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Patterns of school segregation in Europe

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Holmlund, Helena

Öckert, Björn

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E-mail: eac-unite-a4@ec.europa.eu

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Results at a glance

This report documents school segregation across Europe today, and demonstrates the extent to which Europe's different school systems and diverse demographic profiles can explain some of the variation in segregation across countries. It also illustrates how much of the test score gaps across schools can be explained by differences in student background.

Using data from the Programme for International Student Assessment (PISA) 2018, we estimate school segregation by students' family background using the intraclass correlation (the share of the total variation explained by schools). Since segregation is multidimensional, we develop a new all-encompassing measure of student background – predicted test scores – that combines various student background characteristics into a common metric. The underlying items are weighted by how strongly they are related to student test scores in different countries. Since the background variables are scaled against an absolute measure of student performance, the predicted values are comparable across countries. This allows us to assess international differences in school segregation in the dimensions that matter most for student performance.

We document substantial differences in school segregation across countries in three dimensions: parental education, migrant background and predicted test scores. Countries with a comprehensive school system at the time of assessment (when students are 15 years old) have significantly lower school segregation than countries that stream students earlier. We investigate the role of housing segregation, school choice and student selection, and find that school segregation typically is lower in countries with residence-based student admission, while selective admission is associated with larger disparities in the composition of the student body. School segregation is also shown to feed into performance differences between schools, both within and between streaming regimes, and test score gaps are almost halved when accounting for differences in observed student characteristics across schools. The remaining differences in performance between schools are still greater in countries that have more segregated schools, which is likely to be driven by student sorting into schools based on factors not included in the data, as well as any causal pathway between student composition and achievement.

Executive summary

School segregation is an important topic on the education policy agenda, in particular because of its potential consequences for both economic efficiency and equity. School segregation is commonly referred to as differences across schools in students' ability, socioeconomic background or ethnicity. Student sorting into schools based on these dimensions may affect student outcomes in several ways. Some school systems also explicitly use ability-based sorting into alternate classes within schools, which might affect student outcomes differently from segregation across schools. Theoretically, both positive and negative effects of sorting are possible. On the one hand, mixing students with different characteristics may have positive effects on social cohesion and may imply that weak students benefit from better-performing peers. It might also limit the concentration of disadvantaged students at schools, which potentially improves the

learning environment and the possibilities to recruit teachers. On the other hand, grouping students by ability or background may allow for more efficient teaching which specifically targets the needs of the group. Therefore, the optimal way of sorting students between and within schools is theoretically ambiguous.

Research on the effects of school or class composition is methodologically challenging, since it is difficult to separate the effect of the group from that of the student's own background and ability. Recent studies that use randomised controlled trials to study effects on test scores show that the positive impact of targeted instruction in streamed groups may be larger than the positive effect of having high achieving peers in a mixed setting. Yet, mixing students with different backgrounds seems to have positive consequences for behavioural outcomes and social values, such as criminal involvement and tolerance towards minority groups. However, credible evidence on the impact of student group composition is scarce and the results are context-specific.

Since it is both theoretically and empirically challenging to identify the optimal way of allocating students into schools and classes, a pivotal starting point is to understand the driving forces and current patterns of segregation in different school systems. From both a policy and analytical perspective, it is furthermore relevant to investigate to what extent segregation feeds into performance differences across schools.

This report documents the sorting of students across upper-secondary schools in the EU using data from the Programme for International Student Assessment (PISA) 2018. In the EU countries, several different school systems are represented, and we demonstrate how various features of these systems are related to segregation. We find that school segregation differs tremendously among EU member states. Countries that stream students early are characterised by more school segregation than countries that separate students later, and this is likely to be driven by the selective admission of students to streams. When investigating the role of housing segregation, school choice and student selection, we find that school segregation typically is lower in countries with residence-based student admission, while selective admission is associated with larger divergences in the composition of the student body. School segregation has direct consequences for the differences in performance between schools, both within and between streaming regimes. Countries with more school segregation also have greater test score gaps between schools, and the performance differences are almost halved when adjusting for differences in observed student characteristics across schools. The remaining test score gaps between schools are still greater in countries that have more segregated schools, which is likely to be driven by student sorting into schools based on factors not included in the data, as well as any causal pathway between student composition and achievement.

Performance differences across schools are often mistaken for school quality differences. An important insight from this report is that in order to identify performance gaps that are of policy interest – such as disparities in school quality – it is necessary to at least account for student sorting by family background and migration history. At the same time, because students may differ in other respects, the remaining variation in test scores between schools must be interpreted with caution.

Although this report presents correlations rather than causal pathways, we point out policy areas that are relevant for policymakers who wish to influence school segregation.

Residential segregation is a key policy area, in particular in school systems that base admissions on catchment areas. Even so, patterns of residential segregation are hard to influence, at least in the short run, and are thus unlikely to be the most effective measure to combat school segregation. Instead, streaming and admission policies are tools that can be used to influence sorting into schools, and may also indirectly circumvent residence-based segregation.

Aperçu des résultats

Le présent rapport rend compte de la ségrégation scolaire dans l'Europe d'aujourd'hui et montre dans quelle mesure les différents systèmes scolaires et les divers profils démographiques européens expliquent en partie les variations de la ségrégation entre les pays. Il illustre également dans quelle mesure les écarts de résultats aux tests entre les écoles peuvent être expliqués par les différences de milieu des élèves.

À l'aide des données du Programme international pour le suivi des acquis des élèves (PISA) 2018, nous évaluons la ségrégation scolaire en fonction du milieu familial des élèves en utilisant la corrélation intraclasse (la part de la variation totale expliquée par les écoles). La ségrégation étant multidimensionnelle, nous développons une nouvelle mesure globale du milieu des élèves — prédiction des résultats aux tests — qui rassemble diverses caractéristiques du milieu des élèves en une mesure commune. Les éléments sous-jacents sont pondérés en fonction de leur lien avec les résultats des élèves aux tests dans différents pays. Étant donné que les variables relatives au milieu sont mises à l'échelle par rapport à une mesure absolue des performances des élèves, les valeurs prédites sont comparables d'un pays à l'autre. Cela nous permet d'évaluer les différences internationales en matière de ségrégation scolaire dans les dimensions qui jouent le plus sur les performances des élèves.

Nous mettons en évidence des différences substantielles dans la ségrégation scolaire entre les pays dans les trois dimensions suivantes : l'éducation des parents, les origines ethniques et les résultats prévus aux tests. Les pays dotés d'un système scolaire général au moment de l'évaluation (lorsque les élèves ont 15 ans) présentent une ségrégation scolaire nettement plus faible que les pays qui orientent les élèves plus tôt. En étudiant le rôle de la ségrégation en matière de logement, du choix de l'école et de la sélection des étudiants, nous constatons que la ségrégation scolaire est généralement plus faible dans les pays où l'admission des étudiants est basée sur le lieu de résidence, tandis que l'admission sélective est associée à de plus grandes disparités dans la composition du corps étudiant. Nous avons également constaté que la ségrégation scolaire se traduit par des différences de performances entre les écoles, dans et entre les différents types d'enseignement, et que les écarts de résultats aux tests sont presque réduits de moitié lorsque l'on tient compte des différences de caractéristiques observées chez les élèves entre les écoles. Les écarts de performances qui subsistent entre les écoles sont encore plus marqués dans les pays où les écoles sont plus ségréguées, ce qui est probablement dû au tri des élèves dans les écoles sur la base de facteurs non inclus dans les données, ainsi qu'à tout lien de causalité entre la composition du corps étudiant et les résultats.

Résumé

La ségrégation scolaire occupe une place importante dans l'agenda de la politique éducative, notamment en raison de ses conséquences potentielles tant sur l'efficacité économique que sur l'équité. La ségrégation scolaire est souvent définie comme les différences entre écoles en ce qui concerne les capacités, le milieu socioéconomique ou l'origine ethnique des élèves. La sélection des élèves dans les écoles sur la base de ces trois dimensions peut affecter les résultats des élèves de plusieurs manières. Certains

systèmes scolaires répartissent explicitement les élèves dans différentes classes en fonction de leurs aptitudes, ce qui peut affecter les résultats des élèves différemment de la ségrégation entre écoles. Théoriquement, cette répartition peut avoir des effets positifs et négatifs. D'un côté, le fait de mélanger des élèves ayant des caractéristiques différentes peut avoir des effets positifs sur la cohésion sociale et peut conduire à ce que les élèves faibles bénéficient de leurs pairs plus performants. Cela pourrait également limiter la concentration d'élèves défavorisés dans les écoles et ainsi améliorer potentiellement l'environnement d'apprentissage et les possibilités de recrutement d'enseignants. D'un autre côté, le fait de regrouper les élèves en fonction de leurs aptitudes ou de leurs origines peut permettre un enseignement plus efficace qui cible spécifiquement les besoins du groupe. Par conséquent, la manière optimale de répartir les élèves entre les écoles et au sein de celles-ci est théoriquement ambiguë.

Les recherches sur les effets de la composition des écoles ou des classes constituent un défi méthodologique, car il est difficile de séparer l'effet du groupe de celui des antécédents et des capacités des élèves. Des études récentes, qui utilisent des essais contrôlés randomisés pour étudier les effets sur les résultats des tests, montrent que l'impact positif de l'enseignement ciblé dans des groupes homogènes peut être plus important que l'impact positif de la présence de pairs très performants dans un environnement mixte. Cependant, le mélange d'étudiants de milieux différents semble avoir des conséquences positives sur les résultats comportementaux et les valeurs sociales, comme la participation à des activités criminelles et la tolérance envers les groupes minoritaires. Mais les preuves crédibles de l'incidence de la composition des groupes d'étudiants sont rares et les résultats sont spécifiques au contexte.

Étant donné qu'il est difficile, tant sur le plan théorique qu'empirique, d'identifier la manière optimale de répartir les élèves dans les écoles et les classes, il convient de commencer par comprendre les forces motrices et les modèles actuels de ségrégation dans les différents systèmes scolaires. D'un point de vue politique et analytique, il est en outre opportun d'examiner dans quelle mesure la ségrégation se traduit par des différences de performance entre les écoles.

Le présent rapport examine la répartition des étudiants dans les établissements d'enseignement secondaire du deuxième cycle de l'Union européenne en s'appuyant sur les données du Programme international pour le suivi des acquis des élèves (PISA) 2018. Il existe plusieurs systèmes scolaires différents au sein de l'Union européenne et nous démontrons comment différentes caractéristiques de ces systèmes sont liées à la ségrégation. Nous constatons que la ségrégation scolaire diffère énormément d'un État membre à l'autre. Les pays qui répartissent les élèves plus tôt se caractérisent par une ségrégation scolaire plus importante que les pays qui séparent les élèves plus tard, ce qui est probablement dû à l'admission sélective des élèves dans les filières. En étudiant le rôle de la ségrégation en matière de logement, du choix de l'école et de la sélection des étudiants, nous constatons que la ségrégation scolaire est généralement plus faible dans les pays où l'admission des étudiants est basée sur le lieu de résidence, tandis que l'admission sélective est associée à de plus grandes divergences dans la composition du corps étudiant. La ségrégation scolaire a également des conséquences directes sur les différences de performances entre les écoles, dans et entre les différents types d'enseignement. Les pays où la ségrégation scolaire est la plus forte présentent également de plus grands écarts de résultats aux tests entre les écoles, mais ces écarts

sont presque réduits de moitié lorsque l'on tient compte des différences de caractéristiques observées chez les élèves entre les écoles. Les écarts de résultats qui subsistent entre les écoles sont encore plus marqués dans les pays où les écoles sont plus ségréguées, ce qui est probablement dû au tri des élèves dans les écoles sur la base de facteurs non inclus dans les données, ainsi qu'à tout lien de causalité entre la composition du corps étudiant et les résultats.

Les différences de performance entre les écoles sont souvent confondues avec les différences de qualité des écoles. Une conclusion importante de ce rapport est que pour identifier les écarts de performance qui présentent un intérêt politique — tels que les disparités dans la qualité des écoles — il est nécessaire de tenir compte au moins de la répartition des élèves en fonction de leurs origines familiales et de leur parcours migratoire. Dans le même temps, comme les élèves peuvent différer à d'autres égards, la variation restante des résultats aux tests entre les écoles doit être interprétée avec prudence.

Bien que le présent rapport présente des corrélations plutôt que des liens de causalité, nous relevons les domaines d'action pertinents pour les responsables politiques qui souhaitent infléchir la ségrégation scolaire. La ségrégation résidentielle est un domaine d'action essentiel, en particulier dans les systèmes scolaires qui fondent les admissions sur les lieux de résidence. Même ainsi, les modèles de ségrégation résidentielle sont difficiles à influencer, du moins à court terme, et il est donc peu probable qu'ils constituent la mesure la plus efficace pour lutter contre la ségrégation scolaire. En revanche, les politiques de répartition et d'admission sont des outils qui peuvent être utilisés pour influencer la répartition dans les écoles et qui peuvent également contourner indirectement la ségrégation fondée sur le lieu de résidence.

Die Ergebnisse im Überblick

In diesem Bericht wird die aktuelle schulische Segregation in Europa dokumentiert und aufgezeigt, inwieweit sich abweichende Segregationen in einzelnen Ländern mit den verschiedenen Schulsystemen und vielfältigen Bevölkerungsstrukturen Europas erklären lassen. Ebenso veranschaulicht der Bericht, inwieweit unterschiedliche Hintergründe der Schüler für das Ergebnisgefälle zwischen den einzelnen Schulen verantwortlich sind.

Anhand der Daten des Programme for International Student Assessment (PISA) 2018 schätzen wir die schulische Segregation auf Basis des familiären Hintergrunds der Schüler und stützen uns dabei auf die Intra-Klassen-Korrelation (Anteil der gesamten Abweichung, der sich durch Schulen erklären lässt). Da die Segregation mehrere Dimensionen umspannt, entwickeln wir ein neues universelles Maß für die Hintergründe der Schüler, d. h. prognostizierte Testergebnisse, in deren Rahmen verschiedene Merkmale der Hintergründe der Schüler in eine gemeinsame Kennzahl einfließen. Die unterliegenden Aspekte werden nach dem Ausmaß gewichtet, in dem sie mit den Testergebnissen der Schüler in verschiedenen Ländern zusammenhängen. Da die Hintergrundvariablen einem absoluten Maß für die schulische Leistung gegenübergestellt werden, lassen sich die prognostizierten Werte länderübergreifend vergleichen. Dies ermöglicht, internationale Unterschiede bei der schulischen Segregation in den Dimensionen zu erfassen, die für die schulische Leistung ausschlaggebend sind.

