

THE NORTH–SOUTH DIVERGENCE IN ITALY DURING THE *GREAT RECESSION**

by

IACOPO ODOARDI

*Department of Philosophical, Pedagogical and Economic-Quantitative
Sciences, University of Chieti-Pescara, Pescara, Italy*

and

FABRIZIO MURATORE

*National Foundation of Accountants - Economics and Statistical Office,
Rome, Italy*

The economic recession that followed the 2007 crisis has widened the economic gaps between the wealthiest and the relatively poorer regions in Italy. The *Great Recession* has changed the importance of local economic strengths and hindered the possibilities of economic recovery, especially in the *Mezzogiorno* of Italy. We seek the local strengths present in Italian regions in the post-crisis period by comparing two macro areas to observe strong and weak points for intervention. A first analysis using multivariate adaptive regression splines (MARS) is used to filter the relevant determinants in a large dataset, and a panel data analysis serves to obtain group-specific results. Some effects of the prolonged recession are confirmed in all regions, while some weaknesses of the South, such as financial markets, play an increasing role in the regional development scenarios.

1 INTRODUCTION

The economic crisis of 2007 caused a period of prolonged recession in several countries and particularly damaged the regions affected by long-term structural, social and economic weaknesses. The consequences of the crisis were more serious in regions that are less competitive and that lack characteristics for the possibility of resilience, such as the South of Italy (Lagravinese, 2015). In Italy, the post-crisis recession has mostly affected the regions of the so-called *Mezzogiorno* (the southern regions and major islands), amplifying the divergence of this macro area from the wealthy Center-North. This represents one of the most evident cases of the North–South divide; a result of the international crisis is the coexistence of two macro areas that are highly distinct in terms of income and wealth, as well as in numerous social aspects.

The Italian dualism is a well-known phenomenon. The divergence between the central-northern and southern regions began with the unification

* Manuscript received 15.12.2017; final version received 20.05.2018.

of the country in 1861 (Daniele and Malanima, 2007), and already in that period, the weaknesses of the South (in terms of income, health, and education) were notable (Felice, 2007). Important gaps persist in the twenty-first century (Del Giovane *et al.*, 2013; Abramo *et al.*, 2016), and their divergent paths have been accentuated following the negative effects of the 2007 events, amplifying the recessionary effects (Lagravinese, 2015). Starting from these stylized facts, the research question of this paper is as follows: what are the specific economic determinants, or rather the local economic strengths, that influence the development paths of the two macro areas in light of the effects of the so-called *Great Recession*?

Moreover, the discovery of the actual local determinants introduces a second research question: have the effects of the *Great Recession* highlighted new or different local strengths (compared to those known in the literature) that may help the South start a different development path? The aim is to start a path of possible convergence with the ‘rich North’.

To answer these two questions, we study the local strengths influencing the regional income and compare the wealthiest and the poorest areas of the country. We present two hypotheses. First, we expect to find confirmation of the socioeconomic dualism in the comparison between areas in the post-crisis period. Second, we expect to observe the influence of the crisis on key economic factors. In this sense, financial difficulties (e.g. the well-known credit crunch) could occur in the two areas in dissimilar ways. This point implies different policy actions that should exploit the positive local characteristics influenced by the effective economic strengths (e.g. see the local specialization strategy in Capello and Kroll, 2016), as already occurred in some areas of the South before the crisis (Basile *et al.*, 2003).

Our focus is on the 21 Italian regions and autonomous provinces¹ in the period of the crisis and prolonged recession from 2007 to 2015, and we use panel data composed of 15 variables that the literature suggests affect local GDP and influence the Italian North–South dualism. This study’s contribution to the literature on these dynamics is the consideration of socioeconomic aspects using a data mining technique that can deepen variables linked to more policy lines in addition to the main ones concerning regional inequality, e.g. equity in general, the reduction of localized problems (such as unemployment), and the under-utilization of resources in some areas (Hansen, 1995).

To identify the aspects that influence each macro area, we consider clusters of regions suggested by the economic literature for comparison because a spatial division consistent with the period and socioeconomic events studied can improve the analysis (Terrasi, 1999). We compare the Center-North area with the *Mezzogiorno*, which represents the most backward area of the

¹The EUROSTAT NUTS 2 level divides Italy into 19 regions and 2 autonomous provinces (Trento and Bolzano) instead of the Trentino-Alto Adige region.

country (Capello, 2016). In the first step of analysis, we use a multivariate adaptive regression splines (MARS, Friedman, 1991) analysis to efficiently exploit the information present in a large dataset (see Hastie *et al.*, 2001). In particular, MARS is recognized as more efficient than traditional analyses (Leathwick *et al.*, 2006) and can reduce problems between variables, such as multicollinearity. In the final step, after dropping all but the relevant variables, a comparison of fixed and random effects models is employed.

The paper is composed as follows. We present some well-known cases of regional dualism, including Italy, in Section 2. In Section 3, the methods are explained, and the selected variables are presented in Section 4. The clusters of regions are discussed in Section 5. Our analyses (MARS and the fixed vs. random results) for the two clusters follow. In the last section, we suggest policy interventions and compare our results with the economic literature on the North–South divide.

2 LITERATURE REVIEW

North–South divides exist in many countries where development gaps between regions are present. The process of growing divergence usually originates from the fact that in many Western economies, the birth and development of a leading sector leads to the development of a certain area or core region (e.g. Pred, 1965). The strength of this sector self-perpetuates, resulting in stronger economic growth with respect to other areas; furthermore, it contributes to attracting resources from the ‘periphery’ to the more developed area (Friedmann, 1966). In some cases, social and economic changes that occurred in the past attract investments to the peripheral regions, which increase their economic strength and reverse the trends of inequality. This change has occurred for some countries as a consequence of the growing economic integration that occurred among many national markets in North America and Europe (Suarez-Villa and Cuadrado Roura, 1993).

The diverse paths of development do not make it possible to standardize all cases of the North–South divide. An explanatory case is represented by the regional dualism present in the US. During the 19th century, when the Northeast and Midwest areas became the center of the manufacturing industry, remaining a national strength until the 1960s. Subsequently, the creation of innovative points of industrial development in some ‘peripheries’ (South and West areas, see the polarization reversal in Fan and Casetti, 1994) moved the center of economic interest. The change in the competitiveness of sectors and the movement of resources and capital have continued to change the regional inequality scenarios.

Even the stages of inequality can change. In fact, Amos (1988) demonstrates that after a period of decreasing inequality (suggested by Kuznets’ inverted-U hypothesis (1955) and observed regionally by Williamson, 1965),

a new increase can be detected (see also Fan and Casetti, 1994). For example, public policies that favored market forces in the US induced greater inequality during the 1980s (Hansen, 1995).

Two of the major cases of regional dualism are interesting for their evolution and the connected policy implications. One of the main cases of dualism discussed in recent years is the Chinese coastal-inland dualism that has strongly increased over time (Kanbur and Zhang, 1999). The rapid economic development of the coastal provinces with respect to the inland areas became evident during China's robust economic growth of the 1990s (Bhalla *et al.*, 2003). Of course, the coastal provinces exploited advantages in agriculture and trade during the years of opening to foreign markets and thus attracted businesses. Policymakers' efforts after the economic reform (Hao and Wei, 2010) have not helped reduce the divergence (Putterman, 1992). The wealthiest areas have been able to develop the local human capital, enhance capital endowment and foster innovation (Liu and Li, 2006), favoring an increase in the local productivity level (Tsui, 2007), exploiting the market opening and benefiting from the positive aspects of globalization (Hao and Wei, 2010).

