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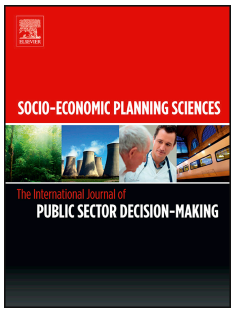

The role of human capital after the crisis in Italy: A regional analysis

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PII: S0038-0121(18)30065-X

DOI: 10.1016/j.seps.2018.07.002

Reference: SEPS 630

To appear in: *Socio-Economic Planning Sciences*

Received Date: 5 March 2018

Revised Date: 4 June 2018

Accepted Date: 16 July 2018

Please cite this article as: Odoardi I, Muratore F, The role of human capital after the crisis in Italy: A regional analysis, *Socio-Economic Planning Sciences* (2018), doi: 10.1016/j.seps.2018.07.002.

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The role of human capital after the crisis in Italy: a regional analysis

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Declarations of interest: none

ABSTRACT

In the years of the prolonged post-crisis recession, the well-known North-South divide in Italy has significantly worsened. Several structural weaknesses limit both post-crisis recovery and socioeconomic convergence. A greater understanding of the economic contribution of workers' human capital, which is not fully exploited in Italy, could address the two issues. We analyze the effects of human capital on local economic performance and productivity, along with other socioeconomic variables, controlling for the endogeneity problem. Workers with a better education can promote economic recovery through productivity enhancement in the South, while traditional aspects related to industrialization are significant in the "wealthy North". However, structural aspects, such as the local financial systems, must be developed to start a path to convergence for the North and the South.

Keywords: human capital; labor force; Great Recession; productivity; economic dualism.

JEL: O15; R10; R11.

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1. Introduction

The presence of areas in a country with very different levels of economic development is considered the *North-South problem*, as originally described for many countries by Jeffrey G. Williamson (1965). This economic problem occurs when an area ("North") has an average income that is significantly higher in comparison to the rest of the country ("South"). Usually, β and σ convergences in the income levels are calculated to test this problem (as, for example, Young et al., 2008, for the US; Rapacki and Próchniak, 2009, for several countries)[1].

In Italy, convergence has been lacking in the last few decades, and despite some signs of club convergence (Piacentino and Vassallo, 2011), the tests do not indicate the causes or the direct aspects in which to intervene to bridge the economic gap.

The economic literature provides many details on the Italian dualism: Lagravinese (2015) finds signs of post-2007 crisis resilience due to the different regional economic specializations, Brida et al. (2014) show traces of club convergence from income data confirming the distance between Center-North and South, and Greco et al. (2017) find a socioeconomic dualism that is even more pronounced with respect to the income inequalities but with good performances in some southern regions.

Studies that consider many macroeconomic causes of the Italian regional gap exist (mainly testing income convergence), while more attention is warranted for the multidimensional aspect of a fundamental resource such as human capital and especially its utility in the post-2007 recession period. With respect to the aforementioned researches, we analyze the local economic characteristics that influence the divergent

[1] Other types of convergence are possible, such as club convergence (e.g., von Lyncker and Thoennessen, 2017, for the European regions) and stochastic convergence (e.g., Genc et al., 2011, for the US).

paths of development by using several variables related to the education of the labor force (human capital), while controlling for other social and economic aspects characterizing the Italian context. In particular, our research question is: can education and vocational training be the correct stimuli for post-crisis economic recovery? Moreover, knowing the strong North-South dualism[2], we also wonder if the contribution of human capital in the two macro areas is different.

Our contribution to the literature on regional dualism (Section 2) consists in analyzing the post-crisis period with a focus on human capital to observe its effectiveness during a period of economic recession. We include in the analysis several economic determinants suggested by the literature as important in the Italian economy in the last decades. The hypotheses and expected results are as follows. First, we are aware that the economic contribution of human capital in the Italian context is weak because of the national economic characteristics (Di Liberto, 2008), despite what the knowledge economy states (Mokyr, 2004; Goldin, 2016). We refer to the widespread low-tech specialization that does not favor the exploitation of the abilities of the so-called knowledge workers. This fact suggests the risk of finding weak significance of the variables related to labor forces' human capital. Second, we expect a positive contribution of the industrial and financial aspects in the northern area, and less to the South. Therefore, the possible presence of a positive contribution of human capital in both areas could suggest an effective and not sufficiently explored way of convergence implying further investigations and appropriate policy indications. This convergence would be based on the linked convergence of productivity levels (Di Liberto et al.,

[2] The two macro areas, Center-North and South, have exhibited separate development paths since at least the 1970s (Felice, 2017).

2008) knowing that in the past human capital convergence was one of the major successes in the national unification process (Felice, 2007).

The focus on human capital in a regional analysis depends on four aspects suggested by the economic literature: the education/growth relationship is not always verified in all Italian regions (Di Liberto, 2008), approximately half of the within-country inequality in income is influenced by education (Acemoglu and Dell, 2010), we know that there is a North-South gap in the quality and endowment of human capital (Abramo et al., 2016), and human capital could be more useful in the less-wealthy areas of the country (Gitto and Mancuso, 2015).

We study the post-crisis period (2007–2015) because inequality grows in the presence of exogenous shocks, influenced by the unequal distribution of economic activities and to the different capabilities of each region to respond to recessionary shocks (Martin, 2012). In fact, the 2007 crisis has profoundly influenced the regional divergence in Italy, as happened in the 1995 crisis (Lagravinese, 2015).

The analysis is carried out on the 21 Italian regions and autonomous provinces[3]. The regional framework of analysis is due to the strong economic effect of human capital at the local level in several contexts (Faggian and McCann, 2009a; Crespo Cuaresma et al., 2014). We consider two groups of regions, i.e., the macro-area formed by the Central and Northern regions, which constitute the wealthiest area of the country, and the economically backward South[4], which can be identified as the so-called *Mezzogiorno* (southern regions and major islands). The study of Italy as divided into these two macro-areas reflects the findings of many scholars (see the literature review in

[3] The Eurostat NUTS 2 level divides Italy into 19 regions and 2 autonomous provinces.
[4] According to the Eurostat NUTS 1 classification, the first group is formed by the Regions of the groups: *Nord-Ovest*, *Nord-Est* and *Centro*. The second group is formed by the Regions of the groups: *Sud* and *Isole*.

Carmeci and Mauro, 2002). Moreover, an appropriate territorial disaggregation is essential in the economic analysis of the Italian context (Terrasi, 1999).

