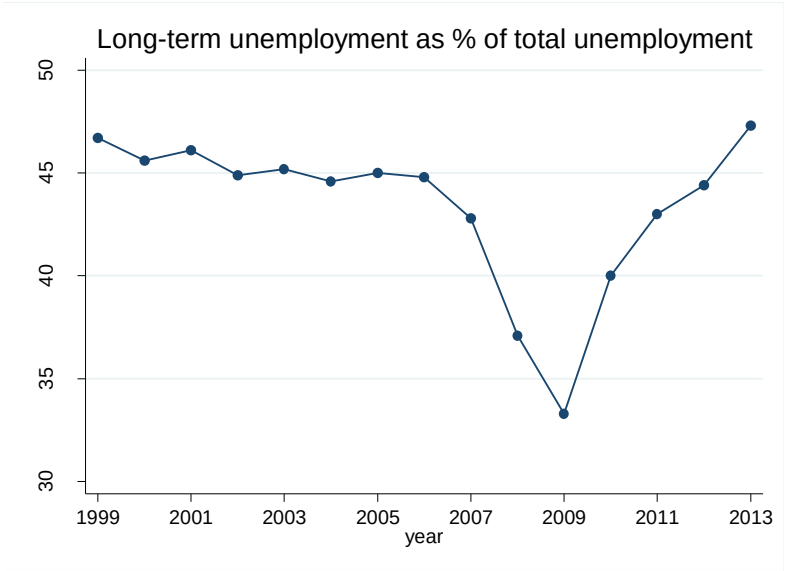

Long-term unemployment as % of total unemployment
50
45
40
35
30
1999
2001
2003
2005
2007
2009
2011
2013
year

Table A1 Description of the variables

Variable	Source	Definition
Dependent variables		
Change in employment	Eurostat - LFS	Annual change of total employed people (aged 15 or over) divided by total regional population.
Change in high-skilled employment	Eurostat - LFS	Annual change of the percentage of employed people (aged 15 or over) with completed higher education (first and second stage of tertiary education - ISCED-97 levels 5 and 6) divided by total regional population.
Change in low-skilled employment	Eurostat - LFS	Annual change of the percentage of employed people (aged 15 or over) with less than primary, primary and lower secondary level of education (ISCED-97 levels 0, 1 and 2) divided by total regional population.
Change in unemployed people being long-term unemployed	Eurostat - LFS	Annual change of long-term unemployment (12 months or more) as percentage of total unemployment.
Change in long-term unemployment rate	Eurostat - LFS	Annual change of long-term unemployment (12 months or more) divided by economically active population..
Growth determinants		
Human capital	Eurostat	Students at ISCED-97 levels 5-6 as percentage of all pupils and students aged 15-24 at regional level.
Innovation	Eurostat	Patent applications to the EPO per million of regional inhabitants.
Transport infrastructure	Eurostat	Kilometres of motor-roads divided by squared kilometres of regional land.
Government quality	QoG Institute - WBGI	Regional Quality of Government (QoG) Index elaborated by the QoG Institute at the University of Gothenburg, a survey-based index constructed around three main pillars: quality of education, public health care and law enforcement; impartiality in education, public health and legal protection; level of corruption in education, health care and the legal system. The index has been combined with the World Bank Governance Indicators to extend it to the 1999–2010 period (Charron et al., 2014).
Control for Okun's law		
Change of log of per capita GDP	OECD	Annual change of natural logarithm of regional Gross Domestic Product divided by regional population.
Labour market controls		
Union density	OECD - ILOSTAT	Trade union density, calculated as the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. National level variable, all regions of a country are assigned the same value.
Share of employees	Eurostat - LFS	Number of employees divided by total regional employment.
Share of part-time workers	Eurostat - LFS	Number of part-time workers divided by total regional employment.
Share of self-employed	Eurostat - LFS	Number of self-employed workers divided by total regional employment.
Share of people employed in the primary sector	Eurostat - LFS	Number of people employed in NACE categories A (Agriculture, forestry and fishing) and B (Mining and quarrying) divided by total regional population.

Share of people employed in the industry sector	Eurostat - LFS	Number of people employed in NACE categories C (Manufacturing), D (Electricity, gas, steam and air conditioning supply), E (Construction) and F (Water supply; sewerage, waste management and remediation activities) divided by total regional population.

