Teacher high school scores or admission exams: what matters for elite and non-elite higher education courses?

(Preliminary version, please do not circulate)

Carla Sá [*†] Pedro Luis Silva [†‡§] Pedro Teixeira [†‡§]

Ricardo Biscaia [†‡]

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Abstract

Students are often admitted into higher education based on their performance in high school. This paper compares two measures of past cognitive skills: teacher and national exam scores. We find that the teacher scores predict students' performance at higher education more accurately. Its predictive power remains the same independently of the institution and degree considered. Additionally, we compute an indicator of the programme's selectivity that segregates programmes between elite and non-elite ones. We found that national exam scores are noisier and only gain relevance as programme selectivity increases. Finally, we explore national exams' volatility and institutional selectivity as potential mechanisms to justify differences on the results.

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[1]Corresponding details: CIPES - Rua 1.º Dezembro 399, 4450-227 Matosinhos, Portugal. Email: plsilva@fep.up.pt or pedro.luis.silva@cipes.up.pt Personal website: pedroluissilva.com

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[*]School of Economics and Management, and NIPE, University of Minho, Portugal

[†]Centre for Research in Higher Education Policies (CIPES), Portugal

[‡]School of Economics and Management (FEP), University of Porto, Portugal

[§]IZA Institute of Labor Economics

1 Introduction

Higher education systems have been changing worldwide, especially due to the expansion leading to mass and universal levels of access (Schofer and Meyer, 2005; Cantwell et al., 2018). One of the leading factors explaining that massification of higher education (HE) has to do with the long-term expected benefits associated with a degree in the labour market, namely regarding employability and earnings (Hanushek and Woessmann, 2015; Psacharopoulos and Patrinos, 2018).

Nonetheless, it has been pointed out that there is evidence of growing diversity among graduates (Peracchi, 2006; Lemieux, 2006). This led to a shift in the discussion, with a growing emphasis on the differentiated benefits of enrolling in a specific program or institution (Anelli, 2020; Chevalier, 2011; Walker and Zhu, 2011). Thus, there is a growing interest in research to look at the impact of those perceptions of institutional and disciplinary stratification for patterns of demand (Varga, 2006; Briggs and Wilson, 2007; Triventi, 2013).

To be selective, institutions often consider different elements in their admission criteria. In most countries, a combination of high school scores (teacher assessment) and admission exams (high stakes assessment) is often considered. In this paper, we try to understand which of these which of these two admission measures is more relevant for future students' academic performance. Academic performance matters not only from an individual perspective, but also because it is costly to the government and institutions. According to (OECD, 2019), of students who enter a bachelor's programme, only 39% graduate within the theoretical duration of the programme. Thus, understanding how institutions can reduce studies delay by selecting a better pool of students is then relevant for public policy.

In this paper, we rely on longitudinal, administrative data for higher education institutions (HEIs) in an entire country (Portugal) over a relatively long observation period (6 cohorts). Employing population data also improves on research that uses relatively small samples of students or universities. For all HEIs we observe students' admission and subsequent performance, having information about individual characteristics as well.

At first, we find that teacher scores seems to be a stronger predictor of students' academic performance. However, when we look at programmes' selectivity, we conclude that the high-stakes exams are relevant. The high stake exams' prediction of university perfor-

mance increases as long as the selectivity increases (when considering elite programmes). In sum, the effect of teacher scores on future student performance is stable and sometimes decreases in elitism levels. On the other hand, the effect is always increasing with the degree of course elitism for admission exams. While we cannot rule out that these results may be partially driven by other unobservable factors - such as the relevance that admission exams constitute for students that want to apply for elite or non-elite courses - we provide suggestive evidence that justify why admission exams might better predict students' ability for elite courses. First, we measure exams' volatility and we show that the admission exams are more volatile for those enrolled in non-elite institutions. The admission exam less predictive power of performance for non-elite institutions. Secondly, we identify institutions' characteristics that might explain their degree of selectivity. Finally, we discuss how students' socioeconomic background may affect our results.

These findings contribute to several related strands of literature regarding the students' performance and selection in higher education. The expansion of HE has also created important challenges on the side of institutions and the need to find the best mechanisms to select those most suitable to the demands of the programme. Moreover, in a context of increasing competition among students and institutions, selectivity mechanisms have been playing a signalling role aiming at identifying best matching options.

On the selection side, this papers adds to the discussion on which screening devices should a HEI consider when selecting their students. Prior work shows that combining high school scores and high stake assessments is the best way of selecting students (Zwick, 2019; Silva et al., 2020; Westrick et al., 2015). Neverthess, both measure have pros and cons. High school scores have the huge disadvantage of comparing students, since grading standards are bound to vary significantly between schools (Atkinson and Geiser, 2009). At the same time, high school scores are the result of continuous testing of students throughout high school, and therefore might result in a better assessment. In turn, high stake assessment has the natural advantage of not being subject to different grading standards. System-wide, it is also effective to control grade inflation in high school system, as it provides a reference standpoint to compare the high school grading system. However, high stake assessment is a one-shot approach, where all the knowledge of the students is assessed only a few times, if not once, and it therefore subject to variables other than knowledge such as the ability of the student to perform well under pressure. Although we

conclude that the high school score seems to be a better predictor of students' academic performance, both criteria are relevant for their performance.

Moreover, recent trends point out that this flexibility in admission methods is catering for the inclusion of students with more diverse backgrounds, mentioned as a "Holistic review" (Bastedo et al., 2018). Previous research shows that a policy of not requiring admission tests to enter HE would increase racial and socioeconomic diversity in HE (Espenshade and Chung, 2010). Selectivity in itself can be positive for student outcomes, and being exposed to a diverse class in terms of skills and competences (therefore, not just ability or knowledge) results in a more positive graduation experience (Stemler, 2012).

This paper also relates to a broader literature on the returns of graduates. There is strong evidence in the literature that there are significant economic returns of attending elite institutions (Brewer and Eide, 1999; Monks, 2000; Long, 2010; Dillon and Smith, 2017). However, there might be heterogenous effects according to the university quality and selectivity (McGuinness, 2003; Walker and Zhu, 2018) and fields of study (Chevalier, 2011; Ballarino and Bratti, 2009). Several studies has focused on returns to HE in different countries (Italy (Buonanno and Pozzoli, 2009; Anelli, 2020), Greece (Livanos and Pouliakas, 2011), German (Grave and Goerlitz, 2012), Norway (Kirkeboen et al., 2016), Japan (Ono, 2004), and China Li et al. (2012); Hu and Vargas (2015)) and found that returns are higher for fields within medicine and STEM areas. Although we do not measure economic returns, our results suggest that the admission exams are relevant precisely for fields where returns are higher according to the literature.

The paper proceeds as follows. In the next section we will briefly review the literature highlighting the growing complexity in students' choices and the relevance of selectivity of institution and field of studies in that respect. Section 3 will focus on the Portuguese case, namely by presenting its HE system and previous studies looking at the patterns of students' demand. This will be followed by the presentation of the methodology and data in Sections 4 and 5. Section 6 discusses the main results of our empirical analysis and in section 7 we will discuss some of the mechanisms that might be behind the results of this study. Section 8 concludes.

2 Selectivity and Access to Elite HE

2.1 The Growing Complexity of Students' Choices in Access to HE

With the expansion of HE, the attention has shifted from general trends to internal differentiation in patterns of demand. Thus, research has been looking at access to HE not so much by focusing on overall levels of enrolment and average returns, but increasingly in different patterns of enrolment by types of institution and fields of studies and the potential impact those dimensions may have in the subsequent trajectory of graduates (Peracchi, 2006; Lemieux, 2006).

Regarding access, Briggs and Wilson (2007) analysed the role of information and recruitment strategies in the context of declining demand and growing institutional competition. Their analysis highlighted the importance of focused and "informed" student recruitment practices. Furthermore, this points out the relevance of policies and strategies designed to expand and enhance the "quality" of the information - including cost information upon which potential students make their decisions (Simões and Soares, 2010).

The issue of the possible effects of college quality in access stratification was also studied by Black and Smith (2004), who found substantial sorting based on ability into colleges of differing qualities for both men and women, with higher ability students disproportionately attending higher quality colleges and more high-ability students at low-quality colleges than low-ability students at high-quality colleges. Varga (2006) explored students' application strategies to HE in Hungary and found that both expected wages and admission probabilities determined students' application strategies.

The issue of field and institutional selectivity and its impact for students' choices and graduates' careers has been extensively studied in the US. In one of the earliest studies, Brewer and Eide (1999) found strong evidence of a significant economic return to attending an elite private institution and that this advantaged increased over time, even after controlling for selection effects. The relevance of the increasing institutional diversity in HE and its potential impacts in the labour market trajectory of graduates was also confirmed by Monks (2000). Long (2010) also found substantial wage premiums associated with additional years of education and that the increasing effect of years of

education on earnings was mirrored by the increasing effects of overall college quality on hourly earnings. Dillon and Smith (2017) found substantively strong and statistically significant main effects of college quality and student ability on degree completion and earnings.

The study of selectivity in access and differences per field and institutional has also received growing attention in Europe. In the case of the UK, there has been significant debate due to the perceptions of stratification in the HE sector. McGuinness (2003) found that the impacts of university quality for UK graduates on job quality and earnings were mainly limited to graduates in particular disciplines (e.g., Social Sciences and Medicine) or those obtaining "poor" degrees from "good" universities (who obtained higher wages than those with comparable degrees from less prestigious HEI).