We examine regional heterogeneity of the two macro-areas with a fixed effects model (FE), searching for the regional factors that influence the GDP *per capita*, which is a measure of economic performance and the usual target variable in North-South studies, and the GDP *per worker*, which is a proxy of the productivity level. Productivity can play a relevant role in an "ideal" convergence path and deserves a detailed analysis, but its levels are very different among the Italian regions, and thus, it represents an indicator of the divergent socioeconomic contexts. Furthermore, a two-stage least squares (2SLS) fixed effects model is used to perform an analysis with the aim of limiting the risk of endogeneity of human capital variables in relation to the GDP *per capita* and *per worker*. Our findings suggest that the economic strengths of the North and South are different but can integrate with each other. Possibilities of convergence can be influenced by investments in education if some of the southern structural problems are corrected.

The paper is arranged as follows. We describe some relevant causes of the Italian dualism and possible connections with the recent crisis in Section 2. After the methods are explained in Section 3, we summarize the variables to be used for the analysis due to their connections with the North-South problem. We propose the FE and 2SLS results in Section 5. In the concluding section, we suggest policy interventions, comparing our results with the specific literature on the North-South problem and the Italian dualism.

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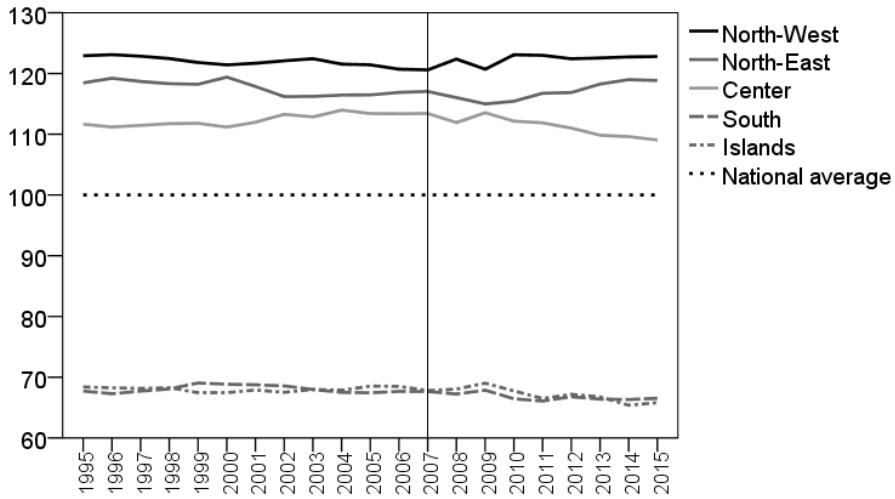
2. Some aspects and causes of the North-South problem

The economic inequality between the Italian regions has been investigated for decades (Daniele and Malanima, 2011). Strong regional differences are not recorded before the Italian unification (1861) or even until 1880 (Daniele and Malanima, 2007), but the gap has increased sharply with the economic modernization of the country. As in many cases of regional dualism, the birth of a leading sector leads to a strong development of a certain area, perpetuating growth and attracting resources to the detriment of "peripheral" areas (Friedmann, 1966). In summary, the northern area became an advanced industrial society after the Second World War, diverging from the agricultural South. The Italian *Mezzogiorno* has gradually become known as the less-wealthy area. The economic and cultural delay of the South derives from the encounter between the two different civil structures at the time of Unification. The North started the industrial revolution and the capitalist modernization, while the South was characterized by an agricultural economy, exploitation of labor and protective tariffs (which have slowed the industrialization process). The Southern economy was also afflicted by clientelism, scarce natural resources and, in the first decades of unification, a drain of resources for the concentration of public spending to create infrastructures for the industrialization of the North (Romeo, 1959). The subsequent extraordinary public interventions in favor of the South have yielded few positive effects (Felice, 2007), also because of inefficient political classes (Fargion, 1996). Thus, different development paths have resulted from centuries of distinct development processes characterized by inequalities in opportunities and resources, besides different behaviors of both the civic societies and the ruling classes (for further explanations, see Felice, 2013; Capello, 2016).

In terms of income convergence[5], for Iuzzolino et al. (2013), the last period characterized by convergence in Italy was in the twenty years after the Second World War. For Carmeci and Mauro (2002), the convergence process continued until the late 1960s; for Terrasi (1999), the convergence occurred only in the 1960–1975 period; and for Barro and Sala-I-Martin (1991), there were still some signs until the 1980s.

The recent development shows strong inequalities in economic terms and the absence of absolute convergence, while the presence of club convergence is observed inside the above-mentioned macro-areas (Piacentino and Vassallo, 2011). We highlight these local differences in Figure 1 by showing the GDP *per capita* of the five institutional macro-areas (considering the North as divided into the West and East zones and the islands separated from the other southern regions). The values are calculated considering the Italian average as equal to 100.

Figure 1. GDP *per capita* (2010 values) of the Italian macro-areas calculated on the basis of 100 (national average) for the period 1995–2015.

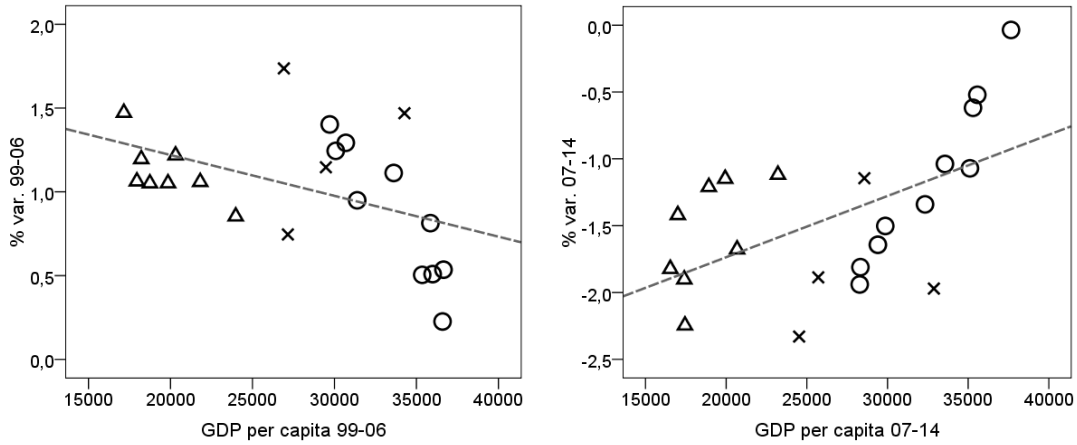


Source: Authors' elaboration based on Istat data.