The U.K.'s North–South divide represents another well-known case in economic literature (Martin, 1988; Baker and Billinge, 2004). In comparison with the northern area, the southern area of England has higher wages, greater wealth, better economic development and even a difference in terms of human capital. This division was born as a result of the various economic development paths in the country that have defined two macro areas with different levels of economic efficiency and productivity (Dunford, 1995). Despite some industrial development in the northern area during the nineteenth century, the strength of the capital, London (in the South), has always attracted the elites, financial power and wealth in general (Rubinstein, 1988). As in other countries, the decades after World War II showed strong economic growth but disfavored the old industrial specialization of the North and induced the transfer of resources toward the South, thus highlighting a different type of development (Dunford, 1995). In the following decades, even the political division (Green, 1988) between the North (Labour Party) and the South (Conservative Party) influenced the lack of socioeconomic convergence. Since the 2000s, neoliberal policies intended to foster recovery in all areas have included attention to growth at the expense of redistribution, attention to cities as points of interest for economic activities, and particularly attention to the market and private companies (see the literature review in González, 2011).

2.1 A Brief Reconstruction and Some Causes of the Italian North–South Divide

The divergence between North and South in Italy is known as the '*Questione meridionale*' ('Southern issue', Salvemini, 1955) and has been recognized

since the late 1800s; this demonstrates how the theme of analysis is complex and began with the first signs of economic modernization in the country (see Nitti, 1900).

The Center-North and the South of Italy were two distinct areas before unification (Daniele and Malanima, 2011). The presence of natural resources and the proximity to foreign markets (Cafagna, 1989) were among the conditions that favored the first steps of industrialization in the North. The interest of ruling classes (Triglia, 2012) and of local elites that often did not coincide with social needs (Capello, 2016) in addition to the scarce endowments of local social and human capital (Felice, 2013) were among the causes that disfavored efforts for the industrial development of the *Mezzogiorno*. In this area, industrialization and infrastructure efforts (since the early 1900s) have encountered the problems of bureaucracy, clientelism, and wasted resources. The investment and localization choices of industries due to the characteristics of the northern regions (A'Hearn and Venables, 2013) and the opportunity to trade more easily with foreign countries influenced the regional development opportunities, particularly since the 1940s, when European integration began to favor the relationships of the northern regions with the European markets.

Over the decades, numerous interventions and public policies (Felice, 2007) failed to facilitate the independent development of the South because of its structural weaknesses and inefficiencies (Felice, 2017), which discouraged local market forces (Alesina *et al.*, 1999). Thus, the South remained a dependent economy, without useful strategic assets and affected by an inefficient role of institutions and fragmented short-term interventions (Capello, 2016).

In the following decades, the different paths of economic development influenced other relevant aspects beyond the economic and infrastructural endowment. Helliwell and Putnam (1995) find a diverse social capital stock that assumes a horizontal structure in the North and a hierarchical form in the South, influencing the civic community's participation. The scarcity of social capital in the South negatively influences cooperation and social norms (e.g. Bigoni *et al.*, 2016). For Ballarino *et al.* (2014), the social background influences the transition between secondary education levels, and a problematic condition is observed in the South. Human capital also suffers from regional disparities (Piffer and Lynn, 2014) up to the level of universities and the research system (Abramo *et al.*, 2016), although the relative North–South convergence in terms of human capital is one of the greatest post-unification successes (Felice, 2007).

3 METHODS

3.1 *MARS Analysis*

We use the MARS model (Friedman, 1991), a non-parametric regression methodology, for its capacity of observing the intrinsic nonlinear and

multidimensional relationship among the selected variables. MARS gives information on the relevance of high-dimensional panel data parameters, thus indicating the most important factors for the formation of GDP *per capita*. The model is built according to the information derived from the data (see Felicísimo *et al.*, 2013), and it has no predetermined assumptions on the functional relationships between the dependent and independent variables. The flexible procedure creates relations that can be additive and can include interactions with fewer variables. The model comprises only the relevant variables with the aim of avoiding arbitrariness in the choice of variables (if collinearity and concurvity are present, Friedman, 1993).

In our model, GDP *per capita* is the dependent variable (y); thus, the model can be written as:

$$y = f(X_1, \dots, X_p) + e = f(X) + e \quad (1)$$

In equation (1), f is the MARS model, $X = (X_1, \dots, X_p)$ is a matrix of p input variables, and e is the fitting error. Friedman's MARS contains basis functions, which are splines piecewise polynomial functions that must have the form $\max(0, x - t)$ with the knot defined at value t , while \max implies that the positive part is considered; otherwise, 0 is assigned:

$$\max(0, x - t) = \begin{cases} x - t, & \text{if } x \geq t \\ 0, & \text{otherwise} \end{cases}$$

MARS can be written as:

$$f(X) = \beta_0 + \sum_{m=1}^M \beta_m \lambda_m(X) \quad (2)$$

where $f(X)$ is MARS model derived from a linear combination of the basis functions and their interactions. The basis functions that involve identical predictor variable sets are brought together. The phases of the model allow testing the variables one by one to get the best sub-model, helping to eliminate the presence of multicollinearity. β are constants estimated via OLS, and λ_m are the basis functions (a spline function or the product of more spline functions).

3.2 Fixed and Random Effects Models

We use fixed (FE) and random (RE) effects models in panel data analysis to limit the effects of possible omitted variable bias. This problem can be present in cross-sectional regressions, as in regional analysis. These panel

data models are used by, e.g. Ozgen *et al.* (2010) to evaluate the effects of the migration process on regional income and convergence and Hong *et al.* (2011) to estimate the impact of infrastructure endowment on the growth rate of GDP *per capita* at the regional level.

Differences exist between the estimation of FE and RE (Elhorst, 2014) due to the context of analysis and the type of data. In our case, an FE model should provide better results because the analysis is applied to two macro areas (not a sample), and the number of regions is relatively low, although the model has limitations (see Johnston and DiNardo, 1997 on the influence of the quality of the data). Our equation for the analysis of panel data is:

$$\text{GDP}_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 x_{it} + \dots + \beta_{15} x_{it} + \varphi_i + \mu_t + \varepsilon_{it} \quad (3)$$

GDP is the regional GDP *per capita*, x are the 15 independent variables, i are the 21 regions and autonomous provinces, t is the nine years considered, and the error term is decomposed into regional (φ_i), temporal (μ_t), and stochastic (ε_{it}) effects. In the comparison between FE and RE, we use the Hausman (1978) test to select the best-fitting model.

4 DATA

In this section, the dependent and independent variables are presented, highlighting their relationship with the recession period and their influence on the regional economies.

The target variable is GDP *per capita*, representing a consolidated measure of regional performance (see the literature review in Greco *et al.*, 2018). We consider constant 2010 values to avoid the effect of inflation.

Among the sources of regional development most affected by the 2007 crisis, the local financial systems of some regions have shown evident weaknesses. Financial systems determine the rate and the degree of development of the related socioeconomic contexts. The difficulties in obtaining loans and the relative cost increases during periods of crisis affect the weakest regions due to the increased risk perception (Del Giovane *et al.*, 2013) and, in the Italian case, amplify the structural weaknesses of the southern financial systems (Deloof and La Rocca, 2015). All these conditions are important during illiquidity periods, as occurred during the *Great Recession*. To gain information on credit allocated to consumption and productive investments, we calculate values representing the access to credit. We consider the average bank loans to consumer households and to businesses calculated by dividing the total loan by the number of resident households and businesses registered. It is evident that the efficiency and entrepreneurial vitality in the northern and central areas enable credit virtuous circles, which in turn support the local aggregate demand. In fact, in the analysis of Ferri and Messori (2000), it is observed that the whole socioeconomic context in

the Italian macro areas is decisive for the efficiency of the banks, allowing greater access to credit in the Center-North (Bank of Italy, 2016).

