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The impact of the European social fund on youth education and employment

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ABSTRACT

The effectiveness of the European Union's Cohesion Policy in reducing regional socio-economic gaps remains an open empirical issue, while evidence as to how the policy is affected by specific territorial factors and which social groups benefit most from it remains sparse. This article seeks to address this gap by disentangling the impact of the European Social Fund (ESF) on youth education and employment prospects. Drawing on macro-level data for the European NUTS-2 regions, we assess the impact that this fund has on different education-specific youth population shares and employment rates. In the case of education, we find that the receipt of funding is associated with a human capital polarization of regional populations. Specifically, we identify a positive impact of the ESF on population shares with lower-secondary and tertiary education, and a simultaneous negative impact on the share of those with upper-secondary education. In the case of employment, we find a positive response for youth of all education levels. A heterogeneity analysis indicates that both the education and employment responses of the youth population to the receipt of the ESF are strongly influenced by local specialization in high-skilled activities.

1. Introduction

One of the primary goals of the European Union (EU) is to reduce the economic disparities across the regions of its Member States, promoting their "overall harmonious development" and strengthening their "economic, social, and territorial cohesion" (see Art. 174–78 of the Treaty of the European Union[1]). To achieve this goal, the European Union is committed to investing heavily in its so-called Cohesion Policy (henceforth CP),[2] which is designed to finance EU regions directly, typically targeting those economies characterized by low levels of (relative) per capita GDP, high and persistent unemployment rates, a low density of economic activity, and low value-added industries.

The objective to reduce regional differences in economic performance was not initially one of the priorities of the EU; however, gradually, European policy makers have adopted a policy aimed at improving the economic performance of its more disadvantaged regions and avoiding large migration flows from its poorer to its more thriving regions [1]. Underpinning CP lies the assumption that if the single market is left alone, the rich European core will accumulate greater advantages, exacerbating the already stark disparities in economic performance between regions [2]. Thus, the EU has opted to devote a large share of its budget – around a third – to its poorer regions (i.e., those whose per capita GDP in purchasing power standards is less than 75% of the EU average) in order to help them catch-up with their more productive counterparts [3].

To achieve this goal one of the main leverages of CP (enacted more specifically, but not exclusively, through the European Social Fund) is fostering human capital through several programmes which target specific territories and education specific groups. In this article, we contribute to the debate on the effects of CP in EU territories by assessing for which demographic and education group, and under which territorial socio-economic conditions, this policy is most effective. More specifically, we assess the effect (if any) that one of the CP funds, the European Social Fund (ESF), exerts on human capital accumulation, its specific target education groups, and the employment prospects of Europe's youth.

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[1] Available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12012E/TXT.

[2] The EU's CP comprises various funds, with different goals. However, as we discuss in section 2 below, here we focus specifically on the European Social Fund. For more details on these different funds, see the Appendix.

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In recent decades, the academic debate has focused on the impact of the EU's CP on regional economic performance and convergence patterns across these territories [4–7]; however, the present study can be distinguished from this stream of literature by its specific focus on the effects of CP (via the ESF) on youth education and employment. Indeed, although it is in the social interests of the European community as a whole to create the conditions to facilitate the transition of young people into the labour market and to initiate or restart a professional career, previous evidence on the impact of the ESF on youth labour market performance is surprisingly scarce.

The ESF directly targets the structural problem of youth unemployment and precariousness. Mario Draghi, the former European Central Bank President, has gone on record as saying that the European social model is "already gone", in light of the youth unemployment rates prevailing in some countries.[3] Indeed, the EU's youth is characterized by high unemployment and job-turnover rates, a high probability of having precarious and atypical forms of employment, and they are extremely sensitive to macroeconomic fluctuations, as well as labour supply and demand shocks [30]. Youth workers have been the first to lose their jobs and the last to re-enter the labour market during the two unprecedented downturns of the Global Financial Crisis and the Covid-19 pandemic [8]; [31].

With this study, we seek to contribute to the debate on the impact of CP on regional wellbeing by providing evidence on the effects of the ESF on youth education and labour market dynamics. The empirical analysis is conducted at the NUTS-2[4] level for the full set of EU-27 countries plus the United Kingdom (UK). Moreover, given the availability of novel data on EU expenditure, we are able to consider the period between 2007 and 2018, which covers two CP programming periods: that is, 2007–2013 and 2014–2020. This represents a key aspect of our analysis for two reasons. First, it ensures that the results are not driven by the presence of any unobserved heterogeneity associated with a specific programming period. Second, it covers different phases of the business cycle – that is pre-, during- and post-financial crisis periods – unlike most existing studies that typically only consider periods of economic expansion (see, for example, [21]). In the first part of this study, the empirical analyses conducted assess the impact the ESF has on both the decision to invest in education and on the employment prospects of the local youth population. We do this by estimating a model that relates the (log of) per capita ESF to different age- and education-specific population shares and employment rates. In the second part, we investigate whether, and the extent to which, the links between the ESF and regional sectoral composition affect the schooling decisions and employment prospects of the youth population. Here, our rationale is that the effectiveness of the CP is strongly correlated with the local productive structure [9,10], while the local sectoral composition can be assumed to influence both the schooling decision and the employment prospects of the local population [11,12]. In order to address the endogeneity of the ESF with respect to local economic conditions, we apply an IV strategy that uses as its instrument a measure of the funds that each region received in the previous programming period (that is, with a lag of 7 years).

The remainder of this paper is organized as follows. Section 2 briefly describes the CP and reviews the relevant literature. Section 3 describes the data used and presents their summary statistics. Section 4 details the empirical model. Section 5 reports the results. Section 6 presents the heterogeneity analysis based on local specialization in high-skilled sectors. Finally, section 7 provides some concluding remarks.

2. Background to the study

2.1. Cohesion Policy and European social fund

The CP represents one of the EU's main investment policies. Its broad objective is to improve the quality of life of European citizens by promoting economic growth and job creation and by favouring competitiveness between different businesses, while seeking to maintain a sustainable model of development. In each programming period almost a third of the total EU budget is set aside to implement these policies. More specifically, in the programming period 2007–13 around 347 billion euros were reserved for CP, 351.8 billion in the programming period 2014–20, and 392 in the programming period 2021–2027. Since 2007, the policy has had three main goals, defined as convergence; regional competitiveness and employment; and European territorial cooperation, with a set of funds allocated to each. Whether or not a specific region is eligible to receive these funds depends on how its economy behaved with respect to these three primary goals over the previous period.

To achieve these goals, the EU created different types of regional funding. In this article, however, we focus exclusively on the European Social Fund, since its main goal is to improve the education of EU citizens (youth in particular) and to promote their smooth transition into the labour market. The ESF provides funding to all EU Member States to support initiatives that, on the one hand, reduce school drop-out rates and, on the other, improve the education and training of their citizens, helping them acquire those skills that make them more competitive in an increasingly dynamic labour market.[5] It specifically targets different youth with distinct education qualifications with the final goal of shifting their human capital and the propensity of retraining or acquiring a job.[6] In addition, the ESF is also designed to boost the employment prospects of EU citizens, a critical concern today, given the current economic crisis that affects employers and employees alike. To this end, the ESF provides funding to both regional and national projects aimed at supporting EU citizens find suitable employment or improve their current job. The funding supports a broad spectrum of educational and training initiatives, which may include Active Labour Market Policies (ALMPs), vocational education, on-the-job training, and lifelong learning opportunities. These activities are often difficult to categorize due to their varying nature and the educational qualifications they target. The ESF has a total annual budget of 10 billion euros, which represents slightly less than 20% of the total CP budget, and, in the programming period 2014–20, it was distributed among Member States as reported in Table A1 in the Appendix. Here, we see that the country that received the highest amount of total funding was Italy, followed by Poland and Spain. Conversely, the countries receiving the smallest amounts were Malta, Cyprus, and Luxembourg. However, the countries that received the highest amounts per capita were Portugal, Slovakia, Hungary, Malta, and Croatia with more than 528 euros per capita, while those receiving the lowest amounts were the Netherlands, Denmark, and Austria with less than 110 euros per capita.

[3] Interview reported in the Wall Street Journal, February 24th, 2012.

[4] NUTS – the Nomenclature of Territorial Units for Statistics – is a geocode standard for referencing the territorial subdivisions of the country members of the EU. The NUTS-2 level corresponds to regions, their population ranging from 800,000 to 3 million inhabitants. EUROSTAT collects a wide range of comparative educational, social, and economic indicators at both the NUTS-1 and NUTS-2 levels. Some countries, such as Germany, Portugal, Slovenia, and the UK, do not provide data at the NUTS-2 level (our preferred areal unit of aggregation) for some indicators. For these countries, we use NUTS-1 level data, which correspond to larger territorial units (e.g., the German Länder). This strategy is widely used in other regional analyses (e.g., Copus, 2011).