[5] See the literature review in Brida et al. (2014).

The gaps in GDP *per capita* between the three wealthiest areas (located in the geographic Center-North) and the *Mezzogiorno* are evident, showing the lack of recent convergence. However, Figure 2 shows that some southern regions had good performance (measured by the variations in GDP) in the period before the crisis, as described in the *New Regionalism* by Rossi (2004). In Figure 2, the positioning of the regions depends on their average level of GDP *per capita* during the period considered (horizontal axis) and their growth rate (vertical axis). There are two periods in the comparative analysis, the 8 years before and after the outbreak of the crisis.

Figure 2. Relationship between the average growth rate of the GDP *per capita* and its average value in the 19 Italian regions and 2 autonomous provinces in the 8 years before and after the first effects of the 2007 crisis (Δ=South, X= Center, O=North).



Source: Authors' elaboration based on Istat data.

The difficulties of the less-wealthy regions in the period of prolonged recession are observable in the right graph. Divergence tends to increase because the less-wealthy regions are also those that grew less after the crisis.

Of course, many causes can explain these North-South differences in the last few decades. Important sources of the regional economic gap are found in the role of businesses and in the market. The natural advantages of the northern regions have favored the industrial location and the industrialization process since the unification of Italy. Subsequently, the industrialization process was strengthened by the growing local wealth that supported the domestic market, sustained by the international relations established thanks to the spatial proximity to several European markets (A'Hearn and Venables, 2013). The proximity of the northern regions to an increasingly integrated Europe is observed in the exports, which instead represent a weaker resource in the South. Furthermore, the large, consolidated presence of public employment and other subsidies has strongly discouraged market-linked activities in the South (Alesina et al., 1999). Thus, the inequality is not caused by inequality in public spending, but by decades of inefficient administration, informal institutions (e.g., the mafia), and inequality in land ownership. In addition, wrong economic choices of the local political classes (Trigilia, 2012), beyond the known structural problems, have caused a wasteful welfare state (Fargion, 1996).

Cultural and social aspects must also be considered. Another vision of the causes of the dualism exists, founded on the different reactions and behaviors of local societies with respect to similar incentives, as in Ichino and Maggi (2000, pp. 1087-1088), for which "*individual backgrounds, group-interaction effects, and sorting effects*" influence the individual behavior and, more generally, the two societies.

In fact, social capital and societal structure are very different among the Italian regions, influencing everything from civic involvement to individual productivity (Helliwell and Putnam, 1995). In particular, Felice (2012) found that social capital was

less relevant immediately after unification and has had a greater weight since the 1970s, while human capital has played an important role in the Italian dualism especially during the liberal and interwar years. Banfield (1958) described a southern society unable to cooperate to achieve common goals and a total absence of social capital, influenced by centuries of social evolution (hierarchical methods typical of the monarchy) that differed from that of the North (horizontal municipal organization, Putnam, 1993).

Human capital and social capital have therefore affected the process of divergence since the time of unification, showing very different contributions in the local economies and societies of the North and South (Felice, 2012). More recently, a North-South divide has been found in the social and cooperative behaviors (Bigoni et al., 2016) and the educational and cultural backgrounds (Piffer and Lynn, 2014; Daniele, 2015) of the two areas. Although the cultural and scholarly uniformity with the North was the greatest success achieved by the South with unification, the current stock of human capital suffers from a quality gap. According to Felice and Vasta (2015, p. 62), the passive modernization (due to interventions by the State) in favor of the South led to "*high convergence in the case of life expectancy, uncompleted convergence in education, divergence in GDP*". Abramo et al. (2016) and Agasisti et al. (2016) prove the presence of a sort of dualism both in the research and in the educational systems, observed through the research performances. For example, the PISA 2015 data (OECD, 2016) show that the top students in the three considered domains[6] make up 3.1% of the students in Lombardy (North) and only 0.8% in Campania (South). Similar results are found by the INVALSI tests (2016, the National Institute for the Evaluation of the

[6] Science, reading, mathematics.

Educational System) that show, e.g., that the 2016 math scores at the secondary level of education demonstrate strong differences between the North (above 210), the Center (197) and the South (186, Italy: 200). The quality of education represents a key aspect to be improved in the backward areas in order to bridge the socioeconomic gaps, as tested by Hanushek (2013) in a cross-country comparison.

Ballarino et al. (2014) confirm that the social background influences the transition between secondary education levels, with a negative impact in the South. This is a serious problem, because human capital explains a relevant part of the divergence in economic growth rates at the local level (Démurger, 2001).

For Gennaioli et al. (2013), the estimate of human capital considering education is the most important determinant of regional income and productivity. The high correlation of human capital with productivity is very significant, because human capital (through productivity) can represent an important determinant of technological catch-up. Marked differences between the Center-North and the South are present (Gitto and Mancuso, 2015). Aiello and Scoppa (2006) prove that the level of efficiency (observed through productivity) explains a large part of the regional gap among the Italian regions, which is not due solely to education or to the infrastructure and capital endowments. For Piacentino and Vassallo (2011), the TFP (total factor productivity) plays a smaller economic role when human capital is taken into account.

3. Method

In the first panel data analysis, we consider variables for the human capital of the labor force and other control variables using a fixed effects model to study the factors influencing the regional GDP. However, if the GDP *per capita* is a consolidated

measure of the regional performance (see the literature review in Greco et al., 2017) and can be a good proxy for income, the use of human capital data can induce a simultaneity problem (see Bils and Klenow, 2000). As in an augmented Solow model, an endogeneity problem can be present in this type of analysis (Durlauf, 2009). Similar arguments apply for the other dependent variable, the GDP *per worker*. For this reason, we propose a 2SLS fixed effects estimation for comparison and to show the robustness of the results.

In a study concerning the GDP *per capita* and *per worker* with several other socioeconomic variables, panel data analysis allows good efficiency and information from the data, limiting the problems of collinearity (Baltagi, 2008). In this study, we consider it appropriate to use a fixed effects model, which is useful when we have collinearity and possible omitted variable bias. The fixed effect of the regions does not derive from random variations and does not vary across time. The differences among the regions are considered parametric shifts in the regression equation, allowing better results because the entire set of regions is considered (see Wooldridge, 2012). FE is appropriate for considering unobserved heterogeneity when there is a small population size and when the entire population is considered (Johnston and Di Nardo, 1997), as we consider two groups composed of all the Italian regions and N is a relatively small number. Furthermore, fixed effects are widely used in regional studies (e.g., Bottasso et al., 2014; Lilles and Rõigas, 2017).