Another fundamental aspect to be considered is human capital, which is one of the main determinants of regional economic performance (Crescenzi *et al.*, 2016). This resource is useful in explaining a great share of the local divergence in economic growth (Démurger, 2001) through its strong influence on the regional economy (Fleisher *et al.*, 2010). Human capital is the skills and capabilities of the labor force, and it can be observed using data on schooling (e.g. Ramos *et al.*, 2010). We consider the male and female educational levels because gender inequalities persist in Italy and are connected with education (see Mussida and Picchio, 2014), resulting in inequality in the labor market, although more women receive advanced education than men. Data on lifelong learning (not sufficiently widespread in Italy, see Jakobi and Rusconi, 2009), the NEET population (Not in Education, Employment or Training, see Bruno *et al.*, 2014 on the crisis effects) and the school dropout rate (influenced by economic and cultural aspects in Italy, see O'Higgins *et al.*, 2008) are added to the data on schooling.

Moreover, relevant causes of the regional dualism are represented by entrepreneur vitality, number of companies (A'Hearn and Venables, 2013) and export strength (as in Meng and Wu, 1998 for China). The North–South dualism, in this case, is also important because the openness to international trade may represent one of the possible keys to economic growth in the southern area (Guerrieri and Iammarino, 2007).

A list of the independent variables and their sources is presented in Table 1.

Considering our variables, similar to an augmented Solow model (Mankiw *et al.*, 1992), there are no common solutions for the endogeneity problem that could be present in this type of analysis (discussed by Durlauf, 2009). However, despite the extensive literature attempting to reduce these problems in growth models (as in Barro and Lee, 1994), our goal is not to explain economic growth but to find differences in the 'useful' GDP determinants at the local level.

5 CLUSTERS OF REGIONS

To compare the local strengths of two divergent areas (Carmeci and Mauro, 2002), we must outline homogeneous clusters of regions. In the selection of the groups of regions, we are aware of strong local heterogeneity in Italy, but we expect that these variations occur in adjacent territories with mutual influence on each other (Ertur *et al.*, 2006), and in general, we expect confirmation of the separation between the geographic North and South. In fact, we can observe two clubs of convergence among the Italian regions, as tested by Brida *et al.* (2014). The clubs are the Center-North and the *Mezzogiorno* of Italy, and they coincide with the groups found by ISTAT

TABLE 1
VARIABLE DESCRIPTIONS

<i>Variable</i>	<i>Definition</i>	<i>Source</i>
(1) HLOAN	average bank loans to households (ratio of loans to households/the number of resident households, in euro)	Bank of Italy and ISTAT (our elaborations)
(2) BLOAN	average loans to businesses (ratio of loans to financial, non-financial and family businesses/the total businesses registered, in euro)	Bank of Italy and ISTAT (our elaborations)
(3-4) ED_PR_F ED_PR_M	population (25-64 years) with less than primary, primary and lower secondary education (male and female; levels 0-2 ISCED ^a 2011, %)	EUROSTAT
(5-6) ED_SE_F ED_SE_M	population (25-64 years) with upper secondary and post-secondary non-tertiary education (male and female; levels 3-4 ISCED 2011, %)	EUROSTAT
(7-8) ED_TE_F ED_TE_M	population (25-64 years) with tertiary education (male and female; levels 5-8 ISCED 2011, %)	EUROSTAT
(9) DROP	school dropout (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)	EUROSTAT
(10) NEET	NEET rate (young people aged 15-24 neither in employment nor in education and training, %)	EUROSTAT
(11) E_LL	employed lifelong learning (employed in the age group 25-64 years and engaged in training and education, %)	ISTAT
(12) U_LL	unemployed lifelong learning (unemployed in the age group 25-64 years and engaged in training and education, %)	ISTAT
(13) ENROL	net enrollment rate in the Company Register (businesses registered minus the ceased ones /the total businesses registered in the previous year, %)	ISTAT (our elaborations)
(14) ICT	use of information and communication technologies by businesses (weighted average value of degree of use of PCs, Internet access, broadband availability, and corporate website (%), for businesses with more than 10 employees)	ISTAT (our elaborations)
(15) EXPORT	export/GDP ratio (%)	ISTAT (our elaborations)

^aInternational Standard Classification of Education

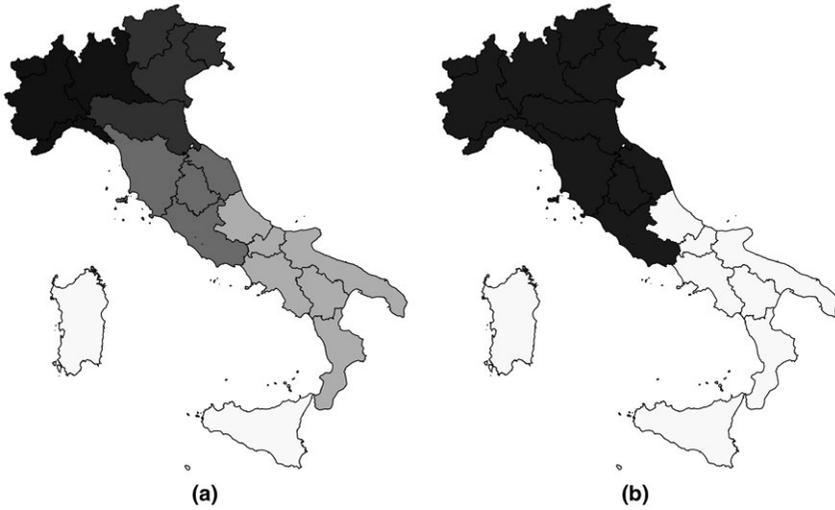


FIG. 1. Comparison between the EUROSTAT grouping (a) and our clusters of Center-North (gray) and *Mezzogiorno* (white) (b)

(the *Italian Institute of Statistics*) and EUROSTAT. The *Mezzogiorno* in particular is confirmed as a distinct area whose socioeconomic development differs from that of the rest of the country, and the latest traces of convergence in incomes between the two areas can be observed from the 1960s (Carmeci and Mauro, 2002) to the 1980s (Barro and Sala-I-Martin, 1991) depending on the analysis. In particular, the first area is composed of three NUTS 1 groups (in Fig. 1(a): *Northwest*, *Northeast* and *Center*, composed of 11 regions and 2 autonomous provinces). The second area (*Mezzogiorno*) is formed by the groups *South* and *Islands*, 8 regions.

The Center-North vs. *Mezzogiorno* division considered in our analysis is represented in Fig. 1(b), and it was used by Terrasi (1999) in studying income convergence. The maps² in Fig. 1 show both the EUROSTAT (NUTS 1) grouping and our two groups.

We know that alternative displacements of the regions are possible because of changing socioeconomic conditions (Pedroni and Yao, 2006). For example, Terrasi also considers groups inspired by the post-war development (*Northwest*, *Northeast plus Center*, *South*) that do not seem appropriate in the period we consider because the first two groups have had a long path of convergence. An alternative grouping is present in Byrne *et al.* (2009), in which the authors consider three groups (*North*, *Center*, *South*) and, differently from the usual division, they move one region (Abruzzo)

²The maps do not show the two autonomous provinces (Trento and Bolzano) but rather their region (Trentino-Alto Adige). The two provinces always fall in the same cluster.

from the South to the Center. These groups, characterized by a smaller population of regions, seem less suited to our analysis.

