Is There an Economic Bias in Academic Success?

Eleonora Santos[1][0000-0003-4693-0804]
[1] Centre of Applied Research in Management and Economics, Polytechnic Institute of Leiria, Portugal

Milena Carvalho[2] [0000-0003-1897-9686]
[2]CEOS.PP/ISCAP/P.PORTO, Rua Jaime Lopes Amorim S/N, 4465-004, Matosinhos, Portugal

Susana Martins[3] [0000-0002-5282-1017]
[3]CEOS.PP/ISCAP/P.PORTO, Rua Jaime Lopes Amorim S/N, 4465-004, Matosinhos, Portugal

eleonora.santos@ipleiria.pt

Abstract- This paper analyses whether schools with better scores in National Exams are in regions NUTs III with greater purchasing power. Accordingly, we analyse the evolution of the ranking of schools considering the purchasing power of the regions where they are located. Using data collected in the media, related to school rankings by region for 2008 and 2014; and in Pordata database for regional purchasing power in 2007 and 2011; we calculate location and specialization measures and perform a regional shift-share analysis. The results show that schools located in regions with very high and high purchasing powers rank first; and both structural and regional changes are positive. A notable exception is the region of Alto Alentejo with a medium purchasing power. In contrast, regions with low purchasing power show negative structural and regional changes. These results indicate that, with an exception, the gap between regions of low and high purchasing powers has been perpetuated.

Keywords: Economic Growth, Education Performance, Human Capital, Regional convergence, Shift-Share Analysis

1 Introduction

The traditional approach both in secondary and higher education is no longer capable of satisfying the needs of strategic industries, in terms of qualified trainings [1]. Hence, high school graduation has become increasingly important as workers are progressively required to adapt to the uncertainties of a fast-changing economy [2]. Moreover, continuing education, beyond the compulsory years, is crucial for social cohesion, prosperity, and firms' competitiveness [3]. Rural settings may hinder academic achievements in many ways [4-7]. Consequently, the regional accessibility impacts on the quality of education [8-10]. Thus, our research questions are: Do rural schools perform worse than those located in urban areas? And what is the impact of the regional purchasing power on school ratings? Bearing this in mind, we compare the ranking of secondary schools with the regional purchasing power across Portuguese regions. Data on regional purchasing power by NUTS III regions were collected from Pordata. The average scores in the national exams by schools for 2008 was retrieved from a study by Sic Noticias;

while the values for 2014 were obtained through a study carried out by the newspaper *O Público*. We also calculate measures of localization and specialization to assess the convergence/divergence between location and purchasing power. Finally, a shift-share analysis is carried out. Besides the introduction, section 2 reviews the literature; section 3 describes the data sources and the methodology; section 4 presents and discusses the results; section 5 concludes.

2 Literature Review

Literature confirms the positive correlation between human capital accumulation and economic growth [e.g., 11-12]. A study [13] estimated that, for every additional year of schooling added to the adult population, economic growth is increased by 6-19% in the long term. There are several ways in which rural settings can limit academic achievement, namely, lack of specialized services, high-quality staff and educational funding; high staff turnover and teacher shortages [4-7]. Thus, regional accessibility impacts on the quality of education [8-10]. Since school achievement is a strong predictor of long-run wealth [14], students in rural areas face more limited educational choices and lesser career opportunities than those of urban areas [6]. Socioeconomic factors have an impact on academic success. Lower economic status is associated with learning-related behaviour problems, inattention, disinterest, and lack of cooperation at school [15-16], economic exclusion and high drop-out rates [17]. Also, students' achievements are related to school resources [18]. For example, a study [19] finds that investment in public school infrastructures increases standardized test scores in mathematics and Italian language. Another study [20] finds that exam scores are positively related to school size (measured by the number of students) and teachers' salaries. The impact of school size on students' performance was also found positive by [21] for Portugal. The school ownership (public/private) also influences students' achievements. Several studies show that private schools deliver, on average, better education outcomes (e.g., [21], for Portugal and [22], for Spain). Likewise, intelligence among individuals is positively associated with a wide range of economic, social, and demographic phenomena, including educational attainment, intellectual achievement, income, and socio-economic status [23]. Intelligence differences are also related to different regional outcomes within nations [24]. For example, a study [25] proposed that IQ differences among Indian regions were explained by educational differences arising from regional development inequalities. Since schools' performance may differ from other factors besides location, a simple inspection of data does not make it possible to assess whether there are any fundamental factors behind the considerable differences in school performance. The role of school location on students' performance was subject of several studies [e.g., 26-27], as well as the impact of socio-economic factors (e.g., [28-30]).

