Are people in the South less intelligent than in the North? Lynn and the Italian Mezzogiorno

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ABSTRACT - Socioeconomic disparity between North and South Italy has been recently explained by R. Lynn (2010) as resulting from a lower intelligence quotient (IQ) of the Southern population. The present article discusses the procedure by Lynn supplementing his data with new information on school assessments and per head regional income. Genetic North-South differences are then discussed on the basis of the most recent literature on the subject. The results do not confirm the IQ-economy causal link suggested.

Key words: Intelligence quotient, Italy, regional disparities, school attainments.

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1. INTRODUCTION

In a recent paper, Lynn (2010) argues that the divide in per capita income between North and South of Italy depends on regional differences in the intelligence quotient (IQ). A merit of Lynn's paper is that it is quite clear and thus easy to summarize. The author assumes that interregional disparities in IQ are reliably proxied by the statistics of the Program for International Student Assessment - PISA 2006 -, based on the results of 15-year-old students in tests on reading comprehension, mathematical ability and the understanding of science (OECD, 2006). He then draws some conclusions on North-South economic differences from the correlations between regional IQ and other variables regarding Italian regions, both today and in the past. These variables concern stature in 1855, 1910, 1927, 1980, per capita income in 1970 and 2003, infant mortality in 1955-57 and 1999-2000, literacy in 1880 and years of education in 1951, 1971 and 2001.

The high correlation among these variables and the IQ seems to support the opinion that the poorest Italian regions are those with a lower IQ and that IQ is correlated both with literacy and stature. According to R. Lynn, "regional differences in intelligence are the major factor responsible for the regional differences in Italy in per capita income and in the related variables of stature, infant mortality, and education" (Lynn, 2010, p. 94). Since, in the opinion of the author, North-South differences in per capita income did exist in Italy well before the 19th century, then it seems logical to assume there to be some primary determinant of such disparities. According to Lynn this divide originates, from the North-South genetic difference, which is the main determinant of the North-South difference in IQ. The causal linkage is clear: *genes → IQ → North-South Italian divide.*

In this article we start with correlations among variables concerning economy and intelligence today; then we go back in time to discuss the relation between economy and IQ one century ago and finally we deal with the genetic heritage of the South of Italy.

The aim of our analysis is neither to demonstrate that the IQ of the Southern Italian population is the same or higher than in the North, but to test both the basic data and the method followed by Prof. Lynn and subsequently check if his data and procedure can support the conclusions drawn by the author. Since, as we will see, some simple facts neglected by Lynn's theory on socioeconomic divide do not fit the recalled set of relationships established in his article, we will propose, at the end, a diverse, and, in our view, more appropriate, framework, to explain the causal links among the variables.

2. IQ AND THE ECONOMY

Intelligence and economic outcomes

The basic idea behind the article by Lynn is that variations in per head income find their explanatory determinants in differences in the IQ. This direction of research has a long history behind; although its quantitative support took shape only quite recently.

From the examination of a sample of non-agricultural white workers in the USA, Jencks (1972) found a correlation between per capita income and IQ. More recently Strenze (2007), on the basis of 85 datasets concerning several countries, found an income-IQ correlation of 0.20; while considering data referring to England, Irwing and Lynn (2006) found a correlation of 0.37 between the IQ measured at 8 years of age and income at the age of 43. In his article, Lynn (2010, p. 94) claims that the positive relationship between intelligence and income holds at three levels: among individuals, among regions and among nations. He recalls regional research concerning the British Isles (Lynn, 1979) and the United States (Mac Daniel, 2006).

At international level, the association between IQ and per capita income has been examined by Lynn and Vanhanen (2002) in a book where the authors show how the IQ explains half the cross-country variance in per capita GDP. In a more recent work, Lynn and Vanhanen (2006) expanded their sample to include 192 countries and have been able to show an existing IQ-income per capita correlation of 0.60 in the year 2002. Among other things, the authors explain how national IQ clarifies a series of social phenomena such as years of schooling (0.64 correlation with IQ), life expectancy (0.77) and the degree of democratization (0.57). According to Lynn and Vanhanen (2002, p. xv), “the intelligence of the populations has been a major factor responsible for the national differences in economic growth and for the gap in per capita income between rich and poor nations”. These results have been supported by Kanazawa (2006a, 2006b) and Whetzel-McDaniel (2006), who maintain that the relationships singled out by Lynn and Vanhanen (2002) between IQ, democracy and economic freedom are statistically significant and robust. These results have also been exploited by economists. By means of cross-country regressions, Weede and Kampf (2002) found a strong, direct relationship between IQ and rates of growth, while Jones and Schneider (2006), following Lynn and Vanhanen, showed how the increase of 1 point per cent in national IQ implies 0.11 per cent increase in national rates of growth. Finally, Ram (2007) finds that the inclusion of IQ in the Mankiw-Romer-Weil growth model increases its explanatory potential.

