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Is There an Economic Bias in Academic Success? A Regional Perspective

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Abstract- This paper aims to evaluate whether schools with better National Exams scores are located in regions NUTs III with greater purchasing power. Accordingly, we analyze the evolution of the ranking of schools in light of 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 shift-share analysis of the regions. The results indicate that schools located in regions with very high and high purchasing power rank first; and both structural and regional changes were positive. A notable exception is the region of *Alto Alentejo* with a medium purchasing power. In contrast, regions with low purchasing power showed negative structural and regional changes. These results indicate that, although there may have been an improvement in a region of medium purchasing power, the gap between regions of low and high purchasing power has been perpetuated.

Key Words- Regional Inequalities, Education Performance, Knowledge-Based Economy, Human Capital, Shift-Share Analysis

JEL Codes- I21, I24, I25

1. INTRODUCTION

The new millennium brought radical social and economic changes related to the knowledge economy. 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 (Rámháp et al., 2017). Thus, high school graduation has become increasingly important as workers are progressively required to adapt to the uncertainties of a fast changing economy (Knoke, 2018). Moreover, continuing on education, beyond the compulsory years, is crucial for social cohesion, prosperity and firms' competitiveness (Ramsay & Rowan 2013).

An extensive body of literature confirms the positive correlation between human capital accumulation and economic growth (DeJong & Ingram, 2001; Dellas & Sakellaris, 2003). For example, for every additional year of schooling added to the adult population, economic growth is augmented by 6%-19% in the long term, after controlling for other factors of long-term growth (Eslake 2015).

There are a number of ways that rural settings are beset with educational problems that limit academic achievement, namely, lack of specialized services, high staff turnover and teacher shortages, lack of high-quality staff, and educational funding (Wallin, 2007, Brown & Schafft, 2011; Baeck & Paulsgaard, 2012; Allen et al., 2018). Several studies conclude that geographic accessibility is an important determinant factor of the type of education that an individual receives (Spiess & Wrohlich, 2010; Gibbons & Vignoles, 2012; Kavrouidakis et al., 2013).

Since school achievement is a strong predictor of long-run wealth (Pokropek et al, 2015), students in rural areas face more limited educational choices and, thus, more uneven life opportunities than those residing in urban areas (Baeck & Paulsgaard 2012).

There are several reasons why socioeconomic factors have an impact on academic success. Lower economic status of students is associated with learning-related behavior problems, inattention, disinterest, and lack of cooperation at school (American Psychological Association, 2016, Douds, 2018), economic exclusion, high drop-out rates among economically disadvantaged youth and growing income inequality (Dueker et al, 2017).

Also, school resources are related to student achievement (Greenwald et al., 1996). For example, Belmonte et al. (2017) test whether investment in public school infrastructure affects students' achievement. They find that investment in infrastructures increases standardized test scores in mathematics and Italian language, and the effect is stronger for lower-achieving students and in mathematics. Krasnopjorovs (2017) finds that exam scores are positively related to school size (the number of pupils in the respective school) and teacher salaries, but negatively with teachers' age. Interestingly, the study concludes that pupils in urban and rural schools would perform similarly if characteristics of schools were the same.

The impact of school size on student performance was also found positive by Pereira & Moreira (2007) for Portugal.

The school ownership (public/private) is another factor that influences student achievement. A number of studies show that private schools deliver, on average, better education outcomes than the public ones (see e.g., Pereira & Moreira, 2007, for Portugal and Crespo-Cebada et al., 2014, 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 (e.g. Mackintosh, 2011). Intelligence differences are also related to different regional outcomes within nations (Lynn et al., 2018). For example, Lynn & Yadav (2015) proposed that IQ differences between Indian states were due to educational differences resulting from regional differences in prosperity.

Since the best performing schools may differ regarding location, among other factors, 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 school performance was subject of several studies (e.g., Alexander et al., 2010; Agasisti, 2013), as well as the impact of socio-economic factors (e.g., Raposo & Menezes, 2011; Yalçın & Tavşancıl, 2014; Huguenin, 2015). 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 aim to compare the ranking of secondary schools with the regional purchasing power. We also perform a shift share analysis to identify the evolution pattern.

This paper is structured as follows. Besides the introduction, section 2 presents the methodology; section 3 analyzes and discusses the results; and section 4 provides some policy implications; and section 5 concludes.

