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University selectivity and returns premium: evidence from Kazakhstan

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ABSTRACT

More selective universities are presumably better in quality and expected to provide better labour market outcomes for their graduates – returns premia. However, various empirical applications have found that part of it should be attributed to selectivity. Using the data on recent higher education graduates' entry salaries with a fuzzy regression discontinuity design, this study reveals no apparent difference in the returns one gains by attending more selective and relatively better-funded national universities as opposed to other public HEIs in Kazakhstan, at least during the first year in employment, which may potentially call for a reconsideration of the associated policies.

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1. Introduction

In line with the transition reforms, Kazakhstan has experienced and is currently experiencing dramatic changes in higher education: a sharp increase in the number of higher education institutions and students, privatization, marketization, changes to academic content and the design of new frameworks and institutional structure. In 2001, nine public universities were granted the status of *'national university'*, allowing them to benefit from relatively better public funding, administrative support and the privilege to raise their tuition fees. In return for better input, they are expected to 'guarantee consistently high world-class standards of education' (Decree 2001) and 'integrate teaching, learning and research at all levels of study' (OECD 2017, 56). In accordance with these expectations, in 2012, national universities were forced to become more selective in their admissions, increasing minimum admission requirements compared to other institutions in order to improve the quality of their student intake. It is natural to expect that such universities should provide better labour market outcomes for their graduates compared to those from other HEIs, and this is confirmed by many empirical examinations worldwide. However, a part of this returns premium is often attributed to selectivity itself in addition to other channels, such as a presumably better academic quality, labour market signals or various peer effects.

The reform of 2012 allows to address the following research question: do more selective national universities provide higher returns to undergraduate degrees than other public HEIs in Kazakhstan, and if so, to what extent are the improved outcomes explained by selectivity? I use administrative data on the entry salaries of a sample of higher education graduates and control for the national universities' selectivity by exploiting the fuzzy regression discontinuity design and the newly established entry test score threshold. Unlike the simple OLS estimations, with FRDD the result did not reveal a returns premia to be gained by attending national universities, at least during the first

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year in employment and for the first affected cohort. This result was found to be robust via several sensitivity checks. Alternative explanations for this could arise from the methodological limitations (particularly, from the local nature of RDD) or data constraints (as only the entry salaries of the first cohort affected by a selectivity policy are considered).

To the best of my knowledge, the current study represents one of very few attempts to estimate the returns to attending more selective institutions in the former Soviet bloc countries. Meanwhile, these countries represent unique and interesting cases due to their particular initial preconditions and the rapid transition from them. It is known that the returns to education in countries with different economic structures will themselves vary. For example, in developing countries, the returns are normally higher than in developed, mostly due to lower levels of human capital accumulation and limited access to education in the latter. In contrast, the Soviet Union heavily invested in education and, as a result, its population was characterised by relatively high educational attainments. However, the rates of returns in the Soviet economy were very low, labour markets were under-developed, and the content of education was purely tailored to fit the planning economic system (Kapelyushnikov 2008). Accompanying this, access to higher education was very competitive since its supply did not meet the demand (Huisman, Smolentseva, and Froumin 2018). Along with that, it is likely that the quality of HEIs was on average substantially better and at the same time much less diverse during the Soviet era than it became after the collapse of the Soviet Union and further reforms.

The motivation behind this study can be comprehensively summarised in the words of Dale and Krueger (2014, 2):

> understanding why students who attend higher quality colleges have greater earnings is crucial for parents deciding where to send their children to college, for colleges selecting students, and for policy-makers deciding whether to invest additional resources in higher quality institutions.

Although it is difficult to judge the quality of HEIs in Kazakhstan due to a lack of reliable evidence, I assume a better than average quality of the national universities based on their higher selectivity and relatively better public funding. Therefore, as a practical point, it is critical to understand whether this anticipated better quality is actually reflected in graduates gaining higher wages.

The remainder of this paper is divided into the following sections. The following section provides a review of the theoretical framework for a link between institutional selectivity and the economic returns to education and various empirical observations worldwide. It is followed by the section setting the country context, explaining institutional framework, the regulations and procedures guiding the centralised entry examination and higher education admission. It additionally briefly explains public funding of higher education which is effectively achieved through the central exam and scholarship allocation scheme, allowing one to understand the differences in the distribution of the test scores across different types of HEIs. The next section describes the dataset used for the analysis, while Section 5 presents the methodology. Section 6 documents the findings, and the final section discusses possible interpretations fitting the country context and the concluding remarks to the study.

2. Theoretical framework and empirical observations

The possible relationship between higher education quality and selectivity and improved labour market outcomes of more selective institutions' graduates is still a trending though well-studied topic. Starting with the pioneering works of Solmon (1975) and Wise (1975), higher education selectivity is commonly defined as an average quality of student intake across institutions measured by the mean entry examination score, such as, for example, the SATs (Standard Aptitude Tests) in the United States or A-Levels in the United Kingdom. As a matter of course, more selective institutions, with their superior students and staff and advanced resources, are presumably better in academic quality (apparently with two-way causality between quality and selectivity) which should normally add relatively more value to the human capital productivity and lead to higher employability and

salaries, as implied by the human capital theory introduced by Becker (1983), Mincer (1974) and Schultz (1960, 1961).

Another path from institutional selectivity to future earnings is the so-called peer effect – being in a class with more able peers creates value by itself, inspiring students to become more (economically) successful in their future lives (Winston and Zimmerman 2004; Stinebrickner and Stinebrickner 2006; Carrell, Fullerton, and West 2009; Brunello, De Paola, and Scoppa 2010; Sacerdote 2011; Garlick 2018). The perspective of the peer-effects literature allows one to understand the nature of the institutional selectivity and two-way causality between peer-effects and selectivity. Winston and Zimmerman (2004) emphasize that peer effects constitute a specific feature of the technological process in (higher) education or so-called 'customer-input technology'. 'High quality colleges are selective because that is the way they assure an ample input of student quality' (Winston and Zimmerman 2004, 23), and, therefore, 'student and institutional quality go hand in hand' (Winston and Zimmerman 2004, 18).

The other possible scenario, however, assumes a negative relation between peers' higher ability and an individual's own achievements referred as 'Big Fish Little Pond Effect' – comparison with more able peers might demotivate and decrease future outcomes (Marsh et al. 1995; Hau and Marsh 2003; Bui, Craig, and Imberman 2014). In either event, empirical evidence often suggests peer effects to be more significant for students either on the bottom of the test score distribution (Winston and Zimmerman 2004; Stinebrickner and Stinebrickner 2006; Garlick 2018) or those from disadvantaged backgrounds who 'might benefit the most from having good peers' (Stinebrickner and Stinebrickner 2006, 7). Equivalently, at the secondary school level, achievements driven by interactions with peers are usually observed among the low-achievers, students from poor families and minorities (Abdulkadiroğlu et al. 2011; Dobbie and Fryer 2011; Abdulkadiroğlu, Angrist, and Pathak 2014). A similar conclusion arises from the literature focused on the impact of student heterogeneity on their outcomes, commonly capturing the effects of weaker students benefiting from their high achieving peers (Lyle 2009; Booij, Leuven, and Oosterbeek 2017; Braakmann and McDonald 2018). On the other hand, some studies have found the best-achieving students being also advantaged by interacting with equal peers (Sacerdote 2001).

There is another path from peer effect to higher returns -- so-called, network externalities -- 'ties formed between college peers' which lead to referral-based 'good' jobs allocation (Zimmerman 2019, 1). However, conclusions from this literature possibly hardly apply to the graduates of the public institutions, as the cause of these effects probably comes from family wealth, and children from wealthier families in many countries tend to study at elite private institutions, which is also the case in Kazakhstan.

Finally, it could be the case that attending more selective institution is a signal of student's greater abilities, as it is perceived by employers, and this sorts more able and productive workers from less able and productive, which is naturally implied by the signalling and sorting theory developed by Spence (1973), Stiglitz (1975) and Arrow (1973). Education could be classified as an experience good (as opposed to inspection good) whose quality can only be determined after purchase (Nelson 1970), and reputation of the producer matters a lot for experience goods (MacLeod et al. 2017). Notably, in this case, the selective university need not necessarily be better in quality, but could rather create reputation effects.

Practically, these effects often coexist and can only rarely be disentangled and decomposed effectively. Using the natural experiment of the reform reducing the amount of coursework at the top university in Colombia, Arteaga (2018) found it to negatively affect the graduates' wages which 'reject a pure signalling model' (Arteaga 2018, 212). She assumes that since the reform has not affected the university's international and national rankings, according to the signalling model the affected graduates' wages should not change while the human capital model predicts their decline, where the latter was indeed the case. At the same time, many empirical observations simply assume the existence of these effects which are expected to contribute to a positive relationship between university selectivity and its graduates' outcomes.

The evidence from the empirical literature is mixed. While most of earlier and the latest evidence from the developed world confirms higher returns to selectivity and quality, there are also exist famous studies arguing in favour of the significant role of selectivity policies contributing to better labour market outcomes of elite institutions' graduates rather than productivity, peer or reputation effects; and these studies are probably of particular interest due to their non-trivial results.

The most researched country is unsurprisingly the USA, where the studies of Solmon (1975), Loury and Garman (1995), Brewer, Eide, and Ehrenberg (1999), Hoekstra (2009), Andrews, Li, and Lovenheim (2016) and Black, Denning, and Rothstein (2020) found certain significant estimates associated with selectivity. Solmon names the average SAT scores among 'the most important of the measurable institutional traits in the earnings functions of former students' (Solmon 1975, 583). Loury and Garman (1995) conclude that every 100 points added to the median SAT could increase earnings by 2.4–5% for white and black men, respectively. Brewer, Eide, and Ehrenberg (1999) controlling for selectivity with the 'selectivity term' with the data on US 1972 high school class find a significant economic return to attending an elite private institution. Hoekstra (2009) modelled a regression discontinuity design based on a rather complicated admission rule to enter flagship public university accounting for both SAT score and the high school GPA. With the data on the earnings of 28- to 33-year olds, he identified considerable returns to 'enrolling at the flagship state university – approximately 20% higher earnings' (Hoekstra 2009, 718). A more recent study by Andrews, Li, and Lovenheim (2016) using unconditional quantile treatment effects methods examines the distribution of college quality premia for the graduates of Texas colleges of 1996–2002. It reveals that for the most selective and prestigious university in Texas – UT Austin – the returns premiums vary from around 3% at the 9th earnings percentile to around 32% at the 97th percentile, while the result is opposite for another high-quality university. The authors tend to explain this discrepancy in results by differences in subject composition between two institutions. Nonetheless, both provide higher returns compared to less prestigious colleges. Finally, the study by Black, Denning, and Rothstein (2020) exploits a unique natural experiment – a policy called 'the Texas Top Ten Percent rule' that guaranteed access at any public university to any top 10 % achiever of their high school class in Texas. The primary effect of the policy was an increase in the number of students from disadvantaged high schools entering a flagship university in Texas – so-called 'Pulled In' students, – at the expense of the ones from the more prestigious high schools -- so-called 'Pushed Out' students. Using administrative dataset tracking individuals from their high school to a university and then the labour market for up to 15 years and random forest machine learning prediction algorithm, the authors have estimated the effect of attending a more selective college on enrolment, graduation, and labour market returns for the 'Pulled In' students. Additionally, unlike any other previous study, they managed to reveal the effect of losing access to selective education for the 'Pushed Out' students. The study concludes that while the first group's increased access to a selective university improved their labour market outcomes, for the second group the policy did not cause a decline in their wages. In addition to an interesting conclusion about both the social and the economic efficiency of the policy, it suggests the existence of various intervening and not easily generalisable sources of the returns to education. For example, with regard to the students 'Pushed Out' by the policy, the authors conclude that 'benefits of attending a more selective public institution may be quite small for these students' (Black, Denning, and Rothstein 2020, 6), possibly due to their better family background.