[5] For instance, the ESF is used by Member States to fund Active Labour Market Policies (ALMP), as described in Ref. [13].

[6] For a detailed overview of the target population of ESF, please refer to page 20 of the Annex II of the EU Regulation No 1304/2013 of the European Parliament and of the Council of 17 December 2013 on the European Social Fund and repealing Council Regulation (EC) No 1081/2006 (available at https://eur-lex.europa.eu/eli/reg/2013/1304/oj/eng.

2.2. Extant literature

This paper contributes to different strands of the extant literature. The first is the study of the socio-economic impact of the EU's CP. In recent decades, a large body of literature has analysed the effects of CP on regional economic wellbeing. Most of these studies assess the impact of CP on economic growth and regional convergence, and, despite the relatively high number of papers, a consensus on the actual impact has yet to be reached (see Ref. [14]. Some studies report a positive impact of CP on regional convergence. More specifically, ref. [15] study the impact of the EU Structural Funds on the so-called Objective 1 regions. Overall, they identify the presence of economic convergence across regions, a trend that remains fairly consistent irrespective of the chosen estimator. However, the authors also report that the impact of Objective 1 funds on economic growth is far from clear-cut and, in some cases, is negligible or even negative (in particular in the case of Germany, Greece and Spain). In a similar vein, ref. [16] estimate the impact of European CP on the economic performance of Objective 1 regions (albeit that they conduct the analysis at the NUTS-3 level). Their estimates identify the presence of regional convergence across regions, driven above all by rural areas located close to cities. Conversely, in the case of rural areas located some distance from urban centres, the impact is negative, although not precisely estimated.[7]

Other papers are more sceptical of the efficacy of CP in promoting regional growth and convergence. Ref. [3] examine the impact of structural funds on regional convergence in the decade 1989–1999. Their results are two-fold insofar as they identify both the presence of economic convergence across regions and the fact that structural funds do not have any impact on the regional steady-states. Similarly, ref. [19] investigate the impact of CP on GDP growth over the period 1980–2005. Again, the results are mixed: Objective 1 programs appear to stimulate economic growth, while Structural Funds do not exert any significant impact.

In an attempt to reconcile these conflicting results, ref. [20] found that the lack of clarity regarding the impact of CP on regional economic wellbeing can be explained in relation to two specific features. The first concerns the fact that the EU's CP is characterized by a set of different programs with quite distinct objectives, while the second is dependent both on the way in which a region's political actors make use of the funds received and on the local context which mediates the effectiveness of the policy. Indeed, the authors stress that the impact of CP differs substantially across Member States depending on their "institutional, organizational or macroeconomic characteristics". Interestingly, the overall the impact appears to be greatest in poorer countries (such as Portugal, Romania, and other CEE countries).

Another interesting group of papers analyse the effects of CP on regional employment and participation. Specifically, ref. [21] identify a positive impact of CP on both employment and plant creation in the case of Italy during the recession induced by the outbreak of the Covid-19 pandemic. Along similar lines, ref. [22] find a positive impact of CP funding on the employment rate for the Italian case. Conversely, ref. [23] find that CP does not appear to have stimulated employment growth in European regions over the period 1989–2006. Ref. [24] report that the two main factors driving a more rapid growth in employment are the presence of high-skilled workers and investment in R&D and innovation. Similarly, ref. [25] study the impact of European regional policy on the participation rate in the convergence regions of Italy. Their results identify a negative labour market participation response that might be attributed to a number of factors, including lack of proper targeting and monitoring or the distortionary effects of intense funding. These contradictory results pointing at heterogeneous patterns of convergence across regions are likely to be driven by territorial disparities that impinge on the effectiveness of CP ([26]; [6]; [53]).

A further strand of the literature analyses the impact of CP on support for the EU. Here again, despite the relatively high number of studies,[8] just whether CP funding helps create a pro-EU sentiment is far from clear. For example, [28] indicates that an increase in public transfers of around 100 euros per capita is associated with a 5–15% increase in the probability of supporting the EU. Conversely, ref. [29] finds that the higher the amount of funds received, the higher is the presence of anti-EU rhetoric in the EU-28 regions. However, this negative relationship may become positive in the presence of an appropriate redistribution of funds over time.

The second contribution made by the present paper is provided by its specific focus on youth labour market outcomes. We contend that focusing on the youth population is one of the most appropriate means for assessing the effectiveness of CP and the ESF. Youth populations are often considered to be one of the most disadvantaged groups in terms of their labour market performance and prospects, being characterized by high unemployment and job-turnover rates, a high probability of having precarious and atypical forms of employment, and being extremely sensitive to macroeconomic fluctuations [30,31]. Moreover, while the effects of EU funding have been widely assessed in terms of local economic development and growth, there are largely unexplored impacts of such funding on other aspects of social progress that are more closely tied to the overall objectives and specific target groups of CP [32–34]. Youth labour market performance is one such area.

Despite some common trends, EU territories generally present asymmetric patterns of youth labour market opportunities [30,31,35]. However, comparative studies of youth labour market integration at the regional level are surprisingly limited. This is especially striking, given the increasing importance assumed by territorial cohesion and regional disparities in the international and European debate [36]. To give just one example, in 2021 more than 2.8 million people aged under 25 were unemployed in Europe, with extremely large spatial disparities: for instance, in the region of Prague the youth unemployment rate was below 1.3%, while in Sicily it was above 50%.

In the extant literature, regional disparities and youth labour markets have often been considered separately, due primarily to limited data availability [37]. Recent exceptions have tended to employ single measures of exclusion and the lack of integration, such as youth unemployment and NEET rates [38,39].

In this context, the general contributions of this paper are multiple. Specifically, to the best of our knowledge, this is the first article to analyse a specific funding mechanism within the CP framework, the ESF, a mechanism moreover that represents an important share of total CP funding and one which has the crucial objective of fostering human capital accumulation and job growth. Moreover, we focus our study on the youth population, which, despite being the demographic group most affected by macroeconomic shocks, it is, somewhat surprisingly, only marginally considered in the extant literature.

3. Data and descriptive statistics

To perform the empirical analysis, we employ two main data sources. Information on the age- and education-specific dependent variables, as well as on the control variables, are drawn from publicly available regional data provided by Eurostat.[9] Information on the ESF are drawn from the historic EU payments provided by the European Commission.[10] The proxies of EU funding use a modelled spending function which redistributes funding over the programming period. The overall sum of all

[7] Other notable examples of papers finding evidence in favour of a positive impact of CP are [2,17,18] and Becker et al. (2010).

[8] For a more comprehensive overview of the extant literature on this issue, see Ref. [27].

[9] For more details, see https://ec.europa.eu/eurostat.

[10] The data can be downloaded at https://cohesiondata.ec.europa.eu/Other/Historic-EU-payments-regionalised-and-modelled/tc55-7ysv.

funding schemes presented in the historic payments' dataset over the 30 years amount to more than EUR 900 billion. Since EU payments were reimbursed after the expenditure was made, we use the modelled expenditures to correct for potential time distortion.[11]

We consider the regions making up the EU-27 Member States and the United Kingdom for a time span that ranges from 2007 to 2018. This encompasses two programming periods, 2007–2013 and 2014–2020, that is the pre-, during- and post-global financial crisis period during which the European economies underwent major changes. We report the descriptive statistics of the main variables analysed in Table A2 of the Appendix. Since this analysis centres on the youth population, we focus primarily on two demographic groups: those aged 20–34 and those aged 25–34.

In terms of their educational distribution, the larger share of the 25–34 group is represented by people with upper-secondary (c. 47%), followed by people with tertiary (c. 27%) and lower-secondary education (slightly higher than 25%). An uneven spatial distribution is also confirmed in Figure A1 of the Appendix which shows the average rate over the period considered by each education specific group. As for the employment prospects of the youth population (i.e., those aged 20–34), the employment rate for individuals with lower-secondary education is, on average, 57%, while it is considerably higher for those with upper-secondary (c. 78%) and tertiary education (slightly less than 85%). However, as in the case of the education-specific youth population shares, both minimum and maximum values of these variables, as well as their standard deviation, highlight the presence of strong spatial variation. Specifically, in some regions-years the employment rate is around 7% for those with lower-secondary education, 35% for those with upper-secondary education and 39% for those with tertiary education, while others present scenarios of almost full employment for the three education levels. The uneven spatial distribution of the different education-specific youth employment rates is again confirmed in Figure A2 of the Appendix (the average is calculated over the period 2007–2018). As can be seen, irrespective of the level of education, some regions – particularly the Southern regions of Spain, France, Italy, as well as those of the Eastern European countries, Greece, and Finland – present lower values, while Central and Northern countries present higher employment rates.