We consider two sets of variables that influence GDP *per capita* and *per worker*: variables representing the human capital and other control variables, described in Section 4. The equation considered for the panel data analysis can be written as:

$$GDP_{it} = \beta_0 + \beta_1 LABFSEC_{it} + \beta_2 LABFTER_{it} + \beta_3 LIFEL_{it} + \beta_4 REGIST_{it} + \beta_5 ICT_{it} + \beta_6 HLOAN_{it} + \beta_7 BLOAN_{it} + \varepsilon_{it} \quad (1)$$

in which the regional GDP *per capita* is the dependent variable (PROD in the analysis on productivity), with the independent variables are described in Section 4 (Tab. 1), considering the 21 Italian regions and autonomous provinces (*i*) for the period (*t*) 2007–2015. In particular, LABFSEC, LABFTER and LIFEL represent the human capital; REGIST, ICT, HLOAN and BLOAN are the control variables used to test the robustness of the results; $\beta_0, \dots, \beta_7$ are the parameters estimated in Section 5 and ε_{it} is the error term.

In the second analysis, the endogeneity problem is considered, and the three human capital variables are transformed and replaced with a consistent estimator. In fact, an estimate of the model using independent variables that can be endogenous with respect to the dependent variable (related to the model's estimation error) results in inconsistent estimates. A 2SLS model uses instrumental variables to remedy the problem. In our case, the GDP level, used for the measure of the two dependent variables, influences the opportunity for education (Akee et al., 2010). More influence can be found in lifelong learning opportunities (Eichhorst et al., 2015), which often consist of expensive training processes. At the same time, decades of studies have shown the relationship between education and earning (from Mincer, 1958 and 1974, to more recent studies, e.g., Boudarbat et al., 2010; van Praag et al., 2013) observed in the so-called "education premium[7]". In our model, considering the risk of reverse causation between GDP and human capital, its related variables are controlled using variables that

[7] The returns from education can be measured in terms of the additional income due to a higher level of education (or an additional year of schooling).

influence the human capital endowment. The instrumental variables are the school dropout rate, the rate of attractiveness of universities, the voluntary rate, and population density. Our choice of instruments is based on the fact that these instrumental variables affect education and training paths (see Section 4) and are mainly influenced by the social capital and the structure of local society.

We report the values of the Sargan test (in all cases, values are above 0.05) for the validity of the instrumental variables. Furthermore, the F-test (Staiger and Stock, 1997) is used to test the strengths of the instruments, having positive results if the values exceed the threshold of 10. The results are reported in Tables 3 and 4.

4. Data description and summary statistics

In our regional analysis, the local GDP *per capita* represents the target value; we use the constant 2010 values (as similarly done by Li and Fang, 2014; see also Di Liberto, 2008 on the Italian regions with a focus on human capital). We also consider the effect of the independent variables on the GDP *per worker*, which is a widely used measure of productivity in regional studies (e.g., it is considered by Maffezzoli, 2006; Gennaioli et al., 2013). We consider the fact that the level of productivity is different among the Italian regions and is one of the main causes of divergence (see Leonida et al., 2004; Maffezzoli, 2006), and, at the same time, a possible area of improvement to promote convergence (Di Liberto et al., 2008).

The analysis of various factors influencing the GDP may have the characteristics of an augmented Solow model (Mankiw et al., 1992). However, we do not present a regional GDP growth model (considering the short and non-representative period studied), and other reasons need to be considered in collecting data. First, the variables

must be representative of the Italian North-South divide and of the economic recession period. Second, the consideration of variables that may be endogenous in relation to GDP suggests the use of a 2SLS model that implies the research of instrumental variables (see Section 3).

The main investigated aspect is the contribution that human capital provides at the regional level. Human capital is one of the main determinants of the long-term regional economic performance (Crescenzi et al., 2016). This economic resource (see the extensive literature review in Goldin, 2016) is useful in explaining part of the local divergence in economic growth (Démurger, 2001) through a strong influence on the regional economy (Fleisher et al., 2010). Knowledge, skills and capabilities of the labor force characterize human capital, and it is observed through data on schooling (Breton, 2013; Hanushek, 2013) and lifelong learning (Edwards et al., 2002).

With the aim of representing the human capital that characterizes the local labor force, we consider the percentages of workers with secondary and tertiary education (Crescenzi, 2005; D'Agostino et al., 2013) and those involved in lifelong learning. We consider the highest education levels because not all levels of education have the same economic impact in advanced economies (Hanushek and Woessmann, 2012; Castelló-Climent and Doménech, 2014), so we expect to find major relevance of the highest level of education in our case (Vandenbussche et al., 2006).

We consider control variables for explaining the GDP during the recession period, in addition to human capital. The local financial system is among the most important economic factors during a post-crisis period characterized by a relevant credit crunch risk. The financial system strongly contributes by providing resources for consumption and investment. The difficulties in obtaining loans and the relative costs

increase during periods of crisis, affecting the most-vulnerable areas (Del Giovane et al., 2013). For this reason, we expect to observe negative consequences due to the structural weaknesses of the southern local financial systems (Deloof and La Rocca, 2015) stressed by the prolonged recession period. In fact, Ferri and Messori (2000, on the Italian macro-areas) observe that the whole socioeconomic context is decisive for the work of the banks and their related efficiency, and positive effects have been registered in the Center-North, allowing for a greater possibility of borrowing (Bank of Italy, 2017). For example, credit availability allowed businesses to sustain their financing needs in the short-term (e.g., Akbar et al., 2013, for the UK) and to survive the weaknesses in European liquidity after the 2007 crisis. We have calculated two values representing the access to credit for consumer households and businesses. However, loans for household consumption and business investments do not have the same importance, and we expect to find a positive role played by corporate credit and a negative role for household credit. Corporate credit is usually associated with economic growth (Aghion et al., 2005), while credit to consumer households could have positive economic consequences if, for example, invested to improve human capital (Galor and Zeira, 1993). Meanwhile, household credit, which in some countries accounts for a greater share of private credit than corporate credit does, has no positive effects on either economic growth or the reduction of inequality (Beck et al., 2012). In regions with less efficient financial systems, such as in southern Italy, a greater share of credit going to households (e.g., influenced by the rising unemployment level in the post crisis period) means there is less credit available to businesses (Mattoscio et al., 2017), which disfavors the positive economic effects of the expansion of corporate credit. We consider the average bank loans (Bank of Italy data) to households and to businesses

(financial, non-financial and family businesses) calculated by dividing the loan values by the number of resident households and businesses registered (Istat data).

