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## Quantifying School Segregation in MENA Countries:

### A Comparative Analysis

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# Quantifying school segregation in MENA countries: a comparative analysis

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## Abstract

While most MENA countries have undergone structural transformation to improve their educational system, little is known about the level of school segregation in those countries. Segregation at the school level is quite important for the region as it could be related to increasing income and educational inequalities, such as achievement gaps, low educational attainment and separation of the rich from the poor. In this paper, we propose a richer analysis of the level of segregation in those countries by using the available TIMSS dataset over the period 2011-2023. We combine students' achievement scores along with background information and school distribution we compute two types of segregation indices: Academic segregation, which illustrates the separation of the high achievers from low achievers, and socioeconomic segregation that represents the divide between the poor and the rich. On the basis of which form of segregation at which grade is more prevalent, we are able to classify countries into two main categories: countries with large levels of SES segregation at early grades and countries with large academic segregation at later grades. This classification allows for better targeted policies to the issue and to understand the prevalent segregation mechanism.

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# 1 Introduction

Most educational reforms in the MENA region have failed to translate educational outcomes into economic ones (El-Kogali et al., 2020), while net enrolments and gender parity were improved, quality of learning and economic benefits didn't follow: MENA countries rank the lowest in international assessment tests, have the lowest learning-equivalent years, and also account for the largest unemployment rates among the young educated. With this in mind, and given the large, persistent inequalities in the region, the question of whether social and income mobility can be achieved through education is of great concern.

While many solutions have been proposed to improve the educational system's ability to reap its benefits, little attention has been given to the question of segregation across MENA schools. Particularly, social and academic segregation.

The question of segregation is of high importance for the following two reasons: first, studies have shown that studying with peers from different socio-economic background or better performing students have large gains on educational outcomes, particularly among lowest achievers (Sacerdote, 2011), this is quite important for the MENA region as it has the biggest gaps in students achievements between top and bottom performers (El-Kogali et al., 2020). Second, Studies have shown that social diversity in schools increases children's social networks and thus social capital (Chetty et al., 2022), which is crucial for employment. Especially in the MENA region, which relies heavily on personal connections as the main driver for labour market outcomes (El-Kogali et al., 2020).

Although many studies have been interested in the question of segregation, little is known about the level of segregation in the MENA region. A first attempt was made by Burroughs et al. (2024), where they calculated SES segregation indices for all the countries that have participated in IEA tests, including eight MENA countries. However, not only was the analysis limited to SES segregation, omitting the academic one, but it also posed many limitations: First, the SES index used for calculating the segregation indices was limited to the number of books a child possesses; such a measure does not account for other dimensions such as parents' education, occupation and other home possessions. Second, the SES index used by the authors was cut out to only two categories (rich and poor). At the same time, this strategy is useful for the sake of simplicity; however, it doesn't fully make use of what an SES index should measure and doesn't allow us to see more variance in the segregation index to be computed from. Third, the authors use the dissimilarity index as a measure of segregation, while the latter is suitable for better interpretability; however, it loses some important

properties when we would like to make comparisons across space and time or move to the multigroup case, a better alternative is the entropy index which has better decomposability properties that we would like to make use of to understand the sources of changes of the segregation [Elbers \(2023\)](#).

In the present paper, we propose an alternative approach to computing levels of both SES and academic segregation in the MENA region using available TIMSS dataset, by implementing the above modification we can provide a better picture of the level of segregation across MENA countries, determine which form of segregation is more prevalent and also decompose the latter to understand which category of students are contributing to its overall level, finally we also make use of the time series present in the dataset to discuss variations of the levels of segregation across time and space.

## 2 Litterature review

Segregation in the school context is important because it has been linked with both academic performance and long-term outcomes such as professional trajectory and school dropout. In the short term, studying with a socially and academically diverse group can benefit children with low abilities or from a lower-income family, due to peer effects. which are defined as any externality of studying with a different income or ability group of students ([Sacerdote, 2011](#)). Studies trying to estimate the size of peer effects using variation in the school composition found large positive effects; however, these effects are overestimated and, in many cases, biased, due to the lack of an exogenous variation. Better estimates that use exogenous variation to peer composition find large positive effects, some find either no effect or small effects. ([Sacerdote, 2011](#)) argues that once we account for the nonlinearity model of peers, those results make sense. By estimating the overall level of segregation in a given country, we are able to determine its relationships with academic performance.

Not only do we care about the level of segregation, but we also want to determine which form is more prevalent, socioeconomic, academic or both. Studies have shown that peers only affect others through their ability, and not through other channels like income or social capital ([Charousset et al., 2023](#)). This also implies that academic segregation is more of a concern.

Moreover, studies have shown that peer effects are more pronounced at the bottom of the distribution than at its top. Low-performing students tend to benefit the most from these

interactions, particularly in the early years of education. These effects get smaller when we move to higher education and become irrelevant at the university level. From a social perspective, homogenous groups tend to benefit more from the presence of high achievers, as long as the percentage of students coming from a disadvantaged background is not high (Charousset et al., 2023). Given this, MENA countries with large levels of segregation in the early levels of education are more concerned with the issue.