Wir dokumentieren substanzielle länderübergreifende Unterschiede der schulischen Segregation anhand von drei Dimensionen: elterliche Erziehung, Migrationshintergrund und prognostizierte Testergebnisse. Länder mit Gesamtschulsystem zum Zeitpunkt der Untersuchung (wenn Schüler 15 Jahre alt sind) weisen eine wesentlich niedrigere schulische Segregation auf als Länder, in denen Schüler früher in Leistungsgruppen eingeteilt werden. Zudem untersuchen wir die Rolle der Wohnsegregation, der Wahl der Schule und der Auswahl der Schüler. Dabei gelangen wir zu dem Ergebnis, dass die schulische Segregation in Ländern mit wohnsitzbasierter Schüleraufnahme in der Regel niedriger ist, wohingegen die selektive Aufnahme mit einem größeren Gefälle bei der Zusammensetzung der Schülergemeinschaft verbunden ist. Die schulische Segregation wird ebenfalls herangezogen, um Leistungsunterschiede zwischen Schulen – sowohl innerhalb als auch zwischen Systemen für Leistungseinstufung – aufzuzeigen. Das Gefälle bei den Testergebnissen halbiert sich nahezu, wenn unterschiedliche Schülermerkmale über die einzelnen Schulen hinweg berücksichtigt werden. Die verbleibenden Leistungsunterschiede zwischen Schulen sind in Ländern mit stärker segregierten Schulen noch immer größer. Ursache hierfür dürfte eine Verteilung der Schüler sein, die auf nicht in den Daten enthaltenen Faktoren beruht. Auch ein Kausalzusammenhang zwischen der Schülerzusammensetzung und den Schulabschlüssen dürfte eine Rolle spielen.

Zusammenfassung

Aufgrund ihrer potenziellen Auswirkungen auf die wirtschaftliche Leistungsfähigkeit und die Gleichstellung genießt die schulische Segregation einen hohen Stellenwert in der Bildungspolitik. Mit schulischer Segregation werden gemeinhin schulübergreifende Unterschiede zwischen den Fähigkeiten, dem sozioökonomischen Hintergrund oder der

Ethnizität der Schüler bezeichnet. Wenn Schüler auf Basis dieser Dimensionen auf Schulen verteilt werden, kann sich dies auf mehrere Weise auf die Lernergebnisse auswirken. In einigen Schulsystemen wird ausdrücklich eine fähigkeitsbasierte Verteilung in wechselnde Klassen in Schulen angewendet. Dies kann die Lernergebnisse anders beeinflussen als bei der Segregation über Schulen hinweg. Theoretisch kann die Verteilung positive und negative Folgen nach sich ziehen. Die Vermischung von Schülern mit unterschiedlichen Merkmalen kann sich einerseits positiv auf den sozialen Zusammenhalt auswirken und mit sich bringen, dass schwache Schüler von stärkeren profitieren. Ebenso kann es die Konzentration benachteiligter Schüler an den Schulen begrenzen, was das Lernumfeld und die Möglichkeiten für die Verpflichtung von Lehrkräften verbessern kann. Andererseits kann die Gruppierung von Schülern nach Fähigkeiten oder Hintergründen einen effizienteren Unterricht ermöglichen, der speziell auf die Bedürfnisse der jeweiligen Gruppe abgestimmt ist. Folglich ist der optimale Ansatz bei der Verteilung von Schülern zwischen und innerhalb von Schulen theoretisch nicht eindeutig klassifizierbar.

Die Erforschung der Auswirkungen der Schul- oder Klassenzusammensetzung ist methodologisch problematisch, da es schwierig ist, zwischen den Auswirkungen der Gruppe und den Auswirkungen der Hintergründe und Fähigkeiten der Schüler zu unterscheiden. Neuere Studien mit randomisiert kontrollierten Tests zur Untersuchung der Auswirkungen auf die Testergebnisse zeigen, dass die positive Wirkung eines zielgerichteten Unterrichts in nach Leistung eingeteilten Gruppen größer sein kann als die positive Wirkung leistungsstarker Schüler im gemischten Kontext. Dennoch scheint die Vermischung von Schülern mit verschiedenen Hintergründen eine positive Wirkung mit Blick auf Verhaltensergebnisse und soziale Werte zu erzeugen, wie die kriminelle Verstrickung und die Toleranz gegenüber Minderheiten. Gleichwohl sind glaubhafte Nachweise der Wirkung der Zusammensetzung von Schülergruppen kaum vorhanden und die Ergebnisse kontextspezifisch.

Da es aus theoretischer und empirischer Sicht schwierig ist, das optimale Verfahren für die Zuweisung von Schülern in Schulen und Klassen zu ermitteln, sind vorab die treibenden Kräfte und die aktuellen Muster der Segregation in verschiedenen Schulsystemen zu analysieren. Aus politischer und analytischer Perspektive ist darüber hinaus die Erkenntnis wichtig, in welchem Ausmaß die Segregation zu Leistungsunterschieden zwischen einzelnen Schulen führt.

In diesem Bericht wird die Verteilung von Schülern in höhere Sekundarschulen in der EU anhand von Daten des Programme for International Student Assessment (PISA) 2018 dokumentiert. In den EU-Mitgliedstaaten bestehen verschiedene Schulsysteme. Wir zeigen dabei auf, wie verschiedene Merkmale dieser Systeme mit Segregation zusammenhängen. Nach unserem Kenntnisstand fällt die schulische Segregation in den einzelnen EU-Mitgliedstaaten äußerst unterschiedlich aus. Länder, die Schüler schon früh in Leistungsgruppen einteilen, sind von einer stärkeren schulischen Segregation gekennzeichnet als Länder mit späterer Einteilung. Wahrscheinliche Ursache dürfte die selektive Aufnahme von Schülern in Leistungsgruppen sein. Wenn die Rolle der Wohnsegregation, der Wahl der Schule und der Auswahl der Schüler untersucht wird, gelangen wir zu dem Ergebnis, dass die schulische Segregation in Ländern mit wohnsitzbasierter Schüleraufnahme in der Regel niedriger ist, wohingegen die selektive Aufnahme mit einem größeren Gefälle bei der Zusammensetzung der

Schülergemeinschaft verbunden ist. Die schulische Segregation wirkt sich unmittelbar auf die Leistungsunterschiede zwischen Schulen aus – sowohl innerhalb als auch zwischen Systemen für die Einteilung in Leistungsgruppen. In Ländern mit stärkerer schulischer Segregation besteht zudem ein stärkeres Gefälle bei den Testergebnissen zwischen Schulen. Das Gefälle bei den Testergebnissen halbiert sich nahezu, wenn unterschiedliche Schülermerkmale über die einzelnen Schulen hinweg berücksichtigt werden. Die verbleibenden Gefälle bei den Testergebnissen zwischen Schulen sind in Ländern mit stärker segregierten Schulen noch immer größer. Ursache hierfür dürfte eine Verteilung der Schüler sein, die auf nicht in den Daten enthaltenen Faktoren beruht. Auch ein Kausalzusammenhang zwischen der Schülerzusammensetzung und den Schulabschlüssen dürfte eine Rolle spielen.

Schulübergreifende Leistungsunterschiede werden häufig mit schulübergreifenden Qualitätsunterschieden verwechselt. Eine wichtige Erkenntnis dieses Berichts besteht darin, dass Leistungsunterschiede, die von politischem Interesse sind – wie Unterschiede der schulischen Qualität –, nur ermittelt werden können, wenn zumindest die Verteilung von Schülern nach familiärem Hintergrund und Migrationshintergrund berücksichtigt wird. Gleichzeitig ist die verbleibende Abweichung der Testergebnisse zwischen Schulen mit Vorsicht auszulegen, da sich Schüler in anderer Hinsicht unterscheiden können.

Obschon in diesem Bericht eher Korrelationen statt Kausalzusammenhänge aufgezeigt werden, werden Politikbereiche hervorgehoben, die für politische Entscheidungsträger von Belang sind, die auf die schulische Segregation einwirken wollen. Die Wohnsegregation ist ein wichtiger Politikbereich, und das insbesondere in Schulsystemen, in denen die Schüler nach Einzugsgebieten aufgenommen werden. Dessen ungeachtet ist es zumindest auf kurze Sicht schwierig, auf Wohnsegregationsmuster einzuwirken, was folglich kaum die wirksamste Maßnahme darstellen dürfte, um schulische Segregation zu bekämpfen. Stattdessen stellen die Einteilung nach Leistungsgruppen und Aufnahmerichtlinien Instrumente dar, mit denen sich die Verteilung auf Schulen beeinflussen und die wohnsitzbasierte Segregation ebenfalls indirekt umgehen lassen.

1. Introduction

School segregation is an important topic on the education policy agenda, in particular because of its potential consequences for both economic efficiency and equity. In Europe, there are substantial differences in the composition of students across schools, and the amount of segregation varies across countries. Previous studies have shown that differences across school systems, for example regarding streaming, student selection and school choice, can explain some of the variation in segregation across countries (Gorard and Smith 2004; Jenkins, Micklewright, and Schnepf 2008; OECD 2019b; Gutiérrez, Jerrim, and Torres 2020; European Commission 2020). But school segregation also mirrors residential segregation patterns, and therefore reflects many aspects of society. Economic inequality, immigration, housing policy, population density and urbanisation are factors that may affect segregation across neighbourhoods and schools.

The concept of segregation refers to separation of groups across spatial units, such as neighbourhoods or schools. School segregation thus implies that students do not meet and interact with peers from all segments of society, whether defined by ability, socioeconomic background or ethnicity. In addition to sorting across schools, sorting into classes within schools can further exacerbate segregation patterns. The consequences of school segregation on society more broadly depend on how social cohesion is affected by separating students along socioeconomic or ethnic lines and on the effects on student achievement from, for example, peer-to-peer interactions.

These topics have received a lot of academic attention – there is a large body of empirical literature that attempts to estimate the effects of peer group composition on a range of student outcomes, including student performance, and social and behavioural outcomes (see Sacerdote 2011; 2014 for overviews). It is empirically challenging to disentangle the effect of peer group characteristics from that of students' own backgrounds, and it has thus proven hard to isolate the causal effects of peer group composition. There is, however, an emerging strand of literature using experimental designs to provide credible estimates, which shows that although peer effects exist, the impact on student performance is relatively small. Instead, the effects on social and behavioural outcomes tend to be larger. Still, because of the potential consequences for student outcomes, it is important to study school segregation and to isolate the underlying mechanisms that drive sorting patterns.

School segregation is multidimensional, and students may sort into schools based on many characteristics, such as immigrant status and socioeconomic background. Some factors matter more for student performance than others, and schools can have students who are better in one respect but weaker in another, making it difficult to assess the overall consequences of student sorting. We propose using predicted test scores – where many background factors are summarised and weighted by their importance for student performance – to study school segregation between countries. It captures the expected effect of school segregation on between-school variation in test scores. At the same time, the actual impact of student sorting on school performance depends, among other things, on the magnitude and direction of any compositional effect, and on other factors or policies that can amplify or dampen its consequences.

This paper documents school segregation across Europe today, and demonstrates the extent to which Europe's different school systems and diverse demographic profiles can explain some of the variation in segregation across countries. Recent immigration trends in Europe further warrant the question of how receiving countries have been able to accommodate large numbers of school-aged migrant children in schools. Using data from the Programme for International Student Assessment (PISA) 2018, we estimate segregation by parents' education and students' migration status, as well as student sorting based on predicted test scores. Furthermore, we illustrate how much of the between-school variation in test scores can be explained by student sorting into schools.

The report is organised as follows. Section 2 presents a short summary of the theoretical and empirical literature on the effects of student composition in schools. Section 3 presents data and methodology. Section 4 documents school segregation patterns in Europe for both separate factors and predicted test scores. Section 5 investigates a number of different explanations for the observed cross-country differences in school segregation. Section 6 analyses test score differences across schools, and to what extent they can be explained by school segregation. Finally, section 7 offers conclusions.

2. Theory and earlier evidence

Student sorting into schools, and into classes within schools, may affect student outcomes in several ways. The type of sorting may also have diverse consequences for outcomes. Socioeconomic segregation implies differences in students' opportunities and family background across schools, but because of its close link to student performance it also implies some degree of segregation by ability. Some school systems nonetheless explicitly use ability-based sorting into alternate classes within schools, which might affect student outcomes differently from segregation across schools. In this section, we present an overview of the theoretical and empirical literature on the consequences of student sorting, focusing on studies that have been able to credibly establish causal links between student composition and outcomes.[1]

First, peer group composition at a school (or in a class) may impact student performance through direct peer-to-peer spillovers (peer effects) (Sacerdote 2011; 2014). There are several theoretical models of peer group effects, but they typically assume that high-performing students can boost the performance of other students. This implies that mixing students with varying abilities can reduce performance gaps between students and schools. Other models of peer group effects assume that in particular low-performing students are favoured by being exposed to high-performing peers. Then, the overall level of student performance may be improved by reallocating students between schools. Integrating students with a range of abilities can therefore have very different consequences for equity and efficiency, depending on the nature of peer effects (Sacerdote 2011).

Second, the effects of peer group composition also depend on how teachers (and students) respond to the characteristics of the student body. If teachers target their

[1] We emphasise that this is not a complete literature review, but rather a selection of studies that aim to illustrate the different branches of the literature.

level of instruction at, e.g. the median student in the group, a mixed group implies that the instruction level is too high for some and too low for others. In a streamed or ability-segregated group, teaching to the median student will suit a larger portion of the class (Duflo, Dupas, and Kremer 2011). Since it is reasonable to assume that students learn more if the level of instruction is closer to their own ability level, the potential advantages of putting high-performing and low-performing students in the same group may be offset by the negative effects of having more students taught at a level that is too advanced or too basic. Hence, the consequences of ability segregation for the level and distribution of student performance is theoretically ambiguous.

Empirically, there is some evidence in support of the notion that the benefits of a mixed peer group can be offset by targeted instruction. Duflo, Dupas, and Kremer (2011) use a randomised controlled trial in Kenya to study how mixed-ability vs streamed classes perform and find that students of all abilities perform better in streamed classes, which is explained by the efficiency of teaching at the right level. In a different context, Carrell, Sacerdote, and West (2013) show that student interactions are affected by the peer group composition: in a mixed group, low-achievers benefit from interacting with high-achievers. Nevertheless, designing groups to maximise low-performing students' exposure to high-ability peers failed, since they led to segregation between ability groups within the class, where low performers could not benefit from interactions with their high-performing peers.

Teachers might also respond to student characteristics by leaving schools with low-performing or disadvantaged students, and move to schools with high-achieving students (Karbownik 2020). Such mobility patterns may cause higher turnover rates in low-performing schools and imply that the weakest students are taught by inexperienced teachers. Additionally, segregation in neighbourhoods and schools can lead to so-called white flight when the minority share reaches a 'tipping point', which further exacerbates segregation (Card, Mas, and Rothstein 2008; Gerdes 2013; Böhlmark and Willén 2020).