Chevalier (2011) found large heterogeneity in the labour market attainment of recent graduates between and within each subject. Walker and Zhu (2018) showed that in the case of the UK the selectivity of undergraduate degree programmes played an important role in explaining the variation in the relative graduate wages and that much of the variation in relative wages across programs was due to the quality of students selected.[1]

This topic has been rather important in some parts of Europe such as Southern regions, plagued by high levels of youth unemployment and brain drain to more dynamic regions. Ballarino and Bratti (2009) examined the effect of different fields of study on the university-to-work transition of graduates in Italy and found that the best-performing subjects in terms of the probability of finding a stable job were the "quantitative" ones (Hard Science, Hard Social Sciences, and Technical degrees), which they largely ascribed to their relative scarcity. In another study for Italy, Buonanno and Pozzoli (2009) confirmed the favourable picture regarding quantitative fields (i.e. Sciences, Engineering, and Economics) in early labour market outcomes of Italian university graduates. Building on this approach, Anelli (2020) found sizeable benefits to attending a more prestigious university in Italy (compared to not-selective institutions), even after controlling for selection in a quasi-experimental setting. Livanos and Pouliakas (2011) analysed the wage returns to qualifications and academic disciplines in the Greek labour market and their results presented considerable variation across fields of study, with higher returns for

[1]This built on their previous work (Walker and Zhu, 2018) in which they have found, also for the UK, very large returns for Law, Economics and Management for men and high returns in all subjects for women.

fields such as medicine, law, and technological fields and lower returns for humanities, physical education and education degrees.

The growing differentiation has been observed even in those parts of Europe with lower degrees of income inequality and a longer tradition of equality in HE supply. Grave and Goerlitz (2012) analysed wage differentials by field of study at labor market entry and five to six years later in Germany and found that graduates from arts/humanities had persistent lower average monthly wages compared to other fields. Kirkeboen et al. (2016) examined data for Norway by field and institution of study and found that different fields of study had substantially different labor market payoffs, even after accounting for institution and peer quality, and those payoffs were consistent with individuals choosing fields in which they had a comparative advantage.

The issue of selectivity in access has attracted attention in Asia, both because some of the earliest examples of mass access and stratification have been in place for many years (e.g., Japan and South Korea), and because the rapid and massive expansion of HE in other parts of the region, notably in China, have placed the focus on potential differentiation among graduates and the importance of choice of program and institutions has increased rapidly. Ono (2004) analysed the impact of college reputation in Japan, a country known by a very significant competition among students in the access to HE, especially when it came to targeting the most prestigious HEI, and found robust evidence that college quality significantly improved earnings. This confirmed that college quality played a crucial role in shaping incentives and earnings in the Japanese labour market, thus the rationality of students' and families' investments in the preparation of applications to HE. This stratification across institutions and fields has been identified even in systems experiencing more recent massive expansion. In the case of China, Li et al. (2012) observed a significant advantage for those students attending elite colleges, though this was reduced when controlling for students' ability, major, location, and individual characteristics and background. Based on a national representative sample from China, Hu and Vargas (2015) and found that college major differentiated graduates' occupational income, with STEM and professional majors having particularly visible benefits. College ranking seemed also to be a relevant dimension in providing better career opportunities and thus being perceived as an effective signal of prestige to employers, especially in more urban areas.

These results are particularly relevant for many Continental European systems, which tend to be characterized by greater homogeneity among HEI and whose process of massification has often led to a very large number of public nonselective universities and very few highly selective universities.

2.2 Admission Criteria for Higher Education

It seems reasonable to theorize that the higher the demand that an HEI faces for their courses, the tighter their selection procedures will be, even though there seems to be no attention in the literature towards the empirical verification of such result. HEIs that have consistently more candidates than the number of vacancies will need to select those who will enter their courses. From an institutional point of view, it seems logical that such selection attempts on capturing the best students, as this provides some advantages. Better students will have lower chances of unemployment, higher chances of entering better career paths, and will ensure that the reputation of the institution remains high, leading the institution to become consistently more demanded along time. Even in the context of Public HE, this selectively is actively sought, even if not intended by the institutions, due to the need that the system has to assign the students according to their preferences and merit. Moreover, a highly demanded institution guarantees its survival and bargaining power when accessing public funding. Therefore, when institutions are able to design their own selection procedures, or if at least they are given some flexibility to choose between different systems, they will opt for those that will choose the best students.

Perhaps the most natural way of selecting students for HE is to rank them according to their High School Grade Point Averages (GPA) or scores. Despite having a huge disadvantage in terms of comparing different students, since grading standards are bound to vary significantly between schools (Atkinson and Geiser, 2009), high school grades are the result of continuous testing of students throughout high school, and therefore might result in a better assessment. This approach is validated by the finding that high school scores are a predictor for HE success, both measured by the Grade Point Average (GPA) (Zwick, 2019; Silva et al., 2020) or by completion rate (Westrick et al., 2015; Silva, 2021). Therefore, institutions would guarantee better students (on average) for their courses by using High School GPA as a criterion.

Another approach for selection of students is the application of standardized tests or national exams for all candidates in HE. The standardized test has the natural advantage of not being subject to different grading standards that might exist around the country of the HE system. System-wide, it is also effective to control grade inflation in high school system, as it provides a reference standpoint to compare the high school grading system. The main disadvantage from such approach is that it is a one-shot approach, where all the knowledge of the students is assessed only a few times, if not once, and it therefore subject to variables other than knowledge such as the ability of the student to perform well under pressure.

A third approach is on institutional testing, in which institutions design their own mechanisms of admitting students into their own courses. These mechanisms could be exams closely related to the contents of the course, that could also attempt to capture other competences, such as soft skills; or even face-to-face interviews. These approaches offer the advantage for HEIs to fine-tune the choice of their candidates according to their own criteria. However, these could be significantly more costly for institutions than standardized tests, which are usually assured by the government or by other external entities. In the context of public HE, these institutional approaches might be questionable due to the subjective nature of the evaluation when assessing candidates' soft skills or performance in an interview. However, it finds some ground in the context of a lower number of admissions, such as Master or PhD students - since there are fewer candidates and the courses are more specialized; and for international students, in which national high school or university grades might not be comparable between different international students.

Even though these approaches have different theoretical foundations, they are usually weighted and combined into a single measure for selection of the prospective students. In systems where institutions have a great deal of autonomy in the selection process, this has allowed some of the most selective institutions to not consider just merit-based standardized tests, and allowed them to transform the expression "best students" into a combination of factors, that could suit the objectives of those institutions at a given point in time (Killgore, 2009). In the United States, this has been visible since selective institutions would use such criteria to select the wealthier students, allowing for their increased survival. However, recent trends point out that this flexibility in admission

methods is catering for the inclusion of students with more diverse backgrounds, which has been labelled as "Holistic review" (Bastedo et al., 2018). Additionally, (Espenshade and Chung, 2010) elaborated on how a policy of not requiring admission tests to enter HE would increase racial and socioeconomic diversity in HE. Selectivity in itself can be positive for student outcomes, and being exposed to a diverse class in terms of skills and competences (therefore, not just ability or knowledge) results in a more positive graduation experience (Stemler, 2012).

3 Background and institutional setting: selectivity and elitism in access to HE in Portugal

The aforementioned trends regarding growing differentiation among graduates and their increasing relevance for students' choices have acquired increasing relevance in Portuguese HE. Centeno and Novo (2014) and Machado and Mata (2001), have showed that the wage gap between graduates and non-graduates has been narrowing since the late 1990s. Figueiredo et al. (2013) have pointed out to an increasing gap between graduates, since the expansion of the Portuguese HE system.

The Portuguese experience is particularly interesting, as it shows the impact of massification on choice and the growing emphasis selectivity of field and institution. Portugal has had historically lower levels of education (Teixeira et al., 2014), when compared to most of the other European countries, and in the latter part of the twentieth century the expansion of HE became a political goal. This led to a fast process of massification that characterized the latter part of the previous century, supported by major social, political, and economic expectations that the expansion would enhance economic growth and create major opportunities for social mobility (Figueiredo et al., 2013).

HE in Portugal is currently composed of universities and polytechnics, both public and private. There is a network of institutions that offer several HE degrees in each of the Portuguese regions. However, the Portuguese system is based on a policy of limiting the number of students who can enter HE to prevent students from being directed to the fields of greatest interest, leaving the others with lower occupancy rates (numerus clausus), implying an obvious restriction on the supply side (Sá et al., 2013). This was introduced after the democratic revolution, due to significant social pressures for

expansion, and it was never reversed. In recent years, it has been regarded as a factor to limit the expansion of most attractive regions, institutions, and programs.

The demand for HE in Portugal has been changing in recent decades due to demographic changes (Portela et al., 2008). Studies conducted in recent years have pointed out that the dominant factors in the choice of students seems to be the location, the field of studies and the type of institution. Location is very important, especially the attractiveness of main metropolitan areas, though the importance of geography varies by institution and fields of study (Tavares and Ferreira, 2012; Sá et al., 2013; Lourenço and Sá, 2019). In addition, there is a strong trend towards the preference of universities over polytechnics (Tavares and Ferreira, 2012; Sá and Tavares, 2018). These preferences are related to expectations regarding employability and future earnings, but can also be influenced by other factors such as social visibility and prestige.

In Portugal, public HEIs select their students based on their national central exams and high school performance. National exam scores and high school score are mandatory requirements to gain admission to HE. In the final year of high school, after observing the national exam results, prospective students apply to HE via a centralized admission process managed by Direção Geral do Ensino Superior (DGES; Directorate-General for Higher Education).

Each year, the government sets the number of vacancies available for each programme (combination of institution/degree), the *Numerus Clausus*, and manages the allocation process. Additionally, the government impose some boundaries on admission requirements that HEIs must respect. The application score of each applicant is a weighted average of the applicant's high school score and her scores on the subject-specific national exam taken at the end of high school. However, the government imposes that each HEI should allocate at least a weight of 50% for the high school score and 35% for the admission exams. The institution distributes the remaining 15% to either or one or both admission criteria. Different programmes require different exams and might use different weights. Therefore, Portuguese Public HEIs have limited instruments to select their students within such a centralized access system. [2]

Nevertheless, each programme can decide which national exams they are going to

[2]Although the majority of programmes consider combinations of one or two national exams. More selective programas tend to give a higher weight to the admission exams (maximum of 50%) while low quality programs tend to give a lower weight (minimum of 35%).

consider as admission exams. They must always consider the field-specific exam of each degree decided by the government (for instance, the government decides that the national mathematics exam is field-specific for the economics degree). However, they can consider a different combination of exams.[3] In each combination, the number of exams considered is either one or two. If considering two exams, they must have equal weight.