Furthermore, the strong regional heterogeneity that is present in Italy can lead to different paths of convergence depending on the variables that are considered, in some cases including regions of the ‘poor’ South in the industrialized North, especially if the provincial level is considered (the NUTS 3 level, see Panzera and Postiglione, 2014) or if the regions of different countries are compared (Fiaschi *et al.*, 2017).

6 RESULTS

The differences between the two macro areas are observable in the values presented in Table 2 concerning the GDP *per capita* and the variables listed in Table 1.

The average income of the South is equal to 61% of that of the Center-North, and the export/GDP ratio is less than half. The average loan to households is 63%, and the average loan to businesses is 34% of the respective Center-North averages. The gaps concerning human capital are less evident: the Center-North has approximately 2% more graduates, while in the South, there is attention to maintaining adequate training of the unemployed.

6.1 MARS Results

The capability of MARS in providing efficient results compared to several traditional techniques and recent methodologies has been tested in many research areas (Wang *et al.*, 2015; Li *et al.*, 2016) and in regional studies (Chen *et al.*, 2018; Odoardi *et al.*, 2018). We test a dataset of 15 variables (2007–2015) with the aim of recognizing the most statistically significant variables for each group of regions. MARS contributes in reducing multicollinearity in the dataset; thus, only the significant variables are reported in Tables 3 and 4. The regional GDP *per capita* is the dependent variable, and the variables in the right column represent the detected local determinants of the GDP.

In Table 3, 8 variables influence the GDP *per capita*, involving the role of human capital, export and credit leverage. Loans to companies play a positive role only when they exceed 177000 euros, while excessive loans (threshold of 22700 euros) to households limit resources for businesses and have a negative effect. Export always has a positive sign, but its coefficient is higher when its value is lower than 16.6% of GDP. The role of ICT is positive only in the regions where ICT is most used by companies. The role of human capital in GDP is ambiguous. The effect of the young NEET population is positive when it remains below the threshold of 13% of the given age group, while the school dropout rate has a positive effect on high values, demonstrating Italy’s incapacity to exploit educated workers. Secondary education

TABLE 2
SUMMARY STATISTICS FOR THE 2 MACRO AREAS

	Center-North				Mezzogiorno			
	Min	Max	Mean	St. Dev.	Min	Max	Mean	St. Dev.
GDP	21913.18	38406.04	30728.32	4005.30	15309.53	24454.40	18764.97	2327.36
EXPORT	6.55	37.89	23.25	8.98	0.99	25.19	11.45	6.28
ENROL	-2.67	2.47	0.12	0.83	-1.24	1.84	0.35	0.64
ICT	61.17	81.82	71.30	4.71	49.63	73.23	63.58	4.95
HLOANS	14746.33	34862.41	24755.10	4925.06	10992.20	20282.49	15583.43	2612.67
BLOANS	110781.04	427019.54	240546.08	86464.10	54268.07	136230.17	91227.73	20277.68
ED_PR_M	31.20	55.40	41.46	5.30	34.50	59.30	49.61	5.69
ED_PR_F	27.60	48.90	38.20	4.94	34.40	57.50	48.07	5.78
ED_SE_M	34.40	52.80	44.32	3.95	32.20	51.00	38.39	4.62
ED_SE_F	37.10	52.10	43.82	2.95	30.50	46.20	36.24	3.73
ED_TE_M	9.30	20.80	14.22	2.25	8.50	15.00	12.00	1.38
ED_TE_F	10.20	25.70	17.98	3.09	11.30	21.00	15.69	2.45
E_LL	3.65	14.21	7.50	1.90	3.38	11.19	5.24	1.30
U_LL	3.98	10.93	6.77	1.39	4.98	10.18	7.04	1.33
DROP	6.93	26.12	14.72	3.67	9.62	28.72	18.76	5.15
NEET	8.76	24.31	15.61	3.72	13.89	40.28	28.90	6.20

TABLE 3
MARS BASIS FUNCTIONS AND COEFFICIENTS FOR THE CENTER-NORTH GROUP (GRAY AREA IN
FIGURE 1-B)

	Coefficients	Variables
	24445.86	
BF1	+0.04	*max(0; BLOANS-177489.06)
BF2	-0.14	*max(0; HLOANS-22753.40)
BF3	+0.42	*max(0; 22753.40-HLOANS)
BF4	+710.32	*max(0; 13.24-NEET)
BF5	+87.39	*max(0; EXPORT-16.59)
BF6	+724.38	*max(0; 16.59-EXPORT)
BF7	+749.88	*max(0; ED_SE_F-45.00)
BF8	+992.49	*max(0; ICT-76.41)
BF9	-660.49	*max(0; ED_SE_M-47.70)
BF10	+264.79	*max(0; 47.70-ED_SE_M)
BF11	+492.28	*max(0; DROP-17.98)

Source: Authors' elaboration based on ISTAT, EUROSTAT and Bank of Italy data.

is the only significant education level; the effect is positive if it involves more than 45% of women and negative if it involves more than 47.7% of men.

In Table 4, 10 variables are significant; 6 of them are shared with Table 3. Loans to companies have a positive effect only if they involve amounts greater than 95500 euros, while loans to households have an inverse relationship with GDP *per capita* when they involve amounts greater than 13000 euros. The condition of exceeding a high threshold for companies (above the average of the area) suggests the inefficiency of the southern financial markets, which are characterized by less access to credit and at higher costs (Resti, 1997). Export has a positive role when its value exceeds 10% of GDP.

Female primary education has a positive influence when it is not too high, while for men of the same level, the effect is negative when involving less than 51.7% of the population. Considering the increasing returns of education (Barro and Lee, 2013), this effect is contrary to what is usually observed in the contribution of human capital to economic development (Petrakis and Stamatakis, 2002). The effect is confirmed for the school dropout rate, which has a positive value when it exceeds 20% of the population aged 18-24. Coefficients regarding lifelong learning are conflicting. Relative to the North, the inability to exploit positive returns from education seems more evident in the South (which disadvantages a possible catch-up among the Italian regions based on productivity related to human capital, Di Liberto *et al.*, 2008).

TABLE 4
MARS BASIS FUNCTIONS AND COEFFICIENTS FOR THE *MEZZOGIORNO* GROUP (WHITE AREA IN
FIGURE 1-B)

	Coefficients	Variables
	20015.00	
BF1	+297.30	*max(0; 28.08-NEET)
BF2	+0.07	*max(0; BLOANS-95457.25)
BF3	-0.07	*max(0; 95457.25-BLOANS)
BF4	+161.92	*max(0; DROP-19.87)
BF5	-0.41	*max(0; HLOANS-13259.90)
BF6	+569.62	*max(0; 44.60-ED_PR_F)
BF7	-145.06	*max(0; 51.70-ED_PR_M)
BF8	-665.57	*max(0; 7.42-U_LL)
BF9	-328.20	*max(0; E_LL-5.43)
BF10	-198.76	*max(0; ED_SE_F-34.30)
BF11	+51.56	*max(0; EXPORT-9.68)

Source: Authors' elaboration based on ISTAT, EUROSTAT and Bank of Italy data.

6.2 Panel Data Analysis on the Two Macro Areas

The variables selected with MARS are used in FE and RE models, with the aim of improving the chances to understand the contribution of the independent variables to the predicted GDP. We compare the results of the FE and RE models and show the robustness of the results, followed by the Hausman test.