3 Data and Methodology

We collected data on regional purchasing power by NUTS III region from Pordata database. Regarding the education performance, researchers typically employ state exam scores or PISA tests. This paper uses the average scores in the national exams by schools, from a study carried out by Sic Noticias in 2008; whereas the values for2014 were obtained through a study carried out by the newspaper O Público. Bearing in mind the previous findings in the literature, we assume:

Hypothesis 1 (H1). High Schools located in rural areas show worse performances measured by scores in National Exams than those located in urban areas.

And,

Hypothesis 2 (H2). Regional purchasing power has a positive impact on school ratings.

We compare data for 2008 and 2014, the last year available. Then, we listed the schools by NUTS III region. In 2008, the minimum and maximum scores were "7" and "15"in a total of 492 schools; while in 2014, the minimum and maximum scores were "6"and "14" in a total of 621 schools. We calculate location and specialization measures to assess the convergence/divergence between location of schools /purchasing power.

The location quotient (LQ) is a measure of relative specialization, and it is most often used in the literature [31-33]. In this study, it measures the relative concentration of the i scores in region j and itis calculated as follows:

$$LO_{ij} = \frac{x_{ij}/x_i}{x_i/X} \quad (1)$$

where the numerator measures the concentration i scores in the schools of region j and the denominator the concentration of the classification i at national level.

The indicator is zero when the classification does not exist in region i and may be higher than 1 if the classification weight is higher than the national level. The location quotient not only allow to elaborate an internal characterization of the regions but also to compare each region with the Country. The analysis of its evolution over time, in particular by means of descriptive statistics, enables a more dynamic understanding of the regions' performance and their interrelations. Thus, even though its results should be interpreted with caution [32], due to its simplicity, the location quotient is a useful tool to assist policymakers regarding the design of policies aimed at reducing regional asymmetries [34].

The location coefficient (LC) compares the share of the average regional scores with the share of the average scores at national level. It is calculated as

$$LC_{ij} = \frac{\sum_j(|Xij - Xj|)}{2} \quad (2)$$

Where X_{ij} represents the i scores of schools in region j and X_j represents the i scores at national level. The closer the coefficient is to 1 the more the average score is different from the one at national level.

The coefficient of specialization relates the share of the average regional scores and the share of the average national scores, being calculated as

$$E_i = \frac{\Sigma_j \left| {}^{X}/_{X_i} - {}^{X_i}/_{X} \right|}{2} \quad (3)$$

If the indicator is zero, there is no specialization in region i in relation to the country. The closer the indicator is to 1 the greater the specialization of region i when compared to the national standard. Finally, we applied a shift-share analysis, to decompose the purchasing power between two periods of time, into three components: the regional growth rate; the rate of change in the region in the period; and the rate of change at national level. The "structural component" measures the difference between the potential growth rate of the region and the growth rate at national level, while the "regional component" measures the difference between the regional growth rate and the regional potential growth rate.

4 Results and Discussion

The location quotients for 2008 are shown in Figure 1. The region of Lisbon has the highest incidence of higher scores; followed by Baixo Mondego, Porto and Setúbal, and this incidence is higher than the national average. The lowest scores were found in the regions of Porto, Alto Alentejo, Beira Interior Norte, Alentejo Central, Douro, Dão Lafões and Ave. In these regions, the incidence of scores between 7 and 8 is much higher than the national average.