Finally, after observing each programme's admission criteria and her national exam results, each applicant can rank up to six programmes to which she applies. Students have an incentive to report a set of preferences (or at least a subset) that they judge feasible. Given that they observe everything, there is an incentive for students to reveal their truthful rank of preferences, conditional on the national exams and high school results. Applicants know that they will be allocated to their higher feasible stated preference.

The government solves the matching problem using a Deferred Acceptance mechanism (DA; Gale and Shapley (1962)). Through an iterative algorithm, the government tries to find a match between applicants' preferences and HEIs' capacity. In the end, each applicant can gain admission in one programme only. If she does not accept it, she will need to re-apply in the following year or round.

4 Data

We use two datasets from two different sources: i) Applications to public HEIs (DGES, 2019); ii) Students' Performance at HE (DGEEC, 2019).

The application dataset contains all application data from DGES (Directorate-General for Higher Education). For each candidate, it contains her list of ranked preferences. Each preference listed includes the degree and institution listed, the corresponding application score, high school score, admission exams' scores, and placement result. Moreover, for each programme, the dataset also gives information regarding the number of vacancies, admission requirements, access' threshold and field of study. We hava data for applicants from 2008-2009 until 2020-2021.

The students' performance at HE dataset is from Direção-Geral de Estatísticas da Educação e Ciência (DGEEC; Directorate-General for Education Statistics). This dataset is a snapshot of all students enrolled in HE. For each student enrolled in HE in each

[3]For a discussion on the nature of these admission exams (see Silva, 2020)

year, the dataset retrieves the programme of enrollment, the field of student and year performance. This dataset also reports socio-economic characteristics, such as parents' education and job status, geographical indicators, and mobility status. The data is observed from 2013-2014 until 2019-2020.

The latest dataset includes either public and private sector.[4] Given that we only observe the applications to the public sector, we merge these two datasets for the public sector and find a one-to-one merge for 96% of the students admitted to first year of HE.[5]

Our final dataset consists of six cohorts, from 2013-2014 to 2018-2019, as we can observe their first-time application to HE and their performance at HE by the end of their first year. We only consider students that applied under the General Access Regime (GAR; the centralized process of application to public HEIs)[6], in the first round of applications.[7] Table 1 presents the descriptive statistics for our analysis dataset.

[Insert Table 1]

We observe that 70% of the students are admitted to either their first or second-ranked preference. Students recognize that they will be admitted to their highest feasible preference, and so, on average, they try to not waste preferences with scenarios that are way out of their possibilities. The majority of students at HE studied at a public high school, and 58% of them are female. However, only 30% of the students has a mother/father with a HE degree, and one-fourth of the students receive a maintenance grant. This indicates that a large proportion of students admitted to HE seems to be from a disadvantageous background.

Surprisingly, half of the students are admitted to an elite programme, mainly concentrated in social sciences, engineering, and Health. In the next section, we define elite, and we distinguish between different types of elite programmes. We show that although

[4]Which represents around 80 % of the systems (According to DGEEC (2019), of the first-year students enrolled in 2016/2017 for the first time, 83% were in a public institution.)

[5]The link between the application and performance dataset was made by Pedro Luis Silva at the premises of the Ministry of Science, Technology and Higher Education in Portugal.

[6]There is a reduced number of students that under GAR may obtain admission through special regimes like diplomat's son, refugees, regional preferences, for instance. We exclude these students from our analysis. GAR accounts for approximately 70% of the candidates to Portuguese public HE. Finally, we only consider individuals that applied to public HEIs in Portugal Maindland.

[7]There are two rounds of application to HE each year. The second round only opens after the first round is finished, and it is only for the vacancies that are still free. However, these students start their programmes one month and a half after the first round. For comparison purposes, we only consider individuals that were admitted in the first round.

50% of the students are in an elite programme, this represents a small number of programmes. In other words, there is a large concentration of students at the top of the programme's distribution, and a large concentration of programmes at the bottom of students' distribution.

5 Methodology

5.1 Elite programme indicator

The definition of elite programme is central to our analysis. Based on student revealed preferences, we compute a strength indicator to identify levels of rigidity in the HE system. That is crucial to determine the potential impacts of changes in HE. Portela et al. (2008) proposed a programme/institution strength measure computed as the ratio between the total number of applicants choosing the programme as a 1st best option and the total number of available places for the programme. Nevertheless, the strength index does not consider how good candidates choosing a given programme as the first choice are. To account for applicants quality, we compute an adapted version of that measure which we designate as strength index plus and is computed as

$$E_i = \frac{fop90_i}{p_i} \qquad \text{(strength index plus)} \tag{1}$$

where $fop90_i$ is the total number of students who: (i) rank programme i as their first choice; and (ii) have an application score above the 90th percentile of all students admitted to HE.[8] If E_i is greater than zero, that means that programme i was able to admit some outstanding students. Those students are in the top 10% of HE admitted students. E_i increases as more outstanding students are admitted to programme i in a particular year.

[Insert Table 2]

E_i is an indicator of the programme's selectivity level. It is a continuous variable that segregates programmes between elite and non-elite ones. For some programmes, this classification differs substantially from the conclusion driven by the more spartan strength

[8] Recall that the application score is always a weighted average of the high school score (at least 50%) and the admission exams specific to each programme.

index s_i. For instance, according to Table 2, the economics degree at the Universities of Minho and Coimbra has a strength index higher than one and an almost zero index strength plus. In other words, a high percentage of students ranked that programme as their first choice (economics/Coimbra or economics/Minho), but none of them was outstanding compared to all HE admitted students. The strength index s_i is high for those programmes only because students wanted to stay there (i.e. due to location). That does not necessarily translate into high-ability candidates. The strength index plus (E_i) is then a measure of selectivity that considers information revealed by students' preferences and evaluates candidates' quality at the same time.[9]

[Insert Figure 1]

The strength index plus give us the indication of which programmes can be considered as elite ones. According to Figure 1, less than one-third of the programmes classified as elite. Moreover, not all elite programmes are from the same type. There are very few programmes with an index above 0.5 (see Table A1 of the appendix). Thus, there is a concentration of programmes at the bottom of the elite indicator's distribution.

In terms of students, elite programmes are able to capture a high ability pool of incumbents. Although 50 % of the students gain admission to an elite programme, only approximately 10% are admitted to the top 5% of elite programmes.

[Insert Table 3]

5.2 Estimation Strategy

In this section, we present our estimation strategy. We focus on student's performance during the first year of HE. We consider as outcome (y_i) the number of credits obtained through the *European Credit Transfer System* (ECTS) by the end of the first academic year.

We estimate a fixed effects negative binomial model based on the following arguments. First, the number of ECTS is a positive integer and its distribution is skewed to the right,

[9]We performed a sensitivity analysis with different percentiles of the application score of all students admitted. Namely, we run robustness check with 85th, 80th and 75th percentiles on the definitions of E_i and we defined E_i^{90}, E_i^{85}, E_i^{80} and E_i^{75}. The classification of elite programmes has remained the same for the majority of the programmes. See Figure 7 of the appendix. Additionally there is a strong correlation between different definitions of programme elite indicator ($corr(E_i^{90}, E_i^{85}) = 0.9744$; $corr(E_i^{90}, E_i^{80}) = 0.9373$; $corr(E_i^{90}, E_i^{75}) = 0.8971$).

which implies a count model type (either poisson or negative binomial, see Cameron and Trivedi (2005)). Since the over-dispersion test rejects the null hypothesis of absence of over-dispersion, the negative binomial model is appropriate. Second, institutions enjoy a certain level of autonomy and freedom when organizing each programme study plan, allocating their teaching staff and defining the teaching and evaluation methods. All combined may make the average number of completed ECTS specific to each programme (level of degree/institution combination), which justifies estimating a fixed-effects negative binomial model to account for possible unobserved heterogeneity.[10]

The number of ECTS, y_i, can then be modeled by means of a negative binomial distribution:

$$P(y_i|\mathbf{x_i}) = \frac{\Gamma(\alpha^{-1}+y_i)}{\Gamma(\alpha^{-1})\Gamma(y_i+1)}\left(\frac{\alpha^{-1}}{\alpha^{-1}+u_i}\right)^{\alpha^{-1}}\left(\frac{u_i}{u_i+\alpha^{-1}}\right), \tag{2}$$

where $u_i = E(n_i|\mathbf{x_i}) = exp(\mathbf{x_i}'\beta)$, α is a constant, and $\mathbf{x_i'}$ the vector of controls, including the three variables of interest: high school score, admission exams' scores and an elite programme indicator.[11]

We control for individual characteristics such as gender, type of high school attended, and home distance. Later in the paper we also consider parent's education as a control. Additionally, we successively control for cohort, field, institution and programme characteristics, as well as, preference fixed effects. Preference is decomposed into dummies indicating the order with which each student applied to the programme that she was admitted to.[12] Finally, we also include later in the paper high school fixed effects as a robustness check.

[10]Similar studies use negative binomial model when measuring demand and performance in higher education. For a review see Cardoso et al. (2008), Portela et al. (2009), Aina et al. (2018), Akee et al. (2014), and Hilmer and Hilmer (2011).