Lynn’s results

As already recalled, the basis of the analysis by Lynn (2010) is the IQ calculated from the PISA 2006 assessment relating to 15-year-old students. Since the PISA assessment resulted in scores in science, reading and mathematical ability, in his database Lynn averaged the results of the tests concerning these three domains for Italian regions and expressed them “in standard deviation units in relation to the British mean”(p. 96). These figures are then converted into conventional IQs by multiplying them by 15. The result is that, while in the North of Italy the level is 100 and thus equal to the British, in the South it is close to 90, with Sardinia at 89.

On the one hand we know that recent research such as that by Lynn and Mikk (2007), relating to 81 countries, and the evidence collected by Luo et al. (2003) has been summarized by the authors saying that “individual differences in mental speed are a main causal factor underlying the observed correlation between general intelligence and scholastic performance in children between the ages of 16 and 13"(Luo et al., 2003, p. 67). Reading comprehension and mathematical ability can actually be considered as primary components of general intelligence. On the other hand, IQ calculated from school tests captures not only intelligence, but years and quality of education, together with environmental influences. We can suppose that the higher the age to which the school tests refer, the higher the influence of all these secondary determinants on the primary cause of difference we like to caputure (Richardson, 2002; Wilkinson, Pickett, 2007). A number of scholars have raised severe criticism on the use of school attainment as a proxy of IQ. The reason is that IQ is, at least in part, a product (rather than a cause) of school-related learning (Richardson, 2002). As shown by Marks (2007), IQ tests measure the degree of literacy much more than intelligence. Growth of the average years of education explains the so-called "Flynn effect", that is the secular rise in IQ (Flynn, 1999).

The results of the correlations established by Lynn among the variables are statistically significant. The relationship between IQ and all the variables is higher than 0.736 and stays mainly in the range between 0.85 and 0.95. IQ is therefore highly and positively correlated to income per head in 1970 and 2003, to years of education from 1951, and negatively, as expected, to infant mortality from 1955 onwards. It is also positively associated to stature. The health-stature-IQ correlation is explained by Lynn (2010) saying that more intelligent populations "are more competent in looking after their babies, e.g. avoiding accidents, and are able to give them better nutrition, which makes them healthier and more resistant to disease" (p. 97).

3. METHOD AND RESULTS

Data description

The database exploited in this article is reported in the following Table 1. Series in columns 5-20 are the same as those in Lynn's article. We have nevertheless added 4 columns to his series. We have supplemented PISA's data with results of recent tests by the Italian National Institute for the Evaluation of Instruction (INVALSI), based on a wide sample of 1,100 primary classes distributed throughout all the Italian regions (Table 1, col. 1, 2). These data concern the assessment for mathematics in the 2nd and 5th classes of the primary school. The enquiry by INVALSI has followed the methodology of similar international comparative enquiries. In particular, tests in mathematics comply the criteria already developed in international research on the theme by IEA-TIMSS - International Association for the Evaluation of Educational Achievement, Trends in International Mathematics and Science Study (Montanaro, 2008; Invalsi, 2009). The INVALSI database has been utilized here to complete the documentary material exploited by Lynn with information concerning average scores for the 2nd and 5th primary classes; that is for children at the age of 7 and 10. These data refer to 20 Italian regions, while PISA assessment only to 12. In Table 1 are, however, reported data relating to 16 regions, that is the same sample examined in Lynn's (2010) article. Two other new series (col. 3, 4) report data on GDP per capita in 1891 and 1911 (in 1911 prices) (Daniele and Malanima, 2007; Felice, 2007). We have established correlations between data by Lynn and these recently published series. Since Lynn deals with the Italian genetic and economic history, we tried to go back in time with our revision of his results.

Cognitive capacity and income

We start by examining the correlation between INVALSI data and per capita regional GDP in 2008, using data for the whole sample of 20 regions, in order to obtain more robust relationships. Subsequently, the sample of 16 regions is considered to compare our results with those attained by Lynn.

Table 2 reports the descriptive statistics for maths scores: with the exception of Sicily, all Southern regions exhibit similar or higher values than the national mean. These data show how the standard deviation is relatively low for the 2nd class and is increasing for the

5th class scores. Figure 1 illustrates the relationship between maths tests scores and regional per capita income. It is easy to see that the relationship is not significant (r^2 = 0.03; p = 0.43), and the correlation is, in any case, low and negative (r = -0.18). Three Southern regions — Calabria, Puglia and Basilicata — occupy the first places in the hierarchy. Regional differences among children begin to appear in the 5th primary class, as we see in Figure 2. The coefficient of determination is, however, low indeed (r^2 = 0.15), the relationship is statistically not significant (p = 0.09), while the correlation between variables is now positive (r = 0.39) and higher than that for the 2nd class.

We examine now the correlation between the INVALSI tests and the variables used by Lynn in his investigation (for the sample reported in Table 1). Table 3 shows how the correlation between the tests for the 2nd class and per capita output in 2003 is weak and negative (-0.18) – regions with higher per capita GDP register worse results in the tests. Maths tests for the 2nd class are also weakly correlated with maths tests according to the PISA assessment (0.16), with mean instruction (0.16) and, as a consequence, with IQ index as computed by Lynn. Correlations with the other variables are weak or negative, the reason being that stature, infant mortality and average years of education are endogenous to the level of regional development measured by GDP. These variables, in fact, exhibit very significant correlations with per capita GDP, but not with the results in mathematics in the 2nd year of the primary school.

