Intelligence 38 (2010) 451–455

Contents lists available at ScienceDirect

Intelligence

IQ differences between the north and south of Italy: A reply to Beraldo and Cornoldi, Belacchi, Giofre, Martini, and Tressoldi

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ARTICLE INFO

Article history:
Received 3 July 2010
Accepted 3 July 2010
Available online 3 August 2010

Keywords:
IQ
Italy
Progressive Matrices
PISA
Income

ABSTRACT

Beraldo (2010) and Cornoldi, Belacchi, Giofre, Martini, and Tressoldi (2010) (CBGMT) have eight criticisms of my paper (Lynn, 2010) claiming that the large north–south differences in per capita income in Italy are attributable to differences in the average levels of intelligence in the populations. CBGMT give results for seven data sets for IQs in the north and south of Italy. All of these show that IQs are higher than in the north than in the south, although the differences are not as great as those I calculated. Other criticisms to the effect that the PISA tests are not measures of intelligence are refuted. The results of two further studies are given that confirm that IQs in the north of Italy are approximately 10 IQ points higher than in south.

Contents

1. Introduction

I thank CBGMT and Beraldo for their thoughtful comments on my paper (Lynn, 2010) claiming that the large north–south differences in per capita income in Italy are attributable to differences in the average levels of intelligence in the populations. Between them, they make eight points and I will reply to them each in turn, and then provide new data on IQs in the Italian regions.

2. PISA as a measure of intelligence

CBGMT dispute the use of PISA as a measure of intelligence. They write "The author does not measure directly IQ, but uses a proxy, the PISA tests, which is, properly speaking, a measure of education, not of IQ." and "the PISA

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doi:10.1016/j.intell.2010.07.001

data, collected to provide estimates of the effective school performance by children from different countries, are little suited for providing comparative estimates on effective intellectual ability, since they also reflect different contexts that are difficult to compare."

Contrary to these assertions, there is no doubt that the PISA data are measures of intelligence. The PISA tests are of reading literacy, mathematical understanding and science understanding. Reading literacy is defined as "An individual's capacity to understand, use and reflect on written texts". This appears as reading comprehension in Carroll's (1993, p. 598–9) definitive text on the factors of intelligence. Carroll (1993, p. 524) gives math ability as quantitative reasoning and as another component of intelligence, and he gives science understanding as general science information and also as a component of intelligence. Science understanding is highly correlated with general intelligence, e.g. at 0.68 in a study by Deary, Strand, Smith, and Fernandes (2007). Because these educational tests are components of intelligence, there is a high correlation between these and IQs. For instance, Deary et al. (2007) report a correlation of 0.81 between an intelligence test taken by approximately 70,000 British school children at the age of 11 and their educational achievement in examinations taken at age 16. This correlation is the same as that typically present between two intelligence tests. We have recently shown that scores in PISA and scores derived from similar international studies are perfectly correlated with IQs ($r = 1.0$) across 108 nations (Lynn & Meisenberg, 2010). The reason for this is that they are both measures of the same construct of intelligence.

The genetic explanation for the high correlation between IQ tests and educational tests are so highly correlated is that the same genes determine both (Bartels, Rietveld, van Baal, & Boomsma, 2002; Petrill & Wilkerson, 2000; Wainwright, Wright, Geffen, Luciano, & Martin, 2005a,b. These are designated "generalist genes" by Kovas, Harlaar, Petrill, and Plomin (2005) because they determine many expressions of cognitive ability including IQs, math, reading, science, etc. More recently, Johnson, Deary, and Iacono (2008, p.475) in a study of the high correlation between IQ measured at age 11 and GPA (Grade Point Average) at age 17 conclude that "The genetic correlation between IQ and GPA was both substantial and significant. " Thus, population differences in all these cognitive tests are expressions of differences in gene frequencies for cognitive ability. This is why there are regional differences in Italy of about the same magnitude in the PISA educational tests and in intelligence tests, as shown in Tables 1 and 2 below.