However, Dale and Krueger, using various approaches to control for the student admission by elite colleges – the so-called "'self-revelation" model because individuals reveal their unobserved quality by their college application behaviour' (Dale and Krueger 2002, 12–13) – concluded that among the school characteristics considered, average tuition costs are more important than average SAT score though the returns to both are 'greatest for students from more disadvantaged backgrounds' (Dale and Krueger 2002, 31). In their second paper, they used extended indicators of college quality (rather than just selectivity as measured by the test score) and discovered significant returns from attending more selective colleges: a '100-point higher SAT score led to students

receiving about 6% higher earnings'; however, this disappeared in the model adjusted by selectivity (Dale and Krueger 2014, 29).

In the UK, the earliest study by Chevalier and Conlon (2003) with the use of propensity score-matching found the returns to attending elite research-intensive and more selective Russell Group universities to be up to 6% higher as compared with other institutions. Along with that, the later study by Walker and Zhu (2018), employing U.K. data, controls for university selectivity by constructing two residual wages measures – selectivity-unadjusted from the wage regression that omits subject and institution, and selectivity-adjusted from the same regression that included the mean standardized A-Level score for each subject-institution cohort, defining the difference as the wage premium attributed to selectivity. The latter turned out to be substantial, though varying widely across universities. According to this study, so-called New Universities (former polytechnics which were granted university status in 1992) perform better in terms of returns premium when adjusted for selectivity, while the opposite is true for the Russell Group universities. Finally, the research report on relative labour market returns in the UK (Belfield et al. 2018) again provides evidence of a clear though not homogeneous hierarchy of UK universities in earnings premia, which is dominated by the Russell Group. The authors then used Inverse Probability Weighted Regression Adjustment (IPWRA) and found these differences in earnings dropped noticeably: 'high-status, high-earnings institutions typically take high-ability individuals who would likely have had high earnings regardless of the institution they attended, whereas low-status universities typically take lower-ability individuals', they conclude (Belfield et al. 2018, 46).

Less research is done within the context of the other developed countries. Research by Canaan and Mouganie (2018) focuses on the economic returns to higher education quality specifically for low-skilled students using the data on high stakes exit exams taken by secondary education leavers in France. As several other papers, they utilise regression discontinuity, taking advantage of the fact that 'barely passing versus barely failing the exam on the first attempt leads to a significant increase in quality of [subsequent] higher education' that is driven by 'universities' policies of enrolling students on a first-come, first-served basis, as well as by students potentially becoming discouraged after failing the first exam attempt' (Canaan and Mouganie 2018, 396–397). Their results are suggestive that exposure to better quality higher education does not affect an employment opportunity but positively affects wages. Discontinuity in the centralised higher education admission test is exploited in the paper of Kirkeboen, Leuven, and Mogstad (2017) that uses the data from Norway to estimate the effect of the field of study choice. Notably, they found out a substantial effect of the field of study on further incomes, more important than the effect of a university selectivity that turned out to be more modest. Anelli (2020) estimates the effect of graduating from a highly selective and expensive private university as opposed to less selective public universities using the data from Italy and sharp discontinuity in the probability of admission based on admission scores. The research suggests a very robust and highly statistically significant income premium of 44–58 log points one gains by attending the elite university under analysis.

There are not that many studies addressing the relation between institutional quality/selectivity and their graduates' outcomes in emerging and developing economies. To the best of found knowledge, the majority are concerned with the secondary education level. Ajayi (2011) measures 'academic outcomes for students who attend [secondary] schools of differing quality' in Ghana and finds 'that the effects of school quality are meaningful' (Ajayi 2011, 71). Hanushek (1995) comprehensively summarises a number of studies based on developing countries' data, comparing them with the similar US data studies, referring to 'a possible differentiation by stage of development and general level of resources available' (Hanushek 1995, 231) between the two. He concludes that school quality is a crucial factor in students' achievements, in particular, that 'low school quality may frequently be an important explanation for the widespread failure to take advantage of the apparently high returns available from education' in developing countries (Hanushek 1995, 236), though it is poorly possible to identify which exact measurable school characteristics are the most significant determinants of quality.

Finally, there are several empirical examinations analysing the effect of school quality on economic rather than academic outcomes in the developing world. The first paper stressing the importance of school quality was undertaken by Behrman and Birdsall (1983). They show that ignoring quality measurement while estimating the returns to schooling might generate upward bias in estimates and, using Brazilian data, show the importance of schooling quality for labour market outcomes. They conclude that "'deepening" schooling by increasing quality' rather than "'broadening" schooling by increasing quantity' could be a more rewarding policy in the context of the developing countries (Behrman and Birdsall 1983, 929).

Psacharopoulos and Velez (1993), exercising the data for higher education quality measured with a number of indicators and individual earnings in Colombia, find that 'the score on the university entrance examination and the university's prestige rating have a significant positive impact on the earnings and occupational status of adults' (Psacharopoulos and Velez 1993, 130). This was recently reconfirmed by MacLeod et al. (2017) who empirically test the effects of college reputation on graduates labour market outcomes using the introduction of the national exit exam as a natural experiment. They assume that bringing in a new signal of individual ability in a form of exit exam should reduce the returns to college reputation given that employers offer wages in accordance with it, and indeed the Colombian data appear to confirm this.

The study using data from Honduras states that 'men educated in counties with better quality schooling earned significantly higher incomes than those men educated in counties with low-quality schools' (Bedi and Edwards 2002, 182).

The centralised university admission system in Chile makes it another interesting setting to empirically test the returns to education quality. The paper by Kaufmann, Messner, and Solis (2015), however, is concerned with individuals' family formation decisions and the intergenerational transmission of human capital rather than the labour market outcomes. Using RDD, they have found that attending a highly ranked university significantly increases a 'quality' of a partner for females (as measured by their test scores, admission to top universities and family backgrounds) and a 'quality' of future children for both males and females (as measured by children's performance at the national standardized cognitive tests in school).

Among emerging and developing economies' papers on selectivity and quality and economic returns, research exploiting the case of China might be particularly relevant due to a similarity in higher education entrance setting. Similar to Kazakhstan, there is a single exam in China fully determining university admissions and a well-defined cutoff point specified by the government at the national level. Kang, Peng, and Zhu (2019) employed IPWRA and reach dataset from the China Family Panel Studies to estimate the effect of the subject and university selectivity and prestige on labour market outcomes. With a classification of Chinese universities into vocational training colleges, ordinary universities and key universities (with selectivity and prestige increasing from the former to the latter), they found out significant returns to selectivity. Moreover, their study confirms a decrease in returns to higher education degree observed in China with a recent massive expansion of higher education provision. However, this turned out not to be the case for the graduates of selected subjects at the most prestigious universities. An interesting explanation for this is a possible effect of HE expansion as not just widening overall access but also intensifying the competition for the most prestigious HEIs.

The economic value of elite higher education in China has also been examined by Jia and Hongbin (2017). The study relies on a large dataset collected by the authors with the survey conducted among the graduates of 100 randomly selected Chinese universities over 5 years. This design allowed them to benefit from data on individual and parental characteristics, and academic performance, in addition to entrance exam score and entry labour market outcomes. More importantly, the study exploits the same methodology -- fuzzy regression discontinuity design effectively comparing students reasonably close to the entry cutoff point. Similarly, with the mentioned above study by Kang, Peng, and Zhu (2019), this paper finds out significant and robust returns to attending an elite university in China: it provides an increase in 'average monthly wages by an amount that

ranges from 30% to 40% of the median monthly wage' (Jia and Hongbin 2017, 3). Thank to the availability of data on parental background, the study interestingly reveals that in China (unlike in the USA, for example) it has an additive and independent effect on the graduates' wages, along with the access to elite education. This means that elite higher education by itself does not equalise social status in China. Further, the authors test potential explanations of the source of higher returns of elite university graduates and conclude that it is likely driven by university-related networks and signalling rather than human capital.

Thus, methodologically, international literature generally agrees on the importance of institutional quality and selectivity as the major factors influencing their graduates' further earnings' variation; however, evidence about the relationship between selectivity and further earnings does not have such a straightforward interpretation. It is worth noting that the empirical studies on the developing countries often suffer from a lack of data and, therefore, use more aggregated indicators of quality (such as average schooling of teachers at a district level, as in Behrman and Birdsall 1983) which could inflate estimates of quality. However, accounting for this possible bias, it seems that institutional quality has even more clear and systematic impact on individual outcomes in developing than in developed countries.

This study contributes to the existing literature by examining the case of a heavily underresearched country from the former Soviet block. To the best of my knowledge, there is the only previous research conducted on the data from post-Soviet countries – Roshchin and Rudakov (2016) found out statistically significant effect of attending a better quality university in Russia. Particularly, they revealed a wage premium of 23% earned by graduates of the highest quality universities compared to the graduates of the lowest quality universities when the quality is measured by their students' average centralised entry test score. At the same time, their estimations reject the effect of the official state ranking quality status on further labour market outcomes.

3. Institutional background and regulatory framework

This section introduces to a reader the country context in relation to the research question addressed.