Finally, data on the characteristics of businesses are considered because they are important in the economic analysis (van Stel et al., 2005), and the North-South differences in Italy are also evident in this case (A'Hearn and Venables, 2013). We include the business's registration rate as a proxy for entrepreneurial vitality, and we calculate an index of the use of information and communication technologies (ICTs) by businesses, representing the ability to adapt to innovation during the knowledge economy era. Innovation is, in fact, a difficult commitment for the widespread Italian SMEs (small and medium enterprises), especially in the South (Scupola, 2003).

The selection of instrumental variables that are representative of the crisis period, uncorrelated with the error term and at least partially correlated with human capital can be inspired by the literature. We have selected four variables among those that explain the Italian dualism in human capital that are not endogenous to the GDP measure. We include data on the early school dropout rate, which has a negative impact especially among the disadvantaged social groups and in the poorest areas[8] (compare with Ream and Rumberger, 2008, for the US). Furthermore, the dropout rate is strongly influenced by the quality of school institutions (Hanushek et al., 2008), and for these reasons it could hit the South harder. Therefore, a related aspect is the quality of education, which is more important to the development of human capital (Faggian and McCann, 2009b) than the mere achievement of qualifications (Hanushek and Woessmann, 2007). In particular, the differences between the quality of universities in Italy can lead students to move, but only if the universities in the region of origin are

[8] The school dropout rate is approximately 20% in the South and 12–15% in the central and northern regions in the last years considered.

not considered of good quality (Ciriaci, 2014). We include the "rate of attractiveness of universities" calculated by Istat as a proxy measure of the quality of the highest level of education. Another fundamental aspect concerns social capital, which must coexist with human capital but is also a basis for its strengthening (Coleman, 1988). Even in this case, differences between North and South are found in Italy (Helliwell and Putnam, 1995), and we observe this phenomenon through the proxy of volunteering (as done by Rush et al., 2015) considered as a measure of social participation (Huang et al., 2009, a study on the connections with human capital). In turn, the number of volunteers does not strictly depend on the number of paid workers or income (Freeman, 1997), which could otherwise link this variable to our dependent variable. Finally, the population density is a proxy for the agglomeration economies (Krugman, 1996), which suggest the attraction of high-skilled workers in areas with a high intensity of economic activities. The agglomeration reduces transaction costs (Quigley, 1998) and is common in regions with a higher population density (Qian et al., 2013), since higher density increases the possibilities of interactions between skilled individuals (Glaeser, 1999).

In Table 1, variables 1–2 are the two dependent variables, variables 3–5 represent human capital, variables 6–9 concern other aspects of the dualism, and variables 10–13 are instrumental in the 2SLS model.

Table 1. Variable descriptions and sources.

	Variable	*Definition*
1	GDP	GDP *per capita*, constant 2010 values (*Source*: Istat)
2	PROD	GDP *per worker*, ratio between the regional GDP (constant 2010 values) and the number of employed people (*Source*: Istat – our elaborations)
3	LABFSEC	share of labor force with secondary education (in % of labor force) (*Source*: OECD)

4	LABFTER	share of labor force with tertiary education (in % of labor force) (*Source*: OECD)
5	LIFEL	population aged 25-64 participating in education and training (last 4 weeks, %) (*Source*: Eurostat)
6	HLOAN	average bank loans to households (ratio of bank loans to households based on the number of resident households, euro) (*Source*: Bank of Italy and Istat – our elaborations)
7	BLOAN	average loans to businesses (ratio of bank loans to financial, non-financial and family businesses based on the total businesses registered, euro) (*Source*: Bank of Italy and Istat – our elaborations)
8	REGIST	net registration rate in the Company Register (the *Italian Business Register*; businesses registered minus businesses closed based on the total businesses registered in the previous year, %) (*Source*: Istat)
9	ICT	synthetic index of businesses' ICTs (our estimates[9] consider the following: degree of use of PCs, Internet access, broadband availability, corporate website, businesses with more than 10 employees) (*Source*: Istat – our elaborations)
10	DROP	school dropout rate, early leavers from education and training, % of population aged 18-24 with at most a secondary school education, and who have not completed a training course recognized by the region with a duration of more than 2 years and who do not attend school courses or training (%) (*Source*: Istat)
11	UNIV	rate of attractiveness of universities (ratio between net migration of students and the total number of enrolled students, %)[10] (*Source*: Istat)
12	VOL	people aged 14 and over who carried out voluntary work based on the total population aged 14 and over (%)[11] (*Source*: Istat)
13	DENS	population density, ratio between the number of inhabitants (average annual population) and the surface area in km^2 (*Source*: Istat)

With the aim of identifying the strong North-South differences, Table 2 shows some summary statistics for the two groups of regions.

[9] This IT index related to businesses is an average value of the four Istat indicators in parentheses.
[10] The 2015 values are obtained as the average of the previous two years.
[11] The 2015 values are obtained by considering the regional time series 1995–2015.

Table 2. Summary statistics for the Center-North and South (in parentheses), 2007–2015.

	Min	Max	Mean	SD
		Dependent variable		
GDP	21913.18 (15309.53)	38406.04 (24454.40)	30728.32 (18764.97)	4005.30 (2327.36)
PROD	57431.86 (55949.67)	91906.88 (66195.87)	74281.48 (60769.99)	7333.32 (2743.28)
		Endogenous variables		
LABFSEC	40.00 (37.70)	55.40 (52.90)	48.45 (43.38)	3.33 (3.62)
LABFTER	10.70 (13.00)	25.90 (20.70)	17.55 (16.82)	2.92 (1.60)
LIFEL	3.90 (4.30)	13.40 (9.70)	7.32 (6.08)	1.66 (1.05)
		Control variables		
REGIST	-2.67 (-1.24)	2.47 (1.84)	0.12 (0.35)	0.83 (0.64)
ICT	61.17 (49.63)	81.82 (73.23)	71.30 (63.58)	4.71 (4.95)
HLOANS	14746.33 (10992.20)	34862.41 (20282.49)	24755.10 (15583.43)	4925.06 (2612.67)
BLOANS	110781.04 (54268.07)	427019.54 (136230.17)	240546.08 (91227.73)	86464.10 (20277.68)
		Instrumental variables		
DROP	6.93 (9.62)	26.12 (28.72)	14.72 (18.76)	3.67 (5.15)
UNIV	-229.05 (-226.35)	33.74 (30.60)	-12.65 (-48.82)	56.65 (65.86)
VOL	8.30 (5.38)	28.11 (12.79)	15.54 (8.50)	5.10 (1.94)
DENS	38.34 (57.10)	419.28 (429.07)	186.52 (159.49)	104.18 (114.10)