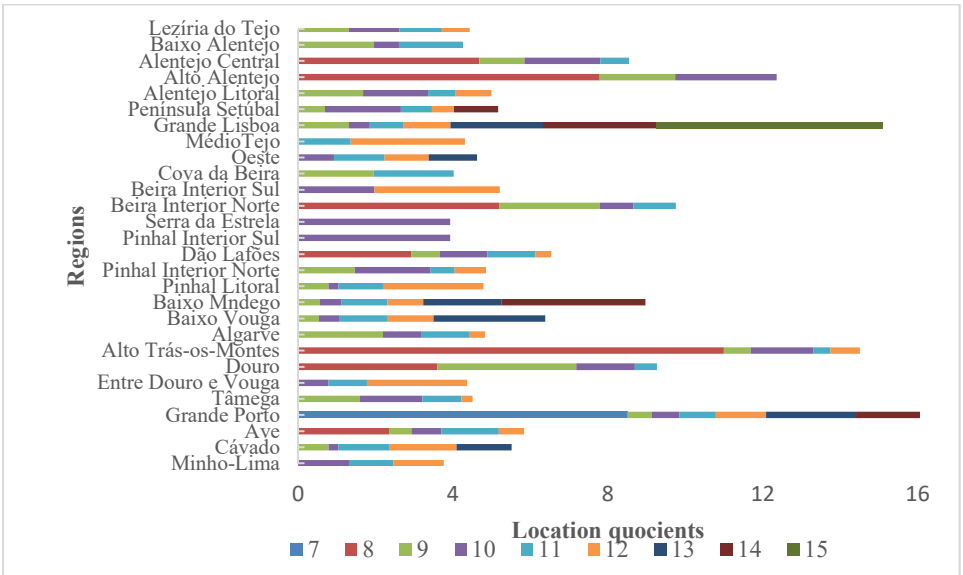

Figure 1. Location quotients across NUTs III regions, 2008

In 2008, the regions of Alto Alentejo, Pinhal Interior Sul, Serra da Estrela, Alto Trás-os-Montes, and Beira Interior Sul were the regions where the average scores differ more from that at national level. On the other hand, the regions of Setúbal, Cávado, Lezíria do Tejo and Tâmega have average scores closer to the national average. The analysis of the standard deviation of location quotients (Table 1) shows that the regions of Alto Trás-os-Montes, Alto Alentejo, Porto and Beira Interior Norte display higher discrepancies between average scores. By contrast, the regions whose scores are closer to the mean are Serra da Estrela, Pinhal Interior Sul, Cova da Beira, and Minho-Lima.

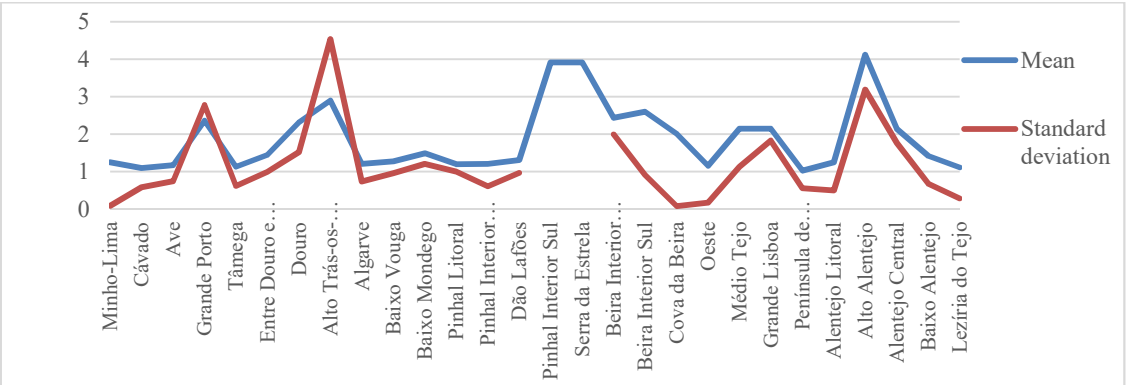

Figure 2 – Mean and standard deviation, across NUTS III region, 2008

Figures 3 and 4 show the same analysis for 2014. The overall scores have worsened compared to 2008, with minimum and maximum values between 6 and 14.