The case is different whenever we look at the correlation matrix for maths tests in the 5th class of the primary school, that is at the age of 10. In this case, the relationship with the PISA test, with years of education and with regional values of IQ is significant (0.72). The correlation with 2003 per capita GDP is relatively high (0.44), although considerably lower than that with IQ. As expected, the results of the tests carried out on 5th class students are correlated with the variables investigated by Lynn, with the only exception of infant mortality between 1955-57 (-0.26); although the correlation is lower than with the PISA tests administered to 15 year-old-students.

Figure 1. Maths test scores (II class) and per capita GDP (2008)

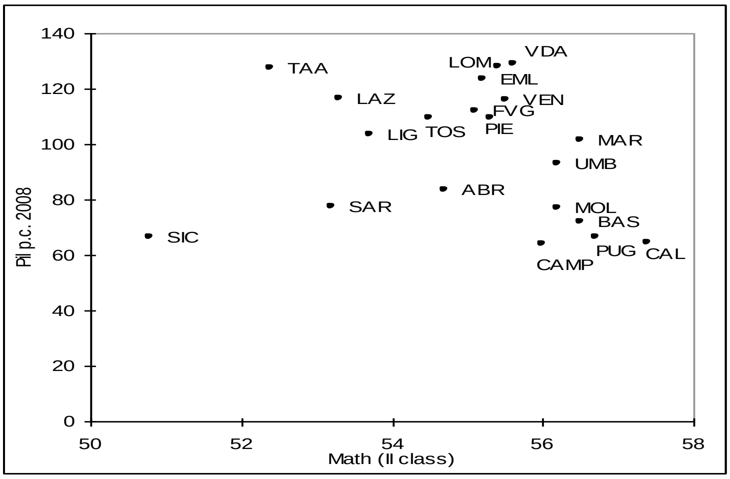
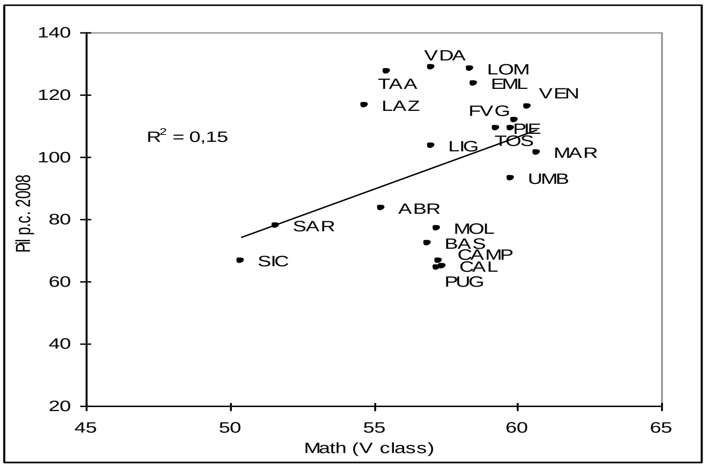


Figure 2. Maths test scores (V class) and per capita GDP (2008)



Note to Figg. 1, 2: PIE (Piemonte), LOM (Lombardia), VDA (Val D'Aosta), TAA (Trentino Alto Adige), VEN (Veneto), LIG (Liguria), EML (Emilia), TOS (Toscana), UMB (Umbria), MAR (Marche), LAZ (Lazio), ABR (Abruzzo-Molise), CAM (Campania), BAS (Basilicata), PUG (Puglia), CAL (Calabria), SIC (Sicilia), SAR (Sardegna). North includes the first 11 regions; South the other ones.

If it is accepted that the 2006 PISA assessment on IQ and the INVALSI tests assessing the capacity of intelligence in problem solving are both reliable, then our provisional results are as follows:

a. correlation with regional disparities in GDP is inexistent in the first years of school;

b. North-South disparities begin to appear in the last primary class (the 5th in Italy);

c. at the age of 15, these regional differences are visible and a relatively high correlation exists between them and per capita income.

IQ and history

In Lynn's opinion, since the IQ of the Southern Italian population has not changed over the last two centuries, a likely correlation could be supposed to exist between IQ and data concerning the standard of living of past Southern populations. According to Lynn, "individuals and populations with a high IQ are able to work more efficiently than those with a low IQ and consequently command higher incomes" (p. 87). The main correlation investigated by Lynn is that between IQ and per capita income.

We have already seen that a significant relationship exists between regional income in 2003 and IQ as measured by PISA scores. However, in recent years, it has become possible to go back in time with our knowledge of per capita product. Research on Italian national accounting resulted in the revision of data on Italian GDP in the years 1891, 1911, 1938 and 1951 (Conti economici dell'Italia). The lengthy research on industrial product by Fenoaltea (2001, 2003) and on agriculture by Federico (2003b, 2003c) have enabled the reconstruction of regional series for these two sectors of activity. Series regarding the service sector on national and regional scales have also been produced (Felice, 2005a, 2005b). Until the last decade, the opinion prevailed that at the date of national Unification in 1861, an economic disparity already existed between Northern and Southern Italy. However, recent research has revealed that, at that time, agricultural output per head was a little higher in the South; industrial product was a little higher in the North; and services were more or less equally present in the North and South. Overall, a deep diversity did not yet exist in the second half of the 19th century, as Fenoaltea (2006) stressed. Distribution of sectoral employment, based on the first Italian national censuses from 1861 until 1911, confirms this opinion (Daniele and Malanima, forthcoming).