3. Factors affecting Pisa data

CBGMT argue that the north–south differences in the PISA data are reduced "when one corrects for family and background variables" such as family incomes and school variables such as financial resources, teacher tenures, and tracking". They conclude that "correcting for family and context background removes a sizable part of the postulated genetic differences between regional groups."

This correction for family background, SES, and other variables is known as "the sociologists' fallacy" identified some forty years ago by Jensen (1973, p. 235–6). As Jensen observed "SES classification is more a result than a cause of IQ variance". The fallacy of the method is that the SES, earnings, etc. of the family are themselves products of the families' IQs, which determine the IQs of the children. CBGMT are evidently aware of this because they acknowledge this procedure "removes a sizable part of the genetic differences." CBGMT therefore implicitly acknowledge that there must be genetic differences in IQs between the north and the south, even after the IQ differences have been corrected by controlling for family and background variables. As far as the educational variables are concerned, these too are most reasonably interpreted as functions of the IQs of the populations rather than as causes of the IQ differences reported in PISA. More is spent on schools in the north, because the populations have higher IQs and higher earnings, and can therefore afford to spend more on schools. However, it is doubtful whether expenditures on schools have any significant on students IQs. The Coleman (1966) report carried out in the United States is the classical study showing that the differences between schools have very little effects on the children's IQs and educational attainment.

In the case of populations such as those of the Italian regions, there is a positive feedback effect such that populations with low IQs transmit these to their children, mainly genetically but also environmentally, from generation to generation. This is known as genotype–environment correlation, defined as "a systematic tendency for certain genotypes and environments to co-occur" (Horn & Loehlin,

Table 1
Regional IQs in Italy from internet source and PISA.

Region	IQ-Internet	IQ-PISA
Trentino	102.2	101
Friuli-Venezia	104.5	103
Veneto	102.2	101
Lombardy	101.1	100
Piedmont	97.4	100
Emilia Romagna	99.8	100
Liguria	96.7	97
Tuscany	98.8	–
Marche	103.0	–
Umbria	98.4	–
Lazio	97.3	–
Abruzzo	98.9	92
Molise	96.7	–
Puglia	95.5	91
Campania	92.6	92
Basilicata	97.8	92
Calabria	93.1	–
Sardinia	93.5	90
Sicily	91.8	89

Table 2
Regional IQs in Italy.

Location	N	Age	Test	IQ	Reference
Florence	2462	11–16	SPM	103	Tesi and Young (1962)
Pisa	500	6–11	CPM	103	Prunetti (1985)
Pisa	459	7–11	CPM	99	Prunetti et al. (1996)
Genoa	600	6–11	CPM	95	Galeazzi et al. (1979)
Rome	1350	Adults	CCF	102	Buj (1981)
Sicily	5370	18	CCF	90	Pace and Sprini (1998)

Note: SPM: Standard Progressive Matrices; CPM: Coloured Progressive Matrices; CCF: Cattell Culture Fair.

2010, p.193). This is precisely what is present in the southern regions of Italy.

4. Sample size and reliability

Beraldo contends that the correlation of .937 between regional IQs and per capita incomes across Italian regions is not robust, because of the inadequate size of the sample. I would be surprised if anyone accepts this contention. The correlation is statistically significant at $p<0.001$. The size of the sample is irrelevant. I doubt whether anyone will dispute that there is definitely something here that needs to be explained.

Beraldo is correct that I did not supply any information about the reliability of the PISA data and the correlation with per capita income. I will make good this omission here. The data for per capita income are sound. What is required is some evidence on the reliability of the IQ data.

Since the publication of my estimates of regional IQs for Italy, new IQ data for Italian regions have appeared and are available on www.sitozero.it. These new data can be used to examine whether my estimates of Italian regional IQs are replicable and reliable. The new data consist of the results of an intelligence test given to a sample of about 50,000 individuals who took the test over the internet. The mean IQ of this sample is 100. In total, 14,200 people had taken the test when the IQ scores from the Italian regions were obtained using the filters available on the website. Scores have only been used for regions for which the sample size was equal to or greater than 50.