[11]We have tested for endogeneity of the elite programme measure, as follows: first, we have estimated the model by OLS and computed the predicted residuals; second, we estimate the negative binomial model with the predicted residuals as an additional explanatory variable; and finally, based on a significance test on its coefficient, we have rejected the endogeneity hypothesis.

[12]After modeling the number of ECTS, we estimate the marginal effects. See Merkaj et al. (2020) for a full derivation of the negative binomial model.

6 Results

Table 4 presents a summary of all our different estimations.[13] First, we start our analysis by considering the reduced form proposed in column (1). Then, in column (2), we include the control variables, and in column (3), we add the programme fixed effects. Later, we consider the elite programme indicator in our analysis in columns (4) to (6).[14] Finally, given that we are estimating a negative binomial model, we only present the average marginal effects, that is, since the model is non-linear, the effect of a unit change in an explanatory variable on the dependent variables varies from individual to individual. The coefficients in the table refer to the average of the effects on each individual.

We observe that teacher scores are a stronger predictor of student performance at university than the admission exams, irrespectively of the model that we use. In particular, within the same programme (column 3), we observe that, on average, a student with an extra point on her high school score complete 28% more ECTS in the first year. However, an extra point on the admission exams only translates into 7.2% more ECTS on average in the first year. Thus, the scores attained in high school are a better predictor of future performance when compared to scores obtained in the admission exams.

Nevertheless, it is also true that this prediction varies according to the type of programme considered. For example, according to column (5), students tend to complete fewer ECTS within the first year on more selective programmes. In particular, when the elite programme indicator increases by 0.1, students complete 48% fewer ECTS within the first year. Thus, on average, students in elite programmes find it more challenging to complete the first year, which is not surprising. What matters to understand is how our main result (that teacher scores are a stronger predictor of performance) vary according to the type of programme considered.

[Insert Table 4]

In columns (6), (8) and (10), we include the interaction terms between the elite programme indicator and the two measures of past performance. However, what we report in the table are the total average marginal effects. Therefore, it would be more inter-

[13] A more detailed version is presented in Table A1 of the appendix

[14] The elite programme indicator is collinear with programme fixed effects. For that reason, we drop the programme fixed effects and introduce institution and field fixed effects as a proxy for programme effects.

esting if we decompose the analysis according to the distribution of the elite programme indicator variable.

In order to assess whether the marginal effects for our main variables of interest differ depending on the selectiveness nature of the courses, we estimate the average marginal effects at different percentiles of the elite programme indicator for the specification used in column (10). Results are presented in Figure 2. We observe that for the less selective institutions, the high school score is more relevant to explain the number of ECTS completed than the admission exams. However, when we look at the top 5%, the conclusion is different. The national exams gain precision in predicting future student performance at the top percentiles of the distribution, and in some years this effect is more important than the one caused by the high school score.

The national exams' prediction of university performance increases as long as the selectivity increases. Standardized tests gain relevance when we consider elite programmes. Those programmes admit a pool of high ability students on average when the admission cutoff is usually very high. Thus, students need to perform exceptionally well in high school and the national exams. In that case, the national exam becomes a more relevant predictor of future academic performance than the high school GPA. In the next section, we provide and explore some reasons for why that would be the case.

From Figure 2, we can also infer that, on average, the effect of high school score on the ECTS completion is more stable, and sometimes decreasing with the increase in levels of elitism. On the other hand, for admission exams the effect is always increasing with the degree of course elitism.

[Insert Figure 2]

7 Mechanisms

This section attempts to explore some heterogeneity level presented on the results. We offer three possible explanations for these results, even though our dataset only allows us to test empirically two of them. Our first untested explanation is the "competition effect". It is based on the irelevance of the admission exams for students, which may vary whether they are applying for elite or non-elite courses. If students are applying for elite courses, they have no room to fail, and they will be mostly well prepared for the exam.

Therefore, the result will be most likely related to their capacities at full performance and preparation levels.

On the other hand, if students are applying for less competitive positions or are less ambitious in terms of their HE choices (for instance, if they would instead enrol by proximity rather than their perception of course quality), they face the admission exam less seriously. In this scenario, their performance might reflect less of their knowledge, but rather their (relative) lack of preparation or interest in the admission exam. They will enroll in one of their courses of their choice anyway. Therefore, in the context of non-elite courses, the admission exams of the student might reflect relatively less their true capabilities, when comparing to those students that were able to enroll in elite courses. The admission exams might be a better predictor of student capacity for the elite courses.[15] The other two effects we labelled as the "Volatility Effect" and the "Institutional Selectivity Effect"

7.1 Selection on the Volatility of Admission Exams - the "Volatility Effect"

A first hypothesis is on the volatility of the results of admission exams. To participate in the first round of the GAR, the students must have taken the admission exam once in that same year. It means that the admission exam is a one-shot procedure, and therefore its result is more dependent on variables other than the knowledge or skills of the student, such as pressure or any other idiosyncratic factor that may happen during the exam. This does not say much regarding those who entered at elite institutions, since these have had certainly higher admission scores (and high school grades too) and are therefore more homogeneous in terms of their grades. However, students that entered institutions with lower requirements might consist of different types of students, namely: those who had significant high school GPAs but had a not so high performance in the exams; or students that have exams similar exams when comparing to their high school scores. Therefore, the effect of the admission exams would be blurred in non-elite institutions. These institutions combine students that suffered from those idiosyncratic effects or not, while elite institutions will have much fewer students suffering from those effects, because

[15] We are unable to test this effect, since student preferences are only revealed after taking the admission exam. It is not possible to capture in our dataset the students that would have applied for elite courses if their exam grades were better.

if they did, their probability of accessing the elite institution would decrease significantly. Therefore, the results of the admission exams will be more volatile for those enrolled in non-elite institutions, giving the admission exam less predictive power on performance for non-elite institutions.

In order to assess the existence of the "volatility effect", we have displayed in Figure 4 the distribution of the scores in admission exams and high school. As expected, the grades in students that access elite institutions are higher than those who did not enter, both in the admission and the elite exams.

However, it is clear in both samples that the admission exams are more volatile than the high school score, reflecting its one-shot assessment nature. Since from Figure 4 it is not visible that the distribution of the elite students is less volatile when comparing with non-elite students, we resort to Figure 7, where we computed the Coefficient of Variation [16] for both High School Score and Admission Exams for different cohorts of elitism in the Higher Education System. Therefore, a Coefficient of Variation is an aggregate measure, and can not be obtained per observation. This prevents us from doing a regression to justify the phenomena.

Some important conclusions can be drawn from Figure 7. The result from Figure 4 is confirmed: Independently from the elitism level, the volatility of the Admission Exam score is relatively higher than that of the High School score. Then, as the elitism level increases, both Admission Exams and High School Score volatility decreases, which can be attributed due to the nature of the distribution, highly concentrated on the right part of the possible [95,200] grades, since students that have entered in very Elite courses ($E_i < 0.6$) have high grades both in the Admission Exam and in High School. The most important conclusion is on the "Volatility Effect". As we hypothesized, the difference between the volatility in Admission Exams and High School Exams would be decreasing for increasing degrees of elitism. That is clear in Figure 7, where the difference is big between 0 and 0.6, but very small when the Elite indicator is higher than 0.4

[Insert Table 5]

[Insert Figure 4]

[Insert Figure 7]

[16] The Coefficient of Variation measures the volatility of a distribution controlled for its mean. It is computed by dividing the standard deviation of a distribution with its mean.

7.2 Types of Admission Exams - Institutional Selectivity

Other explanation for the admission exams explaining performance in Higher Education only for the elite courses is on the institutional selectivity of such admission exams. As discussed, in Portugal, institutions do not have mechanisms to do their own admission exams, or to attribute more weight than the maximum of 50% allowed for these exams. However, there is still a significant range for admission exams' differentiation, as institutions can, if they are more strict, demand the exams of mathematics as mandatory for access; or allow a reduced number of combinations between different admission exams. On the other hand, lower-tiered institutions can ease the access to their institution by allowing entrance with just the Portuguese exam, or allowing for a great variety of combinations to suit the candidate's best interests, namely, for the student to select the exam in which he better performed on. This situation implies that the admission exam is more meaningful for the content of the courses in the elite institutions when compared to the non-elite institutions. This naturally makes the admission exam a weaker predictor of performance on non-elite institutions. Table 6 presents the results for our regression, in which the dependent variable is the Elite indicator. Each observation is a programme, and we opted for a Tobit Regression due to the high number of zeros of the dependent variable. As explanatory variables, we use the information on whether the course is more selective or not according to the limited selectivity options, the institution has. The variable "1 Mandatory Exam" is a dummy variable that reflects whether the course presents at least one exam that is repeated in all its combinations - which is a selectivity procedure given the students inability to avoid such mandatory exams. The "Number of different exams" is a variable that shows the number of different exams used for admission across all combinations. The following variables are categorical, as they refer to the number of combinations allowed, being one combination the omitted category. The following group is also categorical, as it distinguishes between the procedures where admission exams are worth 35%, 40%, 45% or 50%, with 35% being the omitted category. We use other variables as controls.

[Insert Table 6]

The regression shows that part of the elite phenomenon can be explained by the selectivity practices of the institutions. Allowing for less entry combinations, as well

as considering a higher percentage for admission exams significantly improves the elite standard of the programme. While having a mandatory exam does not seem to have a significant effect after introducing field, institution and cohort fixed effects, the coefficient for the number of different exams is also positive, reflecting that, when the program is assumed to have the number of different entrance exams combinations fixed, having more exams implies more selectivity, as the student is most likely forced to present results on more than one exam. For example, in Medicine, students have to take three exams to access the program: Mathematics, Biology and Chemistry. This reinforces the main result of this paper - that admission exams are a good predictor of academic performance, but mostly on the elite programmes. The selectivity of the program plays a role in reinforcing the effect of the admission exams in the performance of students in elite courses.