Social and academic diversity is relevant not only at the academic level but also on other dimensions. Studies have shown that studying in more diverse schools improves the chances of completing education (Akhtari et al., 2024), pursuing education at the university level (Bergman, 2016), and also the perception of the education environment (Azmat and Britton, 2024).

### 3 Data

Computing the level of segregation in a given country boils down to determining the distribution of the population under study, given the parameter we want to measure, both at the country and school level. While ensuring comparability and representativeness within country and across countries. While the first condition can be met through the use of available national education admin data, despite how scarce they are, it will be more difficult to aggregate at the country level to make cross-country comparisons. Fortunately, the International Association for the Evaluation of Educational Achievements conducts every four years a large-scale international assessment that measures students' achievement in science and mathematics (TIMSS) and in reading literacy (PIRLS), which are conducted over several participating countries (64 and 70, respectively). Both IEA assessments provide two advantages for our segregation analysis: First, they are conducted over a sample that is both nationally representative and comparable across countries, since the final goal is to have an international score that ranks countries in those concepts (math, science and literacy). And second, the surveys uses a two-stage sampling procedure, where several schools are randomly selected from the country of study, over which a random sample of intact classes is taken, unlike other surveys like PISA that randomly sample students over classes, which makes it difficult to infer the distribution of the students in the classroom.

Both TIMSS and PIRLS datasets collect information on students' background, school environment, along with parents' and teachers' survey responses. With this information, we are able to compute both SES and academic segregation indices.

For the sake of simplicity, we limit the analysis to the TIMSS dataset, in order to avoid redundancy of samples in both surveys and also since both science, mathematics and literacy scores are highly correlated (Plavčan, 2020).

Given that the TIMSS datasets format and some questions do change, we limit our analysis to the time period 2011-2023, which includes the years 2015 and 2019. For countries, not all MENA countries do participate in the assessment, and even if some does they do for one period or two, to have a consistent sample over time we limite our analysis to the following MENA countries at grade 4 (Iran, Morocco, Qatar, KSA, UAE) and at grade 8 we add (Jordan, Israel and Bahrain).

The final dataset used for the computation of both SES and academic segregation includes 221,656 observations at grade 4 and 291,126 at grade 8, where each observation is a student  $i$  attending school  $k$  in country  $j$  at the time period  $t$ .

## 4 Methodology

The first and foremost issue in studying segregation is how to measure it. While it could be quite obvious, by simply dividing the number of students in one group by the total number of students, measuring segregation is quite a complex process and an unintuitive one. (Frankel and Volij, 2011) provide an extensive review of the indices proposed by the literature, and argue that among the 20 indices proposed, only a few satisfy axiomatic properties.

Among the most used indices in the literature, the Dissimilarity index, proposed first by (Duncan and Duncan, 1955), also called the D index, it departs from the notion of unevenness, where it illustrates how much a given school deviates from the fair distribution of students across groups if they would have been equally divided. It is similar to the idea of the Lorenz curve in measuring income inequalities. However, one of the limits of this index is that it is not decomposable, and when we account for the multigroup case, it becomes composition variant, which means that if the distribution of the minority group changes constantly across units, the index changes (Givord et al., 2016).

A better index that satisfies both these conditions, i.e decomposition, scale invariance and composition invariance are entropy index, these include the M index or the mutual information index and the H index, commonly known as the Theil index. (Frankel and Volij, 2011)

A recent study by [Elbers \(2023\)](#) shows that we can further decompose the changes in entropy indices through space and time, and this is by generating counterfactuals through IPF (Iterative proportional fitting), which allows us to decompose the change in segregation to marginal and structural changes.

For this paper, we make use of the Theil (H) index, which is computed as follows:

$$H = \sum_{k=1}^k \pi_k \frac{h(P) - h(p_k)}{H(P)} \quad (1)$$

Where  $h(P)$  is the entropy at a given country, which represents the social or academic diversity in that country or unit of analysis,  $H(P_k)$  is the entropy at the unit level, which is, in our case, the school, and  $\pi_k$  is the relative size of the unit (school) in the overall country.

The formula for H is the following:

$$h(p) = \sum_{i=1}^I q_i * \ln\left(\frac{1}{q_i}\right) \quad (2)$$

Where  $q_i$  is the number of students in category  $i$  on the overall number of students in class  $k$  or country  $i$ , depending on the unit of analysis.

The H index is normalised; the non-normalised version is the M index, which will also be used further in the analysis to compute the local level of segregation at the school level.

What is left is how to classify students in order to compute the relevant segregation dimension. For academic segregation, we proxy academic performance by the TIMSS international benchmark in mathematics scale, which is a four-point scale that indicates the student's position in their mathematics achievements, ranging from low, intermediate, high and advanced, thus allowing us to decompose students into 4 quartiles, with which we compute relative segregation indices.