2. DATA AND METHODOLOGY

2.1. Data

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 Notícias* in 2008; whereas the values for 2014 were obtained through a study carried out by the newspaper *O Público*. We compare data for 2008 with 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 calculated the measures of localization and specialization to assess the convergence/divergence between the variables under study (location of schools /purchasing power). Finally we applied a shift-share analysis.

2.2. Methodology

2.2.1. Location and Specialization Measures

Location quotients. The location quotient (LQ) is a measure of relative specialization and it is most often used in the literature (Fracasso and Marzetti 2017; Isard 1998). In this study, it measures the relative concentration of the *i* scores in region *j* and it is calculated as follows:

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

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, despite the fact that its results should be interpreted with caution (Isard,1998), due to its simplicity, the location quotient is a useful tool to assist policymakers regarding the design of policies aimed at reducing regional asymmetries (Chiang, 2009).

Location Coefficient. 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

$$LC_{ij} = \frac{\sum_j (|x_{ij} - x_j|)}{2} \quad (2)$$

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.

Coefficient of Specialization. It relates the share of the average regional scores and the share of the average national scores, being calculated as

$$E_i = \frac{\sum_j \left| \frac{x_{ij}}{x_i} - \frac{x_j}{x} \right|}{2} \quad (3)$$

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.

2.2.1. Shift-Share Analysis

One of the most used techniques to analyze the regional dynamics, in a comparative perspective, is the shift-share analysis. It is a method that decomposes the growth rate of a region (here we use 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.

3. RESULTS AND DISCUSSION

Figure 1 shows the Portuguese NUTS III regions, except the Islands.

Fig.1 Portuguese NUTs III regions (Mainland)



The location quotients for 2008 are shown in Table 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.

Table 1. Location quotient by NUTSIII region, 2008

Regions	Average scores									
	6	7	8	9	10	11	12	13	14	15
Minho-Lima					1.31	1.15	1.30			
Cávado				0.78	0.26	1.32	1.73	1.42		
Ave			2.34	0.58	0.78	1.48	0.65			
Grande Porto		8.49		0.64	0.71	0.94	1.30	2.32	2.12	
Tâmega				1.59	1.61	1.01	0.29			
Entre Douro e Vouga					0.78	0.99	2.59			
Douro			3.59	3.59	1.51	0.57				
Alto Trás-os-Montes			10.99	0.69	1.62	0.44	0.76			
Algarve				2.19	0.98	1.24	0.41			
Baixo Vouga				0.53	0.54	1.24	1.18	2.89		
Baixo Mondego				0.56	0.56	1.18	0.93	2.02	3.71	
Pinhal Litoral				0.78	0.26	1.15	2.59			
Pinhal Interior Norte				1.46	1.96	0.62	0.81			
Dão Lafões			2.92	0.73	1.23	1.24	0.41			
Pinhal Interior Sul					3.92					
Serra da Estrela					3.92					
Beira Interior Norte			5.19	2.59	0.87	1.10				
Beira Interior Sul					1.96		3.24			
Cova da Beira				1.95		2.06				
Oeste					0.92	1.31	1.14	1.25		
Médio Tejo						1.35	2.95			
Grande Lisboa				1.31	0.54	0.86	1.22	2.39	2.92	5.84
Península de Setúbal				0.69	1.96	0.80	0.57		1.14	
Alentejo Litoral				1.67	1.68	0.71	0.93			
Alto Alentejo			7.78	1.95	2.62					
Alentejo Central			4.67	1.17	1.96	0.74				
Baixo Alentejo				1.95	0.65	1.65				
Lezíria do Tejo				1.30	1.31	1.10	0.72			

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. 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 standard deviation of location quotients (Table 2) 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.

Table 2 - Descriptive statistics by NUTS III region, 2008

Regions	Mean	Standard deviation
Minho-Lima	1.25	0.09
Cávado	1.10	0.58
Ave	1.17	0.75
Grande Porto	2.36	2.78
Tâmega	1.13	0.62
Entre Douro e Vouga	1.45	0,99
Douro	2.32	1.52
Alto Trás-os-Montes	2.90	4.54
Algarve	1.21	0.74
Baixo Vouga	1.28	0.96
Baixo Mondego	1.49	1.21
Pinhal Litoral	1.20	1.00
Pinhal Interior Norte	1.21	0.61
Dão Lafões	1.31	0.97
Pinhal Interior Sul	3.92	
Serra da Estrela	3.92	
Beira Interior Norte	2.44	1.99
Beira Interior Sul	2.60	0.91
Cova da Beira	2.01	0.08
Oeste	1.16	0.17
Médio Tejo	2.15	1.13
Grande Lisboa	2.15	1.83
Península de Setúbal	1.03	0.56
Alentejo Litoral	1.25	0.50
Alto Alentejo	4.12	3.19
Alentejo Central	2.14	1.76
Baixo Alentejo	1.42	0.68
Lezíria do Tejo	1.11	0.28

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

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 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.