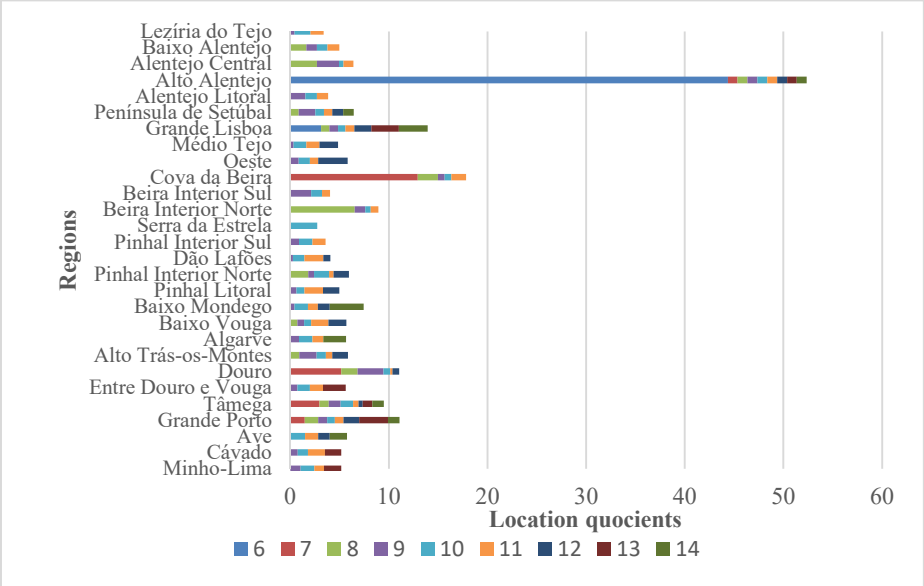

Figure 3- Location quotients across NUTs III regions, 2014

The ranking of schools underwent deep changes with the region of Baixo Mondego taking the lead of the highest scores, followed by Lisbon and Algarve. Porto ranks in 6th. The worst performances were found in Alto Alentejo, Lisbon, Cova da Beira, Douro, Tâmega, Porto and Beira Interior Norte. The regions of Alto Alentejo and Cova da Beira have very high incidence of scores 6 and 7, which is much higher than the national average. The regions of Alto Alentejo, Cova da Beira, Serra da Estrela and Beira Interior Norte show average scores with higher incidence than the national average. In contrast, the regions of Lezíria do Tejo, Setúbal and Dão Lafões tend to behave like the national average.