For socioeconomic segregation, unfortunately, we don't have such a direct measure from the dataset on the socioeconomic background of the student; however, the TIMSS dataset collects at the same time students' background information such as home possessions, parents' education and occupation, Broer 2019 have suggested a 10 scale measure socioeconomic background that we use to compute each students corresponding class.

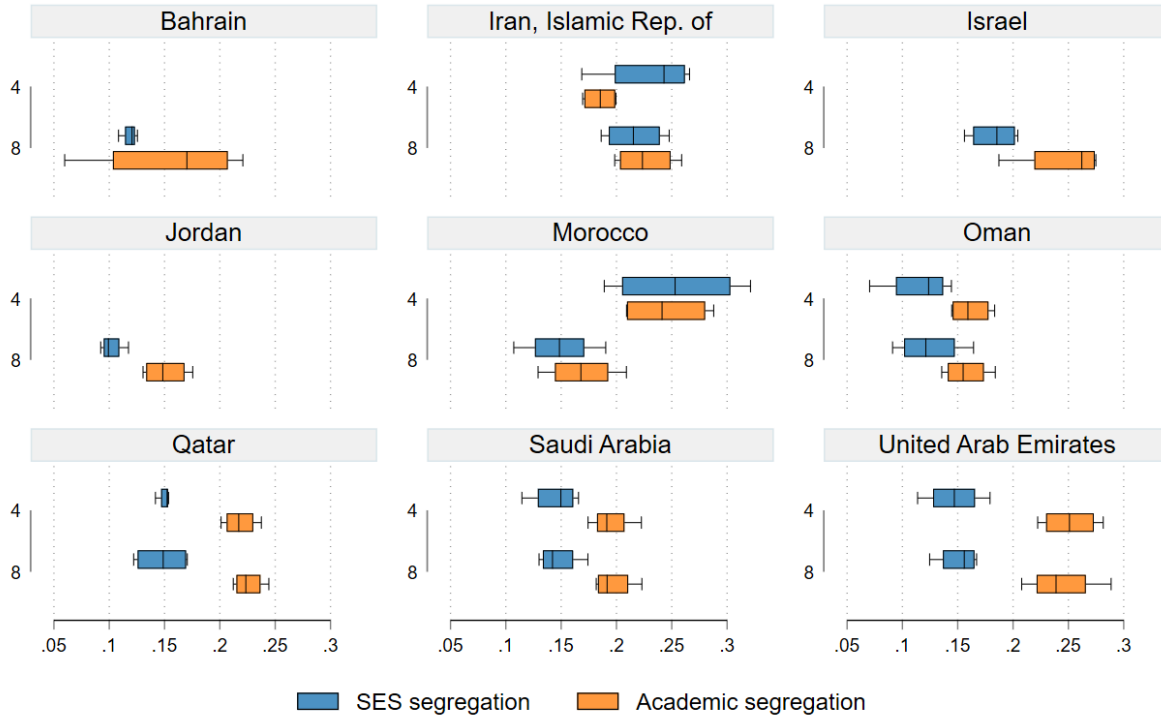
We decompose the index into quartiles at the country level, so that we have correct SES distributions. To test if the index is a good representation of a given country's SES and income distribution, we correlate the SES index with both the GDP per capita of the given country and its level of human capital. Results in Figure 7 show positive and significant correlation with macroeconomic variables, with a positive correlation of around 0.7 with human capital level both at grade 4 and grade 8, suggesting that the computed SES index is a good proxy for the underlying SES level in the country of study.

## 5 Results

### 5.1 Levels of segregation across MENA countries

Figure 1 shows the degree of segregation across MENA countries, both at the academic level and SES level, at grade 4 and grade 8, we observe two types of patterns: countries with large value of both SES and academic segregation at grade 4 like Iran and Morocco, and countries with large values of academic segregation at grade 8 like UAE, Saudi Arabia and Qatar, while having moderate levels of segregation at grade 4, finally countries with low to moderate levels of segregation across all grades and all dimensions. A k-means cluster analysis also classifies countries into those two types.