Third, peer group composition can affect important non-scholastic outcomes. Sacerdote (2011) argues that the evidence points to relatively small peer effects on student achievement, but that the effects on social and behavioural outcomes are substantial. To illustrate, Billings, Deming, and Rockoff (2014) find that the withdrawal of a de-segregation programme in a US county led to significant increases in school segregation, which in turn increased crime among black students.

Finally, student sorting by socioeconomic or migration status implies that young people of disparate backgrounds have fewer opportunities to meet. Exposure to minorities or to other socioeconomic groups may affect value formation, and therefore have consequences for social cohesion (Levin, 1998). Rao (2019) shows that rich students in Delhi schools who are exposed to poorer peers become more generous and increase their willingness to interact with the poor. Merlino, Steinhardt, and Wren-Lewis (2019) show that exposure to black school peers increases the likelihood that white US students form interracial romantic relationships later in life, which can be interpreted as a change of attitudes. A meta-study by Paluck, Green, and Green (2018) summarises recent studies that estimate causal effects of minority group exposure, and finds that there is

some support for the idea that exposure leads to more positive perceptions and more frequent interactions with the minority group.

To sum up, student sorting can have both positive and negative consequences. While ability grouping within schools may result in efficient teaching, socioeconomic or ethnic segregation across schools raises equity concerns and may also have undesired effects when it comes to fostering inclusive values. One aspect about which we yet know very little is how the sorting of immigrant students affects their educational outcomes and integration in the host country. While integrated schools are probably better for developing language and host-country skills, segregation could in theory provide an efficient learning environment with possibilities to provide instruction in students' mother tongue and teaching adapted to migrant students' previous educational experiences.[2]

3. Data and method

We use data from PISA 2018 to study school segregation and performance differences between schools. PISA is an international survey that assesses 15-year-old students' achievement in reading, mathematics and science. The study was initially conducted by the OECD in 2000 and has since been repeated every third year. In each wave, a stratified random sample of about 150 schools is drawn from each country, and a random sample of 35 students is selected within each school.[3] The PISA 2018 study covers more than 600,000 students in 79 countries, including all EU member states.[4]

Students are assessed from a two-hour test in a range of subjects. The test includes both multiple-choice items and questions requiring students to construct their own responses. The final test scores (plausible values) are scaled based on item-response theory. The design of the study ensures that the test scores are comparable across countries and over time. The students also answer questions about various aspects of their home, family and school background. In addition, school representatives fill out questionnaires on organisational issues and educational provision in schools.

Student background

In this report, we propose using school differences in predicted test scores – where many background factors are summarised and weighted by their importance for student performance – to study school segregation between countries. We also study school segregation by two of its main underlying components: parental education and immigrant status. Parental education is reported in the student questionnaire and builds on the ISCED 1997 classification scheme. We take the average of both parents' highest

[2] See Brunello and De Paola (2017) for an overview of the literature on the effects of immigration on students born in the host country and immigrant students. As is evident from their overview, most papers study the effects of immigrants on students in the host country.

[3] We use the student weights to account for the sampling structure in PISA and, thus, make the estimates representative of all students in the participating countries.

[4] Public-use data for Cyprus have not been released, why they are not included in the report.

level of education. Immigrant students are defined as those who are born outside the country of assessment and whose parents are also born in another country.

Predicted test scores

We use predicted test scores to measure overall school segregation. Predicted test scores combine various student background characteristics into a common metric. The underlying items are weighted by how strongly they are related to student test scores in different countries. Since the background variables are scaled against an absolute measure of student performance, the predicted values are comparable across countries. This allows us to assess international differences in school segregation in the dimensions that matter most for student performance.

In practice, we construct students' predicted test scores in two steps. In the first step, we estimate the following model for individual *i*, in school *s*, in country *c*:

$$Y_{isc} = \delta_{sc} + \boldsymbol{X_{isc}}\boldsymbol{\beta_c} + \upsilon_{isc}, \quad (1)$$

where Y_{isc} are test scores, δ_{sc} are school-by-country fixed effects, $\boldsymbol{X_{isc}}$ is a vector of student background characteristics, $\boldsymbol{\beta_c}$ is a vector with country-specific slope coefficients and υ_{isc} is a residual. The background characteristics are collected from the student questionnaire and include the following: gender, month of birth, immigrant status, age at immigration, mother's and father's highest educational level, mother's and father's occupation, years of preschool attendance, age at school start and a number of variables on home possessions (such as the number of books and television sets at home). We use the average of the test scores in reading, mathematics and science to measure student performance, since school gaps in achievement typically do to not differ much between subjects (Brunner et al. 2018).[5]

In the second step, we calculate predicted test scores by multiplying the estimated country-specific slope coefficients with the student background variables:

$$\hat{Y}_{isc} = \boldsymbol{X_{isc}}\widehat{\boldsymbol{\beta}}_{\boldsymbol{c}}. \quad (2)$$

The prediction procedure has two important features. First, we allow the slope coefficients, $\boldsymbol{\beta_c}$, to vary between countries, to account for any differences in the explanatory power of variables across contexts. Parental education may for instance be more highly correlated with student performance in some countries than in others, perhaps because parents are more strongly sorted by academic ability to different levels of education, or because the causal effect of education on children's performance is larger. In addition, the extent of measurement errors may vary across countries, for example if students find it harder to determine their parents' education level in some contexts than in others. Even if the measurement errors are completely random, they tend to attenuate the predictive values of variables. Allowing for country-specific slopes generates an index of predicted test scores that gives more weight to items that matter

[5] We use the first plausible value for each subject.

more for student performance – and are better measured – in the country were the test scores are observed.

Second, the model includes school fixed effects, α_{sc}, which implies that the predictive value of various survey items is estimated by comparing test scores across students in the same school. The school fixed effects account for any correlation between (observed) student characteristics and (unobserved) school quality, which may arise if students sort into schools based on school quality. Without school fixed effects, there is a risk that the predicted values will also pick up differences in school quality between students. Thus, to obtain a measure of student background that is itself not affected by school segregation it is essential to only exploit variation in test scores within schools.[6]

Other studies have used the PISA index of students' economic, social and cultural status (ECSC) or similar metrics to assess school segregation (Gorard and Smith 2004; Jenkins, Micklewright, and Schnepf 2008; Gutiérrez, Jerrim, and Torres 2020). The ECSC index is based on three variables related to family background: parents' highest level of education, parents' highest occupational status and home possessions. The variables are standardised for all students in the participating countries and the index is computed by taking the average of the three components. In comparison with the PISA socioeconomic index, our measure of predicted test scores exploits all the variation in the underlying items and allows them to have different weights in each country. Importantly, we include variables not incorporated in the PISA index, such as immigrant background, gender, month of birth, preschool attendance and age at school start. As a result, the predicted test scores can explain more than half of the variation in actual student test scores (R^2 = 0.54), which is more than twice as much as for the PISA index (R^2 = 0.25).

Selection-adjusted school performance measures

We describe performance differences between schools both with and without attempting to adjust for student selection. Since segregation alters the student composition across schools it is likely to also affect the performance gap between schools. To account for some of the student sorting, we condition on the same factors as when we form the index of predicted test scores. In particular, we use the estimates from model (1) to net out observed student characteristics:[7]

$$\hat{Y}_{isc}^{adj.} = (Y_{isc} - \boldsymbol{X_{isc}}\widehat{\boldsymbol{\beta}}_{\boldsymbol{c}}). \quad (3)$$

The adjusted measure of student performance controls for differences in observed student characteristics, but it is unlikely to account for all factors that affect both student sorting and performance. As a minimum, we would also like to take lagged student

[6] See Chetty et al. (2014) for a similar discussion on the need to control for teacher fixed effects when adjusting teacher value-added estimates for the effect of student characteristics.

[7] In the regressions, we only control for students' own background characteristics. It is possible to also adjust for differences in the student body across schools, such as the share of foreign-born students or the average parental education at the school. However, such controls would also remove any compositional effects caused by school segregation. We therefore refrain from using school-level controls when attempting to correct the estimates for student selection.

performance into account, e.g. test scores at school start, but such information is lacking in PISA and most other international assessments. Therefore, the selection-corrected estimates of performance gaps between schools should not be interpreted as differences in school quality, but rather as the differences in school results for students with similar observed characteristics.

Intraclass correlation

We use the intraclass correlation to measure school segregation and performance differences between schools. It describes how closely students in the same school resemble each other, and can be defined in terms of a random effects model:

$$Y_{isc} = \mu_c + \alpha_{sc} + \varepsilon_{isc}, \quad (4)$$

where μ_c is the overall mean, α_{sc} is a random school effect and ε_{isc} is a residual. The intraclass correlation (ICC) for country *c* is calculated as the ratio of the between-school variation to the total variation:

$$ICC_c = \frac{\sigma_{\alpha c}}{\sigma_{\alpha c}+\sigma_{\varepsilon c}}, \quad (5)$$

where $\sigma_{\alpha c}$ is the between-school variance and $\sigma_{\varepsilon c}$ the within-school variance. The intraclass correlation thus shows the share of the total variance that can be attributed to the variance of the school effects. The higher the intraclass correlation, the more the variation in outcomes can be explained by differences between schools.

An advantage of using intraclass correlation to assess school segregation and performance differences between schools is that it does not impose any restrictions on the level of measurement of the outcome variable of interest. This is convenient when studying continuous variables, such as parental education or predicted test scores. Most dissimilarity indices, on the other hand, are restricted to dichotomous outcomes, which requires a more or less arbitrary split of continuous variables into two groups and thereby ignoring the within-group variation in the data. Dissimilarity indices have also been shown to be sensitive to both the size of the smallest group, e.g. number of immigrants, and the size of the units, e.g. the number of students at the schools (Carrington and Troske 1997).[8] Because segregation indices can be sensitive to low proportions of minority groups, we only present measures of immigrant segregation for countries with shares of immigrant students of at least 1%.

4. School segregation in Europe

Previous research on school segregation in Europe has typically focused on immigrants, or used measures of socioeconomic status (parental occupation or PISA's socioeconomic index) (Gorard and Smith 2004; Jenkins, Micklewright and Schnepf 2008; Brunello and De Paola 2017; Gutiérrez, Jerrim and Torres 2020). Our main contribution is to study

[8] When we split our continuous variables into dichotomous categories (by the median) and use the index of dissimilarity to study school segregation, we obtain results that are very close to those obtained with the intraclass correlation.

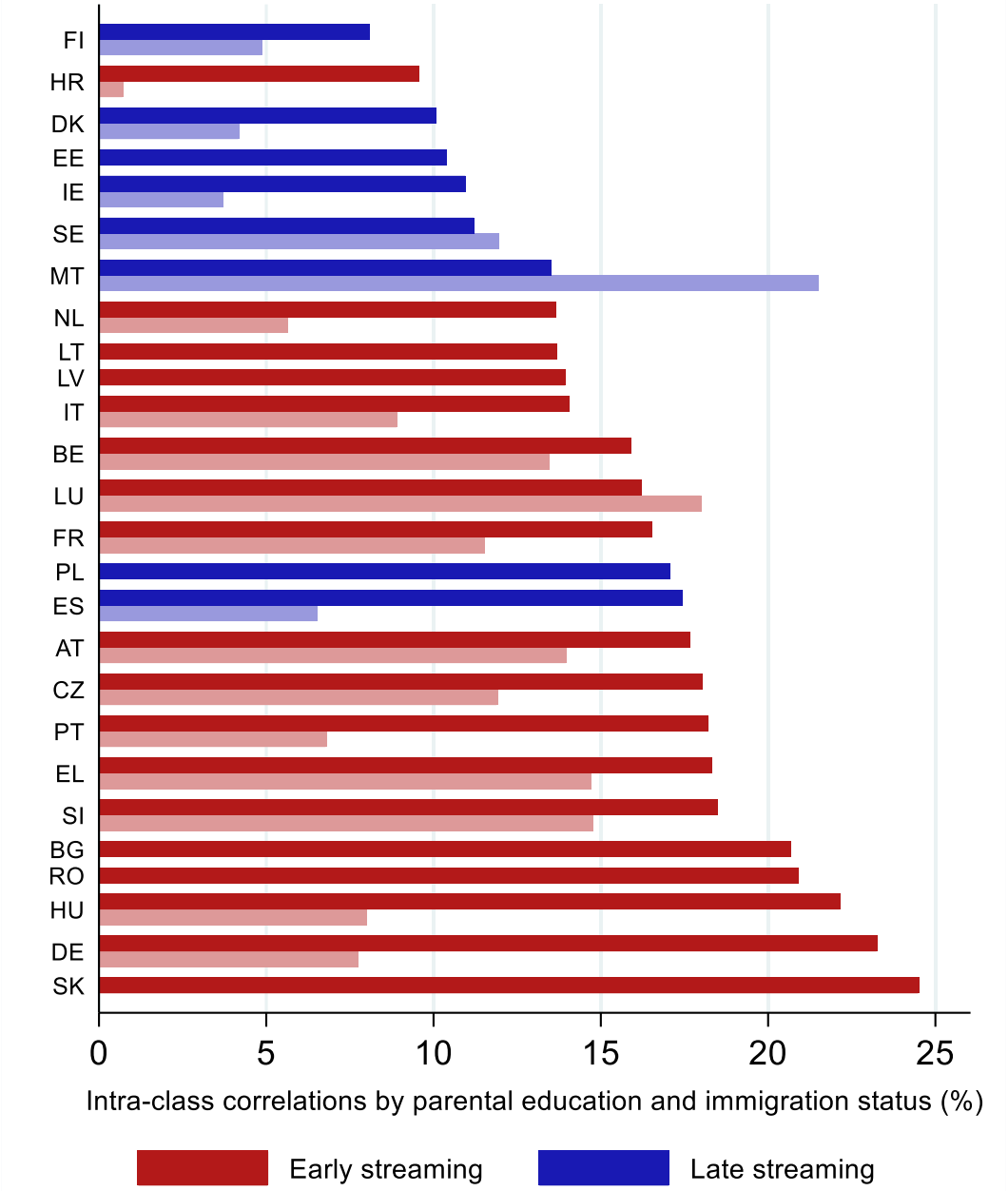
segregation using the intraclass correlation in predicted test scores, but we begin by presenting patterns of school segregation by parental education and immigration status.