7.3 Parents' educational level

As it can be seen in Table 3, our sample is divided between HE students that are enrolled either in elite or non-elite courses. The composition of students that belongs to each group of courses is relatively similar, except for the difference in terms of the parents' educational level. This poses a potential problem as the elite variable is correlated with the educational level of parents, and therefore our estimate of the effect of being in an elite course towards performance might be confounded by this difference in the student composition in each group. However, including the variables on parental education would imply i) A reduction in the number of observations per year, as this information is not available for all students; and ii) significant heterogeneity problems, given the expected high correlation between parental education and the performance variables associated with high school, that is, the internal grade and the admission exam grades.

Our expectations between the relationship of parental education and the performance variables stem from different factors. Firstly, on the relationship between socioeconomic variables and performance, as high-endowed parents usually employ means for their sons and their daughters to perform well in general. This might include investing in extra-curricular activities or private tuition that have a positive relationship on student performance both on the long run but also on the one-shot admission exams (e.g. Smyth, 2009) . Another path for this advantage to occur is on the selection of schools, since having a better socioeconomic background might imply accessing better or more performance-oriented

secondary schools (e.g. Graddy and Stevens, 2005; Green et al., 2012). In Portugal, there is even the possibility that some schools might be inflating their internal grades due to the tight competition to access Higher Education in the country (Nata et al., 2014). This reveals also that these students might have better to the most selective Higher Education Institutions as well. Secondly, better qualified parents by themselves - even after assuming equal socioeconomic conditions - will have a better perception of the value of HE studies for their children, and therefore are a direct factor for better performance across all education levels.

Therefore, as a robustness check, we present on Table A3 of the appendix the main regression of the paper, but adding as explanatory variables the dummy variables on whether the mother and father of the student have higher education, as well as the interactions between these two variables and the internal grade and admission exams variables. As it can be noted from the previous section, the results for the elite programme indicator variable, as well as for the internal score and national exams score exhibit similar patterns of significance. Therefore, we can conclude that our results are robust in relation to the inclusion or exclusion of a variable presenting potential heterogeneity problems.

8 Conclusion

In this paper, we assessed whether the performance on teacher high school scores or admission scores at student level are good predictors for performance in Higher Education, namely, on the completion of ECTS in the first year of the course. To do so, we conducted a negative binomial regression. Other than the necessary cohort and preference Fixed Effects, We tested the robustness of such relationship by making different regressions with a number of controls, as well as field, institution and programme, fixed effects, and the introduction of a course elitism variable. Additionally, we have used a measure for student demand as a proxy for elitism at course level.

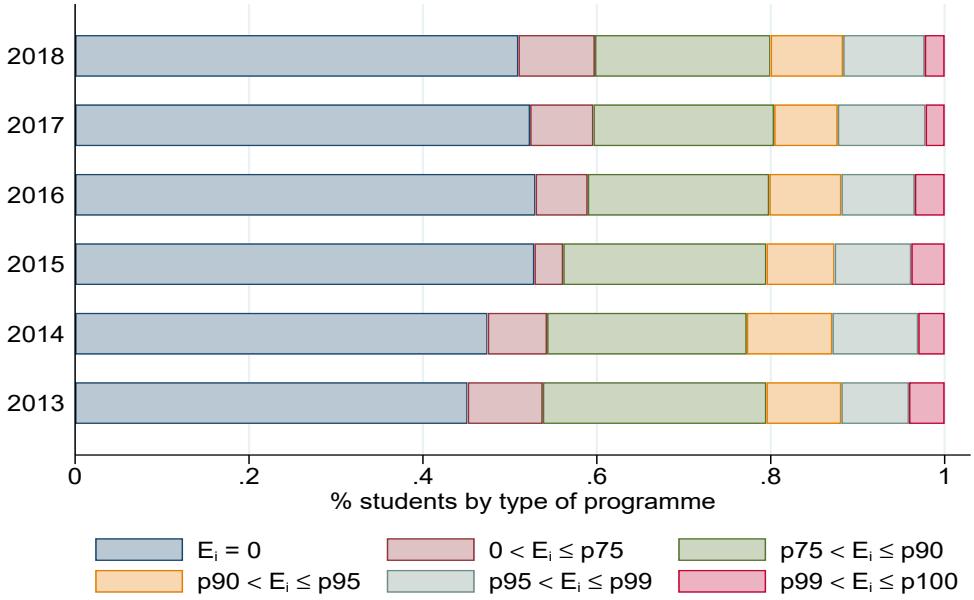
We have concluded that both the high school scores and admission exams are positively correlated with the performance of the student for all the model specifications we have tested, even though the effect of the admission exams is lower. The most novel conclusion that we find in our analysis is that when separating the effect of our two main variables according to the degree of elitism of the course, we conclude that the high

school score effect is more relevant for non-elite courses, and that the admission exams become more relevant for elite courses, even surpassing the effect of the high school scores variables. This result indicates that there is more than meets this eye for this relationship.

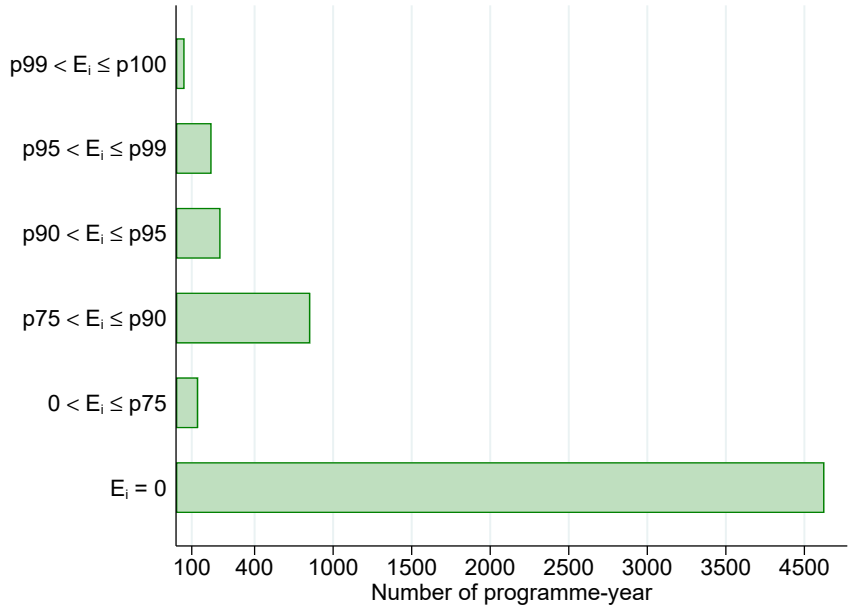
We sought an explanation for this phenomenon and we arrived at two mechanisms, which we have proved to happen empirically. The first is the "Volatility Effect", in which we conclude that the one-shot nature of the admission exams, coupled with the selection issue that those who entered elite institutions are those that have had a good admission exam, leaves us with the idea that the grades in admission exams of students in non-elite institutions are more dependent from one-shot idiosyncrasies, and therefore reflect less the ability of the students, when compare to those that assessed elite courses. We show this mechanism by verifying that the coefficient of variation for elite courses in admission exams is lower than the same value for non-elite courses.

The second mechanism is the "Institutional Selectivity Effect", which arises from the fact that elite courses are more selective when it comes to their admission exams. Therefore, these institutions can 1) allow less combinations of admission exams to access of their courses; 2) attribute a larger weight to the admission exams on the application process; and 3) ask for admission exams that are more closely related to the field of the course. Therefore, the admission exams in elite courses are more meaningful to the course content and to its difficulty when comparing with non-elite courses. We show this mechanism is viable since more elite institutions indeed place a higher weight in the admission exams, as well as restrict the number of combinations when compared to non-elite institutions.