**Figure 1:** SES and academic segregation at grade 4 and 8

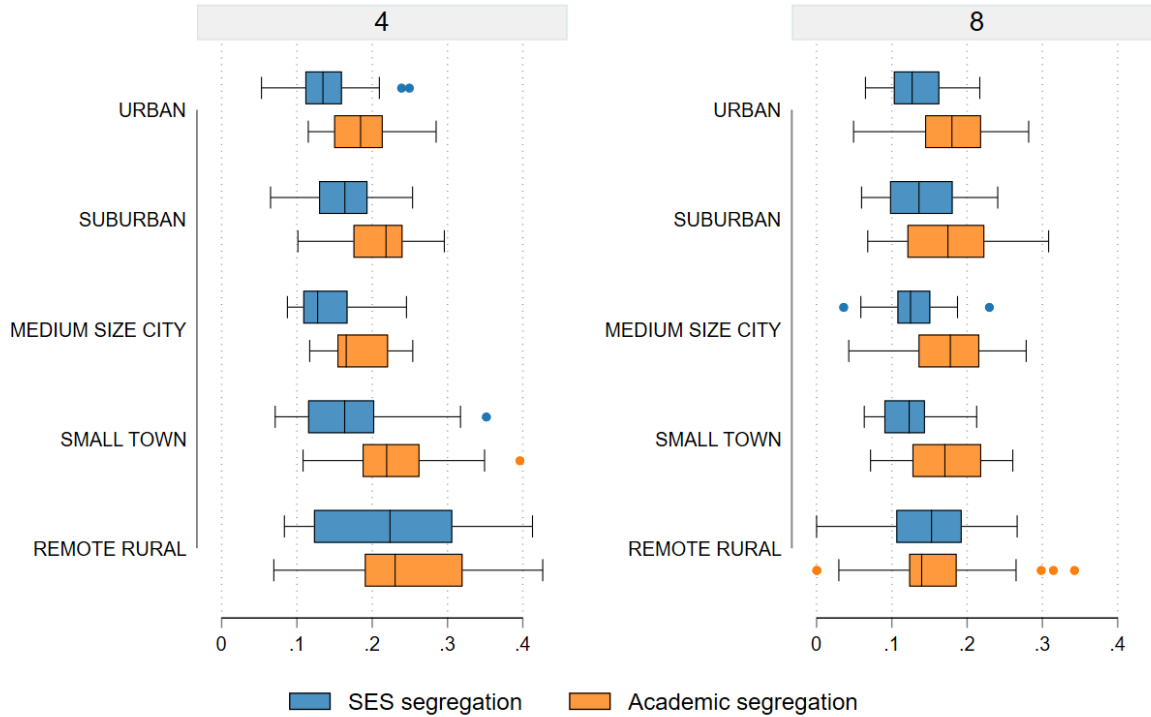


Graphs by Country

Notes: The figure shows a boxplot of the computed levels of socioeconomic and academic segregation both at grade 4 and grade 8, the shown values are averages over the time periods 2011,2015,2019 and 2023. For countries not represented at grade 4, like Bahrain, Jordan and Israel, their corresponding segregation values are omitted; for example, the average level of academic segregation in Oman is around 0.15 both at grade 4 and grade 8 .

In a second step we study the levels of segregation across countries by the school immediate location, results in figure 2 shows that remote rural areas are more concerned with segregation, particularly academic segregation. A simple regression analysis shows that being in a rural area increases the degree of segregation by 4 pp for 8th grade and 6 pp for 8th grade.

**Figure 2:** SES and academic segregation at grade 4 and 8 across locality



Graphs by grade

Notes: The figure shows a boxplot of the average level of segregation across reported school location, both at grade 4 and grade 8 for SES and academic segregation

## 5.2 Segregation decomposition

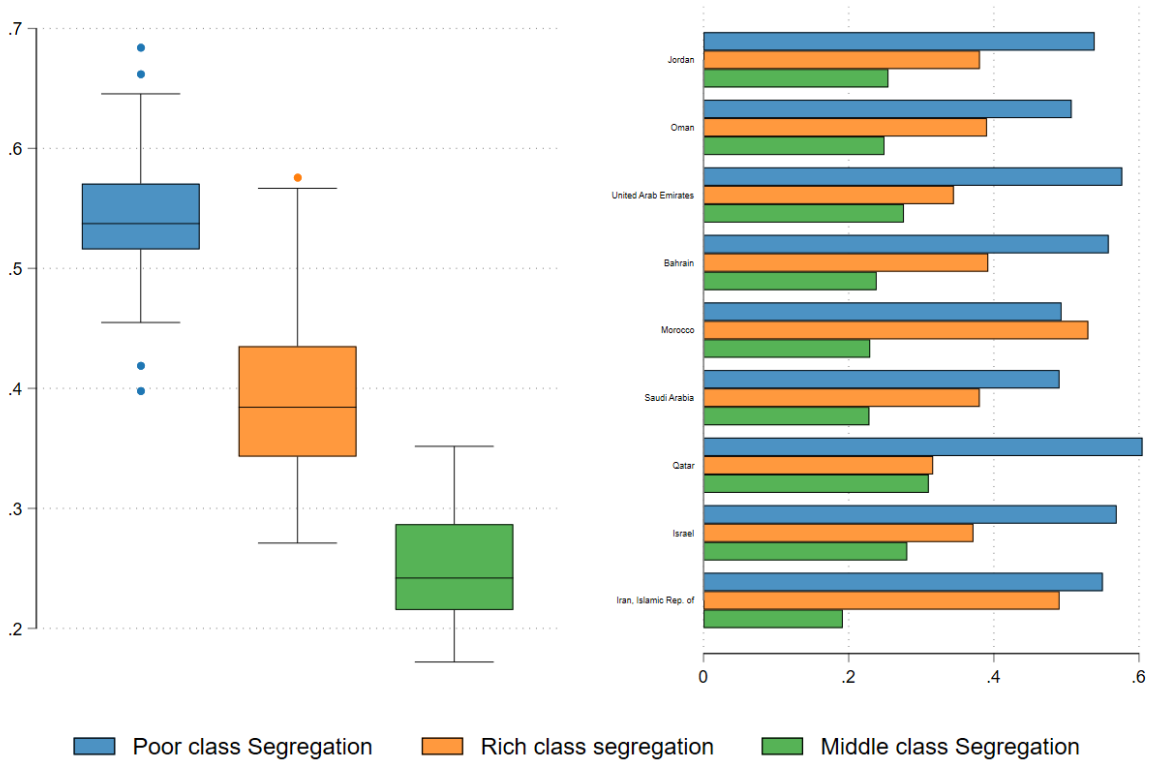
To provide a better picture on the level of segregation across countries, we would like to investigate what category of students (poor vs rich, high vs low achievers) are contributing more to each form of segregation in a given country.