Finally, Figure A3 of the Appendix shows the distribution of per capita ESF in each region-year (i.e., our main independent variable). The average is slightly lower than 40 euros per capita and, as for the other variables, there is considerable variation, with the peripheral (darker blue) regions presenting values that vary from between 49.8 and 711 euros per capita (i.e. the regions in the north of Scotland, Portugal, south and north west of Spain and south of Italy, Greece, CEE countries and north of Finland), while the core regions (Germany, Benelux countries, Denmark, the UK and France) present very low levels of ESF expenditure (i.e. between 4.9 and 16.7 euros per capita).[12] We also report some descriptive statistics about the distribution of ESF by years in Table A8. As a preliminary descriptive result, as requested by an anonymous reviewer, we report in figures A4 and A5 of the appendix some basic correlations between the different age- and education-specific dependent variables and the log of per capita ESF.

4. Empirical model

We empirically assess the effect of the ESF on both education and the employment prospects of the regional population by means of the following model:

$$y_{rt} = \alpha + \beta \log(ESF_{rt}) + \gamma X_{rt} + \varphi_t + \psi_r + \nu_{rt} \quad (1)$$

where y_{rt} is alternatively the share of youth population with lower-secondary, upper-secondary, or tertiary education and the different education specific youth employment rates. The main independent variable – $\log(ESF_{rt})$ – is the (log of) per capita ESF that each region r receives in year t.[13] X_{rt} is instead a vector of local controls,[14] φ_t and ψ_r are year- and region-specific fixed effects, and ν_{rt} is the error term.

In this setting, the parameter of interest – β – captures the impact of ESF on regional education and employment. Importantly, since eq. (1) is a *level-log* model, β is assumed to identify a semi-elasticity of youth education and employment responses to the reception of ESF and should be interpreted as the percentage points change in the dependent variables associated with a 1% increase in the per capita ESF that each region receives (see Ref. [40]).[15]

4.1. Identification issues

The regression model in equation (3) is likely to be characterized by the presence of endogeneity for a number of reasons. The first reason is what [42] define as "omitted variable bias". To address this issue, we include, on the one hand, the vectors of year- and region-specific fixed effects that are assumed to cancel out the year- and region-specific unobserved heterogeneity, and, on the other, a vector of local controls – X_{rt} – that capture the time-varying observable regional characteristics, whose omission might affect the estimates of the effect of interest.

The second reason is that the main independent variable, $\log(ESF_{rt})$, is likely to be endogenous with respect to the economic conditions of the local labour markets under analysis. Indeed, regions that are poorer are, on the one hand, expected to be characterized by lower employment rates and lower shares of high-educated individuals, and, on the other, they typically receive larger amount of funds. In addition, the transfer of funds from the European Commission is conditional on regional governments agreeing to implement a series of programs that can make use of available funding. However, this commitment is highly likely to be correlated with the actual economic condition of the different regions [18]. In terms of the identification of the effect of interest, these aspects could be problematic as they might introduce a problem of reverse causality that would bias estimates of this effect.

It is also important to highlight, however, that there is a time lag between the moment in which a region is considered eligible for the transfer of funds, and the moment in which it actually receives funding. Moreover, the total amount of funding devoted to each region is established at the beginning of each programming period and depends on its past economic performance. This means that the funds received in each year are not correlated with current economic performance, but rather with past performance. However, the indicators of local economic wellbeing are often persistent over time (that is, they display a fairly high degree of serial correlation),[16] which implies that the yearly funds might (somehow indirectly) be correlated with past regional economic trends.

Additionally, funding is transferred to the Member States and not directly to regional governments, the former then deciding the amount of money to allocate to each region. This is a crucial aspect to take into

[11] For a more detailed explanation, please consult https://cohesiondata.ec.europa.eu/stories/s/Historic-EU-payments-by-region-1988-2018/47md-x4nq/.

[12] Maps showing changes in ESF expenditure between 2007 and 2018 of the main variables of interest are available upon request.

[13] We define this variable in per capita terms in line with [15,18].

[14] More details on the control variables used are provided in the Results section.

[15] We decided to implement a model in level with year and region-specific fixed effects as it is equivalent to a model in first differences with only year fixed effects because the two models are methodologically equivalent (see Ref. [41] but the model in levels shows higher first-stage F-statistics. In any case, the results are fairly robust to a specification in first differences.

[16] The most notable example is regional GDP, which depends heavily on its past values.

consideration because it implies that the funding each region receives may not only depend on its economic performance, but it might also be the result of political bargaining (particularly in periods in the run-up to elections).

In order to address this issue, we instrumented the ESF that each region received each year with a measure of all the structural funds (that is, not only the ESF[17]) that each region received in the previous programming period (i.e., 7 years before). In other words, the first stage is as follows:

$$\log(ESF_{rt}) = \alpha + \beta \log(SF_{rt-7}) + \gamma X_{rt} + \varphi_t + \psi_r + \nu_{rt} \quad (2)$$

where $\log(SF_{rt-7})$ is the log of the 7-year lagged total amount of funds (again, not only the ESF) that each region has received. The use of a 7-year lagged measure of funds mitigates the potential correlation between the instrument and the economic conditions of the local labour markets. The estimates of the first stage are reported in Table A3 of the Appendix. This shows that, irrespective of the local controls used, the first-stage correlation appears to be positive at around 0.25 and statistically significant at the 1% level in all specifications, and the F-statistics are always higher than 170. The high F-statistic estimates are relevant because, even in the presence of an instrument that is not fully orthogonal to the economic conditions of the local labour markets under analysis, the resulting bias in the estimates of the effect of interest are likely to be reduced [42].

4.1.1. Instrument validity

The validity of the instrument requires that, conditional to the control for time-varying local characteristics and for year- and region-specific unobserved heterogeneity, the distribution of the ESF among the regions within each Member State is not correlated with the region-specific demand changes in both youth education and employment in the period under analysis.

For this to be ensured, we use, as previously discussed, a 7-year lagged measure of funds as our instrument. The use of a 7-year lag is not casual but is based on two important aspects. First, by so doing, we build an indicator of the funds that each region receives in the previous programming period. Given that the amount of funding is decided at the beginning of the programming period, this allows us to reduce the correlation with the economic conditions of the period under analysis. Second, in building the instrument, we use information of the funding scheme for a period that predates the Global Financial Crisis, which hit the European economy strongly.

We assume that these two aspects strengthen the validity of the instrument, since it is reasonable to argue that the local economic performance affecting the distribution of funding in the period 2000–11 is orthogonal with respect to the trends in education and employment displayed by the local youth populations in the period 2007–18. Anyway, to ensure that this is indeed the case, we regress the (log of the) average amount of funds that each region received in the period 2000–11 on a set of indicators of local economic performance for the period under analysis (i.e., 2007–18). The results of this exercise are shown in Table A4 of the Appendix. Reassuringly, there is basically no correlation between the two magnitudes, which clearly points to the validity of our instrument.

5. Results

In what follows we present the results of the impact of the ESF on, respectively, the educational attainments and employment prospects of European regional populations.

5.1. The impact of ESF on education

Table 1 below reports the estimates of the impact (if any) of the ESF on the human capital accumulation of the population in the European regions, that is, on the different education-specific youth population shares. More specifically, column 1 reports the baseline specification, in which we only include year and region fixed-effects, while in column 2 we add region-level control variables that can be assumed to capture the effects of local characteristics on the dependent variables. These controls are the youth and prime-age unemployment rates (that is, for individuals aged 15–24 and 25–54, respectively) and cohort-size (in line with [44, 45]. The first two variables control for the fact that investment in

Table 1
Impact of ESF on education-specific youth population shares (individuals aged 25–34).