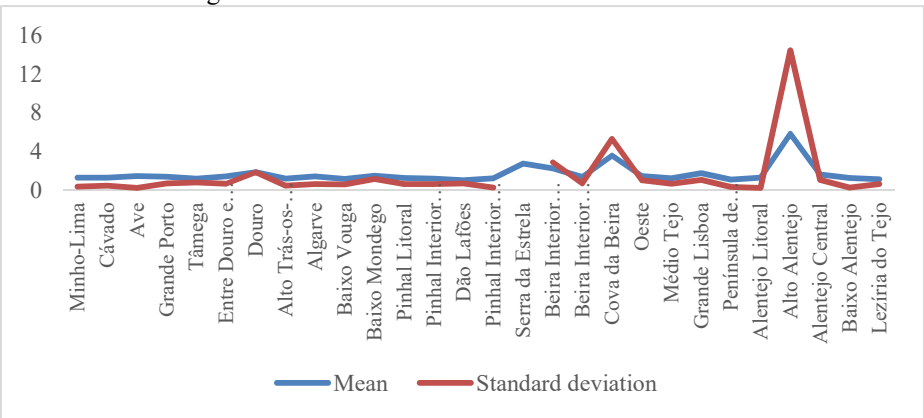

Figure 4- Mean and standard deviation, across NUTS III region, 2014

In terms of discrepancy of these classifications, we highlight Alto Alentejo with a very high dispersion and Cova da Beira and Beira Interior Norte with a moderate dispersion. The regions of Serra da Estrela, Alentejo Litoral, Ave, Baixo Alentejo and Pinhal Interior Sul are among those that had a smaller discrepancy in terms of average scores. Comparing the average regional location quotient in 2008 and 2014, there is a clear change in the performance of some regions, such as Alto Alentejo, Cova da Beira, Serra da Estrela, Beira Interior Sul, Alto Trás- os-Montes and Pinhal Interior Sul.

Table 1 shows that in 2008, the regions whose scores differ most from those at national level are Pinhal Interior Sul, Serra da Estrela, Alto Alentejo, Beira Interior Sul and Cova da Beira.

Table 1-Location coefficient by NUTS III region, 2008 and 2014

Regions	**2008**	**2014**
Minho-Lima	0.37	0.34
Cávado	0.52	0.43
Ave	0.45	0.58
Grande Porto	0.45	0.26
Tâmega	0.42	0.31
Entre Douro e Vouga	0.49	0.45
Douro	0.81	0.78
Alto Trás-os-Montes	0.74	0.37
Algarve	0.39	0.39
Baixo Vouga	0.42	0.49
Baixo Mondego	0.38	0.42
Pinhal Litoral	0.62	0.54
Pinhal Interior Norte	0.57	0.56
Dão Lafões	0.39	0.56
Pinhal Interior Sul	1.49	0.44
Serra da Estrela	1.49	1.27
Beira Interior Norte	0.53	0.70
Beira Interior Sul	1.18	0.50
Cova da Beira	1.02	0.61
Oeste	0.32	0.39
Médio Tejo	0.88	0.50
Grande Lisboa	0.39	0.31
Península de Setúbal	0.50	0.28
Alentejo Litoral	0.46	0.40
Alto Alentejo	1.28	1.33
Alentejo Central	0.68	0.67
Baixo Alentejo	0.69	0.27
Lezíria do Tejo	0.29	0.61

Table 2 shows that, in 2008, regions were specialized in the lowest scores of 7-8 and the highest score of 15; while in 2014 there is a regional specialization in average scores of 6-7.

Table 2 Coefficients of specialization, 2008 and 2014

Scores	**2008**	**2014**

6	0.00	0.83
7	0.88	0.73
8	0.81	0.43
9	0.29	0.21
10	0.26	0.13
11	0.12	0.16
12	0.26	0.36
13	0.55	0.58
14	0.59	0.50
15	0.83	0.00

Table 3 summarizes the results of the shift-share analysis for the NUTSIII regions.

Table 3- Analysis of the components of variation, 2008-2014

Structural Component		***Regional Component***	
		Positive	*Negative*
	Positive	Lezíria do Tejo Alto Alentejo Alentejo Central Alentejo Litoral Algarve	Grande Porto Baixo Mondego Grande Lisboa Baixo Alentejo Península de Setúbal
	Negative	Baixo Vouga Beira Interior Sul Oeste Entre Douro e Vouga Tâmega Ave Minho-Lima Pinhal Litoral Douro Dão-Lafões Cávado	Cova da Beira Médio Tejo Alto Trás-os-Montes Pinhal Interior Norte Beira Interior Norte Serra da Estrela Pinhal Interior Sul

The only regions with a positive structural and regional component are southern regions Lezíria do Tejo, Alto Alentejo, Alentejo Central, Alentejo Litoral and Algarve. The structural and regional components are negative in Cova da Beira, Médio Tejo, Alto Trás-os-Montes, Pinhal Interior Norte, Beira Interior Norte, Serra da Estrela, and Pinhal Interior Sul.