Table 1 gives the mean IQs of 19 Italian regions in this data set in the second column. The third column gives the PISA IQs (in the PISA data Abruzzo and Basilicata are combined, but IQs for each are given in the internet data, so in Table 1 the same PISA IQ is given for each).

It will be seen that the IQs obtained in the internet test and in PISA are closely similar. The average IQ in the six northern regions is 101.2 in the internet test and 100.7 in PISA. The average IQ in the two southern regions of Sardinia and Sicily is 92.6 in the internet test and 89.5 in PISA. The IQs obtained in the internet test make it possible to assess the reliability of the PISA IQs. The correlation between the internet IQ test scores and the PISA scores is 0.89. This is a little higher than correlation typically obtained between two intelligence tests and shows that the PISA IQs have high reliability.

5. Correlation and causation

Beraldo asserts that "the most serious weakness" of my study demonstrating a correlation between regional IQs and per capita income across the Italian regions is that I have failed to understand the distinction between correlation and causation. This would be a valid criticism if this were an isolated correlation that needed to be explained, and if this were the case Beraldo is right that any number of possible explanations could be advanced to explain it. However, it is far from an isolated correlation that needs to be explained. On the contrary, it is a further instance of a well established nomological net in which IQ is a determinant of income which has been extensively demonstrated. The most basic of these demonstrations is the finding that among pairs of brothers, the one with the higher IQ in childhood has the higher earnings as an adult (Murray, 2002). The comparison of pairs of brothers controls for family and socio-economic variables that might otherwise be advanced to explain the positive relationship between IQ and earnings. The causal sequence from IQ to earnings has been further established in a study showing that in a large nationally representative sample in Britain, the IQ of children assessed at the age of 8 years predicted income at the age 43 years. The correlations between IQ and income were .368 for men ($n=1280$) and .317 for women ($n=1085$) (Irwing & Lynn, 2006).

There are numerous studies showing correlations between IQ and income among adults. Twenty-nine of these for samples aged in their thirties and forties in various countries for which the median correlation is .36 are summarized in Lynn and Vanhanen (2006, p. 36).

The positive effect of intelligence on earnings is well established in economics. Typically, economists.avoid the term *intelligence*. They prefer terms like *cognitive ability* (Crawley, Heckman, & Vytlacil, 2001) or *intellectual capacity* (Zax & Rees, 2002). Economists do not normally express the relationship between *cognitive ability* or *intellectual capacity* as a correlation coefficient. They generally prefer to express it as the effect of an increase of one standard deviation of intelligence on the percentage increase in earnings. The median results of nine studies are summarized in Lynn and Vanhanen (2006, p. 41) and is that a one standard deviation of intelligence produces a 17% increase in earnings.

The explanation for the positive association between IQ and income is well understood. It is that people with high IQs work more proficiently than those with low IQs and this makes them more productive and able to earn higher incomes and achieve higher socio-economic status. Nine studies of the relation between IQ and job proficiency in which the median correlation is 0.40 are summarized in Lynn and Vanhanen (2006, p. 49).

The positive association between IQ and income holds for regional populations within nations. This has been shown for the regions of British Isles ($r=.73$), France ($r=.61$) and Spain ($r=.65$) (Lynn, 1979, 1980, 1981) and, more recently, for the states of United States ($r=.28$) (McDaniel, 2006). The positive association between IQ and income also holds across nations, where the correlation for 189 nations is .64 (Lynn & Vanhanen, 2006, p. 110). The reason that the positive association between IQ and income holds for populations is that populations are aggregates of individuals, and because it is clear that IQ is causal to income among individuals, the same association holds among populations.

Thus, the positive association between IQ and income across the regions of Italy is a further instance of a relationship that has already been well established and the explanation for which is already well known. I could have presented the Italian data as a prediction and perhaps it would have been better to have done so for the benefit of those who are unfamiliar with the nomological net into which the Italian data fit.