	OLS		2SLS
	(1)	(2)	(3)
Panel A: lower-secondary education (ISCED 0–2)			
log per capita ESF	0.001	0.001	0.020***
	(0.002)	(0.002)	(0.004)
unemployment rate ages 15–24		−0.055	−0.066
		(0.050)	(0.053)
unemployment rate ages 25–54		−0.017	0.024
		(0.113)	(0.124)
cohort size		−0.016	0.017
		(0.077)	(0.084)
Observations	3104	2756	2753
First stage F-stat.	–	–	227.3
Panel B: upper-secondary education (ISCED 3–4)			
log per capita ESF	−0.005**	−0.006**	−0.049***
	(0.002)	(0.002)	(0.006)
unemployment rate ages 15–24		0.074*	0.101**
		(0.042)	(0.050)
unemployment rate ages 25–54		0.067	−0.031
		(0.100)	(0.115)
cohort size		−0.123*	−0.200**
		(0.071)	(0.087)
Observations	3128	2758	2755
First stage F-stat.	–	–	227.2
Panel C: tertiary education (ISCED 5–8)			
log per capita ESF	0.004**	0.005**	0.029***
	(0.002)	(0.002)	(0.006)
unemployment rate ages 15–24		−0.020	−0.035
		(0.034)	(0.037)
unemployment rate ages 25–54		−0.049	0.007
		(0.095)	(0.094)
cohort size		0.138**	0.182**
		(0.066)	(0.072)
Observations	3114	2758	2755
First stage F-stat.	–	–	227.2
Year & Region FE	YES	YES	YES

Note: In the table, each panel reports the estimates of the different education-specific shares of population aged 25–34. In all cases, the main independent variable is the log of per capita ESF. In all specifications, the F-statistics are always above the 10% maximal IV size critical values of the Stock & Yogo (2005) weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

[17] We also consider the Cohesion Funds and the European Regional Development Funds, which, together with the ESF, are the most important components of EU Regional Policy [25]. Their inclusion is justified on the grounds that each fund has a specific target and, therefore, to consider all the funds that a region receives will tend to increase the exogeneity of the instrument. In any case, the results are robust to the use of the lagged measure of the ESF alone.

education is typically counter-cyclical and, therefore, the higher a region's unemployment rate rises, the greater the tendency of its population to invest in education, while the latter controls for the composition of the local population. Finally, column 3 reports the estimates of the two-stage least squares (2SLS) regression with the full list of controls.

Both in panels A and C, the ordinary least square (OLS) estimates are positive, although in the former case, they are not statistically significant. In the latter case, point estimates imply that a 1% increase in the per capita ESF received by the "average" European region is associated with an increase in the share of the youth population with tertiary education of about 0.004–0.005 pp. A positive response is also found in the 2SLS estimates, which show a positive and significant impact for these two education groups: Point estimates vary between 0.020 for those with lower-secondary education and 0.029 for those with tertiary education. Interestingly, in the case of those individuals with upper-secondary education, both OLS and 2SLS estimates show a negative response, which varies between around −0.005 to −0.006 pp in the first case and is −0.049 pp in the second.

Taken together, these results indicate that the receipt of the ESF has induced a human capital polarization of the populations in these European regions. Indeed, irrespective of the age group considered, both the shares of population with lower-secondary and tertiary education have experienced a fairly strong increase. Conversely, all the age-specific shares of population with upper-secondary education have experienced a decline. Given the consistent increase in the wage differential between low- and high-educated workers that many economies are experiencing [46,47], this might have important implications in terms of income inequality, with all the socio-economic consequences that this entails.

An alternative interpretation of these results may be that regions with less developed economies and receiving higher amounts of the ESF present a lack of aggregate demand and this, in part, might account for their lag in terms of adapting their educational provision.

5.2. The impact of the ESF on employment

Table 2 below reports the estimates of the impact (if any) of the ESF on the employment prospect of the local populations, that is, on the different education-specific youth employment rates (i.e., for those aged 20–34). More specifically, panel A reports estimates for those with lower-secondary education. In this case, the OLS estimates of columns 1 and 2 are negative and statistically significant, implying that a 1% increase in the per capita ESF is associated with a drop in the employment rate of about −0.010 pp. Conversely, in the 2SLS regressions, the estimates are positive and statistically significant and identify an increase in the employment rate of people with lower-secondary education of 0.030 pp.

Panel B reports estimates for those with upper-secondary education. Here, the OLS estimates are only marginally significant, while the 2SLS estimates are positive and statistically significant, implying that a 1% increase in the regional ESF is associated with an increase in the employment rate of people with upper-secondary education of about 0.016 pp.

Finally, Panel C reports estimates for the youth population with tertiary education. Interestingly, the impact is lower than that detected for the other two education levels. Indeed, in the case of the OLS estimates, we identify a negative employment response of −0.002 pp, although they are not precisely estimated. However, the 2SLS estimates are positive and significant, implying an increase in the youth employment rate of 0.015 pp.

Before conducting the heterogeneity analysis, it is important to stress that OLS estimates are typically lower (in absolute terms) than 2SLS estimates. This may reflect the fact that there is a negative correlation between the economic performance of the local labour markets and the amount of funding that regions receive (i.e. regions that are thriving

Table 2
Impact of ESF on the education-specific youth employment rates (individuals aged 20–34).

	OLS		2SLS
	(1)	(2)	(3)
Panel A: lower-secondary education (ISCED 0–2)			
log per capita ESF	−0.010***	−0.009**	0.030**
	(0.004)	(0.003)	(0.012)
log population 20–64		0.089	0.245***
		(0.060)	(0.090)
share pop lower-sec. ages 25–64		−0.004	0.800
		(2.836)	(2.914)
share pop upper-sec. ages 25–64		−0.747	0.146
		(2.842)	(2.911)
share pop tertiary ages 25–64		−0.124	0.813
		(2.816)	(2.882)
Observations	2741	2741	2685
First stage F-stat.	–	–	151.7
Panel B: upper-secondary education (ISCED 3–4)			
log per capita ESF	−0.003	−0.004*	0.016**
	(0.003)	(0.002)	(0.007)
log population 20–-64		−0.077	−0.004
		(0.048)	(0.063)
share pop lower-sec. ages 25–64		1.959	1.724
		(2.132)	(2.105)
share pop upper-sec. ages 25–64		1.140	0.952
		(2.128)	(2.097)
share pop tertiary ages 25–64		1.482	1.347
		(2.107)	(2.082)
Observations	3075	3075	3006
First stage F-stat.	–	–	179.2
Panel C: tertiary education (ISCED 5–8)			
log per capita ESF	−0.002	−0.002	0.015***
	(0.002)	(0.002)	(0.005)
log population 20–64		−0.014	0.045
		(0.034)	(0.048)
share pop lower-sec. ages 25–64		2.960**	2.754*
		(1.480)	(1.465)
share pop upper-sec. ages 25–64		2.656*	2.484*
		(1.488)	(1.470)
share pop tertiary ages 25–64		3.033**	2.882**
		(1.478)	(1.462)
Observations	2947	2947	2894
First stage F-stat.	–	–	165.3
Year & Region FE	YES	YES	YES

Note: In the table, each panel reports the estimates of the different education-specific employment rates for individuals aged 20–34. In all cases, the main independent variable is the log of per capita ESF. In all specifications, the F-statistics are always above the 10% maximal IV size critical values of the Stock & Yogo (2005) weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

typically receive less funding than regions that lag behind), and this may somehow bias our estimates downward.[18]

6. Heterogeneity analysis

Here, we are interested in testing whether the education and employment responses of the local population estimated above differ if we take into consideration the varying degree of specialization in the high-skilled sectors of the local labour markets under analysis. This concern is driven by the literature on youth schooling determinants which indicates that the educational attainment of the population of a local labour market is often influenced by its sector specialization. Indeed, in regions where high-skilled sectors account for an important share of total employment, the population may have stronger incentives to invest in human capital to acquire the skills required to obtain a job in those sectors [11,12].

This heterogeneity analysis is also motivated by the fact that the local economic context appears to play a crucial role in determining the effectiveness of the EU's CP [9,10]. In line with [10]; we assume that, *ceteris paribus*, the impact of ESF on employment and education will differ depending on the regional economic structure.

6.1. Effect of local specialization in high-skilled sectors

In order to disentangle the combined heterogeneous effect of ESF, we proxy the local specialization in high-skilled sectors with the share of workers with tertiary education and employed in science and technology over the total labour force and we interact it with the (log of) per capita ESF. We estimate the following model:

$$y_{rt} = \beta_0 + \beta_1 \log ESF_{rt} + \beta_2 E^{sci-tech}_{r,t-7} + \beta_3 \left(E^{sci-tech}_{r,t-7} \times \log ESF_{rt} \right) + \beta_4 X_{rt} + \varphi_r + \psi_t + \nu_{rt} \quad (3)$$

where $E^{sci-tech}_{r,t-7}$ is the share of workers with tertiary education and employed in science and technology over the total labour force. Notice that we use a 7-year lagged measure to have a proxy of high-skilled specialization that is more exogenous with respect to the economic conditions of local labour markets.[19]

The corresponding estimates are reported in Table A5 in the Appendix. However, our main concern here is to test whether the combination between the receipt of ESF at the local level and sector specialization in a high-skilled activity exerts some influence on youth education and employment. In the case of education, Table 3 reports (i) the average marginal effect of the (log of) per capita ESF on the share of population aged 25–34 with different education levels, and (ii) the marginal effect of the (log of) per capita ESF computed at different points of the distribution of the employment rate in science and technology.