Regional GDP from 1891 onwards has recently been reconstructed independently by Daniele and Malanima (2007) and by Felice (2007), with similar results. According to these reconstructions, in 1891, per capita GDP in the South was lower by 7 per cent. It is plausible, but not certain, that in 1861, the year of the Italian national Unification, the disparity did not yet exist or was modest, at least in per head income. Italy was then a poor agricultural country and areas of backwardness and prosperity existed both in the North and South. An advanced and rich North did not yet exist at that time. In Italy, the increase of literacy followed modern economic growth starting from the late 19th century. Although regional differences in the levels of literacy existed in 1870-80, historians are doubtful about their significance. It has been noted that it is hard to distinguish the literate from the illiterate only from the ability to write one's own name, as historians of literacy have often stressed with reference to the Italian regions (Cipolla, 1969; Vigo, 1983; Lupo, 2005).

On the basis of this recent literature, it has become possible to test the regional income-IQ relationship. Our correlation matrix, including data on regional income in 1891 and 1911, has been reported in Table 4. The correlation between data on regional GDP per head and IQ is negative in 1891 (-0.13) and is not significant in 1911 (0.15). Our series show that the correlation increased year by year from then onwards. A preliminary conclusion is that, in the half century after the Unification, the (supposed) original regional differences in IQs were not correlated at all to regional average incomes. Unfortunately information regarding past living standards and levels of average income is impossible to obtain, however, historical literature suggests that, for a lengthy period spanning antiquity and the early and high Middle Ages, Southern Italy was more advanced than the North (Malanima, 2002).

IQ and genes

According to Lynn, a genetic North-South difference is the main or unique determinant of relative backwardness of the Southern economy. Research on European genetic structure has revealed or confirmed the genetic similarity of the European populations and disclosed that Finns, on the one hand, and Italians, on the other, are the most atypical ethnicities in the continent. As for Italy, a further difference has been highlighted, the Northern populations being more similar to the Europeans and the Southern to the Mediterranean populations (Lao et al. 2008). The gradient between North and South, from a genetic viewpoint, can be established in the Centre of the peninsula.

In their well-known work published in 1993, L. Cavalli Sforza, P. Menozzi and A. Piazza stressed the North-South genetic difference in Italy, noting that "Northern Italians are more similar to central Europeans whereas Southern Italians are closer to other Mediterranean people, being darker and smaller" (Cavalli Sforza et al. 1993, p. 278). While Northern Italian populations are genetically more similar to European peoples — R. Lynn states —, populations of Southern Italy share their genetic characters with "peoples from North Africa and the Near East" (Lynn, 2010, p. 99) who immigrated to the South of Italy in the distant past. Phoenicians, Carthaginians, Arabs are recalled by Prof. Lynn in his article as the ancestors of present Southern Italians. The conclusion by Lynn is not totally new since, at the end of the 19th century, C. Lombroso (1876), a little later A. Niceforo (1898) and, more recently, F. Vöchting (1951) stated similar opinions.

A consequence of this genetic diversity is the difference in stature, which existed in the past and continues to exist today. Despite the increase in stature both in the North and the South during the past century, a 2 per cent difference in people's height remains (Federico, 2003a, p. 291). This difference in stature has been stressed by Arcaleni (1998, p. 37) and has been attributed to genetic reasons.

In his reconstruction, Lynn emphasizes the Phoenician and Arab genetic heritage of the Southern populations, in particular. It is now known that from the Iron Age onwards, Southern Italy underwent colonization first by Phoenicians and Greeks and later by the Arabs (9th-10th centuries). Greek populations were widespread especially in Southern Magna Graecia and Sicily. According to Piazza et al. (1988), towards 400 B.C., Greek inhabitants represented about 10 per cent of the whole population living in the island, but the genetic influence of the Phoenicians was quite superficial: “whereas the Phoenicians directed their main colonizing efforts towards the coasts of North Africa, Spain, Malta, Sardinia and the western triangle of Sicily, the Greeks settled mainly along the Southern and western shores of the mainland and also along the fertile coastal belt of Sicily” (Piazza et al. p. 206). High percentages of Greek also lived in Southern Italy on the whole (Piazza 1991, p. 67). It is not surprising that the main genetic influence in the South is Greek, while the Phoenician is very marginal. The case of Sardinia — one of the Southern regions considered by Lynn — is unique: this region results as being genetically different from all other Italian regions (including Sicily) (Piazza et al. 1988, p. 204).