The current higher education system in Kazakhstan appeared, and was shaped, during the country's Soviet past, when it was 'built into a larger economic planning system' (Huisman, Smolentseva, and Froumin 2018, 7). There was no higher education institution in Kazakhstan up to the 1920s, but by 1975 the number of higher education institutions had reached 47, and the student's population around 200,000, and the number of different degrees awarded was 175 (Huisman, Smolentseva, and Froumin 2018, 201). Academic programmes and curricula were 'in many ways predominantly vocational' (Huisman, Smolentseva, and Froumin 2018, 8), applied, and highly biased towards particular subjects considered to be more important to the Soviet economy, and separated from science and research which was conducted in the special research institutions not involved with teaching and/or training. Although there never was a centralised examination in the USSR, higher education admission was highly centralised and subordinated: the number of higher education institutions, academic programmes taught, and the students enrolled were all dictated centrally. Higher education was free of charge and access was highly competitive: in Kazakhstan, during the Soviet era, there were 226 higher education admission applications per 100 places (Huisman, Smolentseva, and Froumin 2018, 9). This dramatically changed with the disintegration of the Soviet Union and following 'massification' (Roshchin and Rudakov 2015) and 'marketization' of higher education, with its agenda of departure 'from total state control to autonomy, from uniformity to diversity, from the engineering and vocational bias towards greater humanitarization and personal development' (Huisman, Smolentseva, and Froumin 2018, 12). The structural reforms towards achieving internationally recognised frameworks in accordance with the Bologna Principles and European Credit Transfer and Accumulation system, such as the introduction of three levels of higher education (Bachelor, Master and PhD), a cumulative credit-based system and a gradual transition to greater educational

decentralization and autonomy, have been adopted. However, the current system is still highly centralised and regulated by the Ministry of Education and Science (MES).

In Kazakhstan, the speed and magnitude of the reforms were among the most rapid of all post-Soviet countries. The number of higher education institutions grew rapidly from 55 public institutions in 1990/91 to 122 public and private institutions in 2017/18, with the corresponding number of students growing from 287,367 in 1990/91 to 496,209 in 2017/18. Currently, more than half of HEIs are non-public, and the share of students attending them is greater than in any other former Soviet bloc country[1] – 47% versus around 16% on average in the others in 2009 (Smolentseva 2012).[2] Eventually, among the post-Soviet bloc countries, Kazakhstan appeared as the country with the greatest higher education enrolment (Smolentseva 2012).[3] The widening participation increased public concerns with regard to its quality. This perception is to a certain extent confirmed by the associated official data: the OECD Survey of Adult Skills documents that the increased completion of tertiary education by 25- to 34-year-olds (50% versus 27% for 55- to 65-year-olds) has not 'translated [to] a corresponding increase in the skills of the adult population, possibly because of a decline in the quality of education' (OECD 2019, 24). Kazakhstan is the country with the smallest difference in performance between tertiary-educated adults and adults with below upper secondary education among those reported, and this is attributable to the low proficiency of the former (OECD 2019). Along with that, one should keep in mind that the quality of secondary education is also not on par with the developed countries. For example, according to the OECD's Programme for International Student Assessment (PISA) 2018 results, 15-year-olds in Kazakhstan demonstrate substantially below the OECD average performance (387 vs. 487 points in Reading; 423 vs. 489 points in Mathematics; 397 vs. 489 points in Science [4]).

The current higher education hierarchy includes public -- national and state – and private universities.[5] Over the period under analysis, 47 out of 122 HEIs were public, including 10 national universities. In 2001, *'national university'* status was granted to nine large public 'HEIs considered as having the best potential for training and research' (OECD 2007, 169):

1. Al-Farabi Kazakh National University
2. Gumilyov Eurasian National University
3. Kazakh National Agrarian University
4. Satpayev Kazakh National Research Technical University
5. Asfendiyarov Kazakh National Medical University
6. Abai Kazakh National Pedagogical University
7. Zhurgenev Kazakh National Academy of Arts
8. Kurmangazy Kazakh National Conservatory
9. Kazakh National University of Arts.

In 2015, the newly established Kazakh National Academy of Choreography was also given this status. As opposed to the 'national' epithet, other public universities are called 'state HEIs'.[6] Table 1 documents the number of students and share of state-funded scholarship holders in national universities in 2014.

All national universities are situated in Kazakhstan's two biggest cities: the previous capital, Almaty, which remains the main financial and business centre, and the current capital, Nur-Sultan (former Astana). Two of these universities (Al-Farabi Kazakh National University and Gumilyov Eurasian National University) are multidisciplinary, whereas the others specialise in selected subjects. Four out of 10 national universities recently appeared in the QS World University Ranking (Al-Farabi Kazakh National University – 220 in 2019, Gumilyov Eurasian National University – 394 in 2019, Satpaev Kazakh National Research Technical University – 464 in 2019, Abai Kazakh National Pedagogical University – 481 in 2019, Kazakh National Agrarian University – within 651–700 in 2019). In addition, they conventionally occupy the top positions in two national rankings.[7]

Table 1. National universities selected statistics, 2014.

University	City	Number of students in 2014	Share of students with state funded scholarship in 2014
Abai Kazakh National Pedagogical University	Almaty	6534	40%
Al-Farabi Kazakh National University	Almaty	14,091	75%
Asfendiyarov Kazakh National Medical University	Almaty	8853	76%
Gumilyov Eurasian National University	Astana	13,860	81%
Kazakh National Academy of Choreography	Astana	NA	NA
Kazakh National Agrarian University	Almaty	4782	29%
Kazakh National University of Arts	Astana	1283	79%
Kurmangazy Kazakh National Conservatory	Almaty	856	94%
Satpaev Kazakh National Research Technical University	Almaty	10,222	83%
Zhurgenev Kazakh National Academy of Arts	Almaty	1447	74%

Source: IAC (2015b).

While the state universities – mostly being former Soviet institutions – are relatively homogeneous, private universities are more diverse. Some of these appeared in the 1990s with the privatization of the state institutions or upgrade of the post-secondary vocational schools, whilst others have been established more recently. Ownership is also diverse: while the majority are private, 16 operate as joint-stock companies, including some with state participation. Private HEIs significantly deviate from each other (and from public universities) in terms of teaching and research quality, selectivity policies, and student intake, internationalisation, tuition fees and perceived returns to education, varying from very poor 'money-makers' to the most prestigious and expensive 'elite' institutions, whilst at the same time being more marketised than public universities. For instance, the range in tuition fees among private universities was three times as high as the range among state universities and six times as high as the range among national universities, according to 2018 data.[8] They are more likely to deliver market-oriented academic programmes, such as 'Business Studies' and 'Law', and be more specialised and smaller than the national and the majority of the state HEIs. Finally, private universities receive considerably fewer public transfers, for example, in 2012, a private university received 9 times less than a state and 12 times less than a national university on average.[9]

The rules regulating entrance into higher education are centralised and must be followed by all HEIs, regardless of ownership. In 2004, the centralised examination, serving both as an entry exam and as a framework for the merit-based system of funding, was introduced. The Unified National Test (UNT) – an examination given to secondary school leavers – permits entry into higher education as dependent upon gaining the required score and eligibility to apply for the state-funded scholarship on a competitive basis at any university, regardless of ownership. It attempted to reduce corruption associated with higher education enrolment and allocation of the state-funded scholarships and to unify minimum requirements as based on the 'quality' of student intake. The UNT exam is taken over several days across the country and is meticulously monitored and controlled by the authorities, including by officials of the National Security Committee. Measures to prevent cheating are taken seriously, which assume that students are unlikely to manipulate their scores in general. The UNT is a multiple-choice test and is assessed by a computer algorithm in which no personal intervention is allowed. Overall, the test is believed to have improved the admission process in many ways, decreasing corruption, providing more equal access to higher education, and unifying minimum entry requirements across institutions. There is no research on Kazakhstan, however, as compared to a similar initiative in Russia which is known to have promoted social mobility, increasing admission of students from remote areas who were previously under-represented at the most prestigious universities in Moscow and St. Petersburg (Slonimczyk, Francesconi, and Yurko 2017).

Despite its positive effects, the UNT does not compare well internationally as it does not meet the appropriate 'standard of knowledge and skills' as evaluated by the 'main school-leaving and university entry qualification…[examinations]…in most European countries' (OECD 2007, 43). The reason is both the content and the format of the test, which included, at the year under examination, 125

multiple-choice questions evaluating memorised knowledge from five subjects: mathematics, the history of Kazakhstan, first language (Kazakh or Russian), second language (Kazakh or Russian) and an elective subject depending on the career choice. According to the OECD country report on higher education, the UNT places 'excessive emphasis on the acquisition of factual knowledge' and 'orients students towards superficial learning' (OECD 2017, 24) underlooking testing the examinees' skills and thinking abilities.

The centralised test serves as a tool for public funding of HEIs through the *State Order for Training Specialists* which comprises up to 94% of all public funding (MES 2014). Starting from 2004, Kazakhstan gradually began switching to the voucher system of higher education funding. However, it is currently confined by the relatively limited number of best-achieving students awarded academic merit-based scholarships and students from deprived backgrounds who are granted scholarships independent of their academic achievements (in total, they comprised 137,841 out of 496,209 students or 28% in 2017/18[10]). Along with this, the system is, practically speaking, not fully based on the student's choice of a university and, therefore, does not increase competition among universities in terms of student intake, as it was initially supposed to.

After the severe economic crisis in the 1990s, Kazakhstan witnessed an oil boom in the 2000s during which both public and private spending on higher education increased. Public spending on higher education grew from 9,344 million KZT in 2001 to 187,986 million KZT in 2016 (or from approx. 62,344.9 thousand USD in 2001 to approx. 564,031.3 thousand USD in 2016 as per the corresponding exchange rates) (IAC 2017, 342). However, in terms of the share of GDP, public spending on higher education comprised only around 0.3% of GDP and 'accounts for 8.6% of the total state budget for education' (OECD 2017, 53).

Due to limited public funding, all HEIs in Kazakhstan rely heavily on private funding through tuition fees: according to the Ministry of the National Economy data, 'in 2014, approximately 70% of Kazakhstan's total expenditure on higher education came from private rather than public sources…– primarily from tuition fees' (OECD 2017, 53). The share of privately funded students increased respectively – in 2016, they made up 73.3% of the total student body in higher education (as compared to 47.1% in 1998) (IAC 2017). At the same time, this is not the case for national universities where the average share of state-funded scholarship holders is around 70% of all students (Table 2). As the MES argues, public funding is essentially the main source of their funding (MES 2014), although they are additionally allowed to enrol students on the tuition fee basis and, moreover, set higher tuition fees than the state and majority of private universities (Table 2).