The results of the Hausman test indicate that the fixed effects model provides more efficient estimates. In Table 5, three variables are significant, and they coincide for both models. The increasing social problems and the high average unemployment that affected the North during the *Great Recession* mark the number of the NEET population, which in the Center-North area rose from 11.7% (2007) to 19.4% (2015), a greater increase than that in the South (from 28.7% to 35.3%, ISTAT data). The increase in young people who do not study and do not work has a negative effect on the target variable, although human capital (observed through education) is not directly significant (as similarly observed by Di Liberto, 2008). Export is the only variable that shows a direct relationship, and as discussed in Section 2.1, openness to international markets represents one of the main consolidated strengths of the central and northern regions. Finally, the proxy variable of the degree of technological innovation in local companies shows an inverse relationship, confirming the lack of competitiveness of Italian companies, which in technological terms remain in

TABLE 5
FIXED AND RANDOM EFFECTS REGRESSION ON THE CENTER-NORTH GROUP

	Fixed effects		Random effects	
	Coef.	Std. Err.	Coef.	Std. Err.
DROP	-63.64	43.2	-40.94	48.71
NEET	-401.71***	39.31	-417.21***	43.76
EXPORT	166.09***	29.84	122.81***	31.07
ICT	-100.4***	32.79	-71.7*	36.78
HLOANS	0.02	0.05	0.01	0.06
BLOANS	0	0	0.01	0
ED_SE_M	21.35	50.7	-22.36	56.79
ED_SE_F	44.35	75.46	120.67	83.97
Constant	37602.49***	3534.69	34132.42***	3911.77
R ²	0.8176		0.8072	
Hausman test	30.06 [0.0001]			
Obs.	117		117	

Source: Authors' elaboration based on ISTAT, EUROSTAT and Bank of Italy data.
 $p < 0.10^*$, $p < 0.05^{**}$, $p < 0.01^{***}$

many low-tech sectors; this may explain the inability to employ workers with advanced education or training.

The fixed effects model is also considered the more appropriate model for the southern area. In Table 6, two aspects are found in common with the previous analysis. The NEET rate (negative) and the export (positive) show the same signs as in the Center-North but with lower coefficients. The NEET phenomenon is strongly influenced by the high youth³ unemployment rate (54.1% in the South and 32.6% in the Center-North in 2015) and the low number of young people with advanced education⁴ (19.7% in the South and 28.6% in the Center-North in 2015). For the South, the ICT index is not present, thus confirming the findings of Scupola (2003) on the difficulty of southern SMEs (small and medium enterprises) to adapt to the factors that force businesses to implement new technologies.

The signs and relevance of the loan values reveal a strong southern problem linked to the credit crunch effects during the post-crisis period. In

³15-24 years.

⁴Population aged 30-34 that has achieved an educational level of 5 and 6 (ISCED97) as a percentage of the population in the same age group (ISTAT).

TABLE 6
FIXED AND RANDOM EFFECTS REGRESSION ON THE SOUTH GROUP

	Fixed effects		Random effects	
	Coef.	Std. Err.	Coef.	Std. Err.
DROP	52.9	43.29	193.68***	36.65
NEET	-143.89***	33.84	-229.8***	30.36
E_LL	-47.39	88.2	-142.32	88.52
U_LL	126.42	117.21	116.81	125.19
EXPORT	74.27**	28.9	80.21***	26.73
HLOANS	-0.18**	0.09	-0.2***	0.05
BLOANS	0.03*	0.02	0.04***	0.01
ED_PR_M	109.74	69.62	-23.56	49.23
ED_PR_F	-32.42	100.07	-231.25***	72.35
ED_SE_F	26.19	110.03	-152.65	96.07
Constant	15976.79*	7848.42	38399.95***	6358.98
R ²	0.7974		0.7013	
Hausman test	27.60 [0.0003]			
Obs.	72		72	

Source: Authors' elaboration based on ISTAT, EUROSTAT and Bank of Italy data.

$p < 0.10^*$, $p < 0.05^{**}$, $p < 0.01^{***}$

fact, the inefficiency of the southern local financial system is well-known (Deloof and La Rocca, 2015) and allows households and businesses in the South little access to credit and with higher costs (Del Giovane *et al.*, 2013). Indeed, the structural weaknesses of the South combined with the growing unemployment have led to a strong growth of credit to consumer households, which in value reaches the total allocated to businesses (Mattoscio *et al.*, 2017). The relative growth of credit for household consumption deprives companies of resources that would instead be used to make investments and have positive effects on GDP (Sassi and Gasmi, 2014). This well-known relationship with the GDP can be observed for the post-crisis period in our results; credit to households has a negative coefficient, while credit to businesses has a positive coefficient.

7 CONCLUSIONS

The *Great Recession* recalls the need to investigate the economic dynamics in the most fragile areas of several advanced countries. In this sense, the Italian South has proved incapable of post-crisis resilience, and the well-known North–South divide has increased. During the period following the

outbreak of the crisis, the GDP of the South fell by 1.5% per year on average in constant values, and that of the Center-North fell by 0.8%; this reduced the GDP *per capita* in the South to 56.6% of that in the Center-North (2008–2015, ISTAT data).

In this perspective, the analysis of local economic strengths, which are the sources of North–South divergence during the *Great Recession*, can lead to identifying key points for policies to encourage recovery and convergence. Our analysis has detected the local determinants that involve the two divergent areas, i.e. the Center-North and the *Mezzogiorno* of Italy (South).

Two fundamental aspects are found to characterize the economy of all regions during the long post-crisis recession. First, the growing young NEET population is a significant problem that weakens human capital in both areas and is influenced by the high youth unemployment in the studied period (Demidova *et al.*, 2015) and by the tested difficulty in valorizing educated workers (Di Liberto, 2008). Second, export seems to be the only source of economic recovery in a context of weak domestic demand that is also due to high unemployment. These common aspects highlight structural characteristics that, at least during the recession period, characterize both the industrialized North and the backward South.

However, another relevant aspect emerged from the analysis on the South, i.e. the inefficiency of the local financial systems. This is a previous weakness that was aggravated due to the financial nature of the crisis, and it represents a critical issue requiring intervention to overcome some recessionary problems. Beyond the real effects of the crisis, the expansion of financial effects penalized the weakest credit markets and hindered the monetary policy aimed to provide liquidity for company survival in the short term and to support household consumption (Presbitero *et al.*, 2014). The results of our analysis highlight these critical problems. The findings suggest that the South needs resources for consumption, but this does not help economic recovery, as recognized in the literature (Sassi and Gasmi, 2014). In contrast, the companies in the South could exploit these resources in a positive way, generating an increase in the local GDP. Companies in the South were already penalized in terms of credit access before the crisis (Sarno, 2008), and too high a share of private credit is intended for households in the post-crisis years (Mattoscio *et al.*, 2017), while an effort to ensure greater efficiency of the regional financial systems could be at the base of the economic development (see Guiso *et al.*, 2004 for the Italian case). The differences among the estimated coefficients suggest that the southern financial systems need interventions to increase their effectiveness, starting from the local context analyzed and considering the importance of (local) banks in financing and advising the SMEs that characterize the Italian productive system (Baffigi *et al.*, 1999).

Our analyses highlight the undervalued economic role of human capital during the recession years. Negative consequences can be connected

with this deficiency. The scarce economic influence of education, particularly in the ‘poor’ South, can induce educated workers to move to the North (Biagi *et al.*, 2011) because of the different levels of GDP *per capita* and unemployment that are among the main causes of migration (Piras, 2012). Demographic factors and organizational inefficiencies do not favor the efficient allocation of labor among the southern regions (Faini *et al.*, 1997). Consequently, skill-selective migration is present in Italy, causing a transfer of resources toward the more developed North (Fratesi and Percoco, 2014), which is enriched by the southern human capital (Capasso *et al.*, 2012).