Table A2 Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Dependent variables					
Change in employment	1890	0.0018	0.013	-0.072	0.073
Change in high-skilled employment	1898	0.0035	0.007	-0.036	0.052
Change in high-skilled employment	1898	-0.0029	0.008	-0.058	0.099
Change in unemployed being LTU	1821	-0.397	6.27	-26.5	23.9
Change in LTU rate	1764	0.058	1.08	-7	5.2
Lagged dependent variables					
Lagged employment	1898	0.429	0.057	0.155	0.560
Lagged high-skilled employment	1898	0.096	0.041	0.025	0.228
Lagged high-skilled employment	1898	0.115	0.068	0.009	0.457
Lagged unemployed being LTU	1827	39.04	14.06	8.80	83.20
Lagged LTU rate	1772	3.862	3.187	0.40	18.10
Growth determinants					
Human capital (share of university students)	1950	15.46	6.568	0.9	61.4
Innovation (patent applications per million inhabitants)	2092	69.93	94.41	0.018	1045.7
Transport infrastructure (roads per squared km)	1956	1.373	1.474	0.071	11.67
Government quality (QoG Index)	2088	6.992	1.989	0	10
Okun's law					
Change of log of per capita GDP	1898	0.044	0.047	-0.220	0.376
Labour market controls					
Union density	1966	25.416	15.663	7.54	80.63
Share of employees	2064	0.822	0.086	0.389	0.961
Share of part-time workers	2063	0.167	0.106	0.009	0.544
Share of self-employed	2060	0.155	0.062	0.037	0.389
Long-term unemployment as share of unemployment	1992	38.95	13.81	8.8	83.2
Share of people employed in the primary sector	2064	0.071	0.086	0.001	0.612
Share of people employed in the industry sector	2062	0.281	0.073	0.092	0.477

Table A3 Correlations

	$\Delta\, tL_{i,t}$	$\Delta\, hsL_{i,t}$	$\Delta\, lsL_{i,t}$	$\Delta\, U\ being\ LTU_{i,t}$	$\Delta\, LTU\ rate_{i,t}$	$\Delta \log GDP\ p/c_{\ i,t}$	$HK_{i,t}$	$Innovation_{i,t}$	$Infra_{i,t}$	$QoG_{i,t}$
$\Delta\, tL_{i,t}$	1									
$\Delta\, hsL_{i,t}$	0.308*	1								
$\Delta\, lsL_{i,t}$	0.501*	-0.135*	1							
$\Delta\, U\ being\ LTU_{i,t}$	-0.184*	-0.082*	-0.106*	1						
$\Delta\, LTU\ rate_{i,t}$	-0.454*	-0.121*	-0.237*	0.643*	1					
$\Delta \log GDP\ p/c_{\ i,t}$	0.225*	0.067*	0.115*	-0.050*	-0.025*	1				
$HK_{i,t}$	0.016	0.104*	0.027	-0.082*	-0.073*	0.055*	1			
$Innovation_{i,t}$	0.034	-0.021	0.056*	-0.002	0.015	-0.115*	0.031	1		
$Infra_{i,t}$	-0.011	0.036	0.021	0.003	0.026	-0.075*	0.056*	0.147*	1	
$QoG_{i,t}$	0.085*	0.016	0.060*	-0.006	-0.042	-0.222*	0.252*	0.478*	0.172*	1

Note: * p<0.05

Table A4 VIF tests

VIF test on model (1) as specified in column (4)

With both the share of employees and the share of self-employed as controls

Variable	VIF	1/VIF
Change in high-skilled employment	1.12	0.89
Change in low-skilled employment	1.18	0.85
Change of log of per capita GDP	2.02	0.49
Union density	1.32	0.76
Share of employees	66.1	0.02
Share of part-time workers	2.89	0.35
Share of self-employed	54.2	0.02
Share of unemployed people being long-term unemployed	1.6	0.63
Share of people employed in the primary sector	3.65	0.27
Share of people employed in the industry sector	1.82	0.55
Government quality	3.34	0.30
Human capital	1.39	0.72
Innovation	1.61	0.62
Transport infrastructure	1.34	0.75
Year		
2001	2.12	0.47
2002	2.23	0.45
2003	2.36	0.42
2004	2.22	0.45
2005	2.25	0.44
2006	2.24	0.45
2007	2.27	0.44
2008	2.43	0.41
2009	3.12	0.32
2010	2.32	0.43
Mean VIF	6.97	

Without the share of self-employed as control

Variable	VIF	1/VIF
Change in high-skilled employment	1.12	0.89
Change in low-skilled employment	1.17	0.85
Change of log of per capita GDP	2.02	0.49
Union density	1.31	0.76
Share of employees	2.75	0.36
Share of part-time workers	2.89	0.35
Share of unemployed people being long-term unemployed	1.6	0.63
Share of people employed in the primary sector	2.15	0.47
Share of people employed in the industry sector	1.82	0.55
Government quality	3.33	0.30
Human capital	1.38	0.72
Innovation	1.59	0.63
Transport infrastructure	1.33	0.75
year		
2001	2.12	0.47
2002	2.23	0.45
2003	2.35	0.43
2004	2.2	0.45
2005	2.23	0.45
2006	2.21	0.45
2007	2.24	0.45
2008	2.4	0.42
2009	3.08	0.32
2010	2.27	0.44
Mean VIF	2.08	