Table 3. Location quotient by NUTS III region, 2014

Regions	Average scores									
	6	7	8	9	10	11	12	13	14	15
Minho-Lima				1.06	1.37	1		1.73		
Cávado				0.76	1.05	1.72		1.64		
Ave					1.49	1.34	1.18		1.73	
Grande Porto		1.46	1.38	0.9	0.77	0.9	1.59	2.92	1.17	
Tâmega		2.96	0.93	1.21	1.26	0.57	0.4	0.99	1.18	
Entre Douro e Vouga				0.71	1.28	1.34		2,3		
Douro		5.18	1.63	2.65	0.69	0.2	0.71			
Alto Trás-os-Montes			0.91	1.77	0.92	0.67	1.57			
Algarve				0.88	1.37	1.11			2,3	
Baixo Vouga			0.71	0.69	0.72	1.74	1.84			
Baixo Mondego				0.44	1.37	1	1.18		3.45	
Pinhal Litoral				0.62	0.81	1.89	1.66			
Pinhal Interior Norte			1.82	0.59	1.53	0.45	1.57			
Dão Lafões				0.28	1.16	1.9	0.74			
Pinhal Interior Sul				0.88	1.37	1.34				
Serra da Estrela					2.75					
Beira Interior Norte			6.54	1.06	0.55	0.8				
Beira Interior Sul				2.12	1.1	0.8				
Cova da Beira		12.94	2.04	0.66	0.69	1.5				
Oeste				0.84	1.16	0.84	2.97			
Médio Tejo				0.35	1.28	1.34	1.88			
Grande Lisboa	3.14		0.83	0.86	0.75	0.93	1.71	2.79	2.93	
Península de Setúbal			0.86	1.68	0.87	0.84	1.11		1.09	
Alentejo Litoral				1.52	1.18	1.14				
Alto Alentejo	44.36	1	1	1	1	1	1	1	1	
Alentejo Central			2.72	2.21	0.46	1				
Baixo Alentejo			1.63	1.06	1.1	1.2				
Lezíria do Tejo				0.44	1.6	1.34				

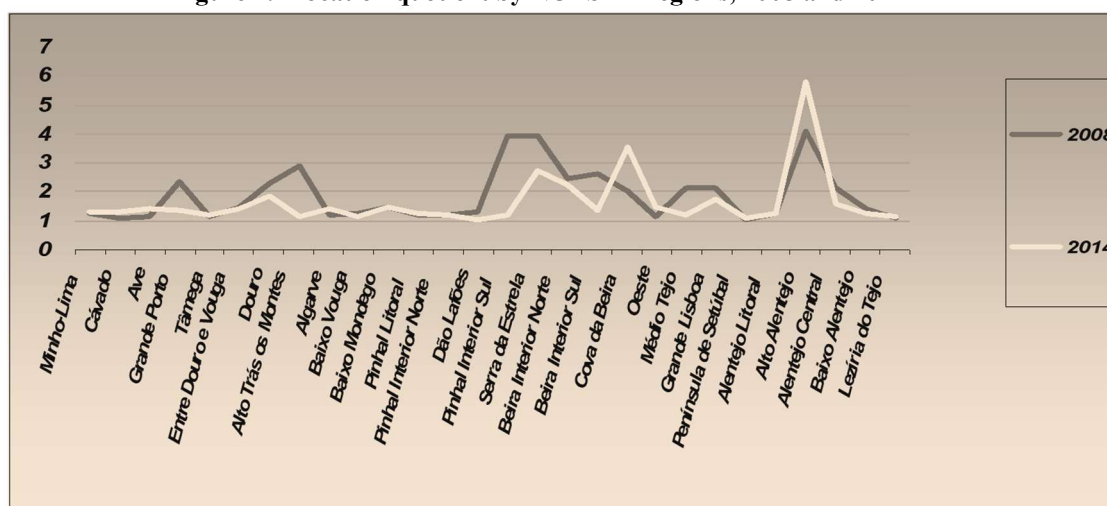
In terms of discrepancy of these classifications, we highlight Alto Alentejo with a very high dispersion and Cova da Beira and Beira Interior Norte with a moderate dispersion. The regions of Serra da Estrela, Alentejo Litoral, Ave, Baixo Alentejo and Pinhal Interior Sul are among those that had a smaller discrepancy in terms of average scores