9 Figures



(a) Students enrolled in elite programmes



(b) Elite Programmes

Figure 1

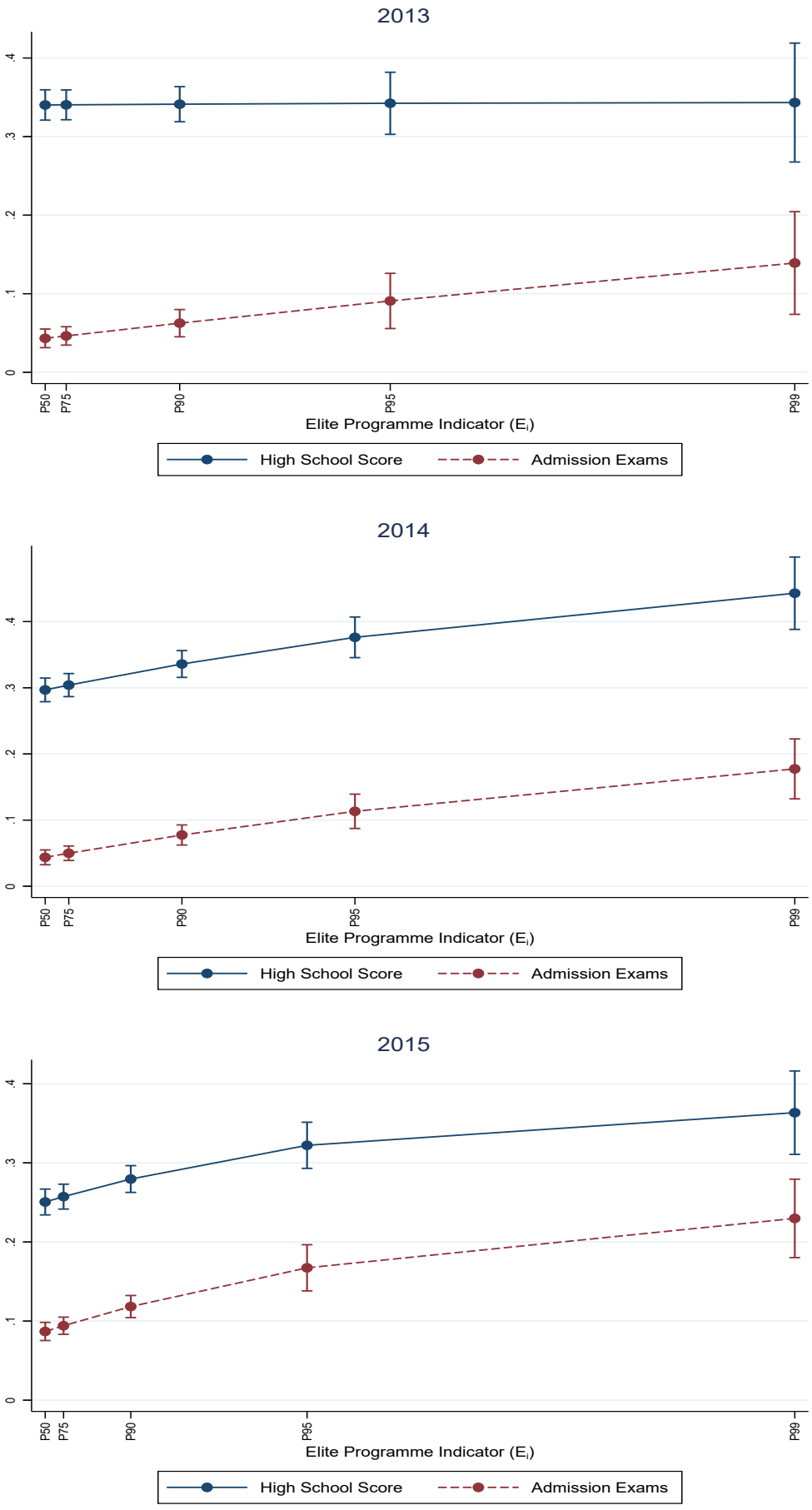


Figure 2: Marginal effects according to programme selectivity

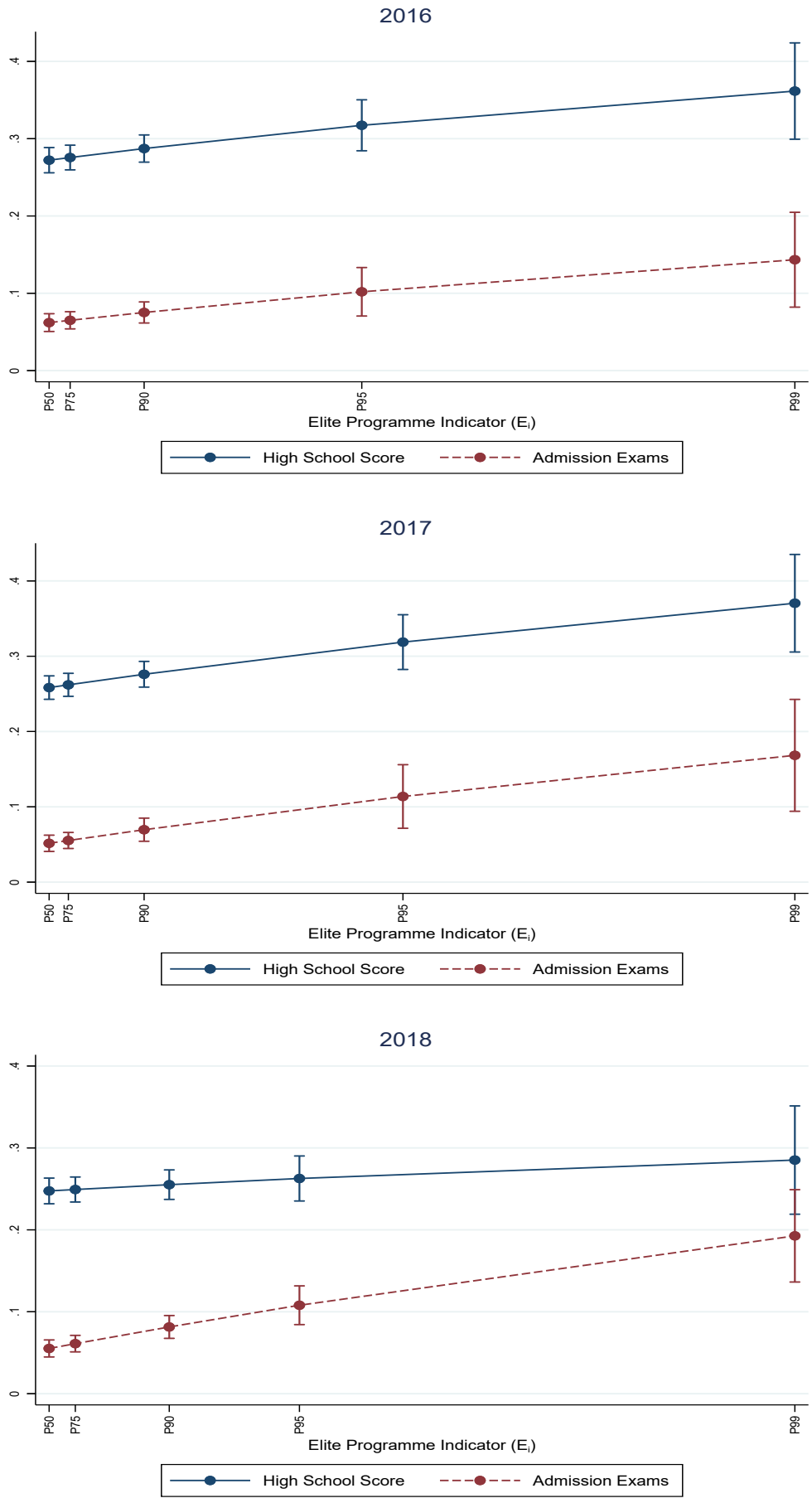


Figure 3: Marginal effects according to programme selectivity (continuation)