To do so, we make use of the decomposability property of the H index. This allows us to decompose the index into a within and a between segregation term. The within term computes the segregation that is coming from one group of students vs the others, and the between term the amount of segregation that is coming from the segregation of other classes among each other.

Results in figure 4 shows that for SES segregation, 60% of the latter is coming from the segregation of the poor from other categories, followed by the segregation of the rich,

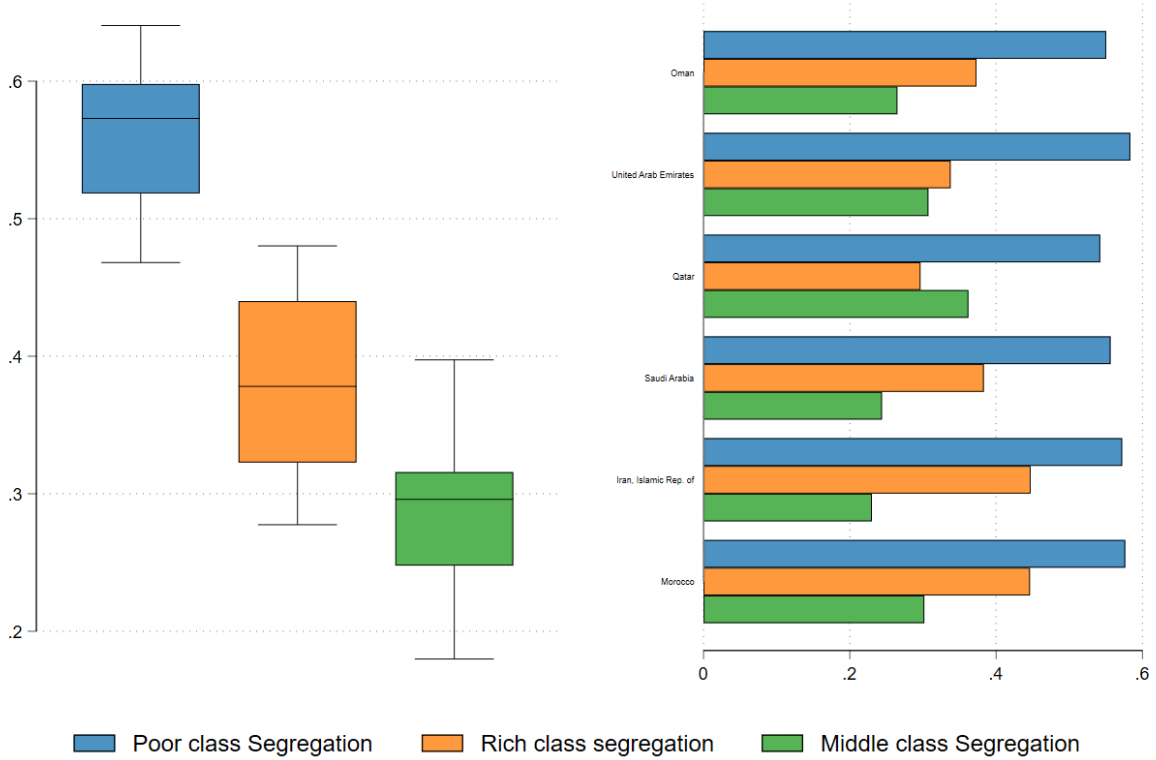
and for a small amount, the segregation of the middle class, the picture is consistent across countries and across grades, except for Morocco, where, at grade 8, the segregation of the rich becomes of same importance as to the segregation of the poor, suggesting the existence of a two type educational system such as the prevalence of private education that tends to segregate one category from the other.