For Sicily, a genetic map based on the variation of Y-chromosome lineages drawn up by Di Gaetano et al. (2009), exhibits a genetic similarity with Greece. The homogeneous distribution across the whole island of the haplogroup E3b1a2-V13, in particular, shows how Greek colonisation resulted in genetic similarity between Greek and Sicilian populations, while genes from North-West Africa are much less widespread on the island. The conclusion of this research is that the genetic contribution of Greek chromosomes to the Sicilian gene pool can be estimated about 37 per cent whereas the contribution of North African populations is estimated to be around 6 per cent.

4. DISCUSSION

Education-economy and economy-education

The extensive literature dealing with the relationship between cognitive ability-genes-intelligence is extensive and growing fast. Two particular developments are of interest to set the intellectual background of our specific research. They deal with: *a.* educational achievement-socio-economic status or the relation *economy → education*; *b.* economic effects of education or the relation *education → economy*. In the following two sections we will deal with the literature on these relationships.

Genes, socio-economic status and school achievements

At the *individual level*, the relationship between cognitive ability, as measured by IQ, and education has been extensively analysed. Jencks et al. (1979) reported the existence of correlations ranging from 0.40 to 0.63 between cognitive tests' scores and years of education. Mackintosh (1998) found in Britain a correlation of about 0.5 between IQ scores of 11-years old children and later educational performance. Deary et al. (2007) performed a longitudinal study of 70,000 English children examining the association between psychometric intelligence at the age of 11 years and educational achievement in 25 academic subjects at the age of 16. They found a correlation between intelligence and educational achievement of 0.81, with general intelligence contributing to achievement in all of 25 subjects under examination.

For individuals, the influence of socioeconomic conditions on cognitive intelligence and school attainments has been extensively studied. Turkheimer et al. (2003) demonstrate that the share of IQ variance explained by the genes and environment is correlated to SES (Socio-Economic Status) in a non-linear way. The models suggest that in relatively poor families, 60 per cent of the variance in IQ is accounted for by the shared environment. In this case genetic contribution is close to zero. In rich families, the result is almost exactly the reverse. The suggested explanation for the lower 'ability' of children from lower SES is only in part genetic. Improvements in the educational system might be, in fact, effective in reducing the difference. After controlling for SES, there is some evidence that even minimal increase in parent involvement play a positive role on the mastery of basic skills (Gorard and Huat See, 2008).

A research referring to the USA (Lara-Cinisomo et al., 2004) shows that the main factors associated with the educational achievement of children are not race, ethnicity, or immigrant status, but, to a much greater extent, the socioeconomic environment. These factors include parental education levels, neighbourhood poverty, parental occupational status, and family income. An ample review by the Royal Society (2008) stresses the strong link between SES and attainment in reading, mathematics and science among students 5-11 years old. Students from higher SES backgrounds obtain, on average, higher marks and examination grades, whatever the subject (Hogrebe et al., 2006). International comparisons support these results (Marks, 2008). Lynn and Mikk (2007) analyse the relationship between national IQ and school achievement in mathematics and sciences (TIMMS and PISA tests) for 67 countries, finding a very high correlation (0.92). Hunt and Wittmann (2008) show that educational data from PISA provides a better predictor of national per capita GDP than Lynn-Vanhanen data. Rindermann (2007) demonstrates how IQ scores collected by Lynn and Vanhanen correlate very high with results from international school assessments, since they seem to share the same basic determinant, namely a "national cognitive ability", practically identical to general intelligence.

The links between IQ and test scores, established for individuals (Bartels et al. 2002), have been examined also at the *national level*, with far from conclusive results.

In any case, while individual differences in cognitive ability depend on genetic factors, on group/ethnic differences the influence of environmental factors appears to be more important (Rindermann and Ceci, 2009). The determinants of national differences in cognitive ability tests are numerous: for group/ethnic differences, the idea that genes are a causal factor for cognitive differences is still a highly controversial hypothesis (Sternberg, 2005; Sternberg, Grigorenko and Kidd, 2005). At the moment, there is no evidence of specific genes that accounts for intelligence and that differ around the world (Cooper 2005; Wicherts and Wilhelm, 2007; Rindermann and Ceci, 2009) and, as clearly pointed out by Spinath (2007, p. 752), the well-documented and highly consistent result that genes contribute to individual differences in intelligence can not be used as evidence for genetic influence on group differences in intelligence. Recent studies show, in fact, that, at the macro-social level, several factors control the average cognitive ability and its rise in developed countries during the 20th century (Flynn effect): health, nutrition, education, urbanisation or the introduction of computers have all been proposed as determinants. The estimate of national IQ by Lynn and Vahnanen correlate highly with all the variables proposed to have caused the Flynn effect: secondary enrollment ratio (.78), pupil to-teacher ratio (-.72), the number of PCs per 1000 persons (.66), fertility rate (-.86) and urbanisation (.67) (Wicherts and Wilhelm, 2007; Wicherts et al., 2010). The result is a national *g*-factor more similar to the socio-economic developmental status of a country than *g* at the individual level (Brunner and Martin, 2007).