North-South differences in average GDP *per capita* are evident (less in GDP *per worker*), with public education allowing the populations to reach similar levels of

education, although the level is lower, on average, in the South. Several variables are strongly affected by the recession in all regions. The use of ICT technologies by businesses is slightly higher in the northern area. The average values of loans show the efficiency and dynamism of the northern financial system.

5. Results

In this section, we analyze the two macro-areas described in the previous section. We use a fixed effects model as done, e.g., by Ozgen et al. (2010) on the effects of the migration process and by Ramos et al. (2010) on the effects of human capital, both on regional income and convergence. We use the same variables to run a 2SLS model to observe differences in the coefficients when instrumental variables are used to limit the endogeneity problem related to human capital. These models are used in regional studies, e.g., in Démurger (2001) to get consistent results.

Table 3. FE and 2SLS regressions on the two groups, GDP *per capita* is the dependent variable.

	Center-North		*South*	
	FE	*2SLS*	*FE*	*2SLS*
LABFSEC	71.86 (77.13)	1364.11 (1004.17)	-94.85 (65.89)	-109.03 (82.40)
LABFTER	-394.88*** (109.88)	-1440.14*** (568.67)	-175.53* (94.50)	705.51*** (200.21)
LIFEL	265.97** (112.51)	-4077.23 (2633.95)	137.26 (128.48)	287.62 (234.64)
REGIST	560.54*** (142.31)	2325.26** (992.55)	-197.89 (123.76)	-201.95 (212.93)
ICT	-92.63** (42.87)	1127.08** (546.17)	-103.27*** (26.60)	-224.79*** (39.99)
HLOAN	-0.19*** (0.07)	-0.81*** (0.32)	-0.07 (0.09)	-0.19* (0.11)

BLOAN	0.01 (0.01)	0.04*** (0.01)	0.03* (0.02)	0.11*** (0.02)
Constant	41943.07*** (3605.18)	-50732 (54995.10)	30279.20*** (2744.81)	16735.37*** (2261.72)
Sargan test p-value		0.7463		0.3747
First-stage F statistic (LABFSEC)		35.79*** [0.000]		28.00*** [0.000]
First-stage F statistic (LABFTER)		36.32*** [0.000]		19.25*** [0.000]
First-stage F statistic (LIFEL)		20.14*** [0.000]		19.02*** [0.000]
R^2	0.6738		0.7255	
N	117	117	72	72

*Note: ***, **, * statistically significant at level 0.01, 0.05 and 0.10.*

In the 2SLS model, LABFSEC, LABFTER and LIFEL are instrumented with DROP, DENS, VOL, UNIV.

Source: Authors' elaboration based on Bank of Italy, Eurostat, Istat, OECD data.

Considering the FE results, the negative effect of the ICT index of businesses is a common aspect between the two areas, possibly due to the widespread low-tech specialization. Concerning the Center-North area, the net registration rate of businesses has a positive sign linked to the ability of local businesses to create wealth. The (not relevant) negative sign in the South suggests an anomaly of the economic system. Thus, this rate confirms the positive contribution of the high industrialization and entrepreneurial dynamism as a local strength that is lacking in the South. Vocational training has a direct relationship with the GDP, according to the FE model in the Center-North, indicating both the interest in keeping the professionalism of workers up-to-date and the presence of the economic conditions to afford this type of training. This is a positive aspect that is lacking in the South, because it implies a greater effort, since

lifelong learning processes are expensive and are often paid for by individuals or funded by large businesses (Eichhorst et al., 2015) that are more widespread in the North.

The 2SLS model highlights ambiguous aspects related to human capital, the relevance of credit, and the consequences of the different characteristics of local businesses.

The share of the labor force with tertiary education has an inverse relationship in the Center-North area. The negative effect of advanced education can be explained by the low economic specialization of companies. The low-tech and labor-intensive production processes influence the high demand for unskilled and low-skilled labor (Reyneri and Fullin, 2008), and these working conditions have led highly educated workers of the northern regions, more than those of the South, in some periods, to emigrate abroad (Becker et al., 2004). The negative sign and the overall scarce significance of human capital are consequences of Italy's historic lack of attention to scientific research and innovation since the North-South unification (Nuvolari and Vasta, 2015). These effects could be influenced by the increasing returns of the different degrees of education (Hanushek and Woessmann, 2012; Castelló-Climent and Doménech, 2014), which may have been exhausted the positive effects in the North, while remaining in the South considering the slight delay of the development of southern human capital.

Of course, this situation could be positive for exploiting a convergence path based on human capital, because the data show that in Italy, and especially in the South, there is much room for improvement of all the characteristics of the knowledge economy. For example, the percentage of graduates is less than 15% in the South and

18-20% in the Center-North compared to the European average of 30.1% in 2015 (Istat and Eurostat data).

The signs of the two types of loans are as expected: positive for corporate credit and negative for credit to households. This report is well-known in the economic literature (Büyükkarabacak and Valev, 2010), where "productive" credit is strongly linked to economic growth (Sassi and Gasmi, 2014), as opposed to credit for households (Beck et al., 2012). The double report is confirmed in both areas, and the coefficients show a higher need of southern business for receiving funds during the recession period.

Finally, the ICT indicator shows that growth in business-related innovation would play a positive role in the Center-North, while it would be useless or a waste of resources in the South. However, we also need to consider that southern companies may not have sufficient resources or even adequate access to credit to make long-term investments in technological innovation (Scupola, 2003). In the South, access to credit is more expensive, and the amount of household loans is almost equal to the corporate credit, while only one-third of these resources is destined to households in the Center-North (Bank of Italy, 2017).

In the next table, we repeat the previous analysis by replacing the dependent variable with the GDP *per worker*, a proxy for the regional productivity level. This analysis can provide detailed information about another important aspect of North-South inequality in Italy.