**Figure 3:** SES segregation decomposition grade 4



Notes: The left-hand side panel of the figure shows for all MENA countries the contribution of each socioeconomic class to the corresponding country level of segregation, the right-hand side panel shows the distribution of the segregation decomposition across countries in grade 4

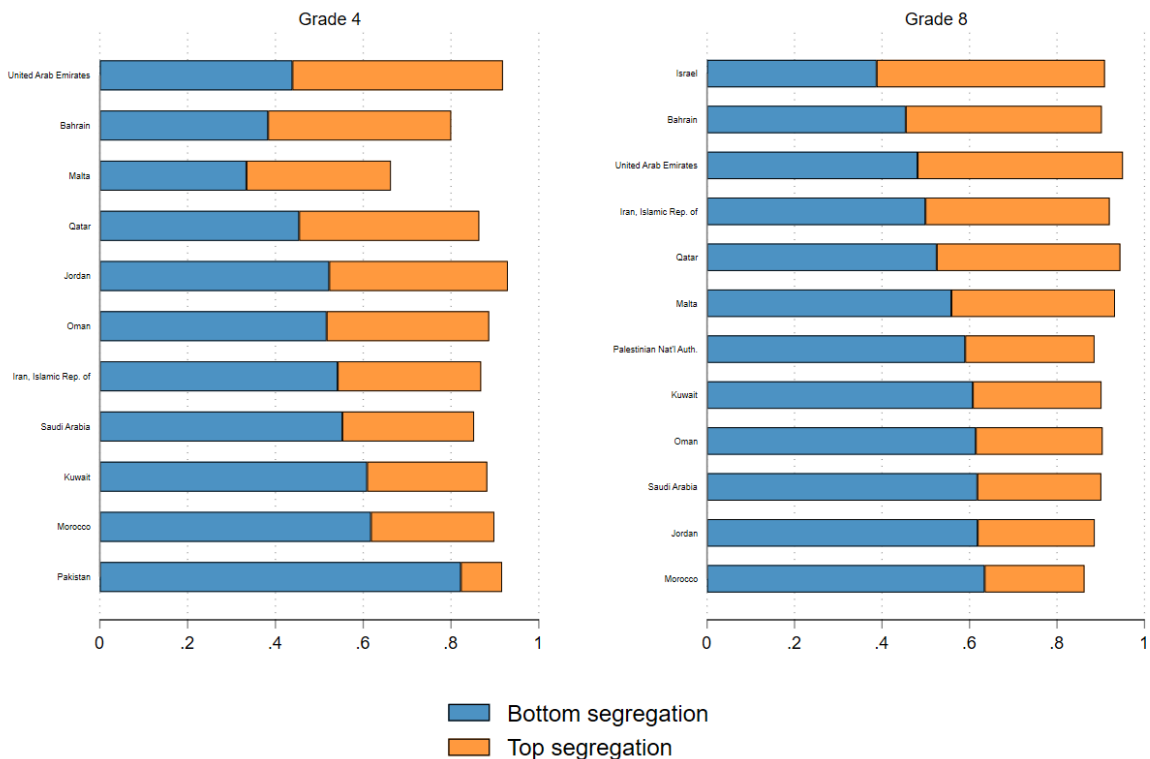
**Figure 4:** SES segregation decomposition grade 8



Notes: The left-hand side panel of the figure shows for all MENA countries the contribution of each socioeconomic class to the corresponding country level of segregation, the right-hand side panel shows the distribution of the segregation decomposition across countries in grade 8

Regarding academic segregation, we use the same analysis as above, which results in figure 5. Unlike SES segregation, where most of it comes from one specific group of students (the poor), Academic segregation is equally important for both the top and bottom performers. For example in grade 4 we see two different types of countries, countries where overall levels of segregation are high, have their academic segregation comes more from the segregation of the low performers (between 60% and 80%), whereas in other countries with low levels of overall academic segregation in grade 4, see's segregation coming both from the best and worst in terms of academic achievements. At grade 8, the picture is quite similar, only now the contribution to overall segregation from the lowest achievers increases.