A disproportionally large share of publicly funded students at national universities can be explained by the process of placement of the annual *State Order for Training Specialists*. First, the Ministry allocates the appropriate scholarship placements across universities based on their assessment: their facilities, research activity, staff, budget, reputation, relevant collaborations, number of students and graduates' employability, all of which essentially favours national universities. Second, the amount given for the state-funded scholarship differs depending on the university status: for state and private HEIs it comprises only about 50–80% of the scholarship allocated to national universities for the same subject (Decree 2010, 2011a, 2012a, 2013, 2014). Third, the scholarship allocation across subjects is also made centrally by the government with consideration for the country's economic agenda and social priorities[11] and the labour market demand, though, to the

Table 2. Average number of students, state-funded students and tuition fees by university status.

	National universities	State universities	Private universities
Average number of students in 2014	6881	4880	3206
Average share of students with state funded scholarship in 2014	70%	45%	8%
Average tuition fees in 2018, KZT	697,802	414,235	494,883

Data source: Average number of students and share of students with scholarships computed from IAC (2015b); data on average tuition fees provided by the MES.

Table 3. Total number of scholarships offered in 2010–2014.

Broad subject area as defined by the MES	Academic year				
	2010/11	2011/12	2012/13	2013/2014	2014/15
Agricultural Sciences	1730	1911	2000	2000	2020
Arts	950	957	820	905	1025
Education	9375	8375	6764	6794	5864
Engineering and Technology	11,465	11,802	11,957	12,432	12,600
Healthcare and Medicine	5000	5000	5000	4500	4000
Humanities	720	820	700	770	790
Law	220	220	170	130	140
Natural Sciences	1000	1323	1350	1470	1470
Military and Security	60	60	60	60	60
Services	900	895	900	900	950
Social Sciences and Business	730	744	750	770	844
Veterinary Science	550	623	630	650	650
Total:	32,700	32,730	31,101	31,381	30,413

Source: Decree (2010, 2011a, 2012a, 2013, 2014).

best of my knowledge, there are no estimations of the labour demand and supply trends providing clear evidence for the policy. As can be seen from Table 3, which shows the total number of scholarships offered to study at the undergraduate level by subject, there is a bias towards those subjects that are comparatively more expensive to run and/or those that are believed to be less lucrative, such as engineering and technology, medicine, science and education (teacher training), which are more likely to be taught by large multidisciplinary public universities.

This suggests that national universities receive better public funding through the State Order than other institutions, which is additionally confirmed by the official data provided by the MES. Figure 1 documents average per university public funding according to university status: in 2012, 9 national universities together acquired around 11 billion KZT (approx. 74 million USD), while 44

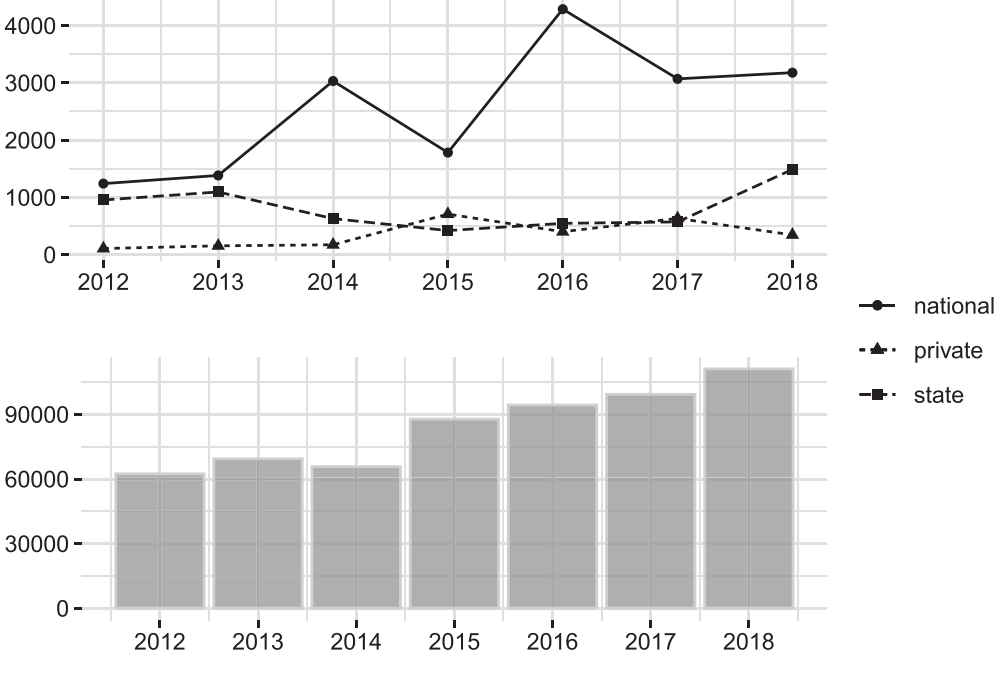

Figure 1. Public funding by the university status.

Data source: data on public funding (bar chart) and public funding by HEIs status were provided by the MES upon request; number of HEIs by status – the Committee on Statistics of the Republic of Kazakhstan, www.stat.gov.kz

state universities together acquired around 42 billion KZT (approx. 280 million USD); and the gap keeps growing over time. They additionally earn more from privately funded students. According to *State Companies' Financial Statements Depository* of the Ministry of Finance,[12] in 2016, incomes from teaching funded privately for three national universities altogether comprised 9,280,318.6 KZT (approx. 27,844.6 USD) and for 26 state universities – 32,052,841.3 KZT (approx. 96,171.0 USD); based on this, private funding was about 2.5 times higher at national universities than at state ones, on average.[13] Finally, they 'enjoy access to enhanced funding for research' (OECD 2017, 56) and are required to pay higher salaries to their academic and administrative staff -- 1.75 times higher than salaries in identical jobs at the state universities – in accordance with the *Model Provisions on the Universities with the Special Status* (Decree 2001).

Before 2012, secondary school leavers were required to attain 50 out of 125 UNT attainment scores to be eligible for entry into any university; and most HEIs did not set additional selection criteria (which is still the case). However, selected degree subjects (specialities) had the right to ignore the test score for subjects other than history and language upon the applicant taking an additional subject-specific examination, as independently set by the university itself (Decree 2012b). The list of these subjects can be seen in Appendix A.

New regulations were adopted in 2012 (Decree 2012c). The minimum required test score to enter national universities was increased to 70, while for other HEIs the minimum score remained unchanged. In addition, in 2012, the test content partly changed with new questions oriented towards the evaluation of logical and reasoning skills being introduced (MES 2012), and the measures taken to prevent corruption and cheating during the test were enhanced (Decree 2011b; Irsaliyev 2011). The measures contributed to a drop in the number of examinees who successfully passed the test and a corresponding decrease in the country-level average score in 2012, as can be seen in Table 4.

4. Data and descriptive statistics

The study uses administrative data on a sample of 6,791 full-time Bachelor's (undergraduate) students who entered seven national ($N = 2,723$) and 24 state ($N = 4,068$) universities in 2012, as recorded by the MES.

According to the national statistics, in Kazakhstan, 234,794 people have graduated from full-time undergraduate (Bachelor) programs in 2014–2016. Thus the initial data recorded by the Ministry and provided upon request consisting of 90,329 individuals who entered higher education in 2010–2012 and graduated in 2014–2016 from 4-year full-time Bachelor's academic programmes at 104 universities comprises approximately 38% of all Kazakhstani graduates. Unfortunately, it was not possible

Table 4. UNT statistics.

Year	Share of secondary school leavers sitting UNT (%)	Share of examinees who failed UNT (%)	Country average test score
2004	76.1	24.2	52.3
2005	83.2	13.5	60.4
2006	83.5	24.8	63.3
2007	81.9	30.6	71.1
2008	79.8	38.2	68.1
2009	80.6	14.5	74.9
2010	76.0	10.8	84.9
2011	79.0	9.6	86.7
2012	74.7	36.8	70.9
2013	68.6	28.8	74.5
2014	68.9	23.1	76.9
2015	66.9	18.6	79.4
2016	69.4	17.0	81.2

Source: MES (2012, 2013a, 2013b, 2014) and IAC (2015a), data for 2016 – the National Testing Centre, http://www.testcenter.kz

to understand the reasons why all students have not been recorded and I have no idea how universities select students for a sample, however, the Ministry representative confirmed that the data is a 'random and more or less representative sample of the university population'.

The data used for the analysis excludes 2,526 graduates recorded at the initial dataset who were not observed to be in official employment for 1.5 years after graduation. Additionally, private university graduates were dropped from this analysis considering their heterogeneity, resulting in a clearer control group of the state universities only. This was also undertaken to eliminate the possible effects of selection policies beyond the official UNT score practised by some private universities.[14] Finally, the sample excluded graduates of the subjects listed in Appendix A due to different entry requirements concerning their admissions. For illustrative purposes, some descriptive plots presented in this section include the wider sample of students who entered national and state universities in 2010–2012 ($N = 27{,}218$).

The data consists of student demographics (gender, university, subject of study, language of instruction and characteristics of the companies for which they work) and their monthly compulsory pension contributions to the Unified Accumulative Pension Fund (UAPF) which mandates each employee to deduct 10% of the salary before tax in accordance with Pensions Act 2013 during each month after graduation up to January 2018 (1.5 years). For summary statistics, see Appendix B.

The dependent variable is the mean of the pension contributions for those months when a person is observed in official employment, excluding the months when they are not, as I have no clear understanding of the reasons for not being in formal employment during those periods. As this proxy for wages is log transformed, the sample used for main estimations includes only employee-graduates deducting pension contributions to the UAPF at least once during the observed period; and I have no knowledge of those graduates who have no social records, whether they are unemployed, self-employed, employed in the informal economy, in further education or are not in work due to personal circumstances. 27% of 2012 cohort's graduates have zero pension contributions for each month for 1.5 years after graduation; for comparison, the share of those for two previous cohorts is essentially the same: 28% for both the 2010 and 2011 cohorts. Table 5 shows the distribution of these graduates by university type, gender and subject. For the majority of subjects, the share of graduates not observed in formal employment is higher at the national than at the state universities, which is possibly explained by better further education opportunities which the national universities might offer to their graduates. Around 18% of the graduates of the Bachelor's programmes in 2016 in Kazakhstan continued their education at the Master's level (computed on data from CSRK (2019b); CSRK 2019a), though some of them might be formally employed during their graduate studies. Along with those continuing their education abroad,[15] this number forms a somewhat reliable approximation of graduates in further education. To the best of my knowledge on the Kazakhstani labour market, the majority of the remainder being likely to be informally employed or self-employed, which could be a voluntary choice at least for some of them. The

Table 5. Share of the graduates with zero mean pension contributions by university status, gender and subject, cohort 2012.