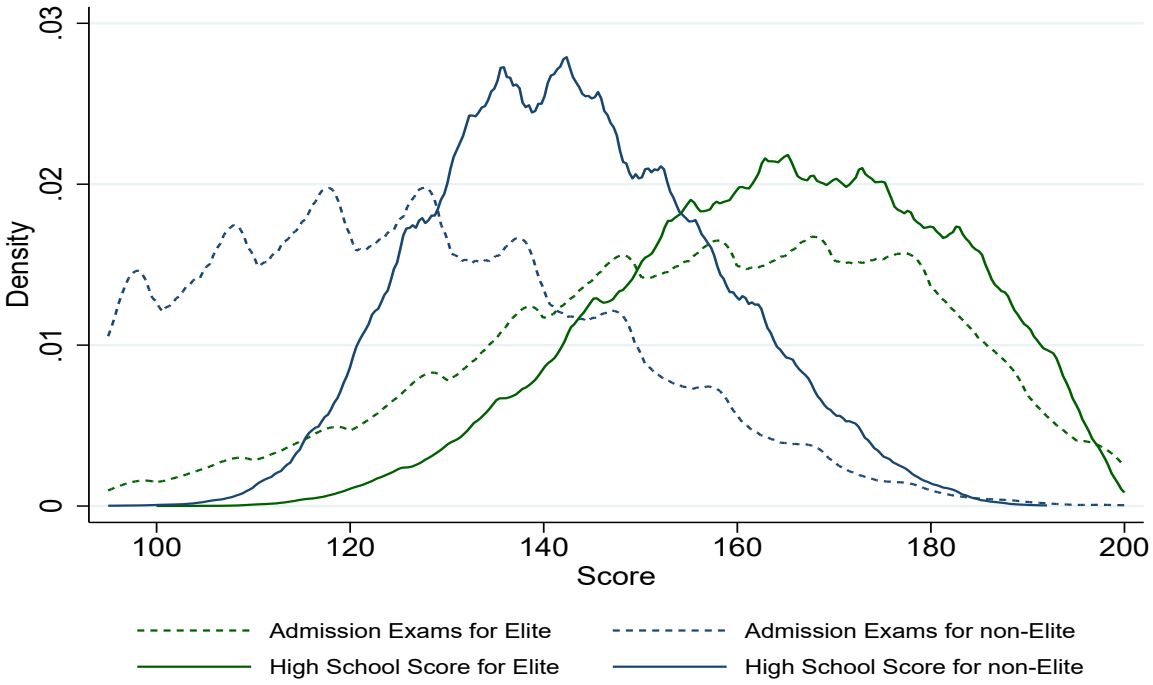


Figure 4: Distribution of admission exams and high school score

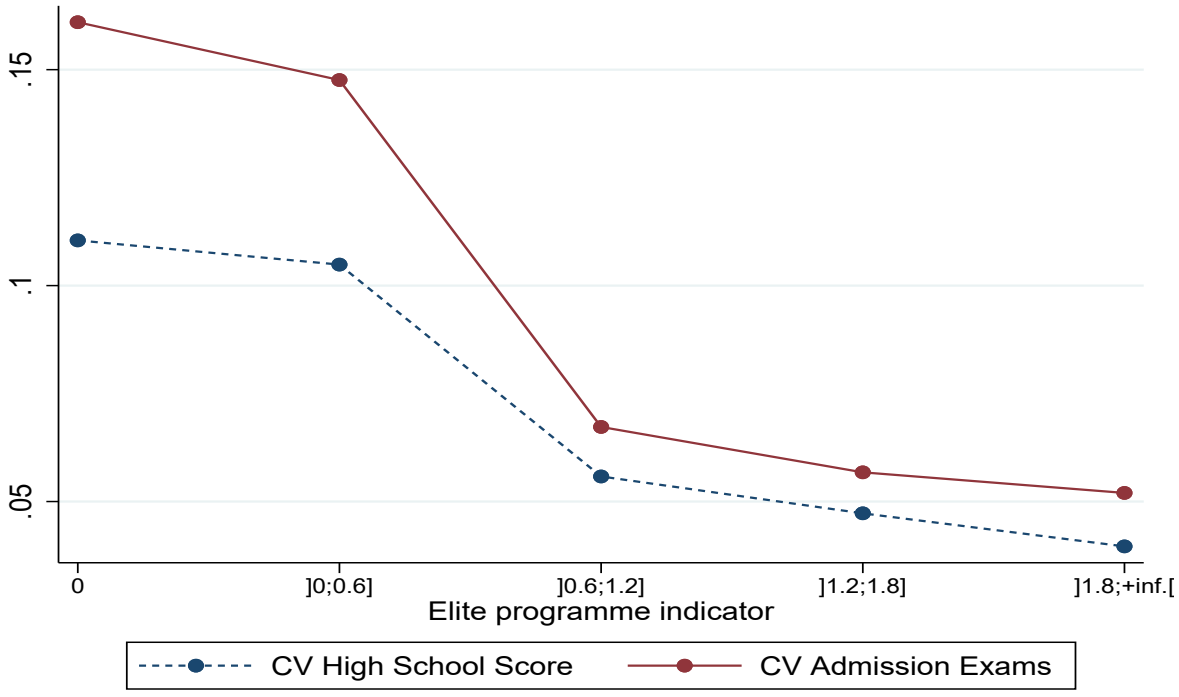


Figure 5: Coefficient of Variation

10 Tables

Table 1: Descriptive Statistics, Analysis Population, **Linked dataset**

A. Data Structure			
Initial year	2013/2014		
Final year	2018/2019		
Number of years	6		
Number of Individuals	177,916		
	Mean	Std. Dev.	N
B. Individuals			
Age	18.28	1.62	177,916
Female (share)	.58		177,916
Admission Exams	140.24	26.17	177,916
High school GPA	152.05	20.14	177,916
Public high school (share)	.91		151,635
Non-local student (share)	.31		177,916
Mother has HE (share)	.35		170,639
Father has HE (share)	.27		167,393
Applied and received to a maintenance grant (share)	.26		177,916
Applied and did not received a maintenance grant (share)	.06		177,916
C. Placement			
Degree of placement (no. individuals)			
Bachelor			140,645
Integrated Master			37,271
Preferences of placement (share)			
1st	.58		177,916
2nd	.21		177,916
3rd	.10		177,916
4th	.05		177,916
5th	.03		177,916
6th	.02		177,916
Admission score (0-200)	147.2	20.17	177,916
Admitted to an elite institution (share)	0.50		177,916
Admitted to an elite Institution by field (share)			
Education	0.01		177,916
Arts & Humanities	0.12		177,916
Social Sciences	0.21		177,916
Sciences	0.11		177,916
Engineering	0.20		177,916
Agriculture	0.01		177,916
Health	0.14		177,916
Services	0.02		177,916
D. Outcomes			
ECTs accumulated by the end of the 1st year	54.05	14.54	152,332

Source: Author's calculations. Notes: Scores are measured in a scale between 0 and 200. We only consider individuals that applied to public HEIs in Portugal Mainland under the GAR in the 1st round of applications

Table 2: Elite Indicator Programme for the economics degree in Portugal

		2015			2016		
Programme	Vacancies	Threshold	s_i	E_i	Threshold	s_i	E_i
Universidade Nova de Lisboa	223	173.5 (1)	2.43 (1)	0.71 (1)	169.5 (1)	2.04 (1)	0.53 (1)
Universidade do Porto	210	171.5 (2)	2.13 (2)	0.61 (2)	169.5 (1)	1.73 (2)	0.47 (2)
Universidade do Minho	79	163.6 (3)	1.00 (4)	0	164.6 (3)	1.06 (3)	0.05 (3)
ISCTE (Lisboa)	80	160.5 (4)	0.81 (6)	0	160.0 (4)	1.06 (4)	0.01 (7)
Universidade de Aveiro	50	156.4 (5)	0.66 (7)	0	154.0 (5)	1.02 (5)	0
Universidade de Lisboa	145	154.5 (6)	0.88 (5)	0.02 (4)	154.0 (5)	0.77 (7)	0.02 (5)
Universidade de Coimbra	154	149.0 (7)	1.42 (3)	0.03 (3)	145.0 (7)	0.92 (6)	0.03 (4)
Universidade de Trás os Montes	36	139.8 (8)	0.61 (9)	0	140.7 (8)	0.61 (9)	0
Universidade da Beira Interior	45	128.0 (9)	0.24 (12)	0	129.9 (10)	0.27 (10)	0.02 (6)
Universidade do Algarve	25	124.2 (10)	0.64 (8)	0	122.0 (11)	0.68 (8)	0
Universidade de Évora	37	118.8 (11)	0.16 (13)	0	120.8 (12)	0.27 (11)	0
Universidade dos Açores	20	112.1 (12)	0.50 (10)	0	133.6 (9)	0.15 (13)	0
Universidade da Madeira	45	98.3 (13)	0.38 (11)	0	106.7 (13)	0.24 (12)	0

Source: Authors calculations. Notes: Scores are measured in a scale between 0 and 200. We only consider the economics degree for the years 2015 and 2016

Table 3: Descriptive statistics by type of programme

	Non-elite programmes		Elite programmes	
	Mean	Std. Dev.	Mean	Std. Dev.
No. Individuals	89,664		88,252	
Age	18.52	1.89	18.03	1.24
Admission Exams	125.91	20.27	154.8	23.28
High school GPA	141.07	15.58	163.2	17.99
Female (share)	.59		.57	
Public high school (share)	.92		.90	
Non-local student (share)	.30		.31	
Mother has HE (share)	.25		.45	
Father has HE (share)	.18		.36	
Applied and received MG (share)	.30		.22	
Applied and did not received MG (share)	.06		.06	
ECTs year 1	52.09	16.17	54.74	14.83

Table 4: Baseline Results (average marginal effects)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
No. of ECTS by the end of the 1st year (Negative Binomial)										
High school score	0.146***	0.136***	0.238***	0.280***	0.164***	0.185***	0.226***	0.234***	0.268***	0.280***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Admission exams	0.029***	0.037***	0.089***	0.072***	0.052***	0.084***	0.072***	0.087***	0.058***	0.069***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
E_i					-4.839***	-18.451***	-1.755***	-9.040***	-1.108***	-8.243***
					(0.110)	(0.682)	(0.149)	(0.671)	(0.153)	(0.674)
Female		4.114***	2.386***	2.213***	4.059***	4.056***	2.590***	2.594***	2.422***	2.427***
		(0.083)	(0.080)	(0.079)	(0.083)	(0.083)	(0.082)	(0.082)	(0.082)	(0.082)
Public high school		1.207***	1.358***	2.668*	1.225***	1.223***	1.484***	1.482***	2.274	2.269
		(0.141)	(0.121)	(1.374)	(0.141)	(0.140)	(0.126)	(0.126)	(1.416)	(1.415)
Non_local student		2.834***	-0.496***	-0.252**	2.794***	2.807***	-0.848***	-0.825***	-0.645***	-0.619***
		(0.090)	(0.091)	(0.099)	(0.089)	(0.089)	(0.093)	(0.093)	(0.101)	(0.101)
N	130,371	130,371	130,371	130,371	130,371	130,371	130,371	130,371	130,371	130,371
Pseudo R2										
High School Score × E_i						✓		✓		✓
Admission Exams × E_i						✓		✓		✓
High School FE				✓					✓	✓
Programme FE			✓	✓						
Field FE (3 dig)							✓	✓	✓	✓
Institution FE							✓	✓	✓	✓
Cohort and Preference FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: Robust standard errors are in parentheses. *,** and *** represents statistical significance from 10%, 5% and 1% respectively.

Table 5: Admission exams volatility effects (OLS)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Admission Exams Score							
High school score	0.869***	0.875***	0.858***	0.326***	0.384***	0.635***	0.649***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)
E_i						15.700***	239.762***
						(0.219)	(4.566)
High School Score × E_i							-1.197***
							(0.024)
Cohort FE							
2014/2015			3.237***	2.713***	2.723***	2.954***	3.013***
			(0.203)	(0.166)	(0.162)	(0.171)	(0.168)
2015/2016 (elections)			9.317***	9.302***	9.344***	9.183***	9.455***
			(0.194)	(0.158)	(0.155)	(0.166)	(0.162)
2016/2017			7.339***	7.722***	7.701***	7.340***	7.669***
			(0.194)	(0.158)	(0.155)	(0.165)	(0.162)
2017/2018			7.552***	9.466***	9.287***	8.267***	8.606***
			(0.190)	(0.155)	(0.153)	(0.161)	(0.158)
2018/2019			4.097***	6.478***	6.261***	5.063***	5.359***
			(0.190)	(0.156)	(0.154)	(0.161)	(0.158)
Constant	7.907***	6.378***	5.602***	86.683***	77.271***	25.076	25.059***
	(0.400)	(0.453)	(0.479)	(0.771)	(1.400)	(48318.743)	(1.823)
N	130,371	130,371	130,371	130,371	130,371	130,371	130,371
R^2	0.413	0.417	0.439	0.658	0.676	0.608	0.621
Programme FE				✓	✓		
Field FE (3 dig)						✓	✓
Institution FE						✓	✓
High School FE					✓	✓	✓
Controls		✓	✓	✓	✓	✓	✓
Cohort and Preference FE		✓	✓	✓	✓	✓	✓

Notes: Robust standard errors are in parentheses. *,** and *** represents statistical significance from 10%, 5% and 1% respectively. Controls: female, public high school, non-local student.