In particular for Italy, the effects of regional socioeconomic conditions on test scores have been analysed by economists. Montanaro (2008), by examining the TIMMS and PISA results, notes that the socioeconomic background of families significantly affects students' performance in these tests. In the first years of education, regional disparities in test scores are very modest and concern primarily students with less favourable family backgrounds. Other studies (Bratti et al., 2007; Checchi, 2007) indicate how the North-South divide of Italian students' capability in mathematics (as measured in PISA 2003) is largely explained by factors related to regional socioeconomic environment, such as school infrastructures and the local labour market, in terms of both employment probability and the presence of irregular and illegal economies. More important, Bratti et al. (2007) find that about 75 per cent of the North-South differential in mathematics is accounted for by resource differences, while geographical differences in "school effectiveness" account for the remaining share.

Educational standard and economic development

The relationship between schooling, psychometric intelligence and income are complex since each variable is linked to the others. The topic has been more widely discussed in behavioural literature than in economic research.

Ceci and Williams (1997) have shown that variations in years of schooling are related not only to variations in intelligence and test scores, but much more to variations in economic conditions. Both the relationship between schooling and earnings and that between intelligence and earnings are influenced by the joint relationship schooling-intelligence. “Some of the benefits that result from staying in school probably derive from its indirect effect on intelligence, just as some of the contribution that intelligence makes to earnings probably derives from its synergy with school-related variables” (Ceci and Williams, 1997, p. 1057). Individuals can expect significant financial gains from extending their education; they also obtain non-financial benefits: more educated people make better choices for health and tend to live longer and healthier (Hanuschek, 2009, p. 41).

Recent studies show how not only the quantity, but also the quality of schooling — the cognitive skills — as measured by ordinary achievements scores (such as TIMMSS or PISA) has a powerful effect on individual earnings, aggregate income and economic growth rates (Hanushek and Kimko, 2000). A research based on a large sample of countries (Jamison, Jamison and Hanushek, 2007), shows that higher levels of education quality (as measured by international student achievement tests) increase growth rates of national income: depending on the specific assumptions, the standard deviation by 1 point in test scores is correlated with an yearly increase in income per capita by 0.5–0.9 per cent and a similar increase in standard deviation in test scores is estimated to engender the decline in infant mortality rates by 0.6 per cent.

The developing countries lag dramatically behind developed countries both for quantity and quality of schooling (or cognitive skills): “in many developing countries, the share of any cohort that completes lower secondary education and passes at least a low benchmark of basic literacy in cognitive skills is below one person in ten” (Hanushek and Woessmann, 2008, p. 657). As suggested by Hanushek and Woessmann (2007a; 2008), cognitive skills are the product of different influences (families, peers) and can be improved by appropriate policies: effectiveness in the use of financial resources, the teacher quality and a system of incentives aimed to promoting competition, autonomy and accountability in the school systems.

5. CONCLUSIVE REMARKS

As stated at the outset, the aim of this analysis is not to demonstrate that IQ in Southern Italy is the same or higher than that in the North. On the other hand, a simple statistical exercise, based on correlations among variables, such as that by Lynn, is far from conclusive. Recent studies have shown a significant statistical relationship (p = 0.008) between the presence of storks in the European continent and the birth rate (Matthews, 2000); an association which seems particularly remarkable in the case of Germany (Höfer et al. 2004). So, are we to believe that storks actually deliver babies? We know how hard it is to explain causality by means of statistical exercises and certainly casual relationships are not captured by simple statistical correlations.

Our previous discussion suggests a different relationship among the variables analyzed by R. Lynn and those collected in the present article. Allowing that school tests are representative of differences in IQ, we have seen that:

- they clearly show how the North-South difference in cognitive ability does not exist at age of 7 years: the correlation between regional educational achievement (INVALSI) and regional per capita income is not-signficant and negative for 7 years old students, while it becomes positive (.44) at the age of 10, but considerably lower than that found through PISA test scores;
- the IQ-average income relationship did not exist in the past, although if it derived from a genetic difference, it would consequently have done so;
- knowledge of genetic differences in Italy does not support Lynn's opinion that peoples from North Africa and the Near East strongly influenced the genetic structure of the Southern Italian population.

The existence of differences in IQ, as revealed by school tests and other tests (supposing that these actually reveal "originary" diversities in intelligence), seems much better explained as being socially, economically and historically influenced rather than being genetically determined. Capabilities in problem solving are enhanced by a developing and stimulating environment, according to the so-called “Flynn effect”.