When comparing school differences in student composition and test scores across countries it is important to stress that institutional features of school systems can give rise to some 'mechanical' divergences in segregation across countries. PISA samples 15-year-old students, and in 'early-streaming' countries (such as Germany and most of southern Europe) students at this age are divided into streams with alternative educational content (academic vs vocational), while in 'late-streaming' countries (primarily the Nordic countries) students are still in a comprehensive system. Since student performance is correlated with socioeconomic background, streaming will imply variations not only in achievement across schools, but also in students' family background. As such, comparisons of school segregation are best made within groups of countries that have similar streaming policies. To facilitate such comparisons, we colour code the figures such that red countries are early-streaming countries, where streaming takes place before age 16 (i.e. before the PISA assessment) and blue countries are late-streaming countries where streaming starts at age 16.[9] Note that we only distinguish between school systems that stream between schools; we do not consider within-school streaming into differing classes in our definition.

Figure 1 presents intraclass correlations with respect to parental education (dark shades) and immigration status (light shades), respectively. For countries where the share of immigrant students is less than 1%, we abstain from presenting estimates of segregation, as they can be sensitive to low proportions of minorities. We observe a clear pattern of lower segregation in late-streaming countries compared with early-streaming countries. Within the group of early-streaming countries, segregation by parental education is particularly high in some Eastern European countries, such as Hungary, Slovakia and Romania. Germany also exhibits a high degree of segregation.

[9] We define late-streaming countries as those that do not separate students before age 16 (OECD 2016) and have at least 90% of normal-aged students in the same stream in PISA 2018. We split the analysis by streaming before age 16, but segregation may be more extensive the earlier streaming takes place, as the correlation between socioeconomic segregation and performance differences can be higher.

Figure 1. School segregation by parental education and immigration status in EU

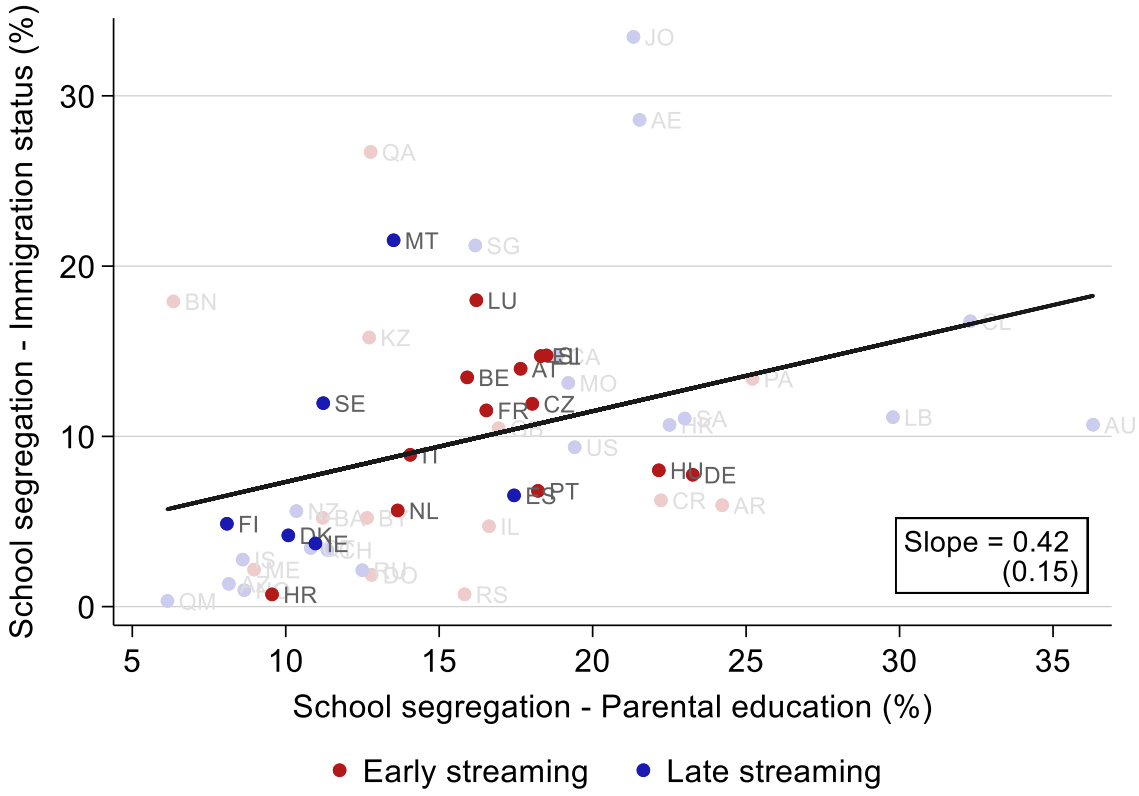


Note: The figure shows the between-school variation (intraclass correlation) with respect to average parental education (dark shades) and immigration status (light shades) in EU member countries. Countries have been sorted by the between-school variation in parental education. The red bars show countries where students are streamed before age 16 (early streaming), while the blue bars represent countries with a comprehensive school system at age 15 (late streaming). School segregation with respect to immigration status is not presented for countries where the share of immigrant students is less than 1%. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

As shown in the figure, segregation by parental education and immigration status do not follow the same pattern, and capture various dimensions of segregation. To study this more formally, Figure 2 plots school segregation by parental education against segregation by immigrant status along with the estimated slope coefficient. Light-shaded circles represent non-EU countries in the PISA data, which we use as a point of comparison.[10] Although there is a clear positive correlation between the two measures of segregation, the slope coefficient is only 0.42, which means that the selection processes for schools are quite different for parental education and immigration status.

Figure 2. School segregation by parental education and immigration status in selected EU countries



Note: The figure shows the relationship between school segregation by parental education (horizontal axis) and school segregation by immigration status (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of the intraclass correlation in immigration status on the intraclass correlation in parental education. The regression is based on all data points, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. The figure is restricted to countries where the share of immigrant students is 1% or higher. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

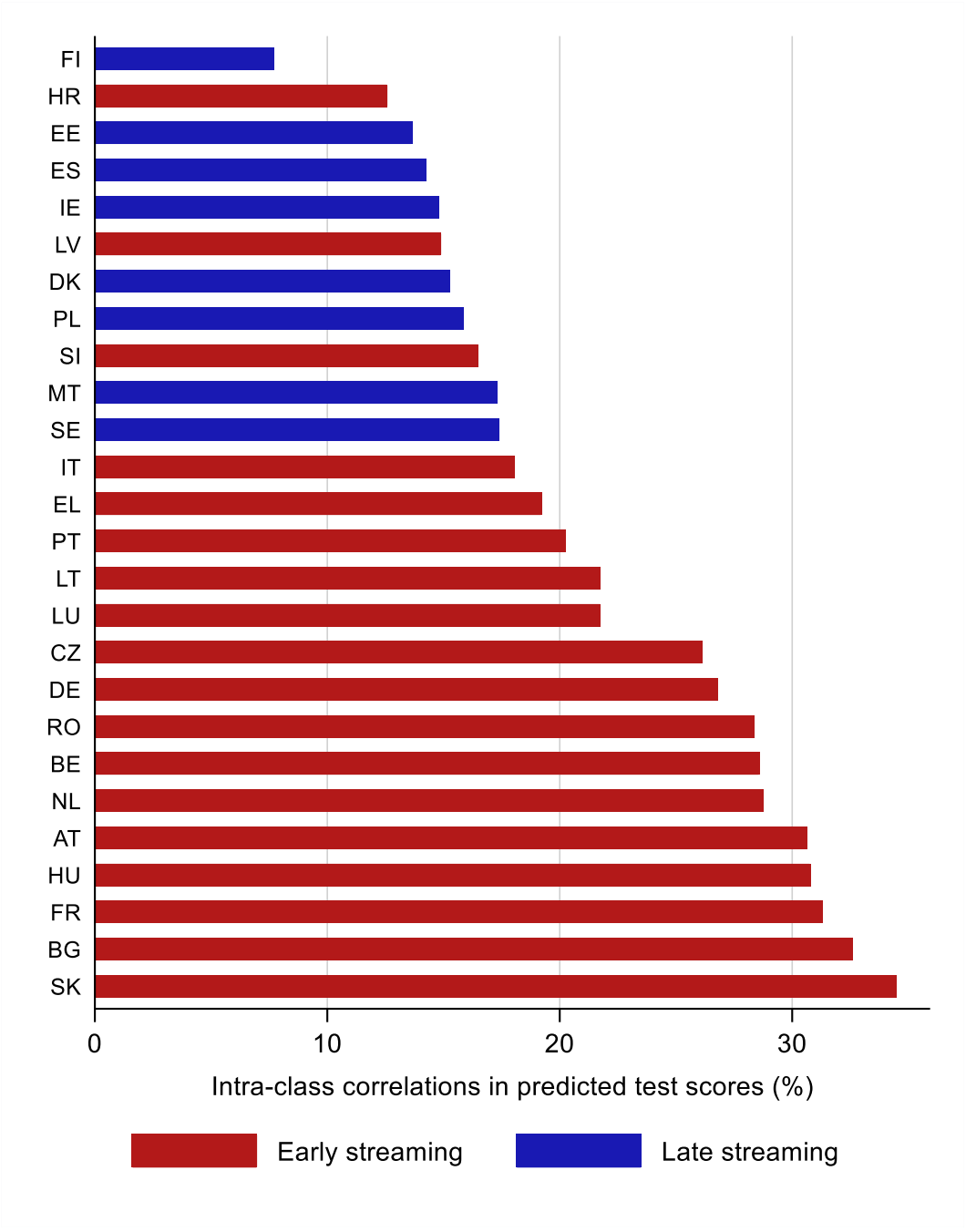
[10] The slope coefficients have been estimated for all countries shown in the figure.

Next, in Figure 3 we present school segregation using predicted test scores. Finland has the lowest level of segregation: 8% of the total variation in the predicted test score can be attributed to between-school variation. Other late-streaming countries have slightly higher levels, with the highest among this group observed in Sweden and Malta, which at 17%, have levels similar to some early-streaming countries, such as Slovenia and Italy. Several of the early-streaming central and Eastern European countries have intraclass correlations above 25%, indicating that more than a quarter of the total variation in predicted test scores is between schools. The streaming regime is thus an important determinant of school segregation, which is in line with the earlier evidence (Jenkins, Micklewright, and Schnepf 2008; OECD 2019a).[11] This is true when we study both segregation by parental education and segregation in predicted test scores.

Even though streaming is important for explaining school segregation, we also observe relatively large differences in segregation between countries with similar streaming systems. Among late-streaming countries, Sweden's intraclass correlation is double that of Finland, and Slovakia's level of segregation is more than two times that of Croatia among the early-streaming countries. In the next section, we explore some institutional and demographic divergences across countries in order to understand the extent to which they contribute to (or correlate with) school segregation.

[11] As discussed above, we use a summary measure of student background that is much more strongly related to student test scores than for example PISA's socioeconomic index. Figure A1 shows the relation between the intraclass correlation using predicted test scores and the corresponding differences between schools with respect to PISA's index. For most EU countries, the measures overlap well, but there is a group of countries, including in particular the Netherlands, Austria, Belgium and France, which exhibits much higher levels of school segregation using predicted test scores. This indicates that students in these countries are sorted into schools along dimensions not captured by the PISA index.

Figure 3. School segregation by predicted test scores in EU countries



Note: The figure shows between-school variation (intraclass correlation) in predicted test scores in EU member countries. Countries have been sorted by the between-school variation in predicted test scores. The red bars show countries where students are streamed before age 16 (early streaming), while the blue bars represent countries with a comprehensive school system at age 15 (late streaming). Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

5. Potential explanations for differences in school segregation

Jenkins, Micklewright, and Schnepf (2008) discuss the underlying factors that explain school segregation and summarise them under three categories: 1) school choice, 2) schools' selection of students and 3) residential segregation.[12] While the first two categories are distinct aspects of the school system, residential segregation could be the result of, e.g. population density, income inequality, immigration and housing policies. In this section we study relationships between school segregation and features of the school system, but also investigate how much school segregation correlates with demographics and inequality. The relationships are purely descriptive and cannot be used to draw conclusions about causal mechanisms.

We first consider the implications of school choice. Previous research has shown that reforms on school choices tend to increase segregation in the school system. Hsieh and Urquiola (2006) study a choice and voucher reform in Chile that increased the private school market share and enrolment in private schools. They find that the reform led to increased student sorting across schools, as the high-achieving students changed from the public to the private sector. Similarly, a reform on choice in Sweden increased the possibilities to attend independent schools, and to choose between public schools. This reform also resulted in higher school segregation (Holmlund et al. 2014; Böhlmark, Holmlund, and Lindahl 2016). The growth of privately owned church schools in Hungary has also increased social selection of schools (Radó 2019).

Choice tends to exacerbate segregation because parents from different socioeconomic groups have different preferences. While all parents value proximity to the school, high socioeconomic status (high SES) parents tend to put less emphasis on proximity (Ruijs and Oosterbeek 2019; MacLeod and Urquiola 2019). Instead, high SES parents tend to value school quality and/or peer composition more (Hastings, Kane, and Staiger, 2009; Burgess et al. 2015; Ruijs and Oosterbeek 2019).

We analyse the relationship between school choice and segregation using two indicators of the degree of school choice in selected countries. We first explore information in PISA's school questionnaire on whether student admissions are based on catchment areas (or other residence-based admission).[13] Next, we focus on the prevalence of private schooling across countries.