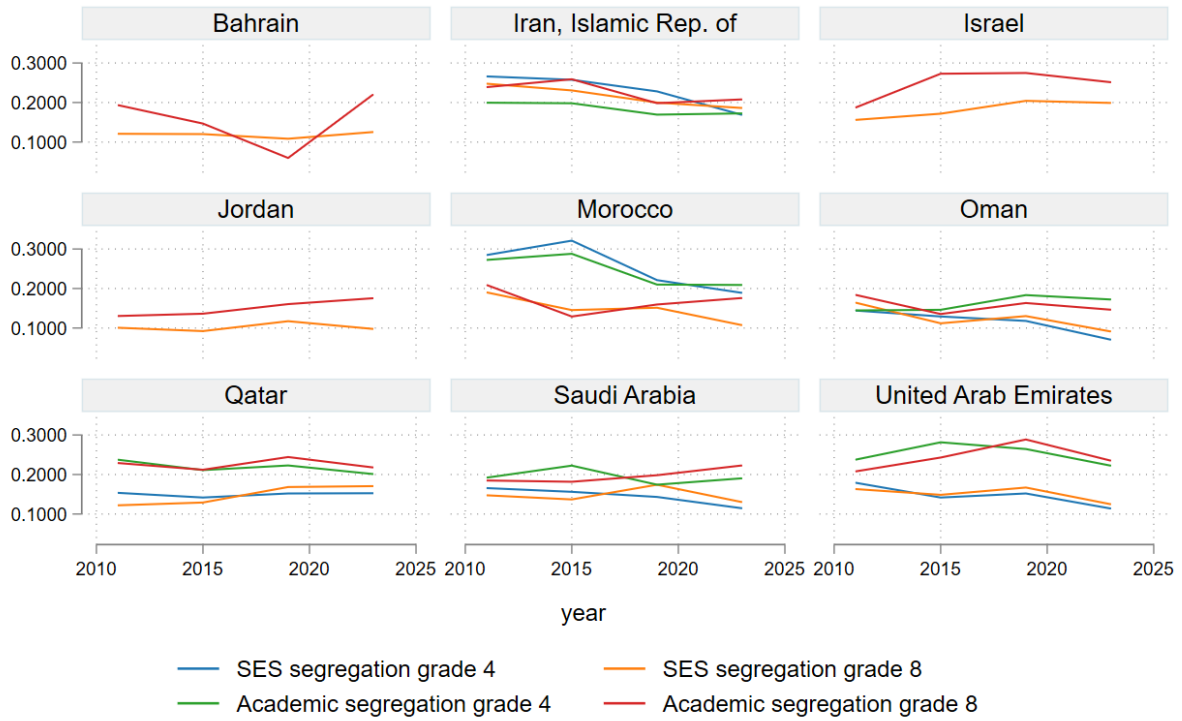
**Figure 5:** Academic segregation decomposition



Notes: The figure shows the average contribution to academic segregation from both high and low achievers at grade 4 and grade 8.

Finally, given that we are working with a panel of countries over a time period, it is interesting to understand if there are variations across time. Figure 6 shows that in most countries, corresponding levels of segregation are constant or are being reduced, particularly in Morocco, where the prevalent form of segregation, which is SES segregation at grade 4, moved downwards.

**Figure 6:** Segregation time-series



Graphs by Country

Notes: The figure shows the evolution of segregation levels across dimensions and grades

## 6 Conclusion

By computing the level of both socioeconomic and academic segregation across major MENA countries present in the TIMSS dataset, we can understand its prevalence and major form, the main result is that most MENA countries have moderate levels of segregation, with two main groups: a group of countries where academic segregation is more prevalent, particularly at the eighth grade, mainly gulf countries, and a second group where socioeconomic segregation is the dominant form particularly at the fourth grade. By decomposing the levels of segregation across urban and rural areas, we see that the MENA region concentrates most of its segregation in rural areas. Furthermore, decomposing segregation across groups of students we see that the poor are the more concerned by socioeconomic segregation, while academic segregation concerns both top and bottom quartiles, depending on the cluster of countries we are looking at, low achievers are more concerned with academic segregation in countries with large levels of segregation, while high achievers are more concerned with academic segregation in countries with moderate levels of segregation. Finally, we observe that across years, the levels of segregation across dimensions and grades are fairly constant across countries.

While inconclusive about the overall level of segregation in the region, given the omission of many countries from the analysis, we still, however, have a clear idea of the overall degree in major countries of the region, and how segregation changes from one country to another, given the dimension we look at and at what grade. This allows us to better understand its causes and also its consequences. Moreover, forms of segregation that are more related to academic achievement and income inequality can have tailored policy interventions, for example, in countries where academic segregation is more prevalent can be related to the presence or not of a tracking system, while countries with more SES segregation can suggest an endogenous factor that is related to the structural distribution of the population in that country.

