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Do differences in IQ predict Italian north–south differences in income? A methodological critique to Lynn

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ABSTRACT

Lynn (2010) suggests that differences in average intelligence explain many of the differences observed across the Italian regions. This paper puts forward a methodological critique to his study, coupling it with an empirical test showing that Lynn's analysis is not sufficiently robust to support its conclusions.

Contents

1. Introduction . . . 456
2. Correlation versus causation . . . 457
3. Robustness checks . . . 458
   3.1. Data . . . 458
   3.2. Determinants of income . . . 458
   3.4. More plausible explanations for regional differences in IQ levels . . . 459
4. Conclusion . . . 460
Acknowledgments . . . 460
References . . . 460

1. Introduction

In a recent article published by Intelligence, Lynn (2010) suggests that regional differences in the average level of intelligence are the major factor responsible for the regional differences in Italy. More precisely, Lynn (2010) presents evidence in support of the following hypotheses: average IQs in Italy are higher in the north than in the south; these IQ differences explain most of the per capita income differences; regional average IQ differences in Italy are evident in the differences in stature, infant mortality, literacy and years of education.

As for the methodology employed, average IQs are calculated for Italy based on data drawn from the OECD Program for International Student Assessment — PISA (OECD, 2007), which assesses some of the basic skills acquired by students near the end of compulsory education. The average IQ for the Italian regions is calculated by averaging the scores on reading comprehension, mathematical ability and scientific understanding, and then expressed in standard deviation units in relation to the British mean. According to the data, natives of the north of Italy display an average IQ which

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equals that of the British people; natives of the south display a substantially lower average IQ.

For example, individuals living in *Friuli Venezia Giulia*, a region located on the extreme north, display an average IQ of 103 (British mean IQ = 100) which is substantially higher than that exhibited by individuals living in a region like *Sicilia* (average IQ = 89), located in the extreme south.

As for the hypothesis that the north–south gradient of average IQs in Italy explains the differences in economic development, Lynn (2010) finds a correlation of 0.937 between average IQs obtained from PISA data (collected in 2006) and per capita income (relative to 2003). On this basis, he states that average IQ differences explain 88% of the variance in per capita incomes across Italian regions.

Lynn (2010) admits that average IQs (in 2006) are highly correlated with the years of education of adults (in 1951), although he gives it little weight in his model.[1]

According to Lynn (2010), a possible explanation for this sharp difference in average IQ levels is that the populations of the north and south are genetically different, and these genetic differences are related to differences in intelligence.[2] As Lynn (2010, p. 99) writes: "The diffusion of genes from the Near East and North Africa may explain why the populations of southern Italy have IQs in the range 89–92, intermediate between those of northern Italy and central and northern Europe (about 100) and those of the Near East and North Africa (in the range of 80–84)".

It is worth mentioning that current explanations of the differences in per capita income levels between the north and the south of Italy, generally emphasize crucial differences in the development of markets, either due to the lack of adequate infrastructures in the south (e.g. SVIMEZ, 2009) or to differences in transaction costs due to both shortage of social capital (Putnam, 1993; Guiso, Sapienza & Zingales, 2008) and the presence of organized crime.

The thesis suggested by Lynn (2010) is grounded on a strand of literature which supports the existence of a causal relationship between average intelligence and wealth (e.g. Lynn & Vanhanen, 2002; Weede & Kämpf, 2002; Whetzel & McDaniel, 2006). Within this strand of literature, the relationship between average intelligence and wealth is generally meant as having different degrees of complexity (e.g. Hunt & Wittmann, 2008), also for the recognition of a substantial influence of economic wealth on cognitive development (Rindermann, 2008). Critics emphasize alternative explanations to this causal interpretation.[3]

Lynn (2010) takes a rather strong position on this question in his analysis of regional average IQ differences in Italy, so it is worth checking whether the empirical evidence he provides to support his conclusions is sufficiently reliable. In this paper I accomplish this task. My analysis suggests that Lynn (2010)'s causal claim is insufficiently supported by the correlational evidence presented.