Table A5 Employment generation in core and peripheral regions (1999-2010)

Dep. Variable:	Change in employment				Change in high-skilled employment				Change in low-skilled employment			
	Core		Periphery		Core		Periphery		Core		Periphery	
	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM	FE	GMM
	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
Human capital	-9.13e-05	0.000518	0.00117***	0.00104*	0.000588***	0.000586**	0.000347*	0.000151	0.000119	-4.34e-05	0.000266	-0.000173
	(0.000177)	(0.000422)	(0.000384)	(0.000563)	(0.000143)	(0.000286)	(0.000177)	(0.000216)	(0.000148)	(0.000281)	(0.000201)	(0.000300)
Innovation	2.23e-05**	4.38e-05**	-0.000101	-5.84e-05	4.79e-06	9.23e-06	3.99e-05	7.68e-05	5.33e-06	1.31e-05	1.60e-05	-3.87e-05
	(9.84e-06)	(1.88e-05)	(6.17e-05)	(7.57e-05)	(8.53e-06)	(1.19e-05)	(3.91e-05)	(5.21e-05)	(7.90e-06)	(1.15e-05)	(3.36e-05)	(3.90e-05)
Transport infrastructure	-2.69e-05	-0.00162	-0.0461**	-0.00347	-0.00375***	-0.00180	-0.00132	0.000960	-0.00187	-0.000884	0.00684	-0.000825
	(0.00193)	(0.00251)	(0.0186)	(0.00591)	(0.00129)	(0.00237)	(0.00679)	(0.00194)	(0.00124)	(0.00160)	(0.00888)	(0.00183)
Government quality	-7.70e-05	0.00102	0.00487**	0.00176	0.000317	0.000104	-0.000398	-0.000436	0.000953	2.42e-07	0.00331**	0.00209***
	(0.00122)	(0.00131)	(0.00231)	(0.00128)	(0.000656)	(0.00105)	(0.00114)	(0.000841)	(0.000763)	(0.000764)	(0.00130)	(0.000702)
Change of log of per capita GDP	0.00998	-0.0351	0.0555***	0.0932***	0.0254***	0.0741***	0.0285***	0.0338**	0.0411***	0.0737***	0.0305***	0.00454
	(0.0105)	(0.0326)	(0.0143)	(0.0343)	(0.00904)	(0.0226)	(0.00766)	(0.0163)	(0.00984)	(0.0222)	(0.00883)	(0.0146)
Change in high-skilled employment	0.559***	0.270**	0.966***	0.923**					-0.246***	-0.194**	0.0314	0.313**
	(0.0792)	(0.123)	(0.162)	(0.378)					(0.0403)	(0.0867)	(0.0692)	(0.134)
Change in low-skilled employment	0.689***	0.753***	0.861***	0.570**	-0.206***	-0.269***	0.0229	0.195*				
	(0.0638)	(0.163)	(0.185)	(0.238)	(0.0333)	(0.101)	(0.0491)	(0.108)				
Lagged employment		-0.254***		-0.131***								
		(0.0765)		(0.0480)								
Lagged high-skilled employment						-0.0513		-0.107**				
						(0.0470)		(0.0444)				
Lagged low-skilled employment										-0.0997***		-0.0292
										(0.0334)		(0.0204)
Labour market controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Region dummies	✓		✓		✓		✓		✓		✓	
Observations	1,106	1,106	476	476	1,106	1,106	476	476	1,106	1,106	476	476
R-squared	0.482		0.532		0.120		0.145		0.174		0.185	
EU regions	106	106	50	50	106	106	50	50	106	106	50	50
Instruments		89		76		83		71		83		71
AR(1) test (p-value)		-5.65 (0.000)		-4.00 (0.000)		-6.64 (0.000)		-4.42 (0.000)		-6.89 (0.000)		-3.79 (0.000)
AR(2) test (p-value)		-1.54 (0.124)		-1.82 (0.068)		-1.28 (0.199)		-1.03 (0.304)		-0.74 (0.462)		-2.43 (0.015)
AR(3) test (p-value)		-0.69 (0.487)		0.89 (0.375)		1.04 (0.299)		0.37 (0.710)		0.66 (0.507)		1.02 (0.306)
AR(4) test (p-value)		0.00 (0.997)		-0.04 (0.966)		-1.28 (0.202)		-0.32 (0.749)		-0.52 (0.601)		0.39 (0.695)
Hansen test (p-value)		85.6 (0.037)		40.3 (0.860)		71.1 (0.135)		22.5 (0.999)		57.4 (0.531)		21.8 (0.999)

Note: Clustered standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments in GMM estimations. Second to sixth order lags used as instruments in columns (17), (21), (25); second to sixth order lags used as instruments in columns (19), (23), (27).