Table 4 shows the purchasing power of the regions in 2007 and 2011. There were some changes in purchasing power in the regions: Algarve went from very high to high; Médio Tejo and Cávado moved from medium to high; Alto Trás-os-Montes and Douro moved from low to medium.1 The choice of years is dependent of data availability.

Table 4-Classification of the Purchasing Power by NUTS III region, 2007 and 2011

	2007	**2011**
Very High	Grande Lisboa Grande Porto Península de Setúbal	Grande Lisboa Grande Porto Península de Setúbal

	Algarve Baixo Mondego	Baixo Mondego
High	Alentejo Litoral Lezíria do Tejo Pinhal Litoral Alentejo Central Oeste Baixo Vouga Beira Interior Sul	Alentejo Litoral Lezíria do Tejo Pinhal Litoral Alentejo Central Oeste Baixo Vouga Beira Interior Sul Cávado Médio Tejo Algarve
Medium	Médio Tejo Alto Alentejo Cávado Entre Douro e Vouga Baixo Alentejo Cova da Beira Ave Minho-Lima Dão Lafões Beira Interior Norte	Alto Alentejo Entre Douro e Vouga Baixo Alentejo Cova da Beira Ave Minho-Lima Dão Lafões Beira Interior Norte Alto Trás os Montes Douro
Low	Alto Trás-os-Montes Douro Pinhal Interior Norte Serra da Estrela Tâmega Pinhal Interior Sul	Pinhal Interior Norte Serra da Estrela Tâmega Pinhal Interior Sul

Tables 3 and 4 suggest that regional purchasing power is related to positive structural and regional performances, confirming H2. Indeed, only regions with high or very high purchasing power have a potential for growth higher than the national average. However, the regional component was only positive for regions with high purchasing power. For regions with very high purchasing power, the regional component was negative. In 80% of cases, only regions with high purchasing power have been able to grow at a rate higher than their potential growth rate. The regions with high and medium purchasing power, with negative structural component and positive regional structural component, represent 45% of total regions, which implies that these regions grew less than the country but more than their potential. In 2014, most of Mainland regions fit into medium and high purchasing power categories. As expected, the regions with low purchasing power show both negative evolution of structural and regional components (Pinhal Interior Norte, Pinhal Interior Sul, and Serra da Estrela) or negative evolution of the structural component (Tâmega).These findings confirm H1

Education is a broad and complex topic. We examine the patterns of academic success inequality at regional level and argue that the socioeconomic status of region is a factor which contribute to educational inequality. Evidence suggests that the educational disparities persist throughout every level of education. Several studies proposed a range of initiatives, interventions and policies that have promised of being effective in enhancing student commitment [e.g., 4-5, 35]. For example, [20] suggests that the quality of education would benefit from structural reforms involving school mergers

and by raises in teacher salaries. However, the reality of educational environment so far has shown that there is no 'one size fits all' approach to the required changes. Indeed, despite public interventions, extensive achievement gaps remain between the Portuguese regions. In this context, one must acknowledge the need of reviewing economic and social policies that affect the education environment, rather than just the educational policies that promote student segregation regarding potential opportunities. Limitations of this study include the lack of more recent data to corroborate these findings.

5 Conclusion

In 2008, the biggest urban centres (Lisbon, Coimbra, Porto, and Setubal) showed higher incidence of highest scores, being this incidence superior to that of the country. The worst performances were found in Porto, Alto Trás-os-Montes, Alto Alentejo, Beira Interior Norte, Alentejo Central, Douro, Dão Lafões and Ave. In 2014, Coimbra took the lead off the highest scores, followed by Lisbon and Algarve. The worst performers were Alto Alentejo, Lisbon, Cova da Beira, Douro, Tâmega, Porto and Beira Interior Norte. The regions of Alto Alentejo and Cova da Beira showed a high incidence of average scores of 6-7. In 2014, the regions of Tâmega, Lisbon, Setubal, Baixo Alentejo and Porto converged to the national average. Regarding specialization, in 2008 the regions were specialized in scores 7-8 and 15; while in 2014, they specialized in scores of 6-7. Regions with greater purchasing powers tend to have better scores. Thus, the purchasing power seems to be a relevant factor for the academic success. This portrait of regional inequality and the preliminary discussions are used as a starting point to begin overhauling the inequalities and to aim a fairer forthcoming educational scenario for Portugal. Moreover, future research will explore the impact of other socio-economic variables on students' performance in Portugal.