The paper is organized as follows. In Section 2 I point out what appears to be the crucial methodological weakness of Lynn (2010)'s article, that of not taking properly into account the distinction between correlation and causation. In Section 3 provide a robustness check of the findings offered by it, emphasizing more plausible explanations for the pattern we observe in the data. Section 3 briefly concludes.

2. Correlation versus causation

There are good reasons to believe that the analysis carried out by Lynn (2010) is not sufficiently robust to support his conclusions. Here I discuss what seems to be a crucial methodological weakness.

A critical point which makes the results of Lynn unconvincing, is that they are not grounded on a clear distinction between correlation and causation. His article just presents a correlation matrix showing high level of correlation among the variables. However, any statistician would have grounds to argue that these results are not robust, given the inadequate size of the sample. The number of observations equals twelve, which is far from what can be considered as an adequate number; with this sample, the significance levels also do not say much about the reliability of the correlations.

In any case, correlation is not causation. As the Nobel laureate James Heckman has pointed out in a more general context (Heckman, 2000, p. 47): "…an important contribution of econometric thought was the formalization of the notion developed in philosophy that many different theoretical models…may be consistent with the same data…this is called the problem of identification.…It makes precise the idea that correlation is not causation… The key insight in the literature of twentieth century econometrics was the discovery of the conditional nature of empirical knowledge".

This is the most serious weakness of Lynn (2010). The very fact that two variables exhibit a similar pattern of variation does not say much. Changes in the first variable could produce changes in the other, or the reverse could be true. There is however the possibility that changes in the variables of interest are produced by changes in some other unobserved variables. This possibility, as Lynn obviously knows, must be taken very seriously in the explanation of either natural or social phenomena. However, the analysis carried out by him neglects this point.

To see how misleading it could be to infer conclusions from a simple correlation analysis, I think that the following passage drawn from Bowles, Gintis and Osborne (2005, p. 13) is worth stating: "Consider the case of South Africa, where in 1993…roughly two-thirds of the intergenerational transmission of earnings was attributable to the fact that fathers and sons are of the same race… Because the traits designated by *race* are highly heritable…we thus find a substantial role of genetic inheritance in the intergenerational transmission of economic status. Yet, it is especially clear in the case of South Africa under apartheid that the economic importance of the genetic inheritance of physical traits derived from environmental influences. What made the genetic inheritance of skin color and other racial markers central to the transmission

[1] As Lynn (2010, p. 97) writes: "The positive relationship between regional IQs and years of education is best envisioned as another positive feedback loop in which the population IQ is a determinant of the amount of education received by children, and the amount of education received by children is a determinant of their IQs."

[2] Lynn (2010) maintains - grounding on some evidence provided by Murray (2003) - that the north–south gradient in Italy has been present since 1400.

[3] As Ervik (2003, p.407) for example points out: "richer countries spend much more on schooling and childcare, and schooling and IQ scores are positively correlated. Hence, rich countries have higher IQ scores."

process were matters of public policy…racial patterns in marriage and the discrimination suffered by nonwhites".

3. Robustness checks

In this section I provide some robustness checks to the findings of Lynn. I am interested in testing whether the correlation he finds between average IQs and income levels across the Italian regions holds despite taking into account additional variables, which, according to standard economic theory, are better predictors of per capita income levels. I also propose, in line with the relevant literature, an alternative explanation for the observed differences in average IQ levels. I use standard regression analysis,[4] even if I am aware that the number of available observations suggests to be very cautious in interpreting the results. My purpose is however not that of carrying out a comprehensive analysis of the determinants of both income levels and average IQs across Italian regions. I simply aim at showing that the correlations found by Lynn are far than robust and do not survive once adequate controls are taken into account.