Table 4. FE and 2SLS regressions on the two groups, GDP *per worker* is the dependent variable.

	Center-North		*South*	
	FE	*2SLS*	*FE*	*2SLS*

LABFSEC	84.40 (162.85)	3720.10 (2503.91)	-139.44 (161.00)	-655.48*** (224.54)
LABFTER	-616.24*** (232.00)	-2336.91* (1417.99)	-127.49 (230.88)	1982.33*** (545.56)
LIFEL	647.76*** (237.54)	-11219.55* (6567.77)	213.96 (313.91)	-2459.27*** (639.38)
REGIST	952.94*** (300.46)	4837.69** (2474.94)	11.76 (302.39)	301.86 (580.24)
ICT	-186.45** (90.52)	2709.77** (1361.89)	-23.58 (65.00)	-59.90 (108.96)
HLOAN	-0.11 (0.14)	-1.71** (0.79)	-0.25 (0.21)	-1.03*** (0.29)
BLOAN	0.01 (0.01)	0.07* (0.04)	0.09** (0.04)	0.19*** (0.05)
Constant	90332.76*** (7611.72)	-151000.00 (137130.86)	65288.61*** (6706.40)	72923.15*** (6163.12)
Sargan test p-value		0.6249		0.1365
First-stage F statistic (LABFSEC)		35.79*** [0.000]		28.00*** [0.000]
First-stage F statistic (LABFTER)		36.32*** [0.000]		19.25*** [0.000]
First-stage F statistic (LIFEL)		20.14*** [0.000]		19.02*** [0.000]
R^2	0.4677		0.2681	
N	117	117	72	72

*Note: ***, **, * statistically significant at level 0.01, 0.05 and 0.10.*

In the 2SLS model, LABFSEC, LABFTER and LIFEL are instrumented with DROP, DENS, VOL, UNIV.

Source: Authors' elaboration based on Bank of Italy, Eurostat, Istat, OECD data.

The second analysis (Table 4) confirms the negative sign of tertiary education for the Center-North and the positive sign for the South. The positive contribution of lifelong learning to productivity improvements is confirmed (with a higher coefficient compared to Tab. 3) in the most developed area of the country only by the FE model. In contrast, the investment in adequate preparation and capacity of workers has a negative effect in both areas according to the 2SLS model. This relationship suggests, besides the

aforementioned scarce capacity in exploiting knowledge workers' capabilities, the difficulty to adapt the training paths to local business needs. The signs of the credit variables are confirmed and expected. The greater need for credit of the southern businesses is evident, as they were penalized by the inefficiencies of the post-crisis local financial systems. The increased availability of credit could affect vocational training processes and therefore the productivity of workers, but it would be less effective for the inefficiencies observed in the period under analysis.

The minor contribution of the selected variables to productivity improvement represents a limit for economic development and for the convergence path. In particular, low-tech specialization is widely known as a limit to Italian socioeconomic development and consequently to labor productivity, as reported, e.g., in the studies of the European Commission: "*Italy's specialisation model is very similar to that of emerging markets such as China, with most of the value added in relatively low-tech traditional sectors, mainly due to Italian firms' limited innovation capacity*." (European Union, 2013, p. 8), and in the 2018 EU report on Italy: "*Investment in 'intangible' assets such as R&D, innovation and training of workers remains below the EU average due to the large number of micro-firms, Italy's lack of specialisation in knowledge-intensive sectors, limited digitisation and digital skills.*" (European Commission, 2018, p. 3).

6. Conclusions and policy implications

In this study, we propose an alternative analysis to a classical *North-South problem* characterizing two Italian macro-areas with a focus on the period of the prolonged recession that occurred after the international crisis of 2007.

The lack of income convergence is a recognized fact. It is well-known that the Italian North-South gap increased during the *Great Recession* (Lagravinese, 2015), and the regional dualism has grown ever stronger, despite decades of efforts by the central government and the European Union to promote regional economic and social cohesion (Monfort, 2008). Convergence is present only within macro-areas (Brida et al., 2014), and the northern and southern areas of the country are going through dissimilar paths of economic development (von Lyncker and Thoennessen, 2017). These paths lead the richest area (Center-North) to overcome the average European income despite the prolonged recession period and the poorest area (South) to have an income that is approximately half that of the northern regions. Despite recent studies that claim that the distinction between macro-areas is irrelevant considering the interconnected smaller contexts (González, 2011, for the UK and Italy), we note an evident North-South distinction by considering the GDP *per capita* (as shown in Fig. 1) and several socioeconomic aspects (Tab. 2), which are added to the absence of recent convergence (Fig. 2).

The post-crisis dynamics deserve detailed investigations. In this circumstance, particular attention is paid to human capital embodied in the labor force, which is considered a relevant economic resource in the knowledge economy era and a possible strength for the less-wealthy area in the post-crisis period.

The North-South differences in the relationships between human capital and economic development show the ambiguous role of education in Italy (observed by Di Liberto, 2008, in the pre-crisis years), influenced by low-tech specialization, the poor Italian ability to gain returns from education and the barriers to productivity growth due to, e.g., recent legislative changes (such as the increased flexibility; see Lucidi and

Kleinknecht, 2010). The lack of attention to innovation and scientific research in Italy during its recent economic development has indeed made it a unique example of development, and at the same time its economy is "fragile" when compared to other advanced economies (Nuvolari and Vasta, 2015). This also implies a marginal role of human capital, at least during the recession, even in the area of labor productivity enhancement, which is was expected to promote.

The economic role of human capital is found to be inadequate, and the reverse relationship between tertiary education and GDP (as well as for the level of productivity) is confirmed in the wealthiest area of the country. In the South, despite lower values of all the variables that characterize human capital, the relationship between advanced education and GDP *per capita* and *per worker* is positive. Furthering advanced education in the South can thus be a strategy to boost growth, rather than focusing investment on expensive and outdated industrial revival plans.