	National	State
Male	0.26	0.29
Female	0.28	0.25
Agricultural Sciences	0.31	0.23
Arts	0.40	–
Engineering and Technology	0.24	0.29
Healthcare and Medicine	–	0.11
Humanities	0.36	0.26
Law	0.32	0.30
Natural Sciences	0.28	0.25
Safety	–	0.17
Services	0.28	0.26
Social Sciences and Business	0.22	0.22

study by Mussurov, Sholk, and Arabsheibani (2019) implies that for a recent higher education graduate in Kazakhstan it might be equally attractive to work in informal vs. formal employment, considering that the higher returns to degree might be overweighted by a higher-earning penalty for those with tenure of less than a year in the formal sector. Moreover, they argue that employees with tenure of less than a year are 'likely to enter the workforce for short-term earnings opportunities' and 'that job separation rates are higher in the informal sector' (Mussurov, Sholk, and Arabsheibani 2019, 278). This is generally consistent with a rather significant proportion of the potentially informally employed or self-employed observed in the administrative data I used. Thus the computations on the likelihood of being observed in formal employment (shown as a robustness exercise) should be interpreted with a degree of caution.

Additionally, to test whether the estimates are uncontaminated by possible non-random selection into employment, I visualise the plot showing the proportion of graduates with zero mean pension contributions against their test score for each cohort (Figure 2). For the cohort enrolled in 2012, the share of those unobserved in formal employment looks fairly unsystematic relative to the test score and somewhat similar to previous cohorts and -- more importantly -- does not jump at the threshold. Furthermore, I run two robustness exercises. First, I re-estimate the models with the log of mean pension contributions computed with all observed months including those with zero deductions. Second, I re-estimate them with the sample of working and non-working graduates ($N = 9{,}317$) with an inverse hyperbolic sine transformation of the mean of pension contributions approximating log transformation but allowing the retention of zero values (Burbidge, Magee, and Robb 1988).

The subject is defined in accordance with the MES classification based on the *Classifier of Specialities for Higher and Postgraduate Education* (Decree 2009) which is partly inherited from Kazakhstan's Soviet past and, therefore, has little compatibility with international classifications; the list of majors attributable to each broadly defined area (referred to as a subject) is given in Appendix C.

To gauge higher education selectivity, following Walker and Zhu (2018), I compute the mean standardized test score by university type for each subject (Figure 3). 'Veterinary Science', 'Military

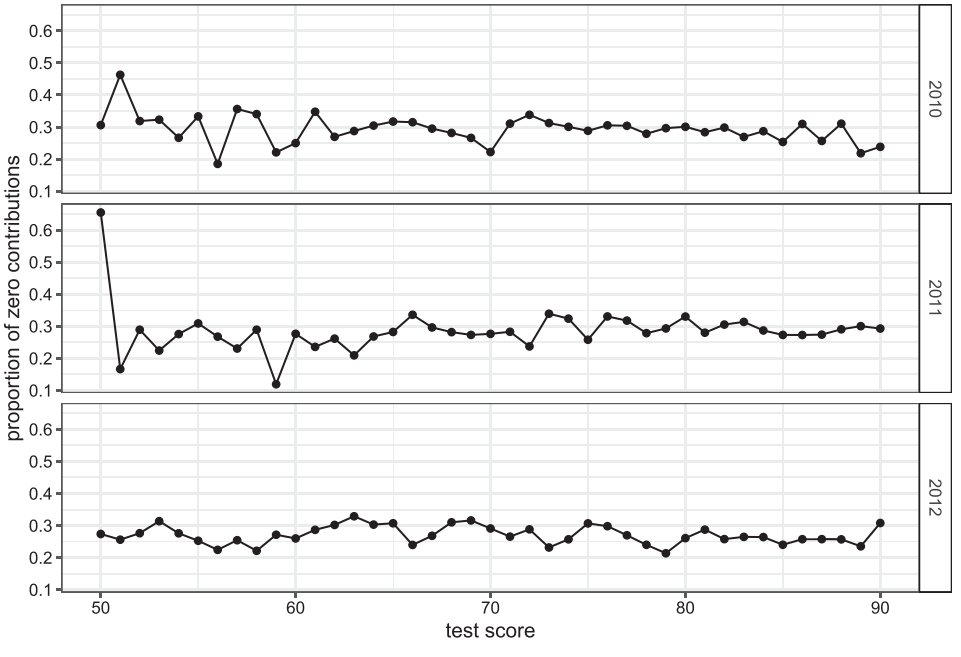

Figure 2. Proportion of graduates with no pension contributions observed in each month during 1.5 year after graduation for 2010–2012 cohorts.

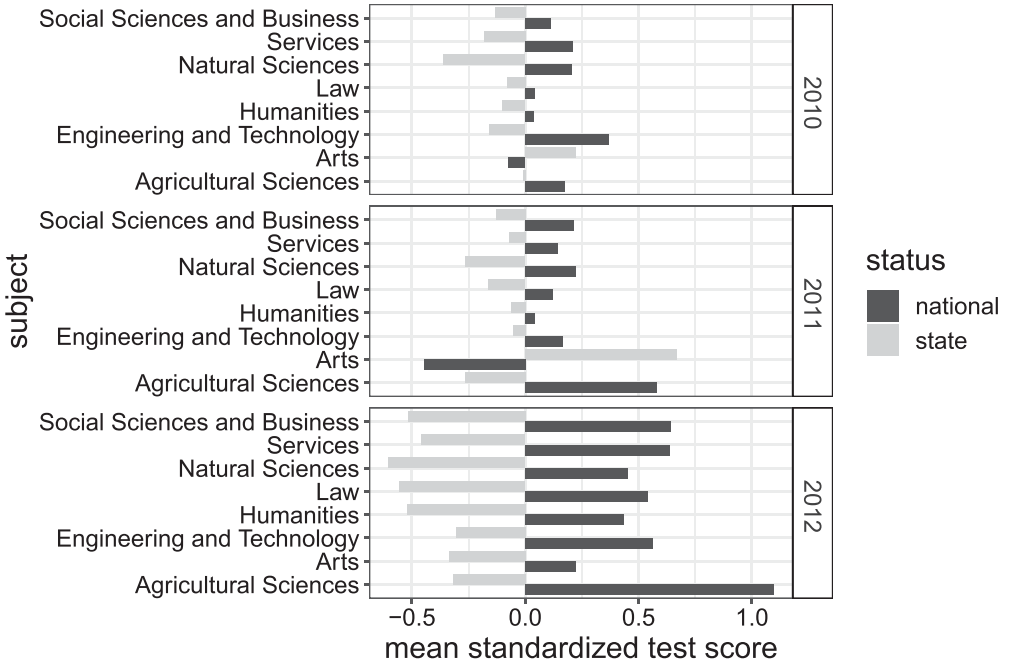

Figure 3. Mean standardized test score by subject across universities for 2010–2012 cohorts.

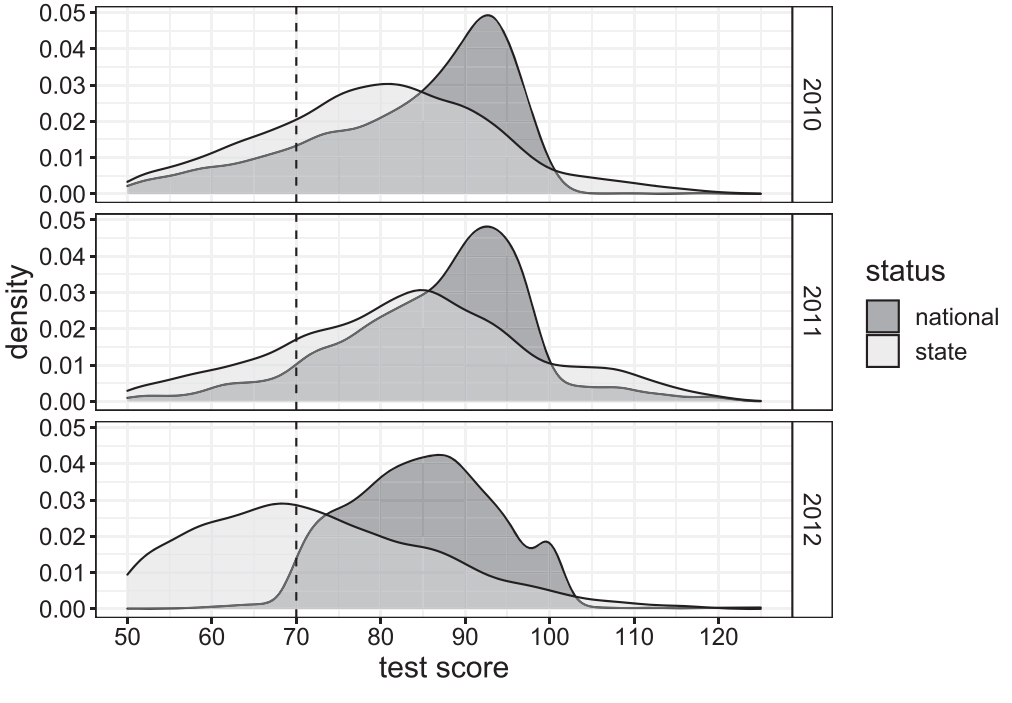

Figure 4. Test score density plot for 2010–2012 cohorts.

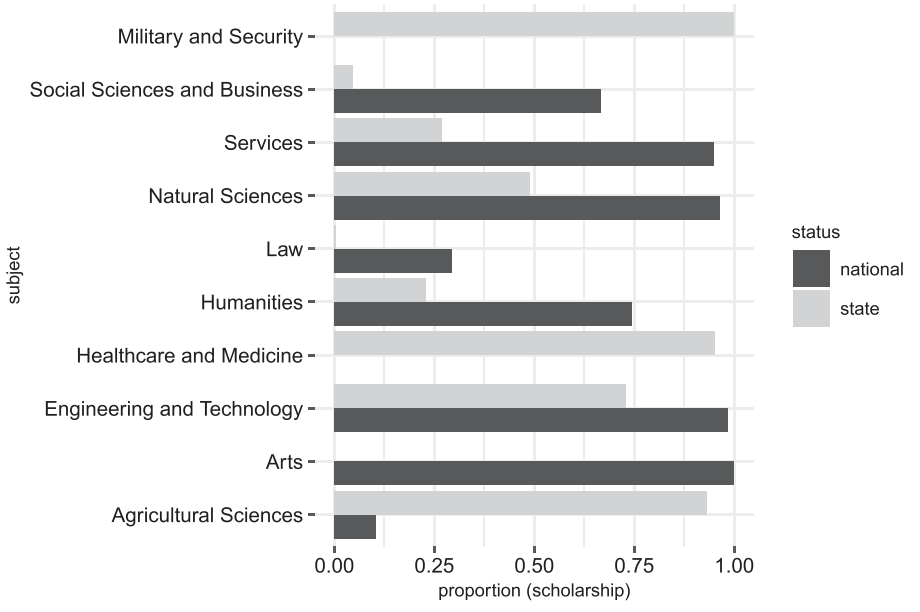

Figure 5. Distribution of state-funded scholarships by university status and subject area (2012, $N = 6{,}791$).

and Security' and 'Healthcare and Medicine' for 2012 are dropped from the plot due to the absence of students studying these subjects at the national universities. As documented by the plot, almost every subject in each year in the national universities are more selective than in the state universities, and this gap expanded in 2012. This suggests that, at any rate, national university education is associated with 'exposure to high achieving peers' (Abdulkadiroğlu, Angrist, and Pathak 2014). Density plots across cohorts depicted by Figure 4 show that in 2012, the number of students with a test score lower than 70 dropped among national universities, though very few such individuals were still enrolled.