My strategy will be as follows. I will first run a set of regressions to explain the variability of income levels across the Italian regions. According to standard economic theory (e.g. Barro & Sala-I-Martin, 1995; Besley, 2001), variability in per capita income levels should be explained - given technology - by the availability of production factors, that is: labour, fixed and human capital inputs. In the first set of regressions I consider average IQ as a predictor, therefore I *de facto* accept the hypothesis that it is exogenous with respect to income, mainly determined by genetic factors. In the second set of regressions I drop this simplification, and consider the average IQ as the dependent variable. I then try to explain its variability across the Italian regions using a set of variables suggested by the literature on the subject.

3.1. Data

Data for income and average IQ levels in Italian regions are drawn by Lynn (2010). To replicate his analysis, I use his data on per capita income in 2003 expressed in euro (INC2003).[5]

As in the first set of regressions the dependent variable is INC2003, according to standard economic theory I use as predictors: the stock of physical capital per employee in 2003 expressed in euro (PHISCAP), estimated on data provided by the Italian Statistical Office (ISTAT, 2008, 2010a); the labour input, measured as the average proportion of adults aged 15–64 employed in the period 1996–2003 (CNEL, 2010)[6]; the years of education of adults in 1951 (EDU1951) drawn from Lynn (2010), to account for differences in the human capital endowment (this latter variable carries the great advantage of being independent from income in 2003). However I also proxy the stock of human capital by using the proportion of individuals who had in 2003 a level of education not higher than the primary (the variable PRIMEDU, provided by ISTAT, 2004).

I also add some controls, capable, in principle, of taking into account some crucial environmental factors. In line with the work of Putnam (1993), I consider the number of non-profit organizations per 100,000 inhabitants (the variable NPO, provided by ISTAT, 2001), to proxy for differences in the level of social capital. I also control for crime: the variable CRIME refers to the average number of violent crimes over 10,000 inhabitants in the period 1995–2003 (computed on data provided by ISTAT, 2010b).

For what concerns the second set of regressions, I try to explain the variability in average IQ in 2006, by using, as regressors: the income level (INC2003), which should control for a region's level of economic development (e.g. Barber, 2005); the regional expenditure in education per student in 2006/2007 (the variable REGEXP, provided by the Agnelli Foundation, 2010); a variable which catches the conditions of the local labour market (YOUTHUNEMP, that is, the unemployment rate among individuals aged 15–24 in 2006, provided by ISTAT, 2008). Indeed, as suggested by Bratti, Checchi and Filippin (2007), individuals facing high unemployment rates may perceive that putting their effort into study is not worth undertaking, since it will not help them finding a decent job or having higher salaries. I also add some controls, previously defined (EDU1951 and PRIMEDU).

As for the use of the variable REGEXP, we would expect better results were a more stimulating environment is provided, which is also (although not only) a matter of resources employed.

3.2. Determinants of income

Table 1 shows the results concerning the first set of regressions, in which the dependent variable is INC2003. The model is estimated by Ordinary Least Squares, and the variables have been transformed in logarithms both to avoid problems due to the use of different units of measurement and to facilitate reading and comprehension of the results.

The first column reports the results of a single regression analysis, in which the only predictor is IQ. The coefficient is of the expected sign and statistically significant. However, as soon as the variable which takes into account the labour input is introduced (LABOR, II column), the effect of average IQ on per capita income becomes not statistically different from zero. The variable LABOR always displays the expected sign. The results show a statistically significant effect on income which persists across the various specifications (columns III–VII). On the contrary, the variable IQ is never statistically significant. Both the variables PHISCAP and EDU1951 have the expected sign. However, the former is never statistically significant, while the latter is (columns IV, VI–VII). These results are also robust to

[4] It is worth noting that a test of the fit with the data of competing models using structural equation modeling may also be appropriate. However, in the case at hand this kind of analysis cannot be carried out, for the number of available observations is inadequate. As Hunt and Wittmann (2008, p. 8) have pointed out: "In theory structural equation modeling could be used to investigate causal models of the sort that Lynn … would like to see explored. In practice, though, there is a serious impediment to such studies."