Financial market efficiency, opening to foreign markets, and human capital are among the aspects of regional economy that lead to different degrees of resilience among the Italian regions. The scarcity of these resources damages the regions of the South that are less able to cope with unexpected events (Di Caro, 2015). As defined by Capello (2016), challenges are detected throughout the development path of the South and are considered limits to the application of long-term and holistic interventions. Policy actions aimed to relaunch the economy and attempt a convergence path with the North must be based on local characteristics, and structural weaknesses must be corrected first. In fact, local differences should induce various policy actions, as Morgan (2006, p. 189) wrote: ‘*Treating unequal regions equally is not a recipe for territorial justice.*’ From our results, it is evident that there is much room for improvement after the consequences of the recession.

For appropriate policy intervention enhancing human capital and increasing the efficiency of financial systems, macro-level policies considering the great heterogeneity of the Italian regions⁵ and crossing the traditional boundaries are required.

In this sense, it would be interesting to conduct further studies with more detailed analysis at the provincial level (NUTS 3 instead of NUTS 2), forming multiple groups and enlarging the dataset and the study period according to the availability of data to exploit the MARS capability of analysis.

REFERENCES

- A’Hearn, B. and Venables, A. J. (2013). ‘Regional Disparities: Internal Geography and External Trade,’ in G. Toniolo (ed). *The Oxford Handbook of the Italian Economy Since Unification* Oxford, Oxford University Press, pp. 599–630.
- Abramo, G., D’Angelo, C. A. and Rosati F. (2016). ‘The North–South Divide in the Italian Higher Education System’, *Scientometrics*, Vol. 109, No. 3, pp. 2093–2117.
- Alesina, A., Danninger, S. and Rostagno, M. (1999). *Redistribution Through Public Employment: The Case of Italy*. IMFWP/99/177.

⁵E.g. the ‘many *Mezzogiorni*’ identified by Guerrieri and Iammarino (2006).

- Amos, O. M. (1988). 'Unbalanced Regional Growth and Regional Income Inequality in the Latter Stages of Development', *Regional Science and Urban Economics*, Vol. 18, No. 4, pp. 549–566.
- Baffigi, A., Pagnini, M. and Quintiliani, F. (1999). Industrial Districts and Local Banks: Do the Twins Ever Meet? Banca d'Italia – Temi di discussione No. 347.
- Baker, A. R. H. and Billinge, M. (eds). (2004). *Geographies of England. The North-South Divide, Imagined and Material*, Cambridge, MA, Cambridge University Press.
- Ballarino, G., Panichella, N. and Triventi, M. (2014). 'School Expansion and Uneven Modernization. Comparing Educational Inequality in Northern and Southern Italy', *Research in Social Stratification and Mobility*, Vol. 36, pp. 69–86.
- Bank of Italy (2016). *Statistic Bulletin (Bollettino Statistico)*, II quarter 2016, Rome.
- Barro, R. and Lee, J. W. (1994). 'Sources of Economic Growth', *Carnegie-Rochester Conference Series on Public Policy*, Vol. 40, pp. 1–46.
- Barro, R. and Lee, J. W. (2013). 'A New Dataset of Educational Attainment in the World, 1950–2010', *Journal of Development Economics*, Vol. 104, pp. 184–198.
- Barro, R. J. and Sala-I-Martin, X. (1991). 'Convergence Across States and Regions', *Brookings Papers on Economic Activity*, Vol. 22, No. 1, pp. 107–182.
- Basile, R., Giunta, A. and Nugent, J. B. (2003). 'Internationalisation Process of Small and Medium Sized Firms in Italy over the Nineties', in C. Pietrobelli and A. Sverrisson (eds), *Linking Local and Global Economies*, London, Routledge, pp. 83–106.
- Bhalla, A., Yao, S. and Zhang, Z. (2003). 'Causes of Inequalities in China, 1952 to 1999', *Journal of International Development*, Vol. 15, No. 8, pp. 939–955.
- Biagi, B., Faggian, A. and McCann, P. (2011). 'Long and Short Distance Migration in Italy: The Role of Economic, Social and Environmental Characteristics', *Spatial Economic Analysis*, Vol. 6, No. 1, pp. 111–131.
- Bigoni, M., Bortolotti, S., Casari, M., Gambetta, D. and Pancotto, F. (2016). 'Amoral Familism, Social Capital, or Trust? The Behavioural Foundations of the Italian North-South Divide', *The Economic Journal*, Vol. 126, No. 594, pp. 1318–1341.
- Brida, J. G., Garrido, N. and Mureddu, F. (2014). 'Italian Economic Dualism and Convergence Clubs at Regional Level', *Quality & Quantity*, Vol. 48, No. 1, pp. 439–456.
- Bruno, G., Marelli, E. and Signorelli, M. (2014). 'The Rise of NEET and Youth Unemployment in EU Regions after the Crisis', *Comparative Economic Studies*, Vol. 56, No. 4, pp. 592–615.
- Byrne, J. P., Fazio, G. and Piacentino, D. (2009). 'Total Factor Productivity Convergence among Italian Regions: Some Evidence from Panel Unit Root Tests', *Regional Studies*, Vol. 43, No. 1, pp. 63–76.
- Cafagna, L. (1989). *Dualismo e sviluppo nella storia d'Italia*, Venezia, Marsilio.
- Capasso, S., Carillo, M. R. and De Siano, R. (2012). 'Migration Flows, Structural Change and Growth Convergence: A Panel Data Analysis of the Italian Regions', *The Manchester School*, Vol. 80, No. 4, pp. 468–498.
- Capello, R. (2016). 'What Makes Southern Italy Still Lagging Behind? A Diachronic Perspective of Theories and Approaches', *European Planning Studies*, Vol. 24, No. 4, pp. 668–686.
- Capello, R. and Kroll, H. (2016). 'From Theory to Practice in Smart Specialization Strategy: Emerging Limits and Possible Future Trajectories', *European Planning Studies*, Vol. 24, No. 8, pp. 1393–1406.
- Carmeci, G. and Mauro, L. (2002). 'The Convergence of the Italian Regions and Unemployment: Theory and Evidence', *Journal of Regional Science*, Vol. 42, No. 3, pp. 509–532.
- Chen, S. H., Lin, H.-W., Bucciarelli, E., Muratore, F. and Odoardi, I. (2018). 'A Data Mining Analysis of the Chinese Inland-coastal Inequality', in E. Bucciarelli, S.-H. Chen, and J. M. Corchado (eds), *Decision Economics*, Cham, Springer, pp. 96–104.
- Crescenzi, R., Luca, D. and Milio, S. (2016). 'The Geography of the Economic Crisis in Europe: National Macroeconomic Conditions, Regional Structural Factors and Short-term