## 7 Appendix

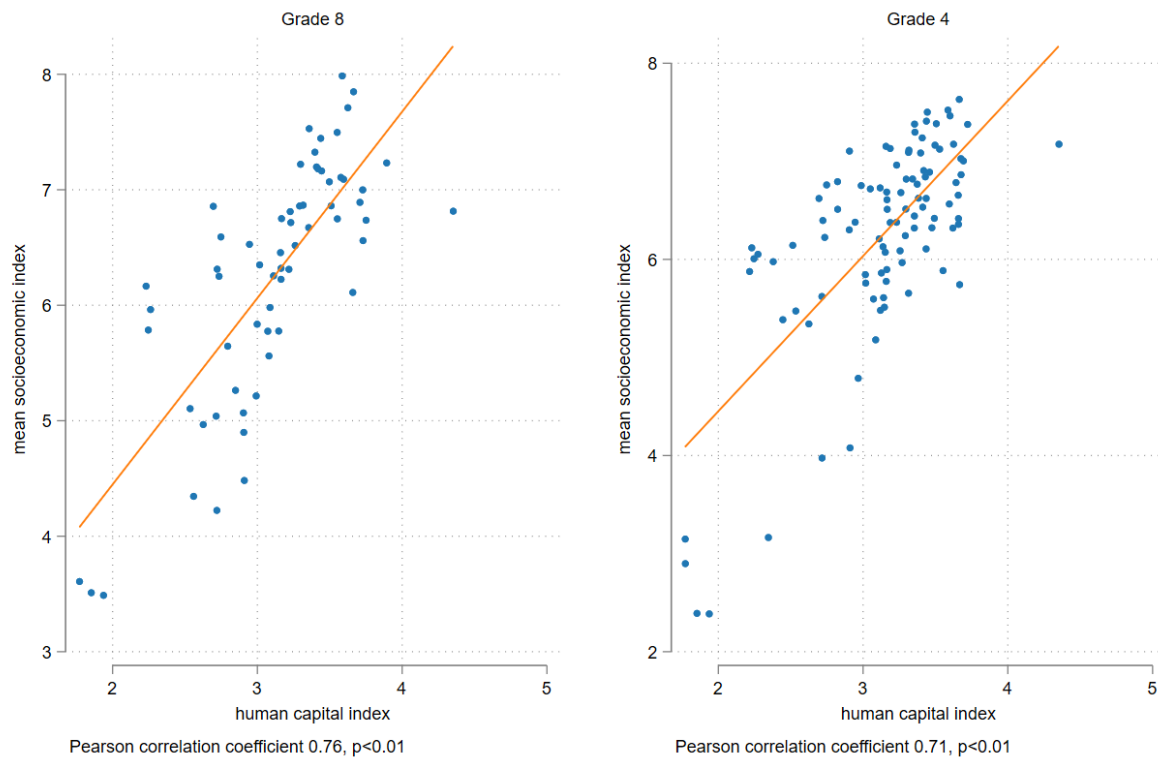
### 7.1 Socioeconomic index

The computation of the socioeconomic index follows the methodology proposed by (Broer et al., 2019), which suggests the calculation of the index on the basis of a 10-point scale defined as follows in table 1:

**Table 1:** SES index construction

SES component	Categories	score
Highest level of parental education	Less than lower secondary education	0
	Completed lower secondary education	1
	Completed upper secondary education	2
	Post-secondary education, non tertiary education	3
	Completed university or higher	4
Home possessions	None	0
Computer/Tablet	1 Home possession	1
Study desk	2 Home possessions	2
Number of books at home	0-10 books	0
	11-25 books	1
	26-100 books	2
	101-200 books	3
	More than 200 books	4

**Figure 7:** Correlation of SES index with human capital index



Notes: The figure shows correlation plots between the computed SES index and human capital index as defined in the Penn World Table for each corresponding country

## References

- Akhtari, M., Bau, N. and Laliberté, J.-W. (2024), ‘Affirmative action and precollege human capital’, American Economic Journal: Applied Economics **16**(1), 1–32.
- Azmat, G. and Britton, J. (2024), ‘Labour market returns to higher education’, Oxford Research Encyclopedia of Economics and Finance .
- Bergman, P. (2016), ‘The effects of school integration: Evidence from a randomized desegregation program’.
- Broer, M., Bai, Y. and Fonseca, F. (2019), Socioeconomic inequality and educational outcomes: Evidence from twenty years of TIMSS, Springer nature.
- Burroughs, N. A., Gardner, J. A., Zuschlag, D. F. and Van Vliet, C. J. (2024), Socioeconomic Segregation and Educational Inequality: Evidence from International Assessments, Springer Nature.
- Charoussat, P., Monnet, M. and Souidi, Y. (2023), ‘Ségrégation sociale en milieu scolaire: appréhender ses causes et déterminer ses effets’.
- Chetty, R., Jackson, M. O., Kuchler, T., Stroebe, J., Hendren, N., Fluegge, R. B., Gong, S., Gonzalez, F., Grondin, A., Jacob, M. et al. (2022), ‘Social capital i: measurement and associations with economic mobility’, Nature **608**(7921), 108–121.
- Duncan, O. D. and Duncan, B. (1955), ‘A methodological analysis of segregation indexes’, American sociological review **20**(2), 210–217.
- El-Kogali, S. E. T., Krafft, C. and Yarrow, N. (2020), ‘Expectations and aspirations [ambitions et aspirations d’une région]’, World Bank Publications-Books .
- Elbers, B. (2023), ‘A method for studying differences in segregation across time and space’, Sociological Methods & Research **52**(1), 5–42.
- Frankel, D. M. and Volij, O. (2011), ‘Measuring school segregation’, Journal of Economic Theory **146**(1), 1–38.
- Givord, P., Guillermin, M., Monso, O. and Murat, F. (2016), ‘Comment mesurer la ségrégation dans le système éducatif?’, Éducation & formations (91), 21–51.
- Plavčan, P. (2020), ‘The comparison of pirls, timss and pisa educational results in member states of the european union’, Proceedings of CBU in Social Sciences **1**, 191–195.
- Sacerdote, B. (2011), Peer effects in education: How might they work, how big are they and how much do we know thus far?, in ‘Handbook of the Economics of Education’, Vol. 3, Elsevier, pp. 249–277.