[5] As mentioned above, Lynn (2010) computes IQ levels from PISA data, averaging the scores on reading comprehension, mathematical ability and scientific understanding, and then expressing the result in standard deviation units in relation to the British mean.

[6] National Counsel of Economics and Labor (CNEL). Data are available on line at http://www.cnel.it/archivio/mercato_lavoro/location.asp?fen=1.

Table 1
Production function dependent variable: Inc2003 OLS.

Variables	I	II	III	IV	V	VI	VII
CONSTANT	−4.6812	0.08195	0.4792	3.66966	1.8027	3.67368	3.61401
	(−4.557)***	(0.042)	(0.188)	(1.458)	(0.647)	(1.351)	(1.366)
IQ	4.5004	1.18928	1.1153	−1.02008	0.5957	−1.02198	−0.75835
	(8.685)****	(0.912)	(0.794)	(−0.685)	(0.407)	(−0.635)	(−0.466)
LABOR		1.04354	1.0992	0.97544	1.1672	0.96700	0.88395
		(2.674)**	(2.380)**	(2.563)**	(2.537)**	(2.227)*	(2.061)*
PHISCAP			−0.0635	0.07694	−0.1793	0.07615	0.03213
			(−0.267)	(0.377)	(−0.697)	(0.345)	(0.141)
EDU1951				0.76864		0.77205	0.75565
				(2.242)*		(2.062)*	(2.095)*
PRIMEDU					−0.3835		
					(−1.098)		
NPO						0.00633	
						(0.060)	
CRIME							−0.04815
							(−0.589)
R^2	0.883	0.9348	0.9353	0.9624	0.9449	0.9624	0.9644
Adj R^2	0.8712	0.9203	0.9111	0.9409	0.9133	0.9311	0.9348
F	75.43	64.49	38.58	44.75	29.98	30.71	32.53

Notes: t-values in parenthesis. Significance levels: ****, ***, **, * indicate significance at 0.1, 1, 5 and 10% levels, respectively. Sample of Italian regions (12): Piemonte, Lombardia, Trentino Alto Adige, Friuli Venezia Giulia, Liguria, Emilia Romagna, Abruzzo and Basilicata, Campania, Puglia, Sicilia, Sardegna.

the introduction of some control variables, which should capture - according to the current explanations of the differences in income levels between the north and the south of Italy - some key differences (columns VI–VII).

As emphasized above, it is necessary to be cautious in handling these results, given the very small number of observations on which they are based. In any case, they confirm that the findings offered by Lynn's analysis are not robust to the introduction of adequate controls.

3.4. More plausible explanations for regional differences in IQ levels

There is extensive evidence of a positive and statistically significant impact of expenditure in education on economic growth. This result is robust to the introduction of controls for institutional factors, and suggests that availability of resources for education affects GDP growth rates by enhancing people's productivity (e.g. Beraldo, Montolio & Turati, 2009). Not surprisingly, those studies which have investigated the question of the uneven distribution of student's skills over the Italian regions, find that the unbalanced distribution of economic resources plays a major role (Bettoni & Asquini, 2002; Bratti et al., 2007, 2008; Agnelli Foundation, 2010). It is noteworthy that as far as the Italian regions are concerned, the per capita expenditure in education is sensibly higher where better results are achieved by students in score tests (for example, regions such as *Trentino Alto Adige*, exhibit a substantially higher expenditure in education per student).[7] Moreover, data from the Italian Ministry of education, shows that the distribution of resources is even more unequal concerning capital expenditure. Bratti et al. (2007, 2008) have estimated that as far as capital expenditure is concerned, the available resources per student in *Friuli Venezia Giulia*'s provinces are many times higher than in *Sicilia* (up to twenty times). In their study, which relies on multiple regression analysis, production functions aimed at assessing the size and the determinants of territorial differences in student performance are estimated. A highly significant positive correlation between the educational expenditure on capital account and student performance is observed. This result highlights the important role of schooling infrastructures. By contrast, the estimates show a negative and significant correlation between performance and expenditure in intermediate consumption and payments to teachers (the type of expenditures more common in the South of Italy, for reasons, mainly political and context-dependent, whose discussion would go beyond the scope of the present paper). Both effects are robust across specifications and are in agreement with the scientific literature on the subject. Moreover, Bratti et al. (2007, 2008) find a significant impact of the labour market conditions on student performance, which suggests that the worse the conditions of the labour market are, the less are the incentives to invest in education, for the simple reason that individuals rationally choose to devote more time to alternative activities (given the low expected return of investing in education).