- Economic Performance', *Cambridge Journal of Regions, Economy and Society*, Vol. 9, No. 1, pp. 13–32.
- Daniele, V. and Malanima, P. (2007). 'Il prodotto delle regioni e il divario Nord-Sud in Italia (1861–2004)', *Rivista di politica economica*, Vol. 97, No. 2, pp. 267–316.
- Daniele, V. and Malanima, P. (2011). Il divario Nord-Sud in Italia 1861–2011, Soveria Mannelli, Rubbettino.
- Del Giovane, P., Nobili, A. and Signoretti, F. M. (2013). Supply Tightening or Lack of Demand? An Analysis of Credit Developments During the Lehman Brothers and the Sovereign Debt Crises, Banca d'Italia – Temi di discussione No. 942.
- Deloof, M. and La Rocca, M. (2015). 'Local Financial Development and the Trade Credit Policy of Italian SMEs', *Small Business Economics*, Vol. 44, No. 4, pp. 905–924.
- Demidova, O., Marelli, E. and Signorelli, M. (2015). 'Youth Labour Market Performances in the Russian and Italian Regions', *Economic Systems*, Vol. 39, No. 1, pp. 43–58.
- Démurger, S. (2001). 'Infrastructure Development and Economic Growth: An Explanation for Regional Disparities in China?' *Journal of Comparative Economics*, Vol. 29, No. 1, pp. 95–117.
- Di Caro, P. (2015). 'Recessions, Recoveries and Regional Resilience: Evidence on Italy', *Cambridge Journal of Regions, Economy and Society*, Vol. 8, No. 2, pp. 273–291.
- Di Liberto, A. (2008). 'Education and Italian Regional Development', *Economics of Education Review*, Vol. 27, No. 1, pp. 94–107.
- Di Liberto, A., Pigliaru, F. and Mura, R. (2008). 'How to Measure the Unobservable: A Panel Technique for the Analysis of TFP Convergence', *Oxford Economic Papers*, Vol. 60, No. 2, pp. 343–368.
- Dunford, M. (1995). 'Metropolitan Polarization, the North-South Divide and Socio-Spatial Inequality in Britain: A Long-Term Perspective', *European Urban and Regional Studies*, Vol. 2, No. 2, pp. 145–170.
- Durlauf, S. N. (2009). 'The Rise and Fall of Cross-Country Growth Regressions', *History of Political Economy*, Vol. 41, No. 1, pp. 315–333.
- Elhorst, J. P. (2014). 'Spatial Panel Data Models', in J. P. Elhorst (ed), *Spatial Econometrics*, Berlin Heidelberg, Springer, pp. 37–93.
- Ertur, C., Le Gallo, J. and Baumont, C. (2006). 'The European Regional Convergence Process, 1980–1995: Do Spatial Regimes and Spatial Dependence Matter?', *International Regional Science Review*, Vol. 29, No. 1, pp. 3–34.
- Faini, R., Galli, G., Gennari, P. and Rossi, F. (1997). 'An Empirical Puzzle: Falling Migration and Growing Unemployment Differentials Among Italian Regions', *European Economic Review*, Vol. 41, No. 3–5, pp. 571–579.
- Fan, C. C. and Casetti, E. (1994). 'The Spatial and Temporal Dynamics of US Regional Income Inequality, 1950–1989', *The Annals of Regional Science*, Vol. 28, No. 2, pp. 177–196.
- Felice, E. (2007). *Divari regionali e intervento pubblico: per una rilettura dello sviluppo in Italia*. Bologna, Il Mulino.
- Felice, E. (2013). *Perché il Sud è rimasto indietro*. Bologna, Il Mulino.
- Felice, E. (2017). 'I divari regionali di reddito nel lungo periodo (1871–2011): stime e periodizzazioni', *Il Risparmio Review*, Vol. 65, No. 1–2, pp. 33–55.
- Felcísimo, Á. M., Cuartero, A., Remondo, J. and Quirós, E. (2013). 'Mapping Landslide Susceptibility with Logistic Regression, Multiple Adaptive Regression Splines, Classification and Regression Trees, and Maximum Entropy Methods: A Comparative Study', *Landslides*, Vol. 10, No. 2, pp. 175–189.
- Ferri, G. and Messori, M. (2000). 'Bank–firm Relationships and Allocative Efficiency in Northeastern and Central Italy and in the South', *Journal of Banking & Finance*, Vol. 24, No. 6, pp. 1067–1095.

- Fiaschi, D., Gianmoena, L., and Parenti, A. (2017). 'Spatial Club Dynamics in European Regions', *Regional Science and Urban Economics*, pp. 1–16.
- Fleisher, B. M., Li, H. and Zhao, M. Q. (2010). 'Human Capital, Economic Growth, and Regional Inequality in China', *Journal of Development Economics*, Vol. 92, No. 2, pp. 215–231.
- Fratesi, U. and Percoco, M. (2014). 'Selective Migration, Regional Growth and Convergence: Evidence from Italy', *Regional Studies*, Vol. 48, No. 10, pp. 1650–1668.
- Friedman, J. H. (1991). 'Multivariate Adaptive Regression Splines', *Annals of Statistics*, Vol. 19, No. 1, pp. 1–67.
- Friedman, J. H. (1993). Fast MARS. Department of Statistics, Stanford University Technical Report, Stanford, CA.
- Friedmann, J. (1966). *Regional Development Policy: A Case Study of Venezuela*. Cambridge, MA, MIT Press.
- González, S. (2011). 'The North/South Divide in Italy and England: Discursive Construction of Regional Inequality', *European Urban and Regional Studies*, Vol. 18, No. 1, pp. 62–76.
- Greco, S., Ishizaka, A., Matarazzo, B. and Torrìsi, G. (2018). 'Stochastic Multi-attribute Acceptability Analysis (SMAA): An Application to the Ranking of Italian Regions', *Regional Studies*, Vol. 52, No. 4, pp. 585–600.
- Green, A. E. (1988). 'The North-South Divide in Great Britain: An Examination of the Evidence', *Transactions of the Institute of British Geographers*, Vol. 13, No. 2, pp. 179–198.
- Guerrieri, P. and Iammarino, S. (2006). 'Euro-Commentary: The Rise Of 'Many Mezzogiorni': An Empirical Assessment of the Internal Differentiation of Italian Southern Regions', *European Urban and Regional Studies*, Vol. 13, No. 2, pp. 167–178.
- Guerrieri, P. and Iammarino, S. (2007). 'Dynamics of Export Specialization in the Regions of the Italian Mezzogiorno: Persistence and Change', *Regional Studies*, Vol. 41, No. 7, pp. 933–948.
- Guiso, L., Sapienza, P. and Zingales, L. (2004). 'Does Local Financial Development Matter?' *The Quarterly Journal of Economics*, Vol. 119, No. 3, pp. 929–969.
- Hansen, N. (1995). 'Addressing Regional Disparity and Equity Objectives through Regional Policies: A Sceptical Perspective', *Papers in Regional Science*, Vol. 74, No. 2, pp. 89–104.
- Hao, R. and Wei, Z. (2010). 'Fundamental Causes of Inland–Coastal Income Inequality in Post-Reform China', *The Annals of Regional Science*, Vol. 45, No. 1, pp. 181–206.
- Hastie, T., Tibshirani, R. and Friedman, J. (2001). *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, New York, NY, Springer-Verlag.
- Hausman, J. A. (1978). 'Specification Tests in Econometrics', *Econometrica*, Vol. 46, No. 6, pp. 1251–1271.
- Helliwell, J. F. and Putnam, R. D. (1995). 'Economic Growth and Social Capital in Italy', *Eastern Economic Journal*, Vol. 21, No. 3, pp. 295–307.
- Hong, J., Chu, Z. and Wang, Q. (2011). 'Transport Infrastructure and Regional Economic Growth: Evidence from China', *Transportation*, Vol. 38, No. 5, pp. 737–752.
- Jakobi, A. P. and Rusconi, A. (2009). 'Lifelong Learning in the Bologna Process: European Developments in Higher Education', *Compare: A Journal of Comparative and International Education*, Vol. 39, No. 1, pp. 51–65.
- Johnston, J. and DiNardo, J. (1997). *Econometric methods*, New York, NY, McGraw-Hill.
- Kanbur, R. and Zhang, X. (1999). 'Which Regional Inequality? The Evolution of Rural-Urban and Inland-Coastal Inequality in China from 1983 to 1995', *Journal of Comparative Economics*, Vol. 27, No. 4, pp. 686–701.
- Kuznets, S. (1955). 'Economic Growth and Income Inequality', *The American Economic Review*, Vol. 45, No. 1, pp. 1–28.
- Lagravinese, R. (2015). 'Economic Crisis and Rising Gaps North-South: Evidence from the Italian Regions', *Cambridge Journal of Regions, Economy and Society*, Vol. 8, No. 2, pp. 331–342.