Aknowledgments. This research was financed by National Funds of the FCT—Portuguese Foundation for Science and Technology within the project UIDB/04928/2020 and under the Scientific Employment Stimulus—Institutional Call CEECINST/00051/2018.

References

1. Rámháp, S., Nagy, D., Országh, Á., Rechnitzer, J. & Filep, B. 2017. Career Choice Motivation of High School Students in Context of Changing Higher Education in Knowledge Economy. Poslovna izvrsnost: znanstveni časopis za promicanje kulturekvalitete i poslovne izvrsnosti, 112: 23-37.
2. Knoke, D. 2018. Changing organizations: Business networks in the new political economy. Routledge.
3. Ramsay, E. & M. Rowan. 2013. Learning to Change Tasmania. Hobart: University of Tasmania. http://www.tasmanianleaders.org.au/wp-content/uploads/2014/04/Learningto-Change-Tasmania.pdf.
4. Wallin, D. 2007. Policy Window or Hazy Dream? Policy and Practice Innovations for Creating Effective Learning Environments in Rural Schools. Canadian Journal of Educational Administration and Policy

5. Brown, D. & Schafft, K. 2011. Rural People and Communities in the 21st Century: Resilience and Transformation. Malden, MA: Polity.
6. Baeck, U. & Paulsgaard, G. 2012. Rural Futures? Finding One's Place Within Changing Labour Markets. Stamsund: Orkana Akademisk.
7. Allen, J., Wright, S., Cranston, N., Watson, J., Beswick, K., & Hay, I. 2017. Raising levels of school student engagement and retention in rural, regional, and disadvantaged areas: is it a lost cause? International Journal of Inclusive Education, 00, 1–17. https://doi.org/10.1080/13603116.2017.1370737
8. Spiess, C. & Wrohlich, K. 2010. Does distance determine who attends a university in Germany? Economics of Education Review, 293: 470-479.
9. Gibbons, S. & Vignoles, A. 2012. Geography, choice, and participation in higher education in England. Regional science and urban economics, 421[2]: 98-113.
10. Kavroudakis, D., Ballas, D. & Birkin, M. 2013. Using spatial microsimulation to model social and spatial inequalities in educational attainment. Applied Spatial Analysis and Policy, 61: 1-23.
11. Baldanzi, A., Bucci, A., & Prettner, K. (2021). Children's health, human capital accumulation, and R&D-based economic growth. Macroeconomic Dynamics, 25(3), 651-668.
12. Diebolt, C., & Hippe, R. (2022). The long-run impact of human capital on innovation and economic growth in the regions of Europe. In Human Capital and Regional Development in Europe (pp. 85-115). Springer, Cham.
13. Eslake, S. 2015. Tasmania Report. Hobart: Tasmanian Chamber of Commerce and Industry.
14. Pokropek, A., Borgonovi, F. & Jakubowski, M. 2015. Socio-economic disparities in academic achievement: a comparative analysis of mechanisms and pathways. Learning and Individual Differences, 42: 10-18.
15. American Psychological Association. 2016. Retrieved fromhttps://www.apa.org/pi/ses/resources/publications/education.aspx
16. Douds, T. 2018. The predictive relationship between student engagement and pass/fail rates of a credit recovery course among high school students. Retrieved fromhttps://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=2879&context=doctoral
17. Cucco, B., Gavosto, A., & Romano, B. (2021). How to Fight Against Drop Out and Demotivation in Crisis Context: Some Insights and Examples from Italy. In Radical Solutions for Education in a Crisis Context (pp. 23-36). Springer, Singapore.
18. Greenwald, R., Hedges, L. & Laine, R. 1996. The effect of school resources on student achievement. Review of educational research, 663: 361-396.
19. Belmonte, A., Bove, V., D'Inverno, G., & Modica, M. 2017. School Infrastructure Spending and Educational Outcomes in Northern Italy No. 2017-20. SPRU-Science Policy Research Unit, University of Sussex Business School.
20. Krasnopjorovs, O. 2017. Why Is Education Performance So Different Across Latvian Schools? Latvijas Banka. ISBN 978-9984-888-92-7.
21. Pereira, M. & Moreira, S. 2007. A stochastic frontier analysis of secondary education output in Portugal. Working Papers w200706, Banco de Portugal, Economics and Research Department.
22. Crespo-Cebada, E., Pedraja-Chaparro, F., & Santín, D. 2014. Does school ownership matter? An unbiased efficiency comparison for regions of Spain. Journal of Productivity Analysis, 411: 153-172.
23. Mackintosh, N., & Mackintosh, N. 2011. IQ and human intelligence. Oxford University Press.15
24. Lynn, R., Fuerst, J., Lynn, R., Fuerst, J., & Kirkegaard, E. 2018. Regional differences in intelligence in 22 countries and their economic, social, and demographic correlates: Are view regional differences in intelligence in 22 countries and their economic, social and demographic correlates: A review. Intelligence, 69: 24–36.
25. Lynn, R. & Yadav, P. 2015. Differences in cognitive ability, per capita income, infant mortality, fertility, and latitude across the states of India. Intelligence, 49: 179-185.