Table A6 Extension of model (4) – long-term effect

Model (4) in its baseline form considers the reaction of the labour market in one year to economic conditions in that very year. This extension analyses the long-term effect of growth determinants on social exclusion by adding time lags to the four economic endowments considered in our study. Human capital, innovation capacity, road infrastructure and government quality are lagged up to three periods to test whether the economic determinants of social exclusion go beyond the very short-term. The results suggest a persistent-in-time association between either human capital or government institutions and social exclusion. For all three time lags government quality reports a significant and negative coefficient, while the regional endowment of human capital remains significant if lagged by one or two periods. Additionally, the effect of institutions increases with time as the coefficient of government quality becomes progressively more negative when additional lags are considered. The coefficient of innovation is insignificant after one period, but is again significant after two periods, suggesting that the link between innovation and labour market exclusion is also persistent.

Long-term unemployment change and lagged growth determinants
GMM estimations

Dep. Variable:	Change in unemployed people being long-term unemployed			Change in long-term unemployment rate		
Lags on growth determinants:	1 lag	2 lags	3 lags	1 lag	2 lags	3 lags
	(34)	(35)	(36)	(37)	(38)	(39)
Human capital	-0.480***	-0.429**	-0.244	-0.111***	-0.0849**	-0.0239
	(0.138)	(0.177)	(0.183)	(0.0302)	(0.0348)	(0.0320)
Innovation	-0.00680	0.0233***	0.0132	0.00115	0.00473***	0.00197
	(0.00897)	(0.00817)	(0.0184)	(0.00121)	(0.00168)	(0.00206)
Transport infrastructure	-0.521	-0.242	-0.307	-0.0318	0.0173	-0.146
	(1.162)	(0.859)	(0.874)	(0.142)	(0.151)	(0.114)
Government quality	-1.199**	-1.550**	-1.823**	-0.202**	-0.229*	-0.323***
	(0.543)	(0.641)	(0.713)	(0.103)	(0.120)	(0.108)
Change of log of per capita GDP	-28.50***	-11.65	-34.37***	-2.865*	-4.033**	-6.445***
	(9.885)	(11.02)	(12.07)	(1.480)	(1.723)	(1.672)
Change in high-skilled employment	-130.1**	-24.87	-76.81	-33.54***	-4.050	12.15
	(64.86)	(77.02)	(81.58)	(10.51)	(11.06)	(11.51)
Change in low-skilled employment	-86.94**	-170.9***	-181.2***	-14.20*	-9.268	-4.310
	(40.42)	(47.64)	(56.59)	(7.790)	(8.168)	(9.781)
Lagged unemployed people being LTU	-0.185***	-0.179***	-0.229***			
	(0.0429)	(0.0422)	(0.0454)			
Lagged LTU rate				-0.170***	-0.178***	-0.150***
				(0.0306)	(0.0414)	(0.0363)

Labour market controls	✓	✓	✓	✓	✓	✓
Year dummies	✓	✓	✓	✓	✓	✓
Observations	1,556	1,406	1,256	1,506	1,361	1,216
EU regions	157	157	157	152	152	152
Instruments	140	119	111	147	129	111
AR(1) test (p-value)	-8.31 (0.000)	-7.40 (0.000)	-7.53 (0.000)	-5.39 (0.000)	-5.53 (0.000)	-5.06 (0.000)
AR(2) test (p-value)	3.32 (0.001)	3.18 (0.001)	3.09 (0.002)	1.97 (0.049)	1.73 (0.080)	1.49 (0.137)
AR(3) test (p-value)	-1.41 (0.159)	-1.77 (0.077)	-1.73 (0.083)	-1.45 (0.148)	-1.60 (0.109)	-1.21 (0.227)
AR(4) test (p-value)	0.73 (0.468)	0.97 (0.333)	0.81 (0.418)	-0.24 (0.809)	-0.86 (0.915)	-1.67 (0.095)
Hansen test (p-value)	138.7 (0.074)	122.2 (0.037)	109.6 (0.029)	136.2 (0.060)	129.9 (0.031)	109.9 (0.015)

Note: Robust standard errors in parenthesis; *** p<0.01, ** p<0.05, * p<0.1. Collapsed instruments. Second-order and higher order lags used as instruments in columns (22), (25); third-order and higher order lags used as instruments in columns (23), (26); fourth-order and higher order lags used as instruments in columns (24), (27).