- Leathwick, J. R., Elith, J. and Hastie, T. (2006). 'Comparative Performance of Generalized Additive Models and Multivariate Adaptive Regression Splines for Statistical Modelling of Species Distributions', *Ecological Modelling*, Vol. 199, No. 2, pp. 188–196.
- Li, Y., He, Y., Su, Y. and Shu, L. (2016). 'Forecasting the Daily Power Output of a Grid-Connected Photovoltaic System Based on Multivariate Adaptive Regression Splines', *Applied Energy*, Vol. 180, pp. 392–401.
- Liu, T. and Li, K.-W. (2006). 'Disparity in Factor Contributions Between Coastal And Inner Provinces in Post-Reform China', *China Economic Review*, Vol. 17, No. 4, pp. 449–470.
- Mankiw, G. N., Romer, D. and Weil, D. (1992). 'A Contribution to the Empirics of Economic Growth', *Quarterly Journal of Economics*, Vol. 107, No. 2, pp. 407–437.
- Martin, R. (1988). 'The Political Economy of Britain's North-South Divide', *Transactions of the Institute of British Geographers*, Vol. 13, No. 4, pp. 389–418.
- Mattosio, N., Muratore, F. and Odoardi, I. (2017). 'Households and Corporate Credit, Development and Italian Local Economic Systems', *Il Risparmio Review*, Vol. 65, No. 1–2, pp. 57–81.
- Meng, X. and Wu, H. X. (1998). 'Household Income Determination and Regional Income Differential in Rural China', *Asian Economic Journal*, Vol. 12, No. 1, pp. 35–63.
- Morgan, K. (2006). 'Devolution and Development: Territorial Justice and the North-South Divide', *Publius: The Journal of Federalism*, Vol. 36, No. 1, pp. 189–206.
- Mussida, C. and Picchio, M. (2014). 'The Gender Wage Gap by Education in Italy', *The Journal of Economic Inequality*, Vol. 12, No. 1, pp. 117–147.
- Nitti, F. S. (1900). Nord e Sud. Torino.
- O'Higgins, N., D'Amato, M., Caroleo, F. E. and Barone, A. (2008). Gone for Good? Determinants of School Dropout in Southern Italy, IZA Discussion Paper No. 3292.
- Odoardi, I., Muratore, F., Bucciarelli, E., and Chen, S.-H. (2018). 'Looking for Regional Convergence: Evidence from the Italian Case with Multivariate Adaptive Regression Splines', in E. Bucciarelli, S.-H. Chen, and J. M. Corchado (eds), *Decision Economics*, Cham, Springer, pp. 77–85.
- Ozgen, C., Nijkamp, P. and Poot, J. (2010). 'The Effect of Migration on Income Growth and Convergence: Meta-analytic Evidence', *Papers in Regional Science*, Vol. 89, No. 3, pp. 537–561.
- Panzer, D. and Postiglione, P. (2014). 'Economic Growth in Italian NUTS 3 Provinces', *The Annals of Regional Science*, Vol. 53, No. 1, pp. 273–293.
- Pedroni, P. and Yao, J. Y. (2006). 'Regional Income Divergence in China', *Journal of Asian Economics*, Vol. 17, No. 2, pp. 294–315.
- Petrakis, P. E. and Stamatakis, D. (2002). 'Growth and Educational Levels: A Comparative Analysis', *Economics of Education Review*, Vol. 21, No. 5, pp. 513–521.
- Piffer, D. and Lynn, R. (2014). 'New Evidence for Differences in Fluid Intelligence Between North and South Italy and Against School Resources as an Explanation for the North–South IQ Differential', *Intelligence*, Vol. 46, pp. 246–249.
- Piras, R. (2012). 'Internal Migration Across Italian Regions: Macroeconomic Determinants and Accommodating Potential for a Dualistic Economy', *The Manchester School*, Vol. 80, No. 4, pp. 499–524.
- Pred, A. (1965). 'Industrialization, Initial Advantage and American Metropolitan Growth', *Geographical Review*, Vol. 55, No. 2, pp. 158–185.
- Presbitero, A. F., Udell, G. F. and Zazzaro, A. (2014). 'The Home Bias and the Credit Crunch: A Regional Perspective', *Journal of Money, Credit and Banking*, Vol. 46, No. s1, pp. 53–85.
- Putterman, L. (1992). 'Dualism and Reform in China', *Economic Development and Cultural Change*, Vol. 40, No. 3, pp. 467–493.
- Ramos, R., Suriñach, J. and Artis, M. (2010). 'Human Capital Spillovers, Productivity and Regional Convergence in Spain', *Papers in Regional Science*, Vol. 89, No. 2, pp. 435–447.

- Resti, A. (1997). 'Evaluating the Cost-efficiency of the Italian Banking System: What can be Learned from the Joint Application of Parametric and Non-Parametric Techniques', *Journal of Banking & Finance*, Vol. 21, No. 2, pp. 221–250.
- Rubinstein, W. D. (1988). 'Wealth and the Wealthy', in J. Langton and R. J. Morris (eds), *Atlas of Industrializing Britain 1780–1914*, London, Methuen, pp. 156–159.
- Salvemini, G. (1955). *Scritti sulla questione meridionale: 1896–1955*, Torino, Einaudi.
- Sarno, D. (2008). 'Capital Structure and Growth of the Firms in the Backward Regions of the South Italy', *Applied Financial Economics*, Vol. 18, No. 10, pp. 821–833.
- Sassi, S. and Gasmi, A. (2014). 'The Effect of Enterprise and Household Credit on Economic Growth: New Evidence from European Union Countries', *Journal of Macroeconomics*, Vol. 39, No. A, pp. 226–231.
- Scupola, A. (2003). 'The Adoption of Internet Commerce by SMEs in the South of Italy: An Environmental, Technological and Organizational Perspective', *Journal of Global Information Technology Management*, Vol. 6, No. 1, pp. 52–71.
- Suarez-Villa, L. and Cuadrado Roura, J. R. (1993). 'Regional Economic Integration and the Evolution of Disparities', *Papers in Regional Science*, Vol. 72, No. 4, pp. 369–387.
- Terrasi, M. (1999). 'Convergence and Divergence Across Italian Regions', *The Annals of Regional Science*, Vol. 33, No. 4, pp. 491–510.
- Triglia, C. (2012). *Non c'è Nord senza Sud. Perché la crescita dell'Italia si decide nel Mezzogiorno*, Bologna, Il Mulino.
- Tsui, K. Y. (2007). 'Forces shaping China's interprovincial inequality', *Review of Income and Wealth*, Vol. 53, No. 1, pp. 60–92.
- Wang, L.-J., Guo, M., Sawada, K., Lin, J. and Zhang, J. (2015). 'Landslide Susceptibility Mapping in Mizunami City, Japan: A Comparison Between Logistic Regression, Bivariate Statistical Analysis and Multivariate Adaptive Regression Spline Models', *Catena*, Vol. 135, pp. 271–282.
- Williamson, J. G. (1965). 'Regional Inequality and the Process of National Development: A Description of the Patterns', *Economic Development and Cultural Change*, Vol. 13, No. 4 (Part 2), pp.1–84.