26. Alexander, W., Haug, A. & Jaforullah, M. 2010. A two-stage double-bootstrap data envelopment analysis of efficiency differences of New Zealand secondary schools. Journal of Productivity Analysis, 342, 99-110.
27. Agasisti, T. 2013. The efficiency of Italian secondary schools and the potential role of competition: a data envelopment analysis using OECD-PISA2006 data. Education Economics, 215, 520-544.
28. Raposo, I. & Menezes, T. 2011. Public School Efficiency Using Data Envelopment Analysis: An Empirical Application for Brazil. European Regional Science Association ERSA Conference Papers, No. ersa11p1594.
29. Yalçin, S. & Tavşancil, E. 2014. The Comparison of Turkish Students' PISA Achievement Levels by Year via Data Envelopment Analysis. Educational Sciences: Theory and Practice, 14 [3]: 961– 968.
30. Huguenin, J. 2015. Determinants of School Efficiency: The Case of Primary Schools in the State of Geneva, Switzerland. International Journal of Educational Management, 29 [5]:539–562.
31. Fracasso, A. & Marzetti, G. 2017. Estimating Dynamic Localization Economies: The Inadvertent Success of the Specialization Index and the Location Quotient. Regional Studies. Routledge, 1–14.
32. Isard, W. 1998. Location Analysis for Industry and Service Trades: Comparative Cost and Other Approaches. In Methods of Interregional and Regional Analysis, edited by WalterIsard, Iwan J Azis, Matthew P Drennan, Ronald E Miller, Sidney Saltzman, and ErikThorbecke, 7–39. England: Ashgate Publishing Limited.
33. Karp, D. N., Bagchi-Sen, S., & Rogerson, P. (2022). Not all shrinking places are similar: The variegated nature of population declines in the United States. Applied Geography, 138, 102581.
34. Chiang, Shu-hen. 2009. “Location Quotient and Trade.” The Annals of Regional Science 43[2]. Springer:399–414.
35. Schafft, K. & Jackson, A. 2010. Rural education for the twenty-first century: Identity, place, and community in a globalizing world. Penn State Press.