Figure 4 displays school segregation (on the y-axis) over the percentage of school admissions based on catchment areas (x-axis). We see that within various streaming regimes, there is variation in the degree of choice. Denmark, Ireland, Sweden and Malta have relatively high levels of choice, compared with other late-streaming countries. Among early streamers, there is notably wide variation in the amount of choice. We find that countries with less school choice also have lower school segregation, but the

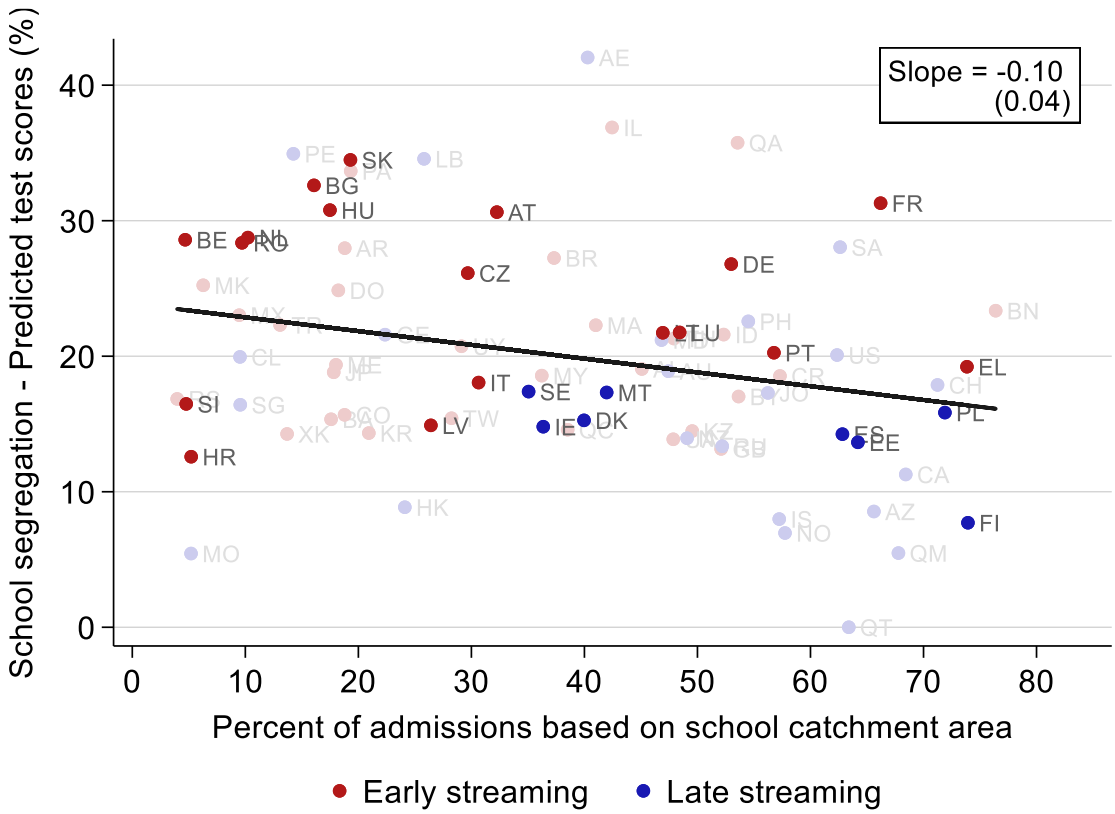
[12] Note that schools' selection of students should be interpreted broadly, and includes both selection on ability and parental background, as well as discrimination towards specific groups.

[13] We define admission as being based on catchment areas if schools report that admissions are always based on residence.

relationship is relatively weak. An increase of 10 percentage points in the share of residence-based school admissions is associated with a 1 percentage point fall in intraclass correlation, or 5% evaluated at the average intraclass correlation in the sample.

Figure 5 presents the relationship between the share of students in private schools and school segregation. Although there is a weak positive relationship, it is not statistically significant.

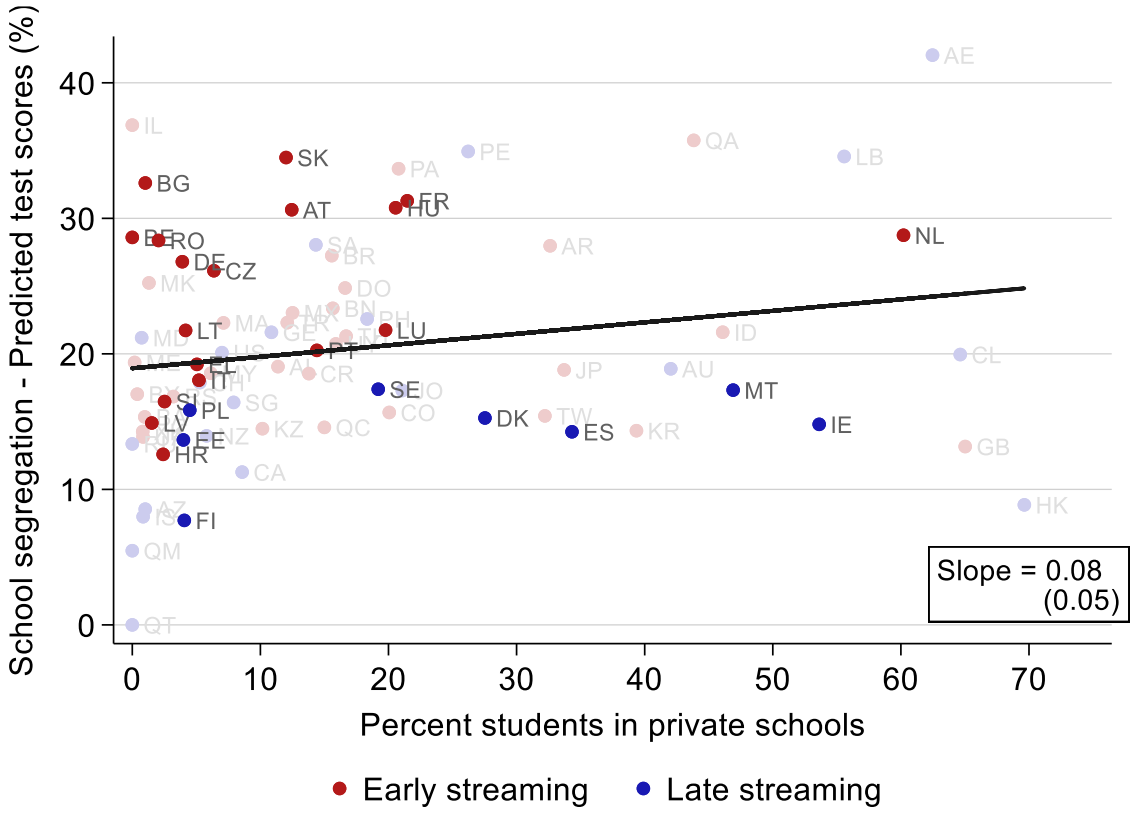
Figure 4. School segregation and share of admissions based on catchment areas



Note: The figure shows the relationship between the percentage of admissions based on catchment areas (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on the percentage of admissions based on catchment areas, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the top right. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Figure 5. School segregation and share of students in private schools



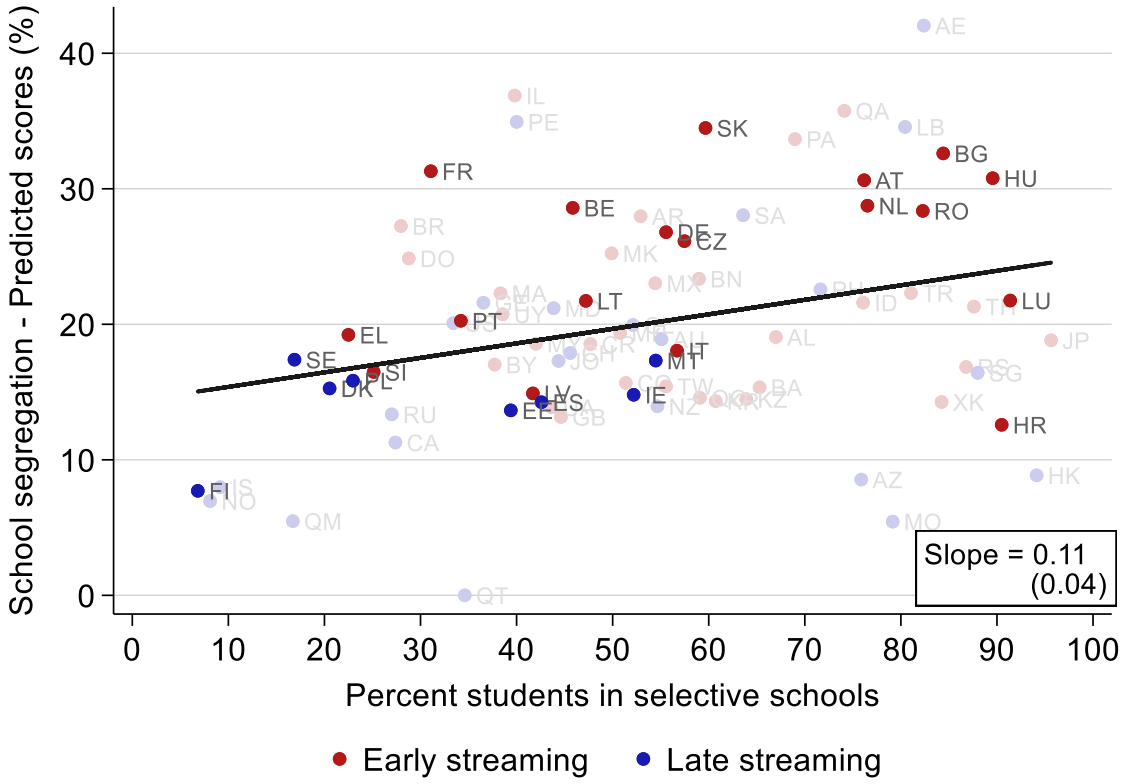
Note: The figure shows the relationship between the percentage of students in private schools (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late racking). The black line shows the slope coefficient from a country-level regression of school segregation on the percentage of students in private schools, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Next, we investigate to what extent school selectivity can explain school segregation. While early streaming is one aspect of selectivity, schools' selection of students (within streaming systems) is another, which has previously been shown to correlate with school segregation (Jenkins, Micklewright, and Schnepf 2008).

Figure 6 presents school segregation over the percentage of students in selective schools, which are defined as schools that select on previous test scores and/or preference linked to a family member of the student. As is evident from the graph, late-streaming EU countries are typically also non-selective. Among early-streaming countries, some are highly selective (such as the Netherlands, Hungary and Croatia) while Greece and Slovenia are some of the least selective of all EU countries. Within the group of early-streaming countries we also find that despite wide variations in selectivity, many exhibit similar degrees of segregation. We find a positive and statistically significant association between school selectivity and school segregation: an increase of 10 percentage points in the share of students attending selective schools is associated with a rise of 1.1 percentage points in school segregation, or 3% evaluated at the average level of segregation.

Figure 6. School segregation and school selectivity



Note: The figure shows the relationship between the percentage of students in selective schools (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in a darker shade refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on the percentage of students in selective schools, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

School segregation is closely linked to the residential locations of parents from differing socioeconomic backgrounds.[14] Since we lack comparable cross-country data on residential segregation, we cannot explicitly study the relationship between residential and school segregation. Instead, we focus on a number of alternative variables that characterise countries in terms of population demographics and inequality. We use data from the World Bank on population density (people per m^2 of land area), share of population living in urban areas and the Gini coefficient of income inequality (World Bank 2021).[15] We also study the relationship between school segregation and the share of immigrant students.

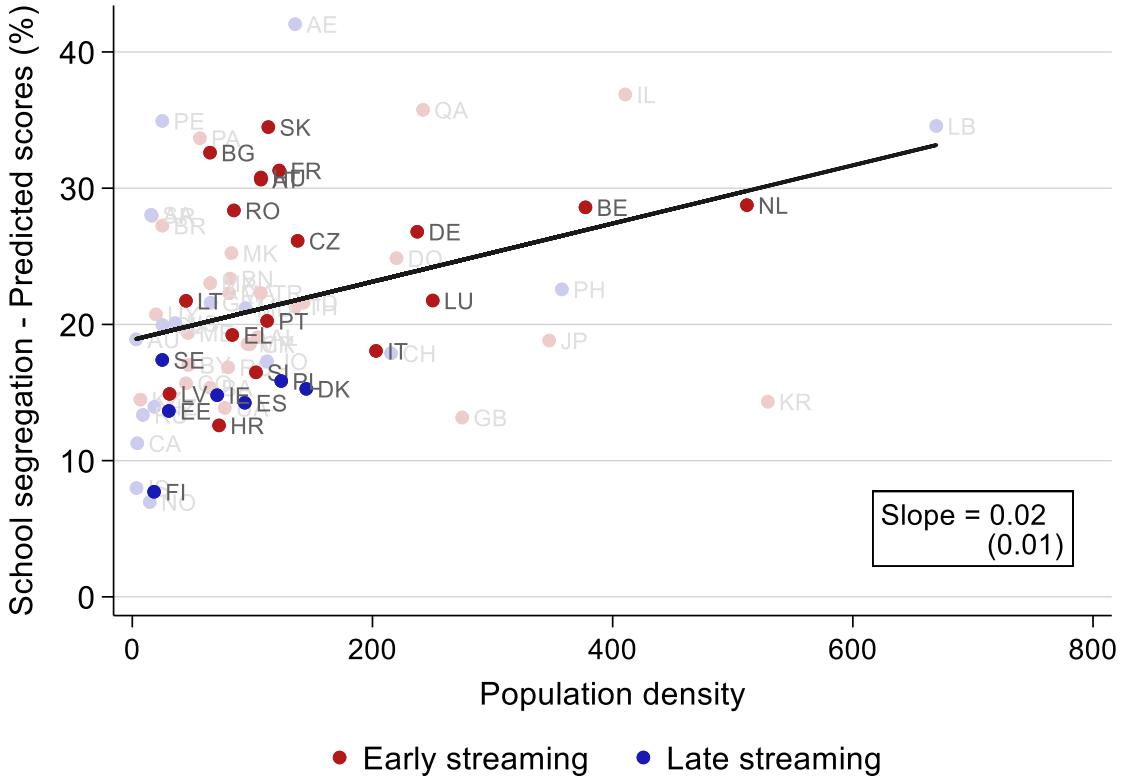
Population density is an interesting dimension because it is likely to imply a larger number of schools within commuting distance, which may allow for more sorting between schools. This hypothesis is supported by the results of Burgess, Wilson, and Lupton (2005), who study school segregation across school districts in England and find that the ratio of school-to-neighbourhood segregation increases with the population density of the area. The authors' interpretation of the result is that greater population density allows for more school choice, and that this in turn is associated with higher segregation. Figure 7 presents school segregation in relation to population density. We find a positive relationship between population density and school segregation, which holds also if highly dense countries (>350 people per m^2 of land area) are excluded from the analysis.

Figure 8 shows school segregation and the share of the population living in urban areas. Despite urban areas being likely to allow for more segregation through higher population density and a larger number of schools within commuting distance, there is no relationship between this variable and school segregation.

[14] See e.g. Jenkins, Micklewright, and Schnepf (2008); Frankenberg (2013); Böhlmark, Holmlund, and Lindahl (2016) for studies on this relationship.

[15] We use data for 2018 if available and substitute with earlier years if missing.