In the past, the Southern Italian economy has at times been more advanced than the Northern one; during the Roman antiquity, for example, and during the high Middle Ages. Perhaps the North and Centre were more advanced than South in the late Middle Ages; although nothing certain can be said on the matter. The following decline of the Italian economy as a whole, from the late Middle Ages and until the end of the 19^{th} century, probably eliminated economic differences. When per capita GDP diminishes and approaches the level of bare subsistence, differences among regions disappear. In the 19^{th} century, Italy was a relatively backward country both in the North and in the South. The statistical material available from the end of the 19^{th} century onwards, does not actually indicate a deep North-South divide, in economic terms. The start of modern growth from then on affected the North much more than the South and economic disparity began to exist between the two parts of the country. In 1891 the North-South difference in per capita GDP was 7 per cent; it was 20 per cent on the eve of World War 1, and 45 per cent after World War 2. Today, per capita GDP in the South is about 60 per cent that of the North (Daniele and Malanima, 2007). As ordinarily happens, relative backwardness implies the accumulation of adverse influences. While literacy and the length of education grew in the North with respect to the South, infant mortality diminished much more quickly in the North than the South. Institutions, including families and schools, work much better in prosperity than backwardness. Proxies of IQ are likely to be higher where families, municipalities, provinces and regions invest more in education. Remarkable emigration from the South to the North, especially between 1950 and 1975, increased the North-South diversity since emigration, in Italy such as elsewhere, is always selective. Since IQ registers education and years of schooling to a greater extent than intelligence, the relative position of the South compared to the North deteriorated in both the cultural environment and the economy and more or less at the same time.

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Table 1. Database for IQs and related variables

	1	2	3	4	5	6	7	8	9	10
	Maths (II cl.)	Maths (V cl)	GDP pc 1891	GDP pc 1911	Maths PISA	Mean Educ.	IQ	Stature 1855	Stature 1910	Stature 1927
Piemonte	55.3	59.3	449.2	672.1	492	502	100	162.1	167.0	168.9
Lombardia	55.4	58.4	478.5	698.7	487	492	100	162.5	166.2	168.1
Veneto	55.5	60.4	374.6	484.8	510	515	101	164.8	167.1	169
Friuli Ven. G.	55.1	59.9	375.0	485.0	513	522	103	165.3	167.4	171.7
Trentino A.A.	52.4	55.5	375.0	485.0	508	512	101			169.2
Liguria	53.7	57.0	529.7	849.9	473	481	97	163.2	167.7	169.7
Emilia	55.2	58.5	464.5	619.5	494	500	100	163.4	166.6	169.2
Toscana	54.5	59.8	445.1	581.8				163.7	166.2	169.8
Umbria	56.2	59.8	513.8	593.7				161.9	164.6	167.2
Lazio	53.3	54.7	463.4	623.1				161.8	164.6	167.6
Abruzzi-Basilicata	55.6	56.1	342.7	416.6	443	447	92	159.6	162.8	164.2
Campania	56.0	57.2	487.5	612.5	436	439	90	160.2	162.9	164.9
Puglia	56.7	57.3	419.8	529.4	435	441	91	159.7	163.1	164.3
Calabria	57.4	57.4	316.6	418.6				158.3	162.2	163.3
Sicilia	50.8	50.4	435.2	520.1	423	427	90	160.2	163.3	164.7
Sardegna	53.2	51.6	431.0	537.6	429	438	89	158.5	160.6	162.1

	11	12	13	14	15	16	17	18	19	20
	Stature 1980	GDP pc 1970	GDP pc 2003	infant mortality 1955-7	Infant mortality 1990-02	Literacy 1880	Years educ ation 1951	Years education 1971	Years educ ation 2001	Latitude
Piemonte	175.3	10,964	20,519		3.86	67.8	5.1	5.5	8.6	45.0
Lombardia	175.2	11,693	22,639	45.4	3.61	63	5.2			45.0
Veneto	177.0	9,223	20,338	36.7	3.17		4.6	5.3	8.8	45.5
Friuli Ven. G.	178.0	8,985	20,750	38.3	2.5	45.9	5.2	5.7	9.0	46.0
Trentino A.A.	177.1	10,930	23,079	44.9	3.47	45.9	5.1	5.7	8.9	46.0
Liguria	175.1	9,517	20,000	40.8	4.05	55.5	5.1	5.9	9.0	44.5
Emilia	175.4	10,058	22,439	36.2	3.73	52.2	4.6	5.2	8.7	44.5
Toscana	175.8	10,022	19,666	35.2	3.24	38.1	4.4	5.2	8.6	43.5
Umbria	175.8	7,815	17,070	39.8	3.76	28.6	4.1	4.9	8.7	43.0
Lazio	175.5	10,317	20,207			41.8	4.8	5.8	9.4	41.5
Abruzzi-Basilicata	174	6,814	15,480	68.1	4.56	18.1	3.8	4.6	8.5	41.0
Campania	173.1	6,481	11,862	62.2	5.21	24.6	3.6	4.7	8.2	40.5
Puglia	173.3	6,313	12,030	70.4	5.88	20	3.4	4.5	8.0	40.0
Calabria	172.4	6,128	11,595	117.5	5.54	14.6	3.5	4.5	8.0	39.0
Sicilia	172.7	6,525	12,488	57.0	6.62	19.1	3.5	4.5	8.0	37.9
Sardegna	171.6	8,054	13,722	53.6	4.1	19.1	3.4	4.6	8.2	40.0

Table 2. Descriptive statistics for Invalsi data on math scores

Variable	Mean	Median	Minimum	Maximum	Std. Dev.	C.V.
Math_II_class	55.01	55.35	50.80	57.40	1.63	0.03
Math_V_class	57.22	57.25	50.40	60.70	2.73	0.05