The estimated average marginal effect is in line with the general effect reported in Tables 1 and 2 More specifically, there is a positive impact on the share of people with lower-secondary (0.024 pp) and tertiary education (0.023 pp), and a negative impact on the share of people with upper-secondary education (−0.047 pp). In the bottom panel of Table 4, we report the marginal effects of interest at different points of the distribution of the share of workers with tertiary education and employed in science and technology over the total labour force (namely 10, 25, 50, 75 and 90 percentile). In the case of those with lower-secondary education the effect is always positive and appears to be stronger in regions characterized by a lower specialization in high-skilled activities and tends to decrease as soon as the specialization in high-skilled activities increases. In the case of those with upper-secondary education, the overall effect is lower (less negative) in

Table 3
Marginal effect of ESF on the share of population with different education levels depending on local specialization in high-skilled sector.

	Lower-sec. education	Upper-sec. education	Tertiary education
AME	0.024***	−0.047***	0.023***
	(0.002)	(0.003)	(0.003)
0.188	0.039***	−0.043***	0.004
	(0.005)	(0.008)	(0.007)
0.285	0.030***	−0.045***	0.014***
	(0.003)	(0.005)	(0.004)
0.347	0.025***	−0.047***	0.022***
	(0.002)	(0.003)	(0.003)
0.402	0.020***	−0.048***	0.029***
	(0.002)	(0.003)	(0.003)
0.488	0.012***	−0.050***	0.039***
	(0.003)	(0.006)	(0.006)
First-stage F-stat.	26.7	26.7	26.7

Note: The table reports the 2SLS estimates of the marginal effect of the (log of) per capita ESF computed at different percentiles of the 7-year lagged population with tertiary education and employed in science and technology (as % of the labour force). All specifications include as controls two age-specific unemployment rates (15–24 and 25–54) and the cohort size (i.e. ratio between the population in the 25–34 age group and the population in working-age). The F-statistics are always above the 10% maximal IV size critical values of the Stock & Yogo (2005) weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level. ***p < 0.01, **p < 0.05, *p < 0.1.

Table 4
Marginal effect of ESF on the different education-specific youth employment rates depending on local specialization in high-skilled sector.

	Lower-sec. education	Upper-sec. education	Tertiary education
AME	0.033***	0.014***	0.016***
	(0.007)	(0.004)	(0.004)
0.188	0.044***	0.007	0.020***
	(0.012)	(0.008)	(0.006)
0.285	0.038***	0.011**	0.018***
	(0.008)	(0.005)	(0.004)
0.347	0.034***	0.014***	0.016***
	(0.007)	(0.004)	(0.004)
0.402	0.031***	0.016***	0.015***
	(0.007)	(0.004)	(0.003)
0.488	0.025***	0.019***	0.013***
	(0.009)	(0.006)	(0.004)
First-stage F-stat.	103.1	58.9	72.1

Note: The table reports the 2SLS estimates of the marginal effect of the (log of) per capita ESF computed at different percentiles of the 7-year lagged population with tertiary education and employed in science and technology (as % of the labour force). All specifications include as controls the (log of) local population aged 20–64 and the share of population aged 25–64 with, respectively, lower-secondary, upper-secondary and tertiary education. The F-statistics are always above the 10% maximal IV size critical values of the Stock & Yogo (2005) weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

[18] Moreover, our estimates survive a set of robustness checks in which we additionally control for regional-specific factors that might affect the different dependent variables, and we specify the model in first differences. For the sake of space, we do not report these results here, but they are available upon request.

[19] There is a high and significant correlation (around 0.25 and significant at the 1% level) between the share of workers with tertiary education and employed in science and technology over the total labour force and its 7-year lag.

Table 5
Marginal effect of ESF on the different education-specific youth employment rates depending on local specialization in high-skilled sector.

	Lower-sec. education	Upper-sec. education	Tertiary education
AME	0.033***	0.014***	0.016***
	(0.007)	(0.004)	(0.004)
0.188	0.044***	0.007	0.020***
	(0.012)	(0.008)	(0.006)
0.285	0.038***	0.011**	0.018***
	(0.008)	(0.005)	(0.004)
0.347	0.034***	0.014***	0.016***
	(0.007)	(0.004)	(0.004)
0.402	0.031***	0.016***	0.015***
	(0.007)	(0.004)	(0.003)
0.488	0.025***	0.019***	0.013***
	(0.009)	(0.006)	(0.004)
First-stage F-stat	103.1	58.9	72.1

Note: The table reports the 2SLS estimates of the marginal effect of the (log of) per capita ESF computed at different percentiles of the 7-year lagged population with tertiary education and employed in science and technology (as % of the labour force). All specifications include as controls the (log of) local population aged 20–64 and the share of population aged 25–64 with, respectively, lower-secondary, upper-secondary and tertiary education. The F-statistics are always above the 10% maximal IV size critical values of the [43] weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

regions less specialized in high-skilled sectors and increases as the specialization in high-skilled sectors increases. Finally, in the case of those with tertiary education, the effect is less pronounced (even absent) in regions less specialized in high-skilled sectors and increases as specialization rises, almost doubling the average marginal effect for highly specialized regions (see Table 5).

Table 4 below reports the estimates of the marginal effects when using the different education-specific youth employment rates as dependent variables. In all cases, the average marginal effect is positive and statistically significant, implying a positive employment response that varies between 0.014 (those with upper-secondary education) and 0.033 pp (those with tertiary education). When we estimate the marginal effect at different points of the distribution of the share of workers with tertiary education and employed in science and technology over the total labour force, the outcomes change slightly. Indeed, in the case of those with lower- and upper-secondary education, the employment responses are again positive and tend to increase as long as the specialization in high skilled activities increases. Conversely, in the case of those with tertiary education, the positive response is driven above all by regions that are less specialized in high-skilled sectors. This result, which at first glance might appear counterintuitive, can be explained by the fact that regions with a high incidence of high-skilled employment attract high-skilled workers from other regions or from abroad and this somehow "displaces" the high-skilled workers already residing there [48].

An alternative approach to capturing regional specialization in high-skilled activities is to define a dummy variable that takes a value of 1 in specialized regions and 0 otherwise. We define a set of dummy variables capturing specialization in high-skilled sectors based on different percentiles of the share of workers with tertiary education and employed in science and technology over the total labour force. Then we interact the different dummies defined in this way with the (log of) per capita ESF.

The corresponding estimates are reported in Tables A6 and A7 of the Appendix. In the case of the impact on education, Table A6 shows, that irrespective of the definition of the dummy variables, the average marginal effects are always significant and positive in the case of those with lower-secondary and tertiary education and negative in the case of those with upper-secondary education. When distinguishing between specialized (dummy = 1) and non-specialized regions (dummy = 0), the response in the case of those with lower-secondary education is stronger in the latter regions. In the case of those with upper-secondary education, point estimates are negative in both specialized and non-specialized regions. However, in the former case, the effects appear to be stronger (i.e. more negative). Conversely, in the case of those with tertiary education, the estimated effects are always positive and stronger in regions specialized in high-skilled sectors.

Similarly, Table A7 reports the estimates for the employment responses. Here, irrespective of the definition of the dummy variables, the average marginal effects are significant and positive for all education groups. Moreover, interestingly, the employment responses appear to be stronger in regions less specialized in high-skilled sectors (with the exception of those with upper-secondary and tertiary education, in panel B).

All in all, these results confirm that both the education and employment responses of the youth population to the receipt of ESF are also influenced by local specialization in high-skilled activities.

7. Conclusion

Since its foundation, one of the main objectives of the EU has been to "strengthen economic, social and territorial cohesion". To achieve this, policy makers created and implemented the Union's Cohesion Policy, which is, today, the main European investment policy, with a disposable budget of about one third that of the EU's total budget. The CP comprises different funds, with different objectives. In this article, we focus specifically on the European Social Fund, the EU's primary instrument for supporting job creation and human capital accumulation among its regional populations. More specifically, we empirically examine the impact of ESF on its main targets as the education and employment of the youth population. We do so by relating different education-specific youth population shares and employment rates to the (log of) per capita ESF that each region receives, that is, for the full set of European Member States (i.e., EU-27 plus the U.K.), over the period 2007–18.

This focus on the youth population has a number of justifications. First, we believe that it is in the interests of the EU to foster both the human capital accumulation and labour market performance of the younger demographic cohorts. Second, the youth are frequently one of the most disadvantaged demographic groups in terms of their labour market performance and prospects and, moreover, they are especially vulnerable to negative macroeconomic shocks (such as the current shock attributable to the Covid-19 pandemic and war in Ukraine).