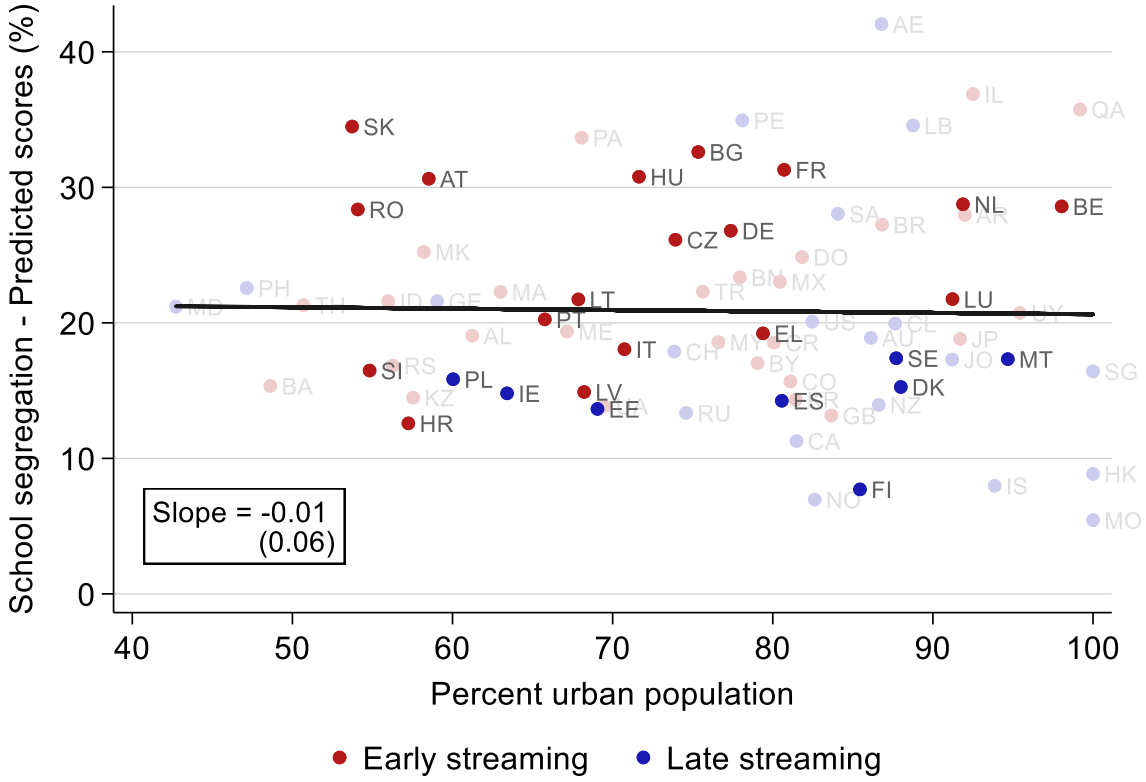
Figure 7. School segregation and population density in selected EU countries



Note: The figure shows the relationship between population density (number of people per m^2 of land area) (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on population density, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. For expositional purposes, Malta is excluded from the figure (Malta has a very high population density of 1500). Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Figure 8. School segregation and the share of urban population



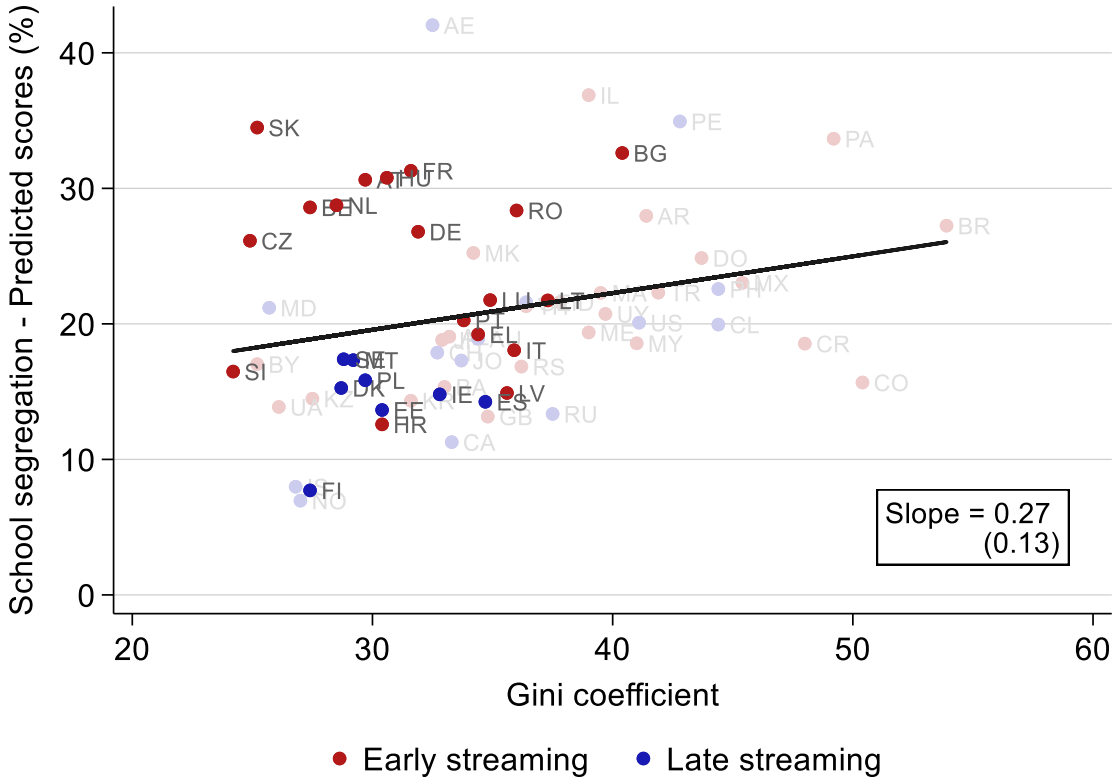
Note: The figure shows the relationship between the share of urban population (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on the percentage of urban population, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom left. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Since earlier research has demonstrated that there is a link between inequality and segregation, we next turn our attention to income inequality. Massey (1990) argues that rising economic inequality exacerbates existing residential segregation between blacks and whites in the US, and creates neighbourhoods with high concentrations of poverty. Reardon and Bischoff (2011) study changes in income inequality in US metropolitan areas between 1970 and 2000 and show that they are associated with changes in residential income segregation. In a recent study, Tammaru et al. (2020) study residential segregation in eight European cities and find that increasing income inequality is associated with increased residential segregation 10 years later. Furthermore, our study of income inequality is also motivated by our focus on predicted test scores. Countries with high levels of income inequality are also likely to exhibit a high degree of inequality in terms of students' family backgrounds, e.g. through unequal education distributions. Lower inequality is instead linked to a compressed distribution of predicted test scores, which may lead to smaller differences across schools.

Figure 9 shows a positive relationship between the Gini coefficient and school segregation across all countries, indicating that higher income inequality is associated with more student sorting into schools. However, when we estimate the relationship only within the group of EU countries (not shown in the figure), there is no significant relationship. Although previous studies have found that income inequality and segregation are related, this link does not appear to be present when we study school segregation in Europe.

Figure 9. School segregation and income inequality



Note: The figure shows the relationship between the Gini coefficient of income inequality (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on the Gini coefficient, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Finally, we turn to the composition of students in terms of immigration status. The size of the immigrant population varies widely across European countries, and these differences were further emphasised during the refugee crisis in 2015, when many school-aged refugees arrived in Europe. Immigrant families typically have fewer economic resources and lower social capital (Dustmann and Frattini 2011), which might limit their choices on the housing market in their host country. Immigration can also

lead to reactions among the resident population, who may move out of neighbourhoods (or schools) in response to rising immigrant concentration (Card, Mas, and Rothstein 2008; Gerdes 2013; Böhlmark and Willén 2020). To shed light on the possible link between immigration and school segregation, we present school segregation over the percentage of immigrant students in two dimensions: predicted test scores and immigration status.

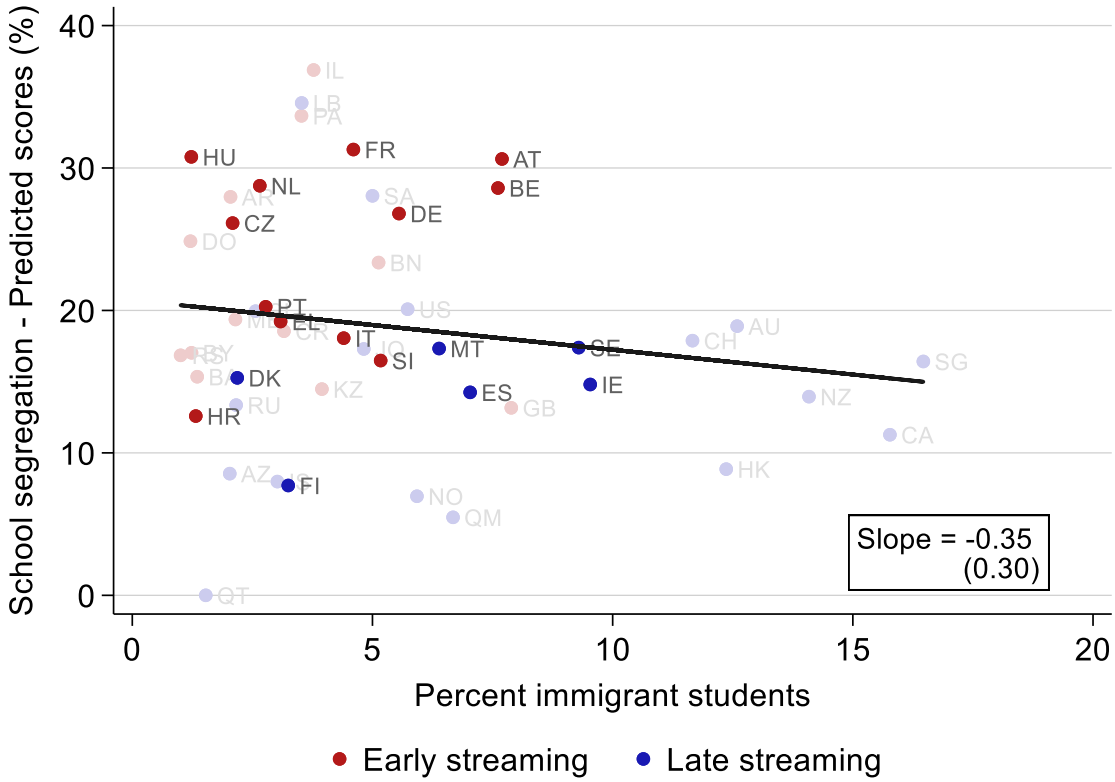
Figure 10 shows that segregation in predicted test scores is unrelated to the share of immigrant students.[16] Figure 11 instead finds a positive relationship between the share of immigrant students and school segregation with respect to immigrant status, but the estimate is not significant if estimated only on the sample of EU countries (not shown in the figure). Nevertheless, the figure reveals that there is a group of countries with low immigrant shares (e.g. Hungary, Croatia, Czechia, Denmark, the Netherlands, Finland and Portugal) that also exhibits low immigrant school segregation, while countries with larger immigrant populations typically have higher levels of segregation.

The correlations between school segregation and the share of immigrant students differ from those previously presented in, e.g. Brunello and De Paola (2017), who find that a higher share of immigrant students is associated with a more equal distribution of immigrant students across schools. We therefore emphasise that the exact nature of the relationship between segregation and immigrant shares is unclear, since it is sensitive to the choice of segregation measure, and because segregation indices do not always perform well when group shares or units are small. The relationship may in fact be non-linear, which may explain why the linear estimates differ across studies.

To sum up, our analyses show that streaming, school choice and school selectivity are related to school segregation. Just as previous studies have shown, these institutional features of school systems are important for understanding cross-country differences in segregation. That being stated, we highlight that school segregation is multidimensional and sorting by parental education does not necessarily show the same patterns as sorting by immigrant background. As such, there are different processes leading to these two types of segregation. Therefore, we propose using predicted test scores to assess school segregation. It is a measure that encompasses a wide variety of characteristics that are important for children's scholastic outcomes and enables us to compare segregation across countries using a common metric.

[16] The share of immigrant students refers to the share observed in the PISA data, i.e. the share among 15-year-old students.

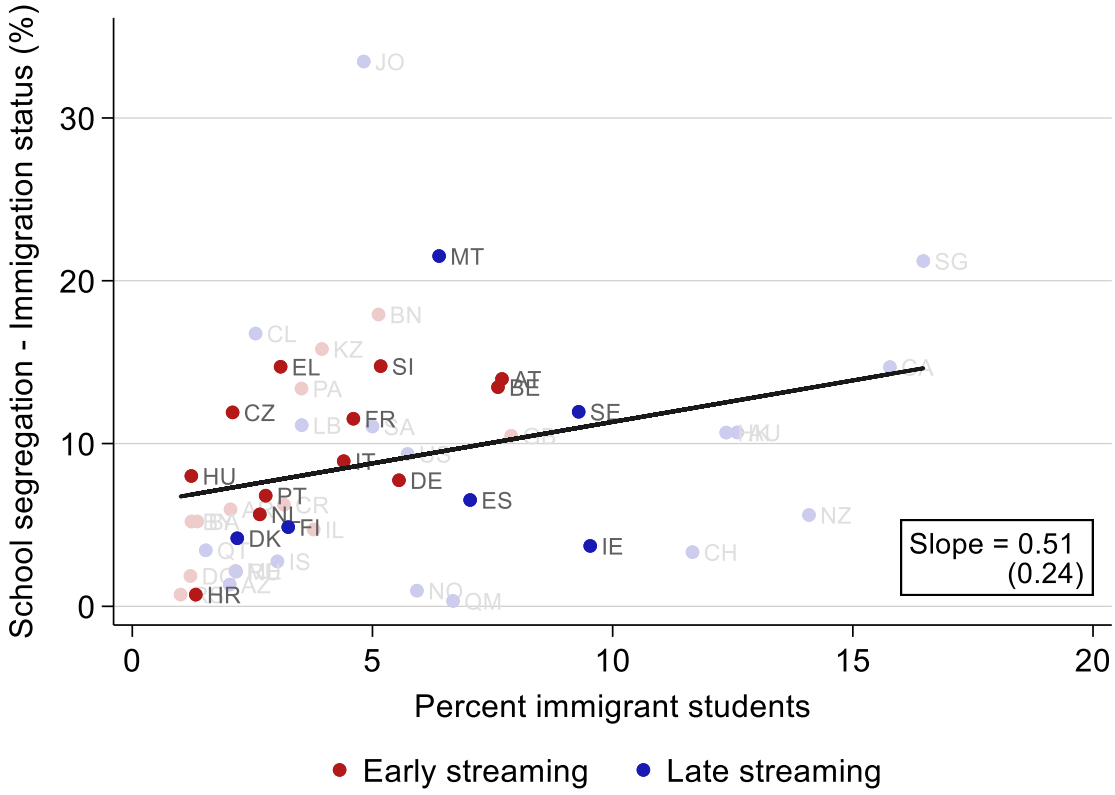
Figure 10. School segregation and percentage of immigrant students in selected EU countries



Note: The figure shows the relationship between the percentage of immigrant students (horizontal axis) and school segregation (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation on the percentage of immigrant students, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. The figure is restricted to countries where the share of immigrant students is 1% or higher. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Figure 11. School segregation by immigrant status and percentage of immigrant students in selected EU countries