The results of the second set of regressions offered by the present paper, in which the dependent variable is the average IQ, are very much in line with the findings mentioned above.

In a single regression analysis, INC2003 is statistically significant and displays the expected sign (column I). The correlation between IQ and income however disappears as soon as a variable which takes into account the conditions of the local labour market is introduced. The variable YOUTHUNEMP displays a negative sign and its effect is statistically significant across specifications (columns II–V). This is in line with what Bratti et al. (2007) suggest. Also in line with their analysis, is the effect of total regional expenditure in education: negative and statistically significant (column V), while the variable EDU1951 has a positive sign and is statistically significant in the reported regressions (columns III and V) (Table 2).

[7] Expenditure in education per student across Italian regions can also be computed by using data made available by the Italian statistical office (see ISTAT, 2009a,b).

Table 2
Determinants of IQs dependent variable: IQ OLS.

Variables	I	II	III	IV	V
CONSTANT	1.15046	1.88016	2.10492	1.88705	2.48988
	(12.006)****	(7.613)****	(9.060)****	(7.253)****	(10.221)****
INC2003	0.19619	0.04660	−0.02794	0.04915	−0.04163
	(8.685)****	(0.909)	(−0.506)	(0.905)	(−0.946)
YOUTHUNEMP		−0.07580	−0.07114	−0.07812	−0.09452
		(−3.083)**	(−3.418)***	(−2.944)**	(−4.946)***
EDU1951			0.13414		0.11459
			(2.168)*		(2.310)*
PRIMEDU				0.02568	
				(0.386)	
REGEXP					−0.07430
					(−2.407)**
R^2	0.883	0.9431	0.9641	0.9441	0.9804
Adj R^2	0.8712	0.9304	0.9507	0.9231	0.9692
F	75.43	74.54	71.68	45.04	87.41

Notes: t-values in parenthesis. Significance levels: ****, ***, **, * indicate significance at 0.1, 1, 5 and 10% levels, respectively. Sample of Italian regions (12): Piemonte, Lombardia, Trentino Alto Adige, Friuli Venezia Giulia, Liguria, Emilia Romagna, Abruzzo and Basilicata, Campania, Puglia, Sicilia, Sardegna.

Overall the results suggest that the conditions of the local labour market matter in determining student's performance, along with the general cultural background. As for the impact of the variable REGEXP, its estimated negative impact on IQ is not surprising: financial resources matter for explaining differences in student performance only when the distinction between current and capital expenditure is taken properly into account.[8]

4. Conclusion

In this paper I have discussed Lynn (2010)'s recent statement that differences in average IQ predict Italian north–south differences in income levels, and I have proposed, in line with the relevant literature, an alternative explanation for the observed regional differences in average IQ levels.

Overall my work suggests to be more cautious in drawing substantial conclusion by a simple correlation analysis, about the effect that proxy of average IQ levels may have on some variables of interest, particularly on income levels. The validity of this methodological standpoint has been made clear by an empirical test showing that Lynn's findings are not robust to the introduction of adequate controls.

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[8] Bratti et al. (2007) consider, in their analysis, a sample of Italian provinces. I am not aware of data on capital expenditure in education on a regional basis.

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