In accord with the MES aggregated data, the national universities in the sample have a larger number of publicly funded students (Appendix B) than the state universities, though this is to some degree dependent on the subject area (Figure 5).

Table 6 displays selected statistics of the pension contributions deducted by the public universities' graduates. Mean pension contributions for these are 8,934 KZT, suggesting the average monthly entry salary for public university graduates of the 2012 cohort is around 90,000 KZT (for comparison, average country-level monthly salary was 149,195.9 KZT for the same period[16] and the average salary of private university graduates in the sample is about 110,000 KZT). State university graduates earned lower salaries (around 83,000 KZT) than students who had graduated from national universities (99,000 KZT), and this is the case for all subjects. The wages computed from the sample very well corresponds with the officially reported entry wages for a university graduate that was around 100,000 KZT for the same period.[17]

There are somewhat more female graduates than male graduates in the sample, whilst the share of students granted a state-funded scholarship is 65%. Recorded contributions are higher for both male and scholarship-holder graduates.

Table 6. Mean pension contributions by gender and scholarship ($n = 6791$).

Mean pension contributions for the months when a person worked	Gender		State scholarship holder	
	Male	Female	Yes	No
Mean	9361.31	8560.60	9173.27	8408.50
Median	7998.77	7173.06	7809.02	7032.44

5. Methodology and identification strategy

5.1. Weighted least square

One way to compute the effect of treatment on the labour market outcome -- where the *treatment* is attending a national university and the *outcome* is the entry wage – is the simple OLS model, with which I start. Since the number of observations per university varies substantially from one university to another, to ensure more information comes from those with a larger number of students in the sample, the regression is weighted by $\sqrt{N}$ per university.[18] To capture possible differences across genders, all computations are performed for two gender subsamples separately, and I control for the graduate's individual test score:

$$\ln Y_i = b_0 + b_1 D_i + b_2 x_i + e \tag{5.1}$$

where Y_i is the mean pension contributions for the months when graduate i worked, as a proxy for their wage -- *outcome*; D_i is the dummy variable for the university status (national vs. state), from which i has graduated -- *treatment*; x_i is the graduate i's test score; $\boldsymbol{e}$ is the composite error term.

The problem with Equation (5.1) is a possible bias caused by the non-random nature of the treatment assignment and, therefore, the bias in estimations and a lack of causality in interpreting the results. This is essentially the endogeneity bias induced by the omitted variable bias since there might be unobserved factors influencing both the probability of being treated and the outcome. To address this issue, I make use of a fuzzy regression discontinuity design, which is possible due to regulation imposing different minimum entry scores for national vs. state universities in 2012.

5.2. Fuzzy regression discontinuity design

As put forward by Thistlethwaite and Campbell (1960), RDD is widely used in many applications in Labour Economics and has been summarised by Angrist and Pischke (2009). With fuzzy RDD, one observes both treated and untreated observations on both sides of the threshold, though the probability of being treated discontinuously jumps at this threshold – the score of 70, in this case:

$$P(D_i) = 1 \mid x_i = \begin{cases} g_i(x_i), & \text{if } x_i \geq 70 \\ g_0(x_i), & \text{if } x_i < 70 \end{cases}, \quad \text{where } g_i(x_i) \neq g_0(x_i)$$

where D_i is the dummy variable for the university status (national vs. state) which graduate i has graduated from -- *treatment*; x_i is the graduate i's test score.

The crucial assumption is that people near the threshold are comparatively similar, to believe the treatment assignment is as good as random. The treatment effect then is the *LATE* (local average treatment effect) and is found in some sensible interval around the threshold as

$$\tau = \frac{\mathbb{E}[\ln Y_i \mid x_i \geq 70] - \mathbb{E}[\ln Y_i \mid x_i < 70]}{\mathbb{E}[D_i \mid x_i \geq 70] - \mathbb{E}[D_i \mid x_i < 70]}$$

where Y_i is the mean pension contributions for the months when graduate i worked, as a proxy for their wage -- *outcome*.

The sample used for FRDD computations includes persons entered higher education in 2012 with the test score [70 $\pm$ 20], i.e. $x_i \in [50; 90]$, comprising 5,605 graduates from seven national ($N =$ 1,979) and 24 state ($N = 3{,}626$) universities. To ensure comparability, WLS with model (5.1) is estimated on the same sample.

I employ fuzzy design because there are both treated and untreated observations on both sides of the threshold: obviously, not everyone with a test score above the threshold will choose to study at a national university, and – despite regulations imposing the minimum score for national universities – there were 28 individuals who entered them in 2012 with a test score below 70, as can be seen from the first stage plot – the binned scatter plot showing D_i for each $x_i \in [50; 90]$ for each year's sample – Figure 6.

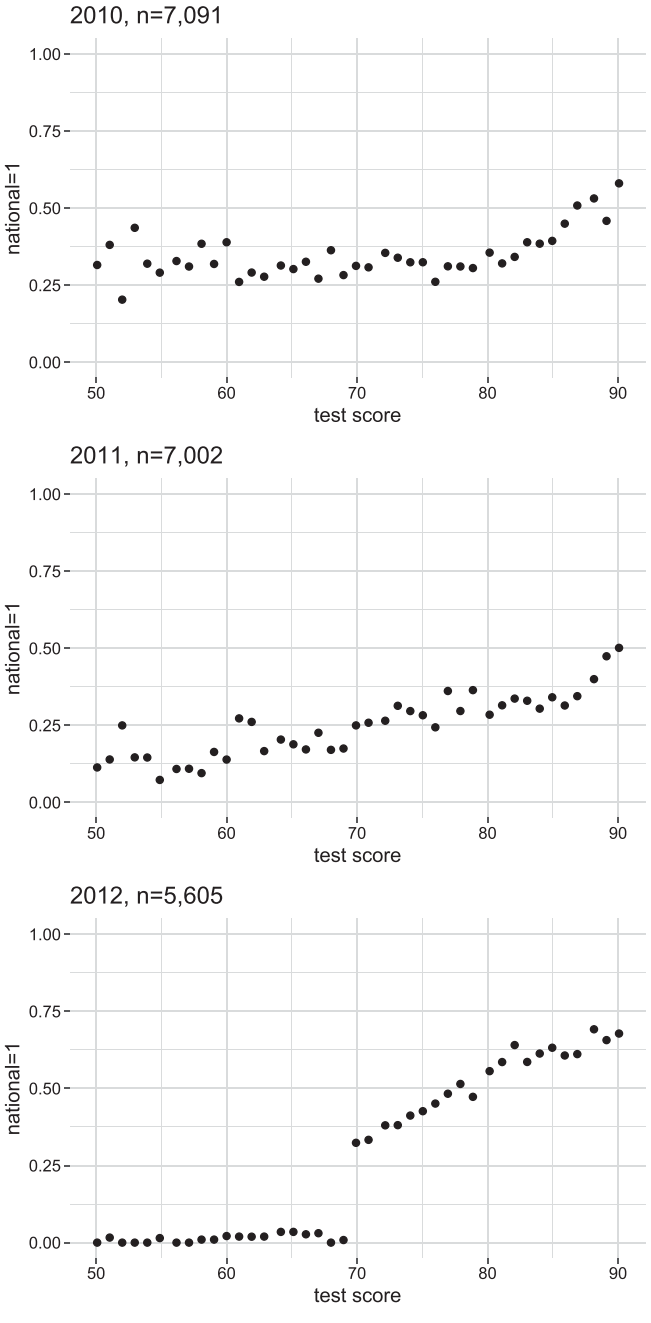

Figure 6. Binned scatter plot for 'national'; dots are the means for 'national' for each test score.

The share of treated observations plotted against each test score within the interval (Figure 6) discontinuously jumps at the threshold only in 2012. Unlike the plot for the treatment, the second stage plot -- mean wages shown by Figure 7 – does not show a discontinuous jump at or around the threshold. To check whether the possible effect is not driven by other, particularly, pre-university characteristics, I run a linear regression of log wages on all of them and use the fitted values from this regression as the outcome variables for FRDD. There are essentially only two pre-university characteristics available in the data -- gender and a year of birth. Due to the

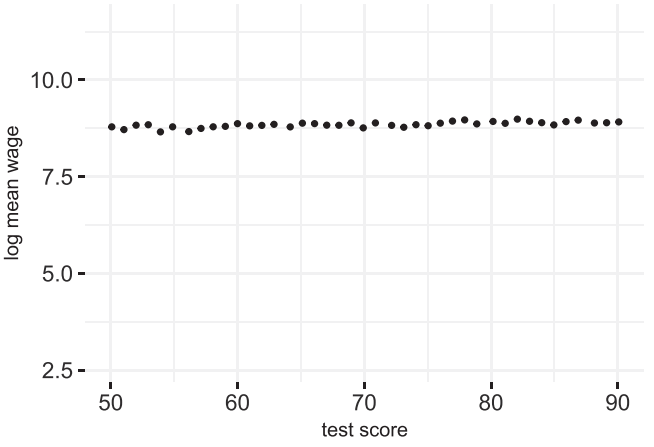

Figure 7. Binned scatter plot for 'log mean wage' (2012 cohort; national and state universities; $N = 5605$). Rplot6wp.

two-stage mechanism granting students with the state-funded scholarship available only at the universities with pre-allocated scholarship places as outlined in Section 3, scholarship holder status cannot be fully considered as a pre-university characteristic. The validity check, shown by the table at Appendix D, reveals smoothness across the threshold. Additionally, I show the first stage plots for state scholarship holder status and gender in Appendix E.