Note: The figure shows the relationship between the percentage of immigrant students (horizontal axis) and school segregation by immigration status (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of school segregation by immigration status on the percentage of immigrant students, where all countries have been given equal weight. The slope coefficient and its standard error are displayed on the bottom right. The figure is restricted to countries where the share of immigrant students is 1% or higher. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

6. Performance differences across schools

This section documents associations between school segregation and differences in test scores between schools. School segregation may feed into uneven performance between schools through many different channels, which, broadly speaking, can be characterised as being either selection or causation. Student sorting tends to amplify the between-school variation in test scores, as it increases the differences in student ability between schools. This selection effect may be further reinforced by the systematic sorting of high-performing students into schools of better quality. Thus, even if there are no compositional effects, school segregation is expected to increase the gap in test scores between schools. In addition, student composition in the school may causally affect

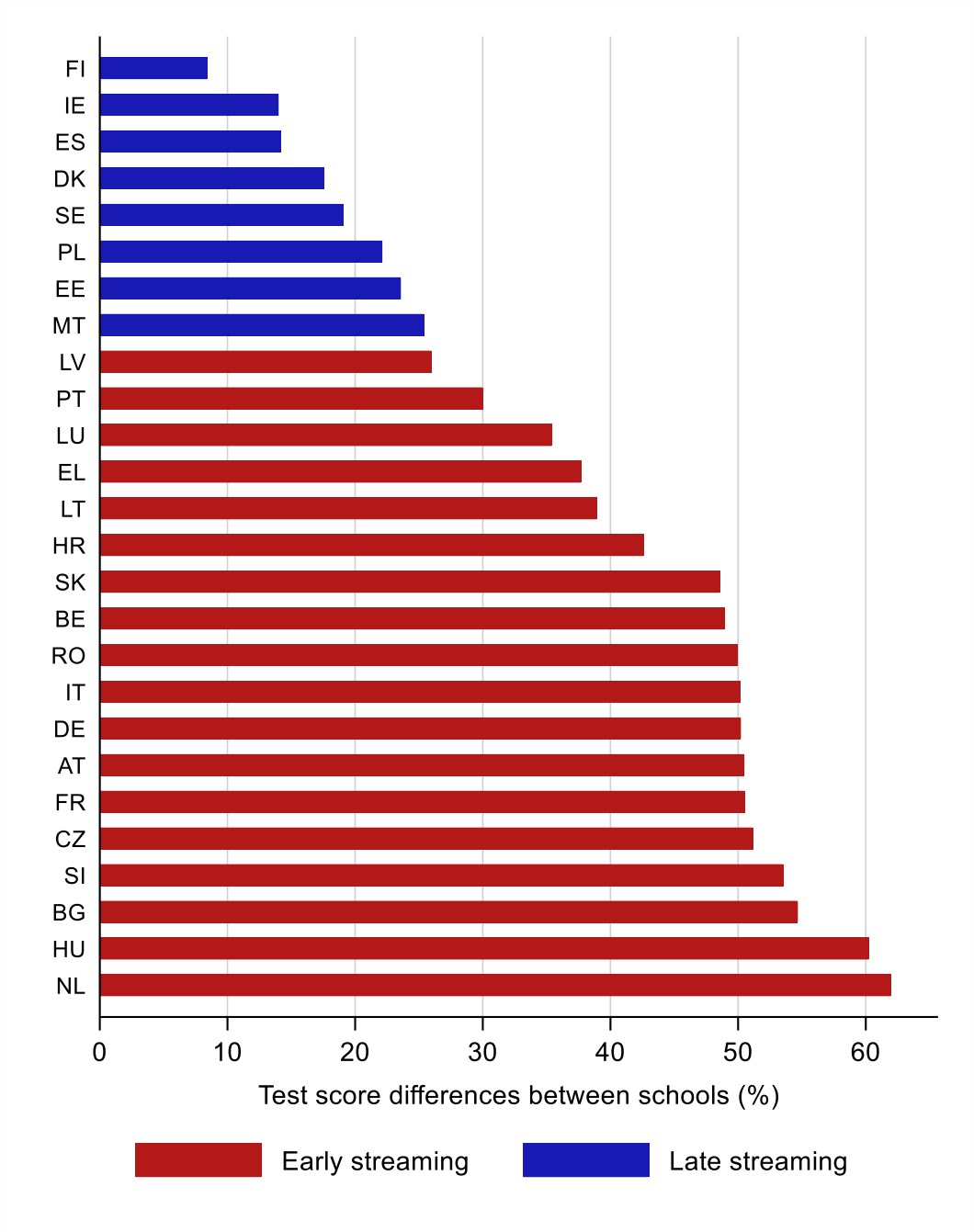
achievement through both peer-to-peer spillovers and teachers' target levels of instruction (see section 2). Assuming that the peer-group effect dominates over the effect of teachers' instructional levels, the causal impact of school segregation may increase the differences in school performance even further.

The analyses in this section are descriptive in nature and should not be given a casual interpretation. There are two reasons for this. First, as noted above, school segregation is likely to amplify differences in test scores between schools, even if student composition has no causal effect on achievement. We will attempt to adjust for student selection by controlling for observed characteristics, but this will probably not free the estimates from bias. Second, even if we were able to address the selection problem, countries with diverging degrees of school segregation may also differ in other respects, such as the characteristics of the student population or the quality of the school system. As a result, it is unclear if any relationship between school segregation and between-school variation in performance is caused by segregation or can be explained by other factors that correlate with segregation.

Figure 12 presents estimates of the differences in test scores across schools for EU member countries. The performance gaps between schools are measured in the same way as school segregation: they show the share of total variation that can be attributed to schools. On average, schools account for about 38% of the variation in test scores in the EU. There is nonetheless substantial heterogeneity across countries. The smallest differences in student performance between schools – about 18% of the total variation – are found in countries with comprehensive school systems at age 16 (Finland, Ireland, Spain, Denmark, Sweden, Poland and Malta). In countries with early streaming, the between-school variation accounts for more than 46% of the overall differences in test scores. Although early streaming may causally affect the variation in school quality, this is likely to mainly reflect the selective admission of students to different programmes in streamed school systems.

There are substantial differences in the degree of between-school variation in test scores also within streaming regimes. Among countries with a comprehensive school system, the gaps in school performance are smallest in Finland, Ireland and Spain while they are somewhat wider in Poland, Estonia and Malta. Among the early-streaming countries, Latvia and Portugal have school differences on a par with some of the late-streaming countries. On the other extreme is the Netherlands and Hungary, where schools account for more than half of the test score variation. The notable differences in the extent of between-school variation in performance within streaming regimes show that the age when students are separated into streams is not the only factor explaining school variation in test scores.

Figure 12. Test score differences between schools in the EU



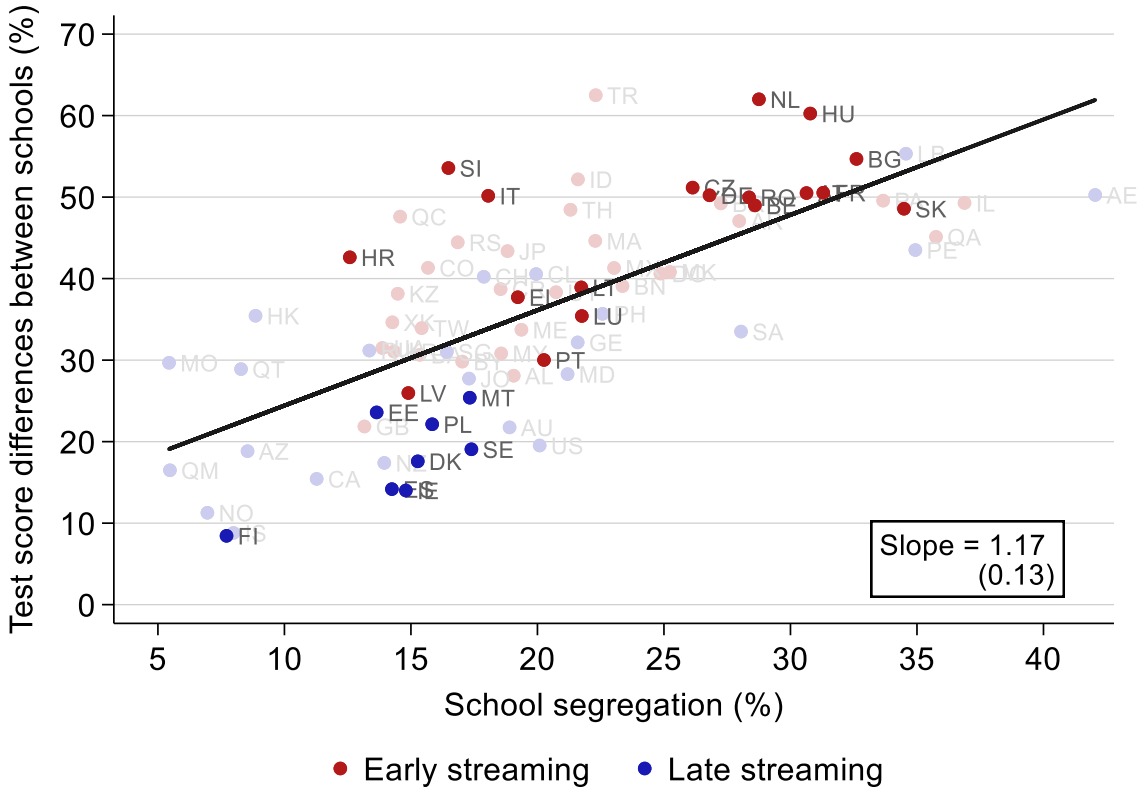
Note: The figure shows the between-school variation (intraclass correlation) in test scores in EU member countries. Countries have been sorted by the performance differences between schools. The red bars show countries where students are streamed before age 16 (early streaming), while the blue bars represent countries with a comprehensive school system at age 15 (late streaming). Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

In the previous section, we documented substantial divergence in school segregation across EU member states. Figure 13 shows that student sorting is closely related to the achievement gaps between schools. Countries with more extensive school segregation

also tend to have wider performance gaps between schools and vice versa. This is true both within and between streaming regimes. There is almost a one-to-one relation between school segregation and performance differences between schools. In contexts where school segregation is 10 percentage points higher, schools explain about 12 percentage points more of the test score variation, on average. This indicates that school policies have not been able to mitigate the effects of student sorting over schools, either because such initiatives have not been taken or they have not been effective. School segregation, accordingly, has important consequences for the between-school variation in test scores and much of the performance gap between schools, both within and between countries, is likely to be driven by student sorting.

Figure 13. School segregation and test score differences between schools



Note: The figure shows the relationship between school segregation (horizontal axis) and performance gaps between schools (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of the test score gap between schools on school segregation, where all countries have been given equal weight. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

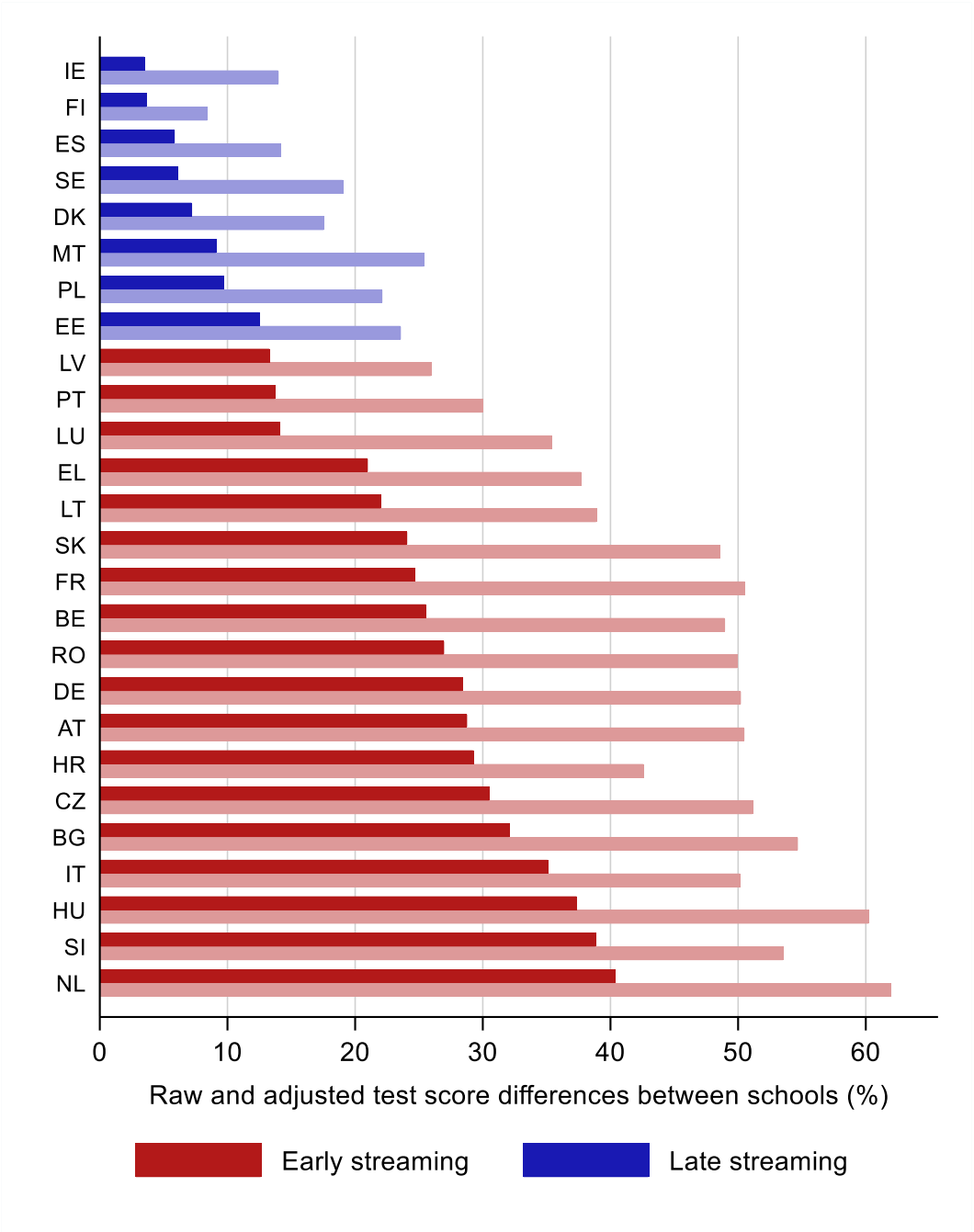
Figure 14 reports between-school variation in selection-adjusted test scores along with raw test scores in EU countries. On average, the performance differences between schools are reduced by about 48% when controlling for differences in student characteristics. Thus, school segregation can explain a substantial fraction of the

performance gaps between schools. The reduction of the between-school variation in test scores when adjusting for student sorting varies between countries, and hence slightly changes the league table of performance gaps between schools. EU countries with comprehensive school systems still rank higher than member states with earlier streaming. Still, there are some minor changes within streaming regimes. Ireland has now taken over the lead position as the country with the smallest performance gaps between schools, while Slovenia has joined the Netherlands and Hungary as the countries with the largest. In Ireland, Finland, Spain, Sweden, Denmark, Malta and Poland, schools explain less than 10% of the variation in test scores, once student selection has been taken into account. Further, in none of the EU member states examined does the between-school variation in adjusted test scores exceed much more than 40%.