Of course, the opportunity to efficiently employ knowledge workers is insufficient if other conditions are not verified. We know that the possible benefit from the various levels of education is strongly linked to the level of economic development of each context. For example, Vandenbussche et al. (2006) attribute the stimulus to economic growth in OECD countries to the positive contribution of the "skilled human capital" and not to the total human capital, and Shapiro (2006) proves the positive economic effect of college graduates, with respect to high school graduates, in the US[12]. This is influenced by the fact that the higher levels of education are connected to the

[12] The so-called returns of education are higher for tertiary education (Castelló-Climent and Doménech, 2014) and lower at lower levels of schooling due to the lower quality of education (Hanushek and Woessmann, 2012). These differences help explain the negative sign for secondary education and the positive sign for tertiary education observed in the *Mezzogiorno* area.

innovation process, while primary education is linked to production activities (Papageorgiou, 2003) and is thus not considered in our analysis.

The next step would be to expand the contribution of continuing education, because its diffusion has been scarce in Italy, despite its recognized usefulness (Jakobi and Rusconi, 2009). Several problems limit lifelong learning, especially in the South: there is a high unemployment level (approximately 8% in the North, 10% in the Center and 20% in the South), businesses are smaller and less wealthy (and a business's size affects the possibilities of lifelong learning, as in Eichhorst et al., 2015), and the average income is lower (so households cannot pay for training courses). For these reasons, adults involved in this type of training comprise up to 13% of the population in the Center-North and less than 6% in almost all southern regions. However, the observed role of lifelong learning is controversial during the recession period. In particular, the negative effect on the GDP *per worker* in the two areas, according to the 2SLS model, suggests the presence of deeper problems, influenced by the history of industrial development, that limit the opportunities, as discussed, of the industrial revival. In fact, two types of public support efforts have occurred in Italy since the 1950s: the creation of large public enterprises in the South and the establishment of small private enterprises in the Center-North. Decades of "extraordinary" interventions (for creating externalities and widespread development) created a sort of distortion of the market (see Alesina et al., 1999), and the South's heavy industry was no longer competitive in the knowledge economy era. Furthermore, EU support policies were used to favor traditional sectors at the expense of innovative ones (Felice, 2007).

Inadequate use of knowledge workers' capabilities is linked to industrial development. Our results suggest that the problem of the lack of industrialization in the

Mezzogiorno (when compared to the "rich North") seems to be a problem that can be overcome under certain conditions. The economic gap can be filled by moving the southern economy towards the exploitation of innovative and high-tech sectors (employing highly educated workers), but the necessary efforts collide with the financial market inefficiencies. The South has already missed the period of strong productivity growth during the ICT revolution (1985–1995) due to the lack of capital and local entrepreneurial initiatives, as well as government inefficiencies (Capello, 2016). Even in the period 2007–2015, we do not observe positive effects of the ICT on productivity. The access to credit is a very important factor in the Italian context (Guiso et al., 2004), and the coefficients suggest that southern companies need more resources to invest and innovate. The lack of resources is due to the inefficiency of the southern financial systems, which makes access to credit difficult (thus also limiting the opportunity to invest in human capital). Also in this case, a North-South divide exists: "*The banking system is split in two: the banks in the North of Italy are closer to the middle-European efficiency levels, while the South and the Centre of the country lag behind*" (Resti, 1997, p. 246). The efforts of businesses and households are therefore burdened by credit constraints.

In conclusion, the North-South divergence is evident in terms of economic performance and productivity, but the different socioeconomic strengths in the North and the South are also evident. Our findings become more interesting by comparing our results with those of Gitto and Mancuso (2015, pp. 10-11), who state that "*in the Northern and Central regions, labor productivity growth is driven primarily by physical capital accumulation, whereas in most of the Southern regions, it is driven by human capital accumulation*". Moreover, labor productivity influenced by human capital is a

major factor influencing the regional catch-up in Italy (Di Liberto et al., 2008). A limit is the brain drain problem that afflicts the southern human capital because of the skill-selective migration in Italy (Fratesi and Percoco, 2014). The low level of specialization encourages educated workers to move to the North (Biagi et al., 2011) or abroad (Becker et al., 2004). These workers are also moving to the North because of its lower rate of unemployment (Bonoli, 2010)[13] and to leave behind the weaker social and cultural capital in the South (Ichino and Maggi, 2000).

Two approaches seem useful for fostering a path that tries to narrow part of the socioeconomic gap: support for the development of human capital, which can come from the strengthening of cultural and social capital (Putnam, 1993), and an effort to make the southern financial systems more efficient (Deloof and La Rocca, 2015, on SMEs).

However, policy actions should take into account the presence of the so-called "many *Mezzogiorni*" (Guerrieri and Iammarino, 2006), i.e., the high heterogeneity present in the *Mezzogiorno* area that deserve a more detailed analysis considering the province level (Eurostat NUTS 3). The availability of data at the NUTS 3 scale would contribute to an improvement in the understanding of the ongoing development paths, such as the study of convergence based on other aspects in addition to income, but this may lead to problems with data availability. The influence of the brain-drain process should also be considered in further studies because of its relevance to the Italian case (e.g., Fratesi and Percoco, 2014). Furthermore, a measure of the quality of human capital could be used to measure each region's competitiveness (e.g., Romijn and Albaladejo, 2002). For example, a high share of graduates in scientific and engineering

[13] Positive aspects concerning human capital can also be found in the origin regions. The success of high-skilled emigration can stimulate the development of human capital in the place of origin, with effects on the economic growth path (Faggian et al., 2017).

areas should enhance the competitiveness of human capital, and strong differences exist between the North and the South of the country. Istat data on students enrolled in universities (by region of residence, 2012) show that the percentage of students enrolled in the study of science is 3.25% in the Center-North and 2.71% in the South, and PISA 2015 data (OECD, 2016) on students' career expectations show that careers as "science and engineering professionals" are sought by 10.3% of students (15 years and +) in Lombardy (North) and 8.5% in Campania (South). The consideration of additional aspects that characterize human capital will be the subject of future research.

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The role of human capital after the crisis in Italy: a regional analysis

Highlights:

- We analyze in an original way one of the most evident cases of the *North-South problem*, the dualism between the Italian regions in the post 2007-crisis period.
- We analyze several economic determinants in the two main macro-areas using fixed effects and 2SLS models. Particular importance is attributed to human capital.
- The economic literature suggests a dualism in human capital and the inability to exploit this economic resource in Italy. Our results partially confirm these relationships, but with obvious territorial differences.
- During the recession period, a convergence path inspired by well-performing regions is infeasible for the less-wealthy area; it is more efficient to exploit the local characteristics.
- Structural weaknesses in the less-wealthy area restrict potential convergence. There is poor support in human capital development and low efficiency in the local financial systems.

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The role of human capital after the crisis in Italy: a regional analysis

Vitae

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