6. MT-advanced data

CBGMT report North–South differences on MT-Advanced tests assessing 9th- and 10th-graders in reading and

mathematics. They give the North–South differences as .31d, .43d, .27d, and .43d. The average of these is .36d and equivalent to 5.4 IQ points. This is evidently an underestimate of the true difference because CBGMT eliminated results "that reflected total disengagement in the task by producing a performance at chance level, a result which could be due to either random responses or substantially incomplete questionnaires", and that according to an analysis of missing PISA data, this would have entailed discarding "over 20% of Southern Italy students but only for 6–7% of students in North Italy." They conclude that "the observations collected with the MT-Advanced tasks, at least for North- and South-Italy samples, cast doubt on the generalizability of PISA data and on the appropriateness of using achievement scores to derive IQ differences."

Contrary to this conclusion, the results confirm that cognitive ability assessed by reading and mathematics is higher in northern Italy than in the south by something over 5.4 IQ points.

7. INVALSI data

CBGMT give these data for 2nd-graders, 5th-graders, and 8th-graders tested in language and mathematics and report that children in the nine northern regions obtained higher means than those in the eight southern regions of .26d and .02d for the 2nd-graders, and .14d and .24d for the 5th-graders, equivalent to 2.1 IQ point and 2.85 IQ point differences. CBGMT do not give means for the 8th-graders, but these can be calculated from their Table 2 and show that the children in the nine northern regions obtained higher means than those in the eight southern regions of .215 (3.2 IQ points) on language, and of .223d (3.5 IQ points) on math. All of these north–south differences are smaller than in the PISA data for 15 year olds. Notice, however, that the north–south differences increase progressively from the younger to the older children. This would be expected if the IQ differences have a genetic basis, because the heritability of intelligence increases progressively from younger to older children.

8. Raven's data

CBGMT give new data in their Table 6 for the mean scores obtained on the recent 2008 standardization of Raven's Coloured Progressive Matrices obtained by children from North and South Italy, for three age groups from age 8.6 to 9.11. They report that the mean IQ of children in the North have a mean British IQ of 103.6, and mean IQ of children in the south have a mean British IQ of 99.8, giving a 3.7 IQ point advantage for children in the north. These IQs are derived from the British 1982 standardization.

This new Italian standardization is clearly defective because CBGMT state that "comparison of CPM Italian norms with four other banks of data gathered from 1954 to 2008 revealed no substantial changes" (Belacchi, Scalisi, Cannoni, & Cornoldi, 2008, p. 54). If this is so, Italy must be the only economically developed nation that has not experienced a substantial increase of intelligence of approximately 2 to 3 IQ points a decade during this period, documented by Lynn (1982), Flynn (1984), Lynn and Hampson (1986), Flynn (2007), and numerous others. Over the 54 years 1954–2008, the Italian IQ must have increased by around 11 to 16 IQ points. As soon as CBGMT noticed that it had not increased at all according to these data, they should have realized that there must be something seriously wrong with this study.

The deficiencies of the 2008 Italian standardization are further evident when the norms are compared with the norms on the British 2007 standardization given by Raven (2008a,b). On these British norms, the three younger Italian age groups obtain mean British IQs of 80, and the two older age groups obtain mean British IQs of 75. Averaging these gives the Italian sample a British IQ of 78. This is obviously much too low. It is not credible that the IQ in Italy can be so much lower than that the IQs in Romania (94), Bulgaria (93), Greece (92) and Turkey (90) given in Lynn and Vanhanen (2006).

An 1Q for Italy can be calculated from the regional IQs calculated from PISA and given in Table 1 of my paper (Lynn, 2010), where the IQs in the regions of the north and center average 100 and the IQs in the south average 90 (the same results are confirmed by those of the IQ tests given in Table 2, below). Weighting these PISA IQs by population size of approximately 39 million in the north and center and approximately 21 million in the south gives an IQ of 96.5 for Italy. This figure is credible, given that the IQ of 100 in the north and center of Italy is pulled down by the low IQs south of Rome. The sampling in the 2008 Italian standardization of the Coloured Progressive Matrices is so defective that it is doubtful whether it can be given any credibility. Nevertheless, even in this unsatisfactory data set, children in the north obtain a mean IQ 3.7 IQ points higher than those in the south.