In terms of the education responses of the local population to ESF, our results are twofold. On the one hand, we identify a positive impact on the population shares with both lower-secondary and tertiary education, while, on the other, we find a concurrent negative impact on the share of people with upper-secondary education. These results are of great interest, as they indicate that receipt of the ESF may be associated with a human capital polarization of the local youth population. This effect is relevant as it suggests funding might be exacerbating the already existing wage gap and income inequality between high- and low-skilled workers, with all the socio-economic consequences that this entails [49]. Moreover, the observed polarization may suggest that ESF programs are unable to address the underlying and structural causes of unemployment or lack of education. For example, training for employees may not be effective if there is a lack of general education that prevents from mastering specific skills and building upon it. In fact, some of the cumulative disadvantages that arise in early years are less likely to be compensated through ESF initiatives. Similarly, research on the effect of ALMPs which share many similarities in its nature and objectives with ESF programs, has yielded similar results especially for youth with low education qualification [50]. In the case of employment, our estimates identify a positive response of the youth population of all education levels. The findings of our study suggest that there is a

division in education outcomes between those with low and upper secondary education that could potentially worsen pre-existing inequality in the long run. This unintended policy consequence should be the subject of further investigation in future research.

In the final section of this paper, we perform a heterogeneity analysis based on the degree of specialization in high-skilled sectors of the local labour markets under analysis. This analysis is justified by the fact that the local economic context appears to play a critical role in determining the effectiveness of CP [9,10]. Thus, we assume that, *ceteris paribus*, the impact of the ESF on employment and education differs depending on the regional specialization in high-skilled sectors, a factor that is also often considered a key determinant of economic growth [51]. Unsurprisingly, our results indicate that the impact of the ESF on local investment in both education and employment prospects appears to be quite significantly affected by the degree of specialization in high-skilled sectors.

However, the results provided should be interpreted in light with some limitations of the analysis. Data available provide only limited comparable information on the ESF programs which funds education, training and labour market initiatives which are managed and implemented at different institutional levels and several some of the education categories are very broad in particular that of low educational achiever which comprises of people with no basic education with those who achieved secondary education. This in a sense limit the interpretation of the effects of ESF on this specific group. Moreover, the countercyclical investment in education might impinge on the current results.

Overall, our results suggest that policy makers should give greater attention to the regional dimension of the European Social Fund in order to enhance its effectiveness. In order to achieve this, it is recommended targeting funding to local specific needs. More specifically, the reasons why the EU's CP has been ineffective ought to be reassessed and asymmetrical resources should be provided to these territories in order to meet local specific needs [26]. Moreover, a bottom-up assessment of skill needs from a local point of view might usefully inform CP policy and, thereby, increase its aggregate impact. This task should be undertaken by involving regional social and economic partners and by articulating their interests at the macro-meso and micro levels. To conclude, an examination of CP and its impact on society is today a pressing concern, given the relevance afforded cohesion in the Next Generation EU package. Moreover, understanding the reasons that can trigger the effectiveness of CP in specific territories is crucial for informing new schemes such as the Youth Employment Initiative (YEI).

Authors statement

Both authors have contributed equally to the writing of this piece of research.

Data availability

Data will be made available on request.

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Appendix

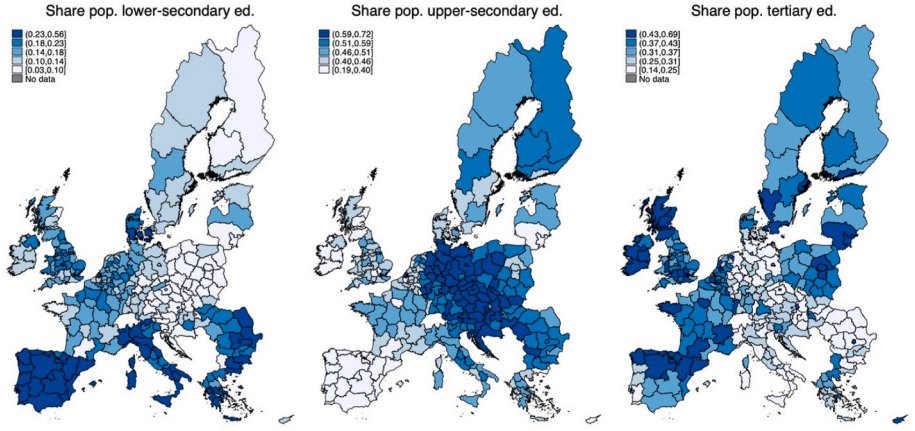


Fig. A1. Spatial distribution of the share of population aged 25–34 by level of education (regional average of the period 2007–2018)

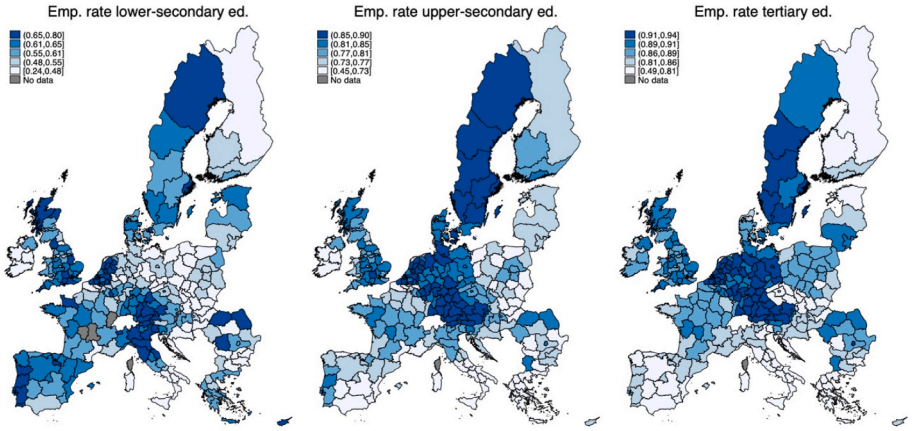


Fig. A2. Spatial distribution of the employment rate for people aged 20–34 by level of education (regional average of the period 2007–2018)

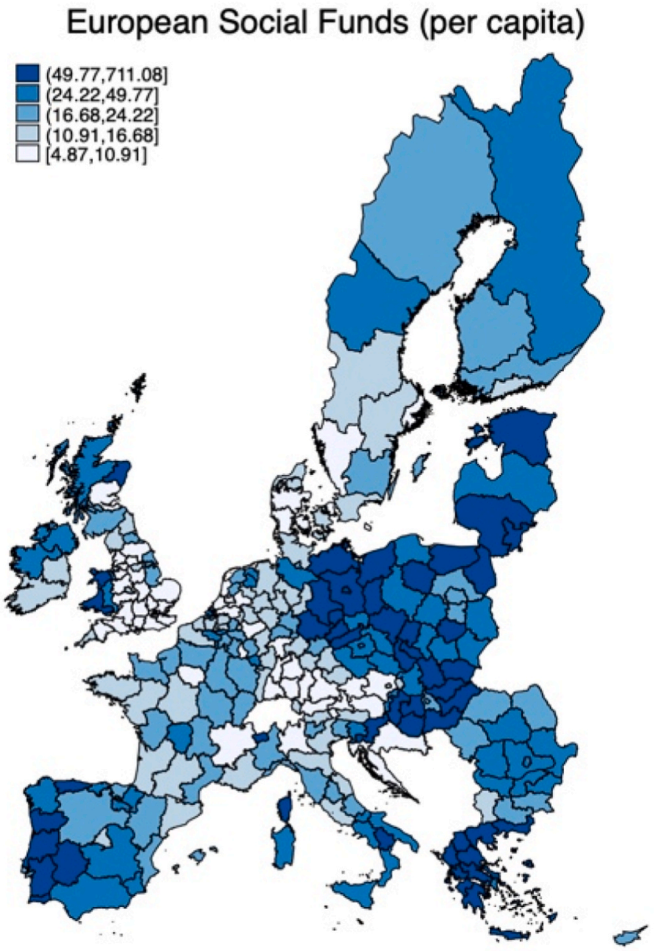
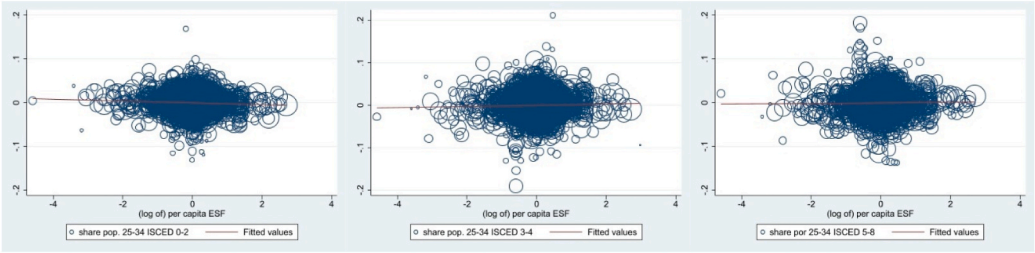
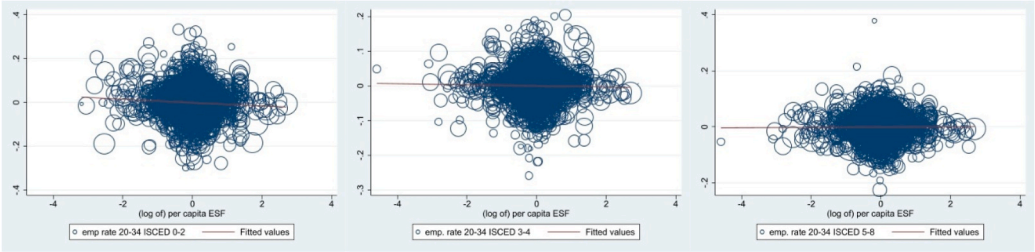