Table 3. Correlation matrix for variables

	Maths (II clas)	*Maths (V cl)*	*Maths PISA*	*Mean Education*	*IQ*	*Stature 1855*	*Stature 910*	*Stature 1927*	*Stature 1980*	*GDP pc 1970*	*GDP pc 2003*	*Infant mortality 1955-7*	*Infant mortality 1990-02*	*Literacy 1880*	*Years educ 1951*	*Years educ 1971*	*Years educ 2001*	*Latitude*
Maths (II clas)	1.00																	
Maths (V cl)	0.70	1.00																
Maths PISA	0.16	0.72	1.00															
Mean Education	0.16	0.72	1.00	1.00														
IQ	0.17	0.72	0.99	0.99	1.00													
Stature 1855	-0.05	0.64	0.94	0.93	0.92	1.00												
Stature 1910	0.01	0.66	0.90	0.89	0.90	0.93	1.00											
Stature 1927	-0.09	0.61	0.92	0.92	0.93	0.96	0.96	1.00										
Stature 1980	-0.02	0.63	0.95	0.94	0.93	0.94	0.87	0.92	1.00									
GDP pc 1970	-0.25	0.31	0.80	0.81	0.84	0.67	0.73	0.74	0.66	1.00								
GDPpc 2003	-0.18	0.44	0.92	0.92	0.94	0.84	0.86	0.86	0.84	0.93	1.00							
Inf. Mort. 1955-7	0.39	-0.26	-0.83	-0.85	-0.84	-0.78	-0.67	-0.72	-0.66	-0.68	-0.72	1.00						
Inf..Mort. 1990-02	-0.06	-0.61	-0.86	-0.87	-0.86	-0.77	-0.67	-0.76	-0.81	-0.75	-0.83	0.67	1.00					
Literacy 1880	-0.10	0.46	0.83	0.84	0.86	0.75	0.87	0.81	0.67	0.90	0.88	-0.66	-0.64	1.00				
Years educ 1951	-0.15	0.46	0.90	0.90	0.93	0.82	0.90	0.89	0.83	0.89	0.94	-0.63	-0.76	0.92	1.00			
Years educ 1971	-0.27	0.33	0.86	0.87	0.87	0.78	0.83	0.86	0.79	0.86	0.88	-0.64	-0.75	0.86	0.96	1.00		
Years educ 2001	-0.21	0.32	0.88	0.88	0.89	0.72	0.69	0.76	0.80	0.77	0.85	-0.72	-0.87	0.69	0.86	0.91	1.00	
Latitude	0.04	0.65	0.97	0.97	0.98	0.89	0.90	0.89	0.89	0.81	0.91	-0.70	-0.89	0.85	0.90	0.81	0.73	1.00

Table 4. Correlation matrix for variables

	GDP pc 1891	*GDP pc 1911*	*Mean Education*	*IQ*	*Stature 1855*	*Stature 910*	*Stature 1927*	*Stature 1980*	*GDP pc 1970*	*GDP pc 2003*	*Infant mortality 1955-7*	*Infant mortality 1990-02*	*Literacy 1880*	*Years educ 1951*	*Years educ 1971*	*Years educ 2001*	*Latitude*
GDP pc 1891	1.00																
GDP pc 1911	0.88	1.00															
Mean Education	-0.17	0.11	1.00														
IQ	-0.13	0.15	0.99	1.00													
Stature 1855	0.23	0.33	0.93	0.92	1.00												
Stature 1910	0.29	0.51	0.89	0.90	0.93	1.00											
Stature 1927	0.22	0.38	0.92	0.93	0.96	0.96	1.00										
Stature 1980	0.01	0.10	0.94	0.93	0.94	0.87	0.92	1.00									
GDP pc 1970	0.29	0.49	0.81	0.84	0.67	0.73	0.74	0.66	1.00								
GDP pc 2003	0.19	0.37	0.92	0.94	0.84	0.86	0.86	0.84	0.93	1.00							
Inf. Mort. 1955-7	-0.52	-0.46	-0.85	-0.84	-0.78	-0.67	-0.72	-0.66	-0.68	-0.72	1.00						
Inf..Mort. 1990-02	-0.06	-0.17	-0.87	-0.86	-0.77	-0.67	-0.76	-0.81	-0.75	-0.83	0.67	1.00					
Literacy 1880	0.41	0.67	0.84	0.86	0.75	0.87	0.81	0.67	0.90	0.88	-0.66	-0.64	1.00				
Years educ 1951	0.21	0.47	0.90	0.93	0.82	0.90	0.89	0.83	0.89	0.94	-0.63	-0.76	0.92	1.00			
Years educ 1971	0.25	0.50	0.87	0.87	0.78	0.83	0.86	0.79	0.86	0.88	-0.64	-0.75	0.86	0.96	1.00		
Years educ 2001	0.23	0.37	0.88	0.89	0.72	0.69	0.76	0.80	0.77	0.85	-0.72	-0.87	0.69	0.86	0.91	1.00	
Latitude	0.13	0.32	0.97	0.98	0.89	0.90	0.89	0.89	0.81	0.91	-0.70	-0.89	0.85	0.90	0.81	0.73	1.00