Table 6: Elite programmes volatility effects (OLS)

Elite Indicator Programme (E_j) - Tobit model	(1)	(2)	(3)
1 Mandatory Exam	-0.055***	-0.072***	-0.018
	(0.017)	(0.017)	(0.017)
No. of different exams	0.123***	0.120***	0.116***
	(0.022)	(0.022)	(0.020)
No. of entrance exam combinations allowed			
1 Two	-0.190***	-0.186***	-0.149***
	(0.033)	(0.033)	(0.031)
1 Three	-0.345***	-0.341***	-0.265***
	(0.043)	(0.043)	(0.039)
1 Four	-0.432***	-0.418***	-0.373***
	(0.067)	(0.066)	(0.059)
1 Five	-0.567***	-0.563***	-0.501***
	(0.099)	(0.099)	(0.088)
1 Six	-0.496***	-0.478***	-0.425***
	(0.120)	(0.119)	(0.107)
Admission Exams weight			
1 40%	0.318***	0.318***	0.029
	(0.021)	(0.022)	(0.029)
1 45%	0.382***	0.380***	0.228***
	(0.068)	(0.069)	(0.056)
1 50%	0.479***	0.480***	0.194***
	(0.028)	(0.028)	(0.025)
Share of Females		0.031	0.036
		(0.023)	(0.025)
Share of Public High School		0.259***	0.159***
		(0.042)	(0.042)
Share of Non local students		0.053***	0.513***
		(0.018)	(0.059)
Constant	-0.570***	-0.790***	-0.692***
	(0.047)	(0.061)	(0.071)
N	5,687	5,687	5,687
Pseudo R^2	0.27	0.28	0.40
Field FE (3 dig)			✓
Institution FE			✓
Cohort FE			✓

Notes: Robust standard errors are in parentheses. *,** and *** represents statistical significance from 10%, 5% and 1% respectively.

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For Online Appendix

A Appendix: Data

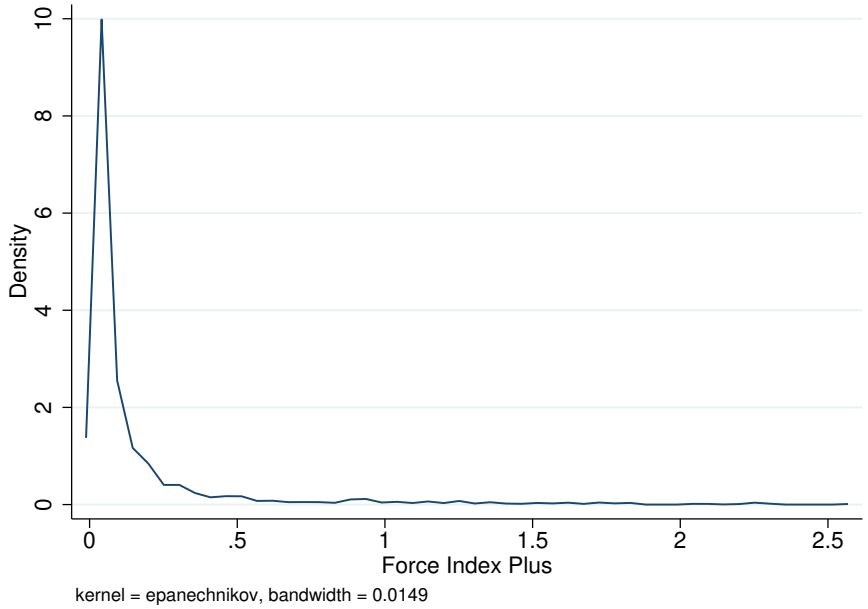

Figure 6: Distribution of Elite Programmes

Source: Authors' calculcation. Notes: Only include programmes with $E_i > 0$.

Table A1: Distribution of Elite Indicator Programme (E_i)

	2013/2014			2014/2015			2015/2016		
	Max E_i	No. programmes	No. Individuals	Max E_i	No. programmes	No. Individuals	Max E_i	No. programmes	No. Individuals
$E_i = 0$	0	677	12,277	0	678	12,818	0	692	16,173
$0 < E_i \leq$ p75	0.018	29	2,347	0.014	21	1,840	0.012	10	1,016
p75 $< E_i \leq$ p90	0.070	147	6,993	0.067	140	6,194	0.063	140	7,153
p90 $< E_i \leq$ p95	0.200	49	2,342	0.183	43	2,655	0.169	46	2,402
p95 $< E_i \leq$ p99	1.007	35	2,116	0.925	38	2,665	0.933	38	2,698
p99 $< E_i \leq$ Max	1.619	10	1,214	1.616	9	819	2.176	9	1,174
N	-	947	27,289	-	929	26,991	-	935	30,616

Table A2: (Distribution of Elite Indicator Programme (E_i) - continuation

	2016/2017			2017/2018			2018/2019		
	Max E_i	No. programmes	No. Individuals	Max E_i	No. programmes	No. Individuals	Max E_i	No. programmes	No. Individuals
$E_i = 0$	0	698	16,180	0	696	16,522	0	688	15,674
$0 < E_i \leq$ p75	0.013	19	1,827	0.016	22	2,296	0.020	39	2,701
p75 $< E_i \leq$ p90	0.073	139	6,374	0.077	142	6,559	0.086	146	6,229
p90 $< E_i \leq$ p95	0.150	49	2,527	0.183	48	2,309	0.219	48	2,580
p95 $< E_i \leq$ p99	1.033	37	2,573	1.171	39	3,186	1.122	39	2,880
p99 $< E_i \leq$ Max	2.259	10	1,045	2.553	9	765	2.313	10	773
N	-	952	30,526	-	956	31,637	-	970	30,837

Source: Authors' calculations. Notes: Scores are measured in a scale between 0 and 200. We only consider individuals that applied to public HEIs under the GAR in the 1st round of applications.

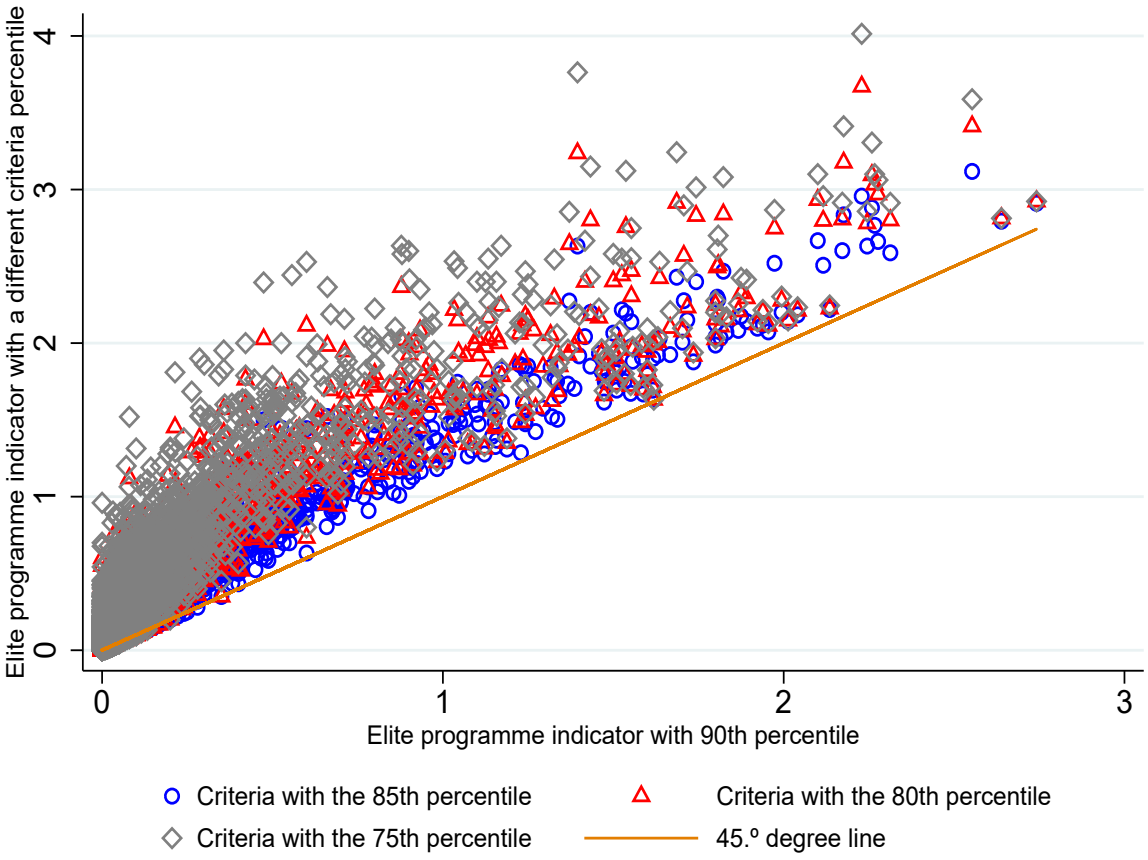

Figure 7: Elite programme indicator with different criteria percentiles

Table A3: Parents' Education (average marginal effects)

	(1)	(2)	(3)	(4)
High school score	0.236***	0.235***	0.274***	0.274***
	(0.003)	(0.003)	(0.004)	(0.004)
Admission exams	0.074***	0.074***	0.058***	0.059***
	(0.002)	(0.002)	(0.002)	(0.002)
E_i	-1.563***	-1.868***	-1.044***	-1.414***
	(0.156)	(0.158)	(0.160)	(0.162)
N	122,291	122,291	122,291	122,291
Pseudo R2				
Mother with HE	✓	✓	✓	✓
Father with HE	✓	✓	✓	✓
Mother with HE $\times$ E_i		✓		✓
Father with HE $\times$ E_i		✓		✓
High School FE			✓	✓
Controls	✓	✓	✓	✓
Field FE (3 dig)	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓
Cohort and Preference FE	✓	✓	✓	✓

Notes: Robust standard errors are in parentheses. *,** and *** represents statistical significance from 10%, 5% and 1% respectively. Controls: female, public high school and non-local student.