9. New Raven's data

I welcome CBGMT's point that it would be desirable to find new data on north–south differences in IQ in Italy. I have provided these in Table 1, and I am now able to provide more of these in the studies summarized in Table 2. The Italian IQs are expressed in relation to a British mean of 100 (Sd, 15) and are Flynn Effect (FE) corrected to equate Italian and British IQs for the year in which the data were obtained. The corrections applied are 2 IQ points a decade for the Progressive Matrices, in accordance with previous procedures (Lynn & Vanhanen, 2006), and 2.5 IQ points a decade for the Cattell Culture Fair, adopting the rate of increase from 1936 to 1986 reported by Lynn, Hampson, and Mullineaux (1987). Notes explaining these studies are given below the table.

The first five studies set out in Table 2 are for Italy north of the 41st line of latitude, about mid-way between Rome and Naples. This treats Italy as two geographical regions, adopting the same dichotomy as CBGMT. We see that the first five studies show that the population north of this line of latitude has an average British IQ of 100, confirming the results of the PISA data. The IQ of 90 in the bottom row is for Sicily and is not significantly different from the 89 calculated from the PISA data. This again confirms the results of the PISA data that in the five Italian regions south of the 41st line of latitude there is an average IQ of 90. Thus, the same 10 IQ point difference between the north and south of Italy is present whether this is measured by the PISA data or by IQ tests.

The IQs given in Table 2 have been calculated as follows.

Tesi and Young (1962). This sample scored at the 47.3rd percentile of the British 1979 standardization sample = 99 IQ. Add 4 for the FE increase of the Italian IQ 1960–79 = 103.

Prunetti (1985). This sample scored at the 56.4th percentile of the British 1982 standardization sample = 103 IQ. No FE correction.

Prunetti, Fenu, Freschi, and Rota (1996). This sample scored at the 54th percentile of the British 1982 standardization sample = 101.5 IQ. Deduct 2.5 for the FE increase of the British IQ 1982–94 = 99.

Galeazzi, Castelli, and Saccomani (1979). This sample scored at the 34.3th percentile of the British 1982 standardization sample = 94 IQ. Add 1 for the FE increase = 95.

Buj (1981). This study on adults in Rome obtained a British IQ of 102 of the Cattell Culture Fair test.

Pace and Sprini (1998). This sample gives results of a standardization of the Cattell Culture Fair test (CCF Scale 2 A) in Sicily on a sample of 5370 18 year old school students. The mean score was 31. This is equivalent to an IQ of 103 on the American and British norms given in Cattell (1959, p. 25). The American and British norms were collected in 1961, and the mean scores on the CCF in Britain increased by 2.5 IQ points a decade from 1936 to 1986 (Lynn et al., 1987). Assuming that the Sicilian data were collected two years before publication (i.e. in 1996), the British IQ will have increased by 8.75 IQ points to 108.75 (35 years × 2.5) during the 35 years 1961–1996. Hence the Sicilian IQ of 103 must be reduced by 8.75 IQ points to 92. A further adjustment is required because the sample was all in schools, and the study did not sample 18 year olds not in schools. The sample had the benefit of more schooling than their unsampled age group not in schools. It is estimated that schooling increases IQs by 2 IQ points a year (Ceci, 1991). Assuming that about half the 18 year olds had left school at the age of 16 years, their IQ would have been 88. Averaging the two figures gives an IQ of 90 for 18 year olds in Sicily.

10. Conclusion

CBGMT give results for seven data sets for IQs in the north and south of Italy. All of these show that IQs are higher than in the north than in the south. The results of the internet study and of six further studies confirm this conclusion and show that the difference between the north and the south of Italy is approximately 10 IQ points.

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