Fig. A3. Spatial distribution of the European Social Fund (regional average of the period 2007–2018 in euros per capita)



Note: The vertical axis shows the population shares for individuals aged 25-34 with, respectively, lower-secondary (left panel) upper-secondary (central panel) and tertiary education (right panel), while the horizontal axis shows the log of per capita regional ESF. All variables are cleaned from the time average and are computed as yearly changes to get rid of the year- and region-specific unobserved heterogeneity. The size of the circle is proportional to the population in the region. In the left panel, the slope of the line

Fig. A4. Education-specific population shares of people aged 25–34 and (log) per capita ESF.
Note: The vertical axis shows the population shares for individuals aged 25–34 with, respectively, lower-secondary (left panel) upper-secondary (central panel) and tertiary education (right panel), while the horizontal axis shows the log of per capita regional ESF. All variables are cleaned from the time average and are computed as yearly changes to get rid of the year- and region-specific unobserved heterogeneity. The size of the circle is proportional to the population in the region. In the left panel, the slope of the line



Note: The vertical axis shows employment rate for individuals aged 20-34 with, respectively, lower-secondary (left panel) upper-secondary (central panel) and tertiary education (right panel), while the horizontal axis shows the log of per capita regional ESF. All variables are cleaned from the time average and are computed as yearly changes to get rid of the year- and region-specific unobserved heterogeneity. The size of the circle is proportional to the population in the region. In the left panel, the slope of the line is -0.002 with s.e.=0.001 (significant at 1%), in the central panel, the slope of the line is 0.001 with s.e.=0.001 (not significant), while in the right panel the slope is 0.003 with s.e.=0.001 (significant at 5%).

Fig. A5. Education-specific employment rates of people aged 20–34 and (log) per capita ESF.
Note: The vertical axis shows employment rate for individuals aged 20–34 with, respectively, lower-secondary (left panel) upper-secondary (central panel) and tertiary education (right panel), while the horizontal axis shows the log of per capita regional ESF. All variables are cleaned from the time average and are computed as yearly changes to get rid of the year- and region-specific unobserved heterogeneity. The size of the circle is proportional to the population in the region. In the left panel, the slope of the line is −0.002 with s.e. = 0.001 (significant at 1%), in the central panel, the slope of the line is 0.001 with s.e. = 0.001 (not significant), while in the right panel the slope is 0.003 with s.e. = 0.001 (significant at 5%).

Table A1
ESF budget by country (2014–20)

Country	European Social Funds (2014–20)			
	EU amount (million EUR)	National amount (million EUR)	Total amount (million EUR)	Total amount per capita
Austria	530.60	433.65	964.25	110.38
Belgium	1099.19	1196.92	2296.11	202.28
Bulgaria	1706.51	259.36	1965.87	276.85
Croatia	1944.74	249.66	2194.40	528.64
Cyprus	215.32	26.53	241.85	280.46
Czechia	3656.82	843.87	4500.70	424.95
Denmark	267.70	198.75	466.45	81.32
Estonia	589.34	105.65	694.99	526.79
Finland	569.69	556.56	1126.26	204.93
France	6381.51	4188.15	10569.65	158.23
Germany	8302.49	5058.93	13361.42	162.48
Greece	3998.65	1137.55	5136.20	476.07
Hungary	4954.88	1046.04	6000.93	611.61
Ireland	504.71	416.37	921.08	192.32
Italy	16635.72	6815.78	23451.50	388.29
Latvia	668.31	117.94	786.24	402.65
Lithuania	1237.39	211.83	1449.22	507.27
Luxembourg	93.25	20.06	113.31	192.44
Malta	245.84	33.66	279.50	599.48
Netherlands	730.70	604.25	1334.94	78.09
Poland	12948.65	2274.29	15222.94	400.80
Portugal	7444.98	1542.65	8987.63	869.97
Romania	4856.43	816.18	5672.61	288.79

(*continued on next page*)

Table A1 (*continued*)

Country	European Social Funds (2014–20)			
	EU amount (million EUR)	National amount (million EUR)	Total amount (million EUR)	Total amount per capita
Slovakia	2873.79	520.40	3394.19	624.42
Slovenia	731.97	179.69	911.67	440.19
Spain	10928.32	3245.83	14174.14	303.55
Sweden	1012.75	716.96	1729.71	173.18
United Kingdom	4722.01	3810.96	8532.96	130.16

Source: European Commission

Table A2
Descriptive statistics

	Mean	S.D.	Min.	Max.
Dependent variables				
Share population aged 25–34 with:				
lower-secondary education	0.253	0.140	0.024	0.820
upper-secondary education	0.473	0.141	0.105	0.796
tertiary education	0.274	0.094	0.068	0.672
Employment rate aged 20–34 with:				
lower-secondary education	0.571	0.123	0.069	0.951
upper-secondary education	0.778	0.095	0.354	0.976
tertiary education	0.845	0.093	0.389	1.000
Independent variables				
Funds				
ESF per capita	39.964	77.977	0.183	1182.267
Controls				
Unemployment rates				
ages 15–24	0.223	0.131	0.034	0.792
ages 25–54	0.085	0.057	0.011	0.360
Cohort size	0.197	0.033	0.084	0.385
Share population aged 25–64 with:				
lower-secondary education	0.253	0.140	0.024	0.820
upper-secondary education	0.473	0.141	0.105	0.796
tertiary education	0.274	0.094	0.068	0.672
Emp. in science and tech.	0.395	0.095	0.129	0.768

Note: The table reports mean, standard deviation, minimum and maximum of the main variables under analysis.

Table A3
First-stage regressions

	(1)	(2)	(3)
SF_{rt-7}	0.252***	0.249***	0.249***
	(0.017)	(0.019)	(0.019)
Observations	2782	3064	2758
R-squared	0.498	0.510	0.515
Year & Region FE	YES	YES	YES
F-stat	227.60	179.72	169.78

Note: The table reports the first-stage estimates, where the dependent variable is the log of per capita ESF and the main independent variable is the average amount of funds that each region received in the previous programming period. Controls in column (1) are the cohort size and two age-specific unemployment rates (15–24, 25–54), in column (2) we include the log of local population aged 20–64 and the share of population aged 25–64 with lower-secondary, upper-secondary and tertiary education, and finally in column (3) we include the full set of covariates previously described. In all specifications, the F-statistics are always above the 10% maximal IV size critical values of the [43] weak identification test. All regressions are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

Table A4
Instrument validity

	(1)	(2)
share pop lower-sec. aged 25–64	−310.113	52.712
	(340.066)	(247.374)
share pop upper-sec. aged 25–64	−312.307	50.486
	(344.721)	(251.401)

(*continued on next page*)

Table A4 (*continued*)

	(1)	(2)
share pop tertiary aged 25–64	−316.097	48.039
	(342.883)	(250.037)
real growth rate of GVA at basic prices	−0.017	−0.016
	(0.067)	(0.061)
log emp. in high-tech manuf. & KIS	0.133	0.221
	(0.152)	(0.153)
log population density	0.033	−0.043
	(0.108)	(0.126)
NEET rate aged 15–24	2.308	2.040
	(1.701)	(1.988)
log GDP in PPS (million EUR)	0.212	0.215*
	(0.171)	(0.107)
Observations	218	219
R-squared	0.719	0.702
Weights	Yes	No

Note: The table reports the correlation between the log of the average amount of funds that each region received in the period 2000–11 and indicators of the economic performance of the local labour market under analysis computed as averages for the period 2007–18.
***p < 0.01, **p < 0.05, *p < 0.1.