Finally, I run McCrary test (McCrary 2008). The test is based on an idea of falsification and the assumption that if the treatment assignment is as good as random, then there would be a continuity in the density of the forcing variable at the cut-off point. The visualisation of the McCrary test is shown by Figure 8. It is unlikely that the test-takers can completely or even partially manipulate their test score around the threshold, especially, if one considers a relatively limited time frame between the first announcement of the policy (January 2012, Decree 2012c) and the test time (June 2012). As it is seen from the plot, McCrary test fairly confirms this providing evidence of no proven discontinuity at the cut-off.

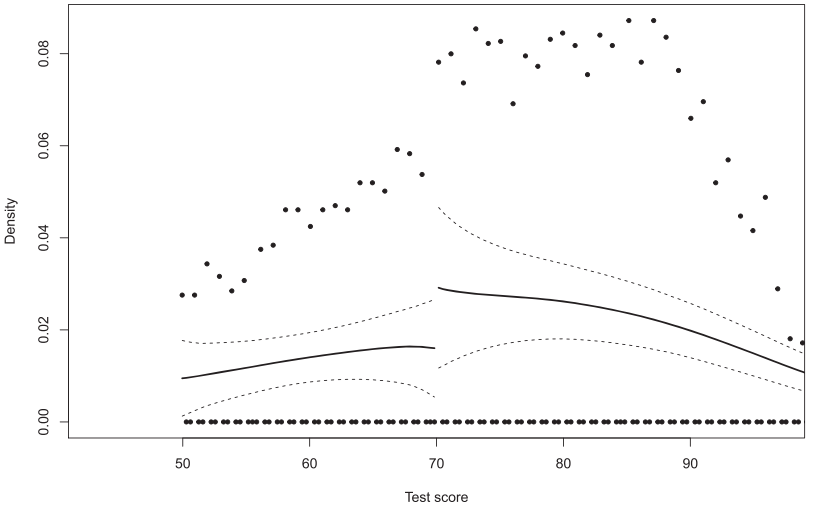

Figure 8. Density of test score: McCrary test.

Note: McCrary density plot is visualised with DCdensity command from R package rdd (Dimmery 2016). The bandwidth is defined with bandwidth selection calculation from McCrary (2008).

Technically, fuzzy RDD is a 'design where the discontinuity becomes an instrumental variable for treatment status…[which]…leads naturally to a simple 2SLS estimation strategy' (Angrist and Pischke 2009, 260). At the first stage, regressing D_i on the instrument (forcing variable) and covariates allows one to estimate the part of it that is uncorrelated with e; at the second stage, the predicted values of D_i are used to gain an unbiased estimator for β_1 by regressing Y_i on $\hat{D}_i$ and covariates:

1^{st}*stage*:

$$D_i = w_0 + w_1 x_i + w_2 (x_i \times z_i) + w_3 z_i + u \tag{5.2}$$

2^{nd}*stage*:

$$\ln Y_i = a + b x_i + d (x_i \times z_i) + t \hat{D}_i + e \tag{5.3}$$

where $z_i = \begin{cases} 1, & \text{if } x_i \geq 70 \\ 0, & \text{if } x_i < 70 \end{cases}$ is the forcing variable (instrument),

u and e are the error terms, and

t is the Local Average Treatment Effect (LATE).

RDD has both strengths and weaknesses; generally, in solving the endogeneity problem it can, however, produce biased estimates if people around the score threshold are not 'sufficiently similar'. Moreover, considering its local nature, RDD estimates the effect only around the threshold and might not be generalisable towards the graduates with UNT scores higher than 90.

6. Outcomes

6.1. Selectivity returns premia: mean real wages

This section presents the main estimations for the higher education selectivity premia in a form of (higher) wages earned by the graduates. In addition to main parametric estimations, as a robustness exercise, I run non-parametric robust FRDD.

Tables 7 and 8 document the results of the estimated parametric models separately for gender subsamples. For FRDD estimations, the narrower bandwidth – $x_i \in [60; 80]$ – is additionally used to test robustness of the results. Table 9 presents the outcomes of non-parametric local polynomial regression using the biased-corrected robust inference (Calonico, Cattaneo, and Titiunik 2014, 2015; Calonico, Cattaneo, and Farrell 2019; Cattaneo, Idrobo, and Titiunik 2020). Figures shown in Appendix F illustrate second-stage plots estimated with these regressions.

Table 7. WLS and FRDD estimates of the returns to attending national university vs. state university, men.

	WLS	FRDD		FRDD	
		1st	2st	1st	2st
Dep.var.: ln *Y*					
National	0.101*		−0.358		−0.508
	(0.045)		(0.235)		(0.366)
Score	0.002				
	(0.002)				
Instrument, *z*		0.275***		0.249***	
		(0.023)		(0.031)	
N	2657	2657		1483	
Bandwidth		[50; 90]		[60; 80]	
Adj./Centred R^2	0.0064		−0.0496		−0.0907
F statistic	5.14**		4.17**		1.18
F test for excluded instruments		138.60***		64.99***	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 8. WLS and FRDD estimates of the returns to attending national university vs. state university, women.

	WLS	FRDD		FRDD	
		1st	2st	1st	2st
Dep.var.: ln *Y*					
National	0.176***		0.075		−0.027
	(0.034)		(0.124)		(0.166)
Score	−0.001				
	(0.002)				
Instrument, *z*		0.354***		0.358***	
		(0.023)		(0.030)	
N	2948	2948		1577	
Bandwidth		[50; 90]		[60; 80]	
Adj./Centred R^2	0.0139		0.0155		−0.0018
F statistic	17.70***		6.71***		1.73
F test for excluded instruments		239.24***		139.99***	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 9. FRDD estimates of the returns to attending national university vs. state university: non-parametric robust estimation.

	Men		Women	
	1st	2st	1st	2st
Dep.var.: ln *Y*				
National		−0.554		0.031
		(0.506)		(0.228)
Score	0.271***		0.368***	
	(0.040)		(0.037)	
N	3170		3621	
BW est. (h)	6.595		6.934	
BW bias (b)	11.956		16.876	

Notes: FRDD estimated using local polynomial regression with rdrobust package in Stata (Calonico et al. 2017). MSE-optimal bandwidth is chosen with rdbwselect command. Method: conventional. Standard errors in parenthesis. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

With the weighted least square model, national universities turned out to provide a returns premium of about 11 p.p. and 19 p.p. for men and women, respectively, and the result is statistically significant. The models are significant as well, though they explain only about 1% of the variation in female graduates' entry salaries and even less in male graduates. However, significance fully vanishes with FRDD, demonstrating no difference between national and state universities as soon as university selectivity is explicitly controlled for. Narrowing the test score bandwidth for FRDD essentially does not change the results, yet produces higher variance due to the smaller sample size. Non-parametric robust estimations effectively confirm the parametric models' outcomes.

The instrument is highly statistically significant and supports the idea that the probability of entering national university is about 28 p.p. and 36 p.p. higher for applicants with a test score above or equal to 70 UNT scores, respectively, for males and females choosing to study in the public higher education system. The comparison between WLS and FRDD clearly shows a selectivity effect and selection on unobservables in the national (more selective) universities. Moreover, the second stage of the FRDD for the male sample suggests that national university graduates, in fact, earn about 43 p.p. (73 p.p. for non-parametric robust FRDD) less than the state university graduates once the selectivity policy is explicitly accounted for, though the coefficient is not statistically significant. This should be interpreted as follows: the value added to human capital by the national universities is smaller than the value added by the state university. This is not the case for female graduates, amongst whom national university graduates still earn more albeit the coefficient drops from a 19 p.p. premium to about 8 p.p. (3 p.p. for non-parametric robust FRDD) and loses statistical significance.

To test the robustness and to capture possible interfering effects, the same models are recalculated on different samples. First, I recompute them on a pooled sample controlling for gender and a detailed subject set of dummies assuming that there might be a difference in subject compositions across university types and some subjects might be better (or worse) rewarded in largest cities vs. local labour markets. Additionally, to capture possible variation across subjects the models are estimated separately for three subject subsamples: (1) Agriculture and Natural Sciences; (2) Engineering and Technology (additionally includes 36 graduates of Healthcare and Medicine programmes); (3) Social Sciences, Humanities, Business, Services and Law.

Second, it is likely to expect significant geographical differences in Kazakhstan, therefore WLS and FRDD are recomputed for the sample consisting of two cities only – Almaty and Astana – where all the national universities are situated.

Third, there could be a trade-off between wages and better employment opportunities when comparing national universities with other public institutions. In an attempt to capture the possibility of better employment perspectives of the national universities' graduates, I use all available months after graduation while computing the mean of their pension contributions, including those with zero contributions, assuming that this should produce 'better' estimates for the national universities.

Finally, I compute the same models on the sample of all graduates including those with no social contributions recorded in each or some months after graduation using IHS instead of logarithmic transformation to keep zero values. There 9,317 such graduates, however, the exclusion of those with a test score above 90 UNT points leaves me with the sample of size 7,677 (3,577 men and 4,100 women).

The results are documented in Tables 10–15.

As Table 10 reports, results for the second stage of FRDD have changed with the detailed subjects introduced as the confounders. In all models, gender turns out to be statistically insignificant suggesting a little gender pay gap for young graduates typical for many (developed) countries (Belfield et al. 2018), which is not the case for the majority of the subjects. Additionally, with controlling for the subject studied, the main FRDD (with a wider bandwidth) produces a coefficient for a national university that approaches a 5% significance level but is negative. Possibly, selectivity policy and differences across subject compositions are the main contributors to the observed gap in the returns to education at a national vs. state university observed with descriptive statistics and WLS. However, the main models recomputed on wider subject subsamples turn out

Table 10. WLS and FRDD estimates of the returns to attending national university vs. state university, all working graduates.

	WLS	FRDD		FRDD	
		1st	2st	1st	2st
Dep.var.: ln *Y*					
National	0.149***		−0.323		−0.350
	(0.031)		(0.171)		(0.222)
Score	−0.0006				
	(0.001)				
Instrument, *z*		0.231***		0.239***	
		(0.016)		(0.021)	
N	5605	5605		3060	
Bandwidth	[50; 90]	[50; 90]		[60; 80]	
Adj./Centred R^2	0.06		−0.005		−0.002
F statistic	200.61***		356.6***		65.18***
F test for excluded instruments		204.67***		132.73***	
Gender dummies	yes	yes		yes	
Subject dummies	yes	yes		yes	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 11. WLS estimates of the returns to attending national university vs. state university for disaggregated subject groups.

	Agriculture and Natural Sciences	Engineering and Technology	Social Sciences, Humanities, Business and Law
Dep.var.: ln *Y*			
National	0.272***	0.059	0.164**
	(0.063)	(0.041)	(0.048)
Score	−0.002	−0.000	0.003
	(0.004)	(0.002)	(0.003)
N	1014	2856	1720
Asj. R^2	0.0302	0.0014	0.0182
F statistic	14.09***	1.23	11.63***

Notes: WLS computations are done in Stata with aweight command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 12. FRDD estimates of the returns to attending national university vs. state university for disaggregated subject groups.