Figure 15 shows that there is a close link between school segregation and performance gaps between schools, on the one hand, and the reduction in test score differences between schools when accounting for student sorting, on the other. Just as the between-school variation in raw test scores is largest in countries with greater school segregation, the reduction in school differences when adjusting for student selection is also greater. Consequently, accounting for differences in student sorting significantly weakens the relation between school segregation and performance gaps between schools; in countries where the student sorting is 10 percentage points higher, schools explain 5 percentage points more of the variation in test scores. Yet, the correction for student selection does not break the correlation between school segregation and performance gaps between schools.

There may be many reasons why the selection-adjusted performance gaps between schools are still larger in countries with more school segregation. First, in countries where students are sorted into schools based on observed characteristics, they may also be sorted based on factors we have not observed, such as lagged test scores. The variables used to control for student selection explain about half of the variation in test scores in PISA, which in turn reduces the correlation between school segregation and between-school variation in performance by about half. Even though it is unclear whether additional controls for student selection would have the same impact, it seems likely that the link between schools' performance gaps and school segregation would weaken further had we been able to adjust for more of the factors affecting both student achievement and sorting. Therefore, some of the remaining performance differences between schools may be due to unobserved student selection rather than a reflection of true differences in school quality. Second, high-performing students may be more likely to sort into better schools in countries with more school segregation. Since the selection-adjusted estimates do not account for systematic matching between student quality and school quality, this may also explain some of the observed differences between schools. Finally, student composition may causally affect student achievement, which will feed into performance gaps between schools. Unfortunately, it is not possible to decide what fraction of the remaining performance gaps between schools is due to unobserved student selection and what is caused by student composition.

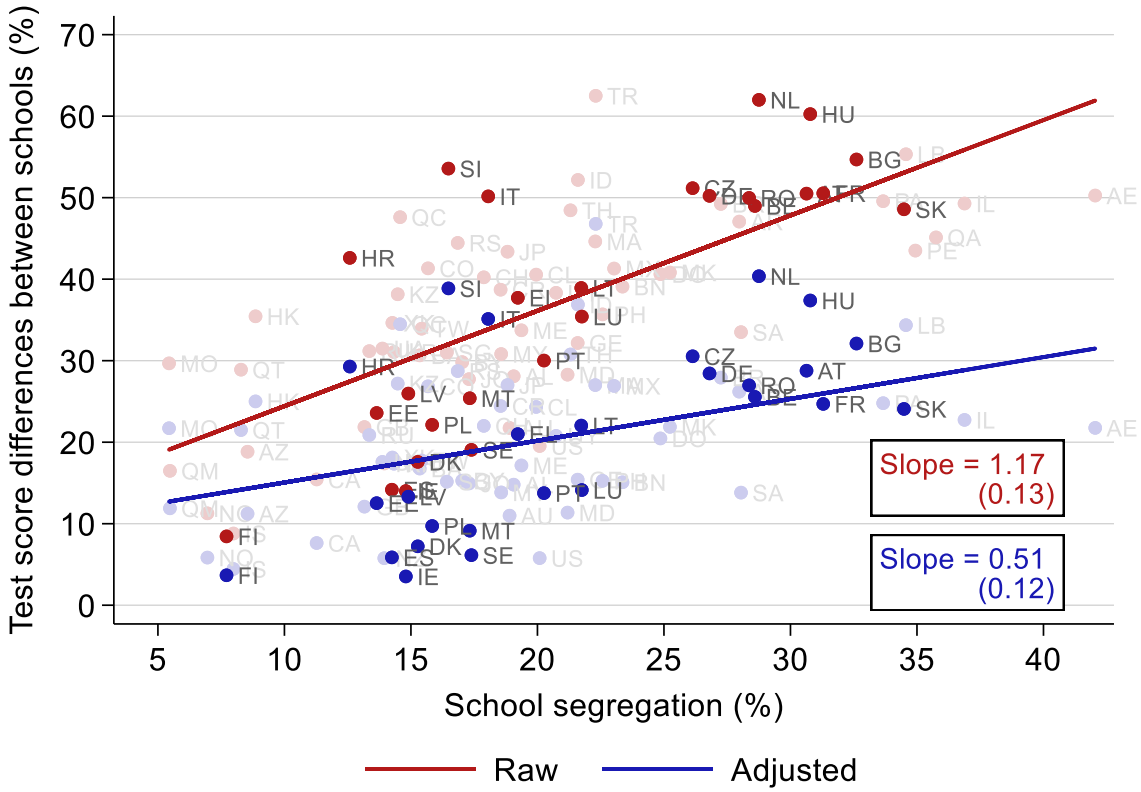
Figure 14. Raw and adjusted differences in test scores between schools



Note: The figure shows the between-school variation (intraclass correlation) in raw test scores (light shades) and selection-adjusted test scores (dark shades) in EU member countries. Countries have been sorted by the between-school variation in adjusted test scores. Test scores have been adjusted for student background characteristics by taking the residual and school fixed effects from a regression of test scores on student characteristics and school fixed effects. The between-school variation in adjusted test scores is related to the total variance in unadjusted test scores. The red bars show countries where students are streamed before age 16 (early streaming), while the blue bars represent countries with a comprehensive school system at age 15 (late streaming). Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

Figure 15. School segregation and test score differences between schools, with and without controls for student selection



Note: The figure shows the relationship between school segregation (horizontal axis) and performance gaps between schools (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. The raw test score differences between schools are represented by the red circles (raw), while the test score gap between schools after adjusting for differences in student's background characteristics are in blue (adjusted). Test scores have been adjusted for student background characteristics by taking the residual and school fixed effects from a regression of test scores on student characteristics and school fixed effects. The between-school variation in adjusted test scores is related to the total variance in unadjusted test scores. The red line shows the slope coefficient from a country-level regression of the raw test score gap between schools on school segregation, while the blue line shows the slope coefficient from a regression of the adjusted test score gap between schools on school segregation. All countries have been given equal weight in the estimations. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

To summarise, there is substantial variation in student performance across schools in the EU. Countries with comprehensive school systems have significantly smaller differences between schools than countries with earlier streaming, which is likely to be the result of selective admission to streams. At the same time, there is also much heterogeneity in the between-school variation in test scores within streaming regimes. In particular, the performance differences between schools is vaster in countries with extensive school segregation, and there is almost a one-to-one relation between school segregation and school gaps in test scores. A substantial fraction of the between-school performance gap is driven by student selection, and the test score gaps between schools

are reduced by about half once differences in observed student characteristics are accounted for. The selection-adjusted test score gaps between schools are still larger in countries with more school segregation. Sorting based on factors not observed by us – related to both student ability and school quality – is likely to explain much of the remaining dissimilarities between schools, but there may also be a causal link between student composition and performance.

7. Discussion

This report documents student sorting across upper-secondary schools in EU countries using data from PISA 2018. We argue that school segregation is multifaceted; students are sorted into schools based on many different characteristics in various ways. Accordingly, countries with an uneven distribution of students over schools in one dimension, like the share of immigrant students, may be more equal in other dimensions, like students' socioeconomic backgrounds. Although the study of separate indicators can be informative about the underlying mechanisms, it is fundamentally the allocation of student ability across schools that feeds into performance gaps between schools, through both selection and causation. Therefore, we propose using predicted test scores – where many background factors are summarised and weighted by their importance for student performance – to study school segregation between contexts.

School segregation is found to vary tremendously between EU member states when it comes to separate student characteristics and predicted test scores. On average, about 20% of the variation in predicted test scores can be attributed to schools, ranging from 8% in Finland to 34% in Slovakia. The streaming regime is an important divider, and student composition in schools is much more heterogeneous in countries with comprehensive school systems at age 15. Early-streaming countries, on the other hand, have more segregated schools, possibly due to the selective admission of students to streams. The differences in student sorting into schools, however, also varies significantly within streaming regimes.

Even though streaming is a dominating factor, it is important to consider other explanations for school segregation, both within the school system and in society more broadly. We perform an explorative analysis to investigate the role of residential segregation, school choice and student admission policies for explaining the country differences in school segregation. The student body is found to be more heterogenous in countries where more students are admitted to schools based on residence. This indicates that school choice may be more segregating than residential admission, but the correlation could also have alternative explanations. Moreover, the analyses reveal that the degree of school segregation is higher in countries with more selective school admission and in societies with more economic inequality. Again, these correlations are suggestive at most, and should not be given a causal interpretation.

Research on the consequences of school segregation is non-conclusive and very context-specific. This is one of the main challenges for the shaping of school admission and streaming policies – there is no clear consensus as to what the right policy is for maximising educational output. Further research is warranted on this topic and it is of great importance that such studies use credible methods to identify causal parameters. Recent randomised controlled trials in education settings are good examples, and similar

experiments could be used in education systems around Europe to gather more evidence.

Despite the scarce evidence, many policymakers find school segregation to be troublesome, typically because of the perception that large concentrations of ethnic minorities or socioeconomically disadvantaged students are detrimental to the learning environment. Although this report presents correlations rather than causal pathways, we point out policy areas that are relevant for policymakers who wish to influence school segregation. Residential segregation is a key policy area, in particular in school systems that base admissions on catchment areas. Yet patterns of residential segregation are hard to influence, at least in the short run, and are thus unlikely to be the most effective method to combat school segregation. Instead, streaming and admission policies are tools that can be used to influence sorting into schools, and may also indirectly circumvent residence-based segregation.

School segregation is closely linked to achievement gaps between schools, and countries with an uneven student allocation in terms of family background also exhibit greater differences in school performance. There is a near one-to-one relation between school segregation and between-school variation in test scores; countries where student sorting across schools is 10 percentage points higher have test score gaps between schools that are roughly 10 percentage points higher, on average. Much of the performance gap between schools is driven by school segregation, and the between-school variation in test scores is reduced by about half once student selection is taken into account. The selection-adjusted performance differences between schools are still larger in countries with more extensive school segregation, which may be due either to student selection on factors not available in the data or to any causal link between student composition and student achievement (or to both).

Performance differences across schools are often mistaken for school quality differences. This report shows that for identifying performance gaps that are of policy interest – such as variation in school quality – it is necessary to at least account for student sorting by family background. We show that rich data on student background can be used to explain a large fraction of the variations in test scores across schools. Not all datasets allow for the same rigorous control for background characteristics, and in addition, sorting based on unobserved traits may also explain performance differences. The lesson that performance and quality cannot be equated is an important one for students, parents and policymakers alike. Evidence-based education policies require an awareness of student sorting as an important driver of performance differences across schools.

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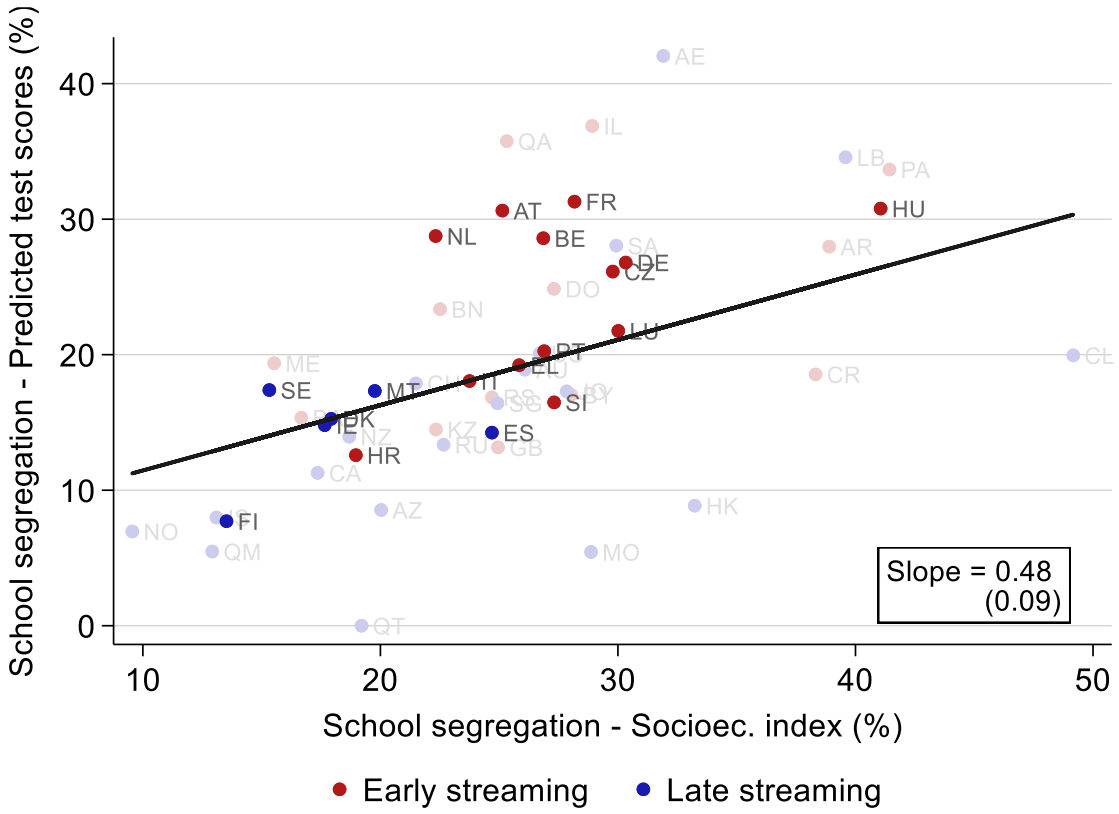
Appendix

Figure A1. School segregation by predicted test scores and by PISA's socioeconomic index



Note: The figure shows the relationship between school segregation by PISA's socioeconomic index (horizontal axis) and school segregation by predicted test scores (vertical axis) in the countries participating in PISA 2018. Circles in darker shades refer to EU member states. Countries where students are streamed before age 16 are represented by red circles (early streaming) and countries with a comprehensive school system at age 15 by blue circles (late streaming). The black line shows the slope coefficient from a country-level regression of the intraclass correlation in predicted test scores on the intraclass correlation in PISA's index. The regression is based on all data points (EU and non-EU countries) and all countries have been given equal weight in the estimation. The slope coefficient and its standard error are displayed on the bottom right. Public-use data is not available for Cyprus.

Source: Authors' estimates based on data from PISA 2018.

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