Table 4 - Descriptive statistics by NUTS III region, 2014

Regions	Mean	Standard deviation
Minho-Lima	1.29	0.34
Cávado	1.29	0.46
Ave	1.44	0.23
Grande Porto	1.39	0.69
Tâmega	1.19	0.78
Entre Douro e Vouga	1.41	0.66
Douro	1.84	1.85
Alto Trás-os-Montes	1.17	0.47
Algarve	1.42	0.62
Baixo Vouga	1.14	0.59
Baixo Mondego	1.49	1.15
Pinhal Litoral	1.25	0.62
Pinhal Interior Norte	1.19	0.63
Dão Lafões	1.02	0.69
Pinhal Interior Sul	1.20	0.27
Serra da Estrela	2.75	
Beira Interior Norte	2.24	2.88
Beira Interior Sul	1.34	0.69
Cova da Beira	3.57	5,27
Oeste	1.45	1.02
Médio Tejo	1.21	0.64
Grande Lisboa	1.74	1.05
Península de Setúbal	1.08	0.32
Alentejo Litoral	1.28	0.21
Alto Alentejo	5.82	14.45
Alentejo Central	1.60	1.05
Baixo Alentejo	1.25	0.26
Lezíria do Tejo	1.13	0.61

Figure 2 compares the average regional location quotient in 2008 and 2014.

Figure 2. Location quotient by NUTS III regions, 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 5 allows us to draw conclusions about the location coefficient. 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 5-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

On the other hand, Lezíria do Tejo, Oeste, Minho-Lima and Baixo Mondego were closer to the national level. In 2014, there were significant changes, with Alto Alentejo and Serra da Estrela moving away from the national average, while the regions of Tâmega, Lisbon, Setúbal, Baixo Alentejo and Porto converged to the national average.

Table 6 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 6 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 7 summarizes the results of the shift-share analysis for the NUTSIII regions. The only regions with a positive structural and regional component are southern regions Lezíria do Tejo, Alto Alentejo, Alentejo Central, Alentejo Litoral and Algarve.

Table 7- Analysis of the components of variation, 2008-2014

		Regional Component	
		Positive	Negative
Structural Component	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 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 8 shows the purchasing power of the regions in the years 2007 and 2011.¹ 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 8-Classification of the Purchasing Power by NUTS III region, 2007 and 2011

	2007	2011
<i>Very High</i>	Grande Lisboa Grande Porto Península de Setúbal Algarve Baixo Mondego	Grande Lisboa Grande Porto Península de Setúbal Baixo Mondego
<i>High</i>	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
<i>Medium</i>	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
<i>Low</i>	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

Data on Tables 7 and 8 appear to indicate that regional purchasing power is related to positive structural and regional performances. 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).

4. POLICY IMPLICATIONS

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 a region is a factor which contribute to educational inequality. Evidence suggests that the educational disparities persist throughout every level of education. A number of studies proposed a range of initiatives, interventions and policies that have promised of being effective in enhancing student commitment (e.g. Wallin, 2007; Schafft & Jackson, 2010; Brown & Schafft, 2011). For example, Krasnopjorovs (2017) suggests that the quality of education would benefit from structural reforms involving school mergers and a rise in teacher salaries. However, the reality of educational environment so far have shown that there is no ‘one size fits all’ approach to the required changes. Indeed, despite public interventions, extensive achievement gaps still 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.

5. CONCLUSION

In 2008, the large urban centers (Lisbon, Coimbra, Porto and Setubal] showed a higher incidence of highest scores, being this incidence superior than that of the Country. The worst performance was found in Porto, Alto Trás-os-Montes, Alto Alentejo, Beira Interior Norte, Alentejo Central, Douro, Dão Lafões and Ave. In 2014, the *ranking* of schools underwent some changes, with Coimbra taking the lead of the highest scores, followed by Lisbon and Algarve. The regions that performed worse 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.

The shift-share analysis indicate that regional purchasing power is related to positive structural and regional performances. In other words, regions with greater purchasing power tend to have better scores. Thus, the purchasing power seems to be a relevant factor for the academic success. Ultimately, we hope that 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.

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