	Agriculture and Natural Sciences		Engineering and Technology		Social Sciences, Humanities, Business and Law	
	1st	2st	1st	2st	1st	2st
Dep.var.: ln *Y*						
National		−0.000		−0.334		0.0181
		(0.191)		(0.275)		(0.147)
Instrument, *z*	0.416***		0.223***		0.396***	
	(0.040)		(0.021)		(0.032)	
N	1014		2856		1720	
Centred R^2		0.004		−0.049		0.0160
F statistic		1.33		2.37		7.65***
F test for excluded instruments	110.56***		113.02***		157.47***	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 13. WLS and FRDD estimates of the returns to attending national university vs. state university, cities of Almaty and Astana.

	Men			Women		
	WLS	FRDD		WLS	FRDD	
		1st	2st		1st	2st
Dep.var.: ln *Y*						
National	−0.216		0.008	−0.005		−0.229
	(0.123)		(0.397)	(0.092)		(0.434)
Score	0.003			−0.001		
	(0.005)			(0.004)		
Instrument, *z*		0.523***			0.378**	
		(0.136)			(0.130)	
N	862	862		1250	1250	
Adj./Centred R^2	0.0015		0.0015	0.0000		−0.0077
F statistic	1.76		0.49	0.04		0.50
F test for excluded instruments		14.83***			8.43**	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

to be robust across all subjects with the same insignificant coefficient for a national university variable.

There are very few people in the sample who have graduated from the state universities in Almaty and Astana – 63 and 70 against 799 and 1,180 national universities' graduates, for men and women respectively. Possibly due to the small sample size, the estimations run on them identify no statistically significant difference between national and state university, even with the weighted least

Table 14. WLS and FRDD estimates of the returns to attending national university vs. state university, mean pension contributions computed with zero contributions.

	Men			Women		
	WLS	FRDD		WLS	FRDD	
		1st	2st		1st	2st
Dep.var.: ln *Y*						
National	0.067		−0.658	0.105		−0.073
	(0.067)		(0.347)	(0.059)		(0.225)
Score	0.005			0.003		
	(0.003)			(0.003)		
Instrument, *z*		0.275***			0.354***	
		(0.023)			(0.023)	
N	2657	2657		2948	2948	
Adj./Centred R^2	0.0035		−0.0570	0.0042		−0.0003
F statistic	3.53*		2.84*	5.40**		1.76
F test for excluded instruments		138.60***			239.24***	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 15. WLS and FRDD estimates of the returns to attending national university vs. state university for all graduates including those unobserved in formal employment and with mean pension contributions computed with zero contributions.

	Men			Women		
	WLS	FRDD		WLS	FRDD	
		1st	2st		1st	2st
Dep.var.: IHS Y						
National	0.155		−0.281	0.959***		1.148
	(0.198)		(0.924)	(0.185)		(0.733)
Score	0.026**					
	(0.009)					
Instrument, *z*		0.293***			0.361***	
		(0.021)			(0.019)	
N	3577	3577		4100	4100	
Adj./Centred R^2	0.0062		0.0019	0.0122		−0.0077
F statistic	8.02***		1.93	19.12***		1.16
F test for excluded instruments		202.25***			355.58***	

Notes: FRDD computations are done in Stata with ivreg2 command. Robust standard errors in parentheses.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

squares. This is also the case for both models with zero social records accounted for, except for WLS estimations for the female subsample including graduates not observed to be in employment. It seems that graduating from a national university does not improve social security with regard to the labour market, at least to the extent to which zero contributions could serve as a proxy for unemployment or informal (self-)employment.

6.2. Selectivity returns premia: probability of official employment

This section attempts to outline the effects of university selectivity on the probability of being observed in official employment. The probability of being employed is computed with the FRDD and bivariate probit model that has an advantage over the 2SLS approach which might cause an issue of too large (in absolute term) point estimates while estimated for the binary outcome. Simple probit not accounting for endogeneity estimations are additionally displayed for illustrative purposes. Models are computed for gender subsamples separately. Tables 16 and 17 demonstrate the outcomes.

With any model for both gender subsamples the probability of being observed as officially working is not statistically significant. However, as mentioned in the data section this result

Table 16. Probability of being observed in official employment, men.

	Probit	FRDD		Bi-Probit	
		1st	2st	1st	2st
Dep.var.: Employment status					
National	−0.027		0.019		0.074
	(0.018)		(0.101)		(0.074)
Score	0.002*				
	(0.001)				
Instrument, *z*		0.293***		0.408***	
		(0.021)		(0.042)	
N			3577		
Pseudo/Centred R^2	0.001		0.0001		
LR/Wild chi2	4.33				654.3***
F statistic			1.61		
F test for excluded instruments		202.25***			

Notes: Average marginal effects are computed with margins option for probit and biprobit commands in Stata. FRDD computations are done in Stata with ivreg2 command.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table 17. Probability of being observed in official employment, women.

	Probit	FRDD		Bi-Probit	
		1st	2st	1st	2st
Dep.var.: Employment status					
National	0.023		0.137		0.087
	(0.017)		(0.082)		(0.071)
Score	−0.0002				
	(0.001)				
Instrument, *z*		0.361***		0.440***	
		(0.019)		(0.044)	
N			4100		
Pseudo/Centred R^2	0.0004		−0.0106		
LR/Wild chi2	2.03				758.32***
F statistic			1.02		
F test for excluded instruments		355.58***			

Notes: Average marginal effects are computed with margins option for probit and biprobit commands in Stata. FRDD computations are done in Stata with ivreg2 command.*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

should be interpreted with a degree of caution since there is no knowledge about those graduates who have no pension contributions recorded, whether they are unemployed, self-employed, employed in the informal economy, in further education, work abroad or out of labour force due to personal circumstances. For instance, one might reasonably assume that a national university graduate would have better opportunities to continue their education at the postgraduate level since the national universities have more Master's programmes and more scholarship places to offer than other universities, and they might give preference to their graduates when allocating them or just better promote these opportunities among their Bachelor's graduates. Their graduates might also have better opportunities to continue their education abroad or migrate abroad to work than the graduates of the provincial state universities. Both likely increasing during the last several years. Figure 9 confirms that the number of students from Kazakhstan studying abroad soared from the early 2000s, with a majority of them choosing CEE, particularly, Russia. Additionally, the recent IOM report on youth migration from Central Asian countries states that 31% of respondents from Kazakhstan note that they want to emigrate due to a lack of labour market demand for professional skills and perspectives for self-realization and career (IOM 2019).[19]

7. Discussion and concluding remarks

There might be several alternative explanations for the results obtained.

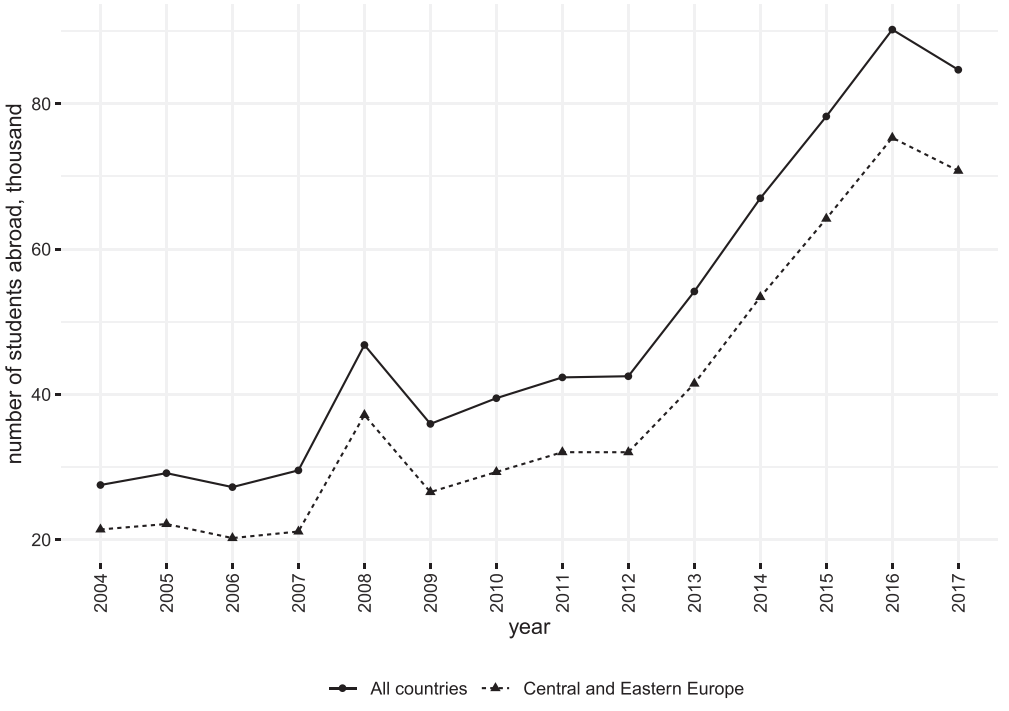

Figure 9. Total outbound internationally mobile tertiary students from Kazakhstan studying abroad.
Data source: UNESCO Institute for Statistics (UIS), http://data.uis.unesco.org/

The first is driven by locality of RDD: it could be that the students with test scores varying around the threshold are not those benefiting the most. The main FRDD model captures observations up to the 81st percentile of the total test score distribution in 2012 (70th for national and 89th for state university graduates), leaving 20% of the top performers beyond. Although empirical examinations worldwide usually find the students on the bottom of the distribution to gain more from advanced quality education than the top achievers likely having good labour market outcomes regardless of the type of university they attend, there is still a possibility for the latter to benefit the most. After all, they are the ablest students who can best follow more advanced and research-intensive curricula, enjoy better library resources and labs, learn from more qualified academic staff and high achieving peers, if there are any of the listed.

The second set of possible explanations arises from the data constraints. The data used in this study raises concerns with a possible sample selection issue. First, I compute the returns to university selectivity conditional on being observed in official employment. If this sample is positively selected (abler students are observed), the returns to graduating from the better-quality institutions are underestimated. Along with this, if one assumes that the national universities provide their graduates with better opportunities for postgraduate studies (such as the Master's programme abroad), then the downward bias is aggravated further. Second, restricting the sample to only public university graduates might cause another selection issue if the policy redistributes the enrollees or a part of them from national to 'elite' private rather than state universities. This affects the identification and external validity since discontinuity affects the probability of going to a national university