Table A5
Estimates of the heterogeneity effect

	lower-sec.	upper-sec.	tertiary
	(1)	(2)	(3)
Panel A: Education			
log per capita ESF	0.056***	−0.038***	−0.018
	(0.009)	(0.015)	(0.015)
log per capita ESF * emp. sci & tech.	−0.090***	−0.026	0.117***
	(0.022)	(0.039)	(0.039)
emp. sci & tech.	0.205***	−0.122	−0.084
	(0.060)	(0.099)	(0.112)
unemployment rate ages 15–24	−0.063**	0.096***	−0.034
	(0.025)	(0.031)	(0.024)
unemployment rate ages 25–54	0.052	−0.004	−0.047
	(0.059)	(0.070)	(0.054)
cohort size	−0.013	−0.216***	0.229***
	(0.038)	(0.047)	(0.041)
Observations	2756	2758	2758
R-squared	0.942	0.925	0.936
First-stage F-stat	26.7	26.7	26.7
Panel B: Employment			
log per capita ESF	0.056***	0.000	0.024**
	(0.021)	(0.014)	(0.010)
log per capita ESF * emp. sci & tech.	−0.064	0.039	−0.024
	(0.052)	(0.036)	(0.023)
emp. sci & tech.	0.283*	−0.178*	0.074
	(0.154)	(0.100)	(0.063)
log population 20–64	0.226***	0.009	0.038
	(0.056)	(0.036)	(0.028)
share pop lower-sec. aged 25–64	0.541	1.846	2.645*
	(2.875)	(1.910)	(1.460)
share pop upper-sec. aged 25–64	−0.042	1.038	2.401
	(2.867)	(1.907)	(1.461)
share pop tertiary aged 25–64	0.549	1.483	2.778*
	(2.864)	(1.906)	(1.459)
Observations	2689	3009	2894
R-squared	0.775	0.843	0.878
First-stage F-stat	103.1	58.9	72.1

Note: The table reports the 2SLS estimates of the specification sketched in eq. (3). The F-statistics are always above the 10% maximal IV size critical values of the [43] weak identification test. All regressions include year and region fixed-effects and are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

Table A6
Marginal effect of the ESF on the share of population with different education levels depending on local specialization in high-skilled sector

	Lower-secondary education	Upper-secondary education	Tertiary education
Panel A: dummy based on median			
AME	0.021***	−0.049***	0.027***
	(0.002)	(0.004)	(0.003)
dummy = 0	0.024***	−0.047***	0.022***
	(0.003)	(0.004)	(0.005)
dummy = 1	0.019***	−0.050***	0.032***
	(0.003)	(0.004)	(0.004)
First-stage F-stat.	47	47	47
Panel B: dummy based on 75th percentile			
AME	0.021***	−0.049***	0.028***
	(0.002)	(0.004)	(0.003)
dummy = 0	0.023***	−0.047***	0.024***
	(0.003)	(0.004)	(0.004)
dummy = 1	0.015***	−0.055***	0.039***
	(0.004)	(0.008)	(0.008)
First-stage F-stat.	19.4	19.4	19.4
Panel C: dummy based on 95th percentile			
AME	0.021***	−0.051***	0.031***
	(0.002)	(0.004)	(0.004)
dummy = 0	0.020***	−0.050***	0.029***
	(0.002)	(0.004)	(0.004)
dummy = 1	0.030***	−0.080***	0.050**
	(0.008)	(0.027)	(0.022)
First-stage F-stat.	4.3	4.4	4.4

Note: The table reports the 2SLS estimates of the marginal effect of the (log of) per capita ESF computed at different percentiles of the 7-year lagged population with tertiary education and employed in science and technology (as % of the labour force). All specifications include as controls two age-specific unemployment rates (15–24, 25–54) and the cohort size. All regressions include year and region fixed-effects and are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

Table A7
Marginal effect of the ESF on the employment rates with different education levels depending on local specialization in high-skilled sector

	Lower-secondary education	Upper-secondary education	Tertiary education
Panel A: dummy based on median			
AME	0.038***	0.017***	0.018***
	(0.007)	(0.005)	(0.003)
dummy = 0	0.053***	0.022***	0.025***
	(0.011)	(0.007)	(0.005)
dummy = 1	0.024***	0.012**	0.012***
	(0.008)	(0.005)	(0.004)
First-stage F-stat.	108.5	94.4	96.2
Panel B: dummy based on 75th percentile			
AME	0.031***	0.017***	0.015***
	(0.007)	(0.005)	(0.004)
dummy = 0	0.035***	0.015***	0.014***
	(0.008)	(0.005)	(0.004)
dummy = 1	0.021*	0.021***	0.018***
	(0.012)	(0.007)	(0.005)
First-stage F-stat.	23.8	28.4	25.8
Panel C: dummy based on 90th percentile			
AME	0.031***	0.016***	0.014***
	(0.008)	(0.005)	(0.004)
dummy = 0	0.032***	0.016***	0.014***
	(0.007)	(0.005)	(0.004)
dummy = 1	0.013	0.011	0.005
	(0.029)	(0.017)	(0.010)
First-stage F-stat.	4.4	5.4	5.4

Note: The table reports the 2SLS estimates of the marginal effect of the (log of) per capita ESF computed at different percentiles of the 7-year lagged population with tertiary education and employed in science and technology (as % of the labour force). All specifications include as controls the log of local population aged 20–64 and the share of population aged 25–64 with lower-secondary, upper-secondary and tertiary

education. All regressions include year and region fixed-effects and are weighted by the working-age population of each region in 2006. Standard errors, in parentheses, are clustered at the regional level.
***p < 0.01, **p < 0.05, *p < 0.1.

Table A8
ESF summary statistics by year

Year	Variable	Mean	SD	Min	Max
2007	ESF per capita	52.50764	102.6962	.1833347	1182.267
	ESF (000)	39851.24	40274.27	354.771	396115.1
2008	ESF per capita	42.32156	72.22379	2.869909	772.3724
	ESF (000)	32056.11	29490.61	1450.049	280213.3
2009	ESF per capita	42.70161	76.19148	2.079775	724.4496
	ESF (000)	34675.3	42834.52	621.947	450097.9
2010	ESF per capita	37.73353	76.06827	2.757572	835.2926
	ESF (000)	30269.7	37733.85	350.378	380619.4
2011	ESF per capita	49.50697	100.397	3.543452	1143.219
	ESF (000)	39280.68	48958.86	815.232	452338.4
2012	ESF per capita	54.20422	89.35316	3.230432	893.7025
	ESF (000)	44352.14	51327.08	100.388	459588.4
2013	ESF per capita	55.59763	89.86748	1.032972	823.0563
	ESF (000)	44013.27	50102.19	786.164	459223.1
2014	ESF per capita	49.50895	89.85357	1.273169	984.0141
	ESF (000)	38474.28	43658.86	23.299	342191.7
2015	ESF per capita	40.38912	86.59146	1.542626	1111.945
	ESF (000)	33068.9	40979.32	38.892	458675.5
2016	ESF per capita	13.57646	22.53739	.2665508	284.9136
	ESF (000)	12942.68	18266.22	87.402	178469.6
2017	ESF per capita	22.94539	25.482	.783907	161.0706
	ESF (000)	23353.75	29033.68	264.647	270863.4
2018	ESF per capita	18.73068	28.54821	.5435202	301.7558
	ESF (000)	18434.03	29355.47	173.546	339697.9

Description of the EU's Cohesion Policy

The Cohesion Policy is part of European Regional Policy, which is built on a medium/long-run perspective, articulated in funding periods of seven years. More specifically, this policy comprises different funds, with different goals. The most important are: (i) the European Regional Development Fund (ERDF), whose objective is to modernise local economic structures in order to strengthen regional economic development; (ii) the European Social Fund (ESF), which has two main objectives, to improve the education and training of young people and to create new job opportunities for European citizens; and (iii) the Cohesion Fund (CF), which specifically targets those Member States with a gross national income (GNI) lower than 90% of the EU average and consists of a set of interventions aimed at improving trans-European transport networks. Other funds are made available from different areas of the EU budget that are assumed to contribute to regional development. These are: (i) the European Agricultural Fund for Rural Development (EAFRD), whose goal is to improve the agricultural competitiveness of the EU's rural areas, by promoting the sustainable management of natural resources; (ii) the Youth Employment Initiative (YEI), which is designed to help Member States address the problem of youth unemployment and comprises a set of initiatives aimed at fostering the labour market integration of young people not in education, employment or training; (iii) the European Maritime & Fisheries Fund (EMFF), which is a financial instrument to assist implementation of the EU Integrated Maritime Policy (IMP); and, finally, (iv) the Fund for European Aid to the Most Deprived (FEAD), which is designed to help Member States promote actions and strategies aimed at providing food and basic assistance to the poorest and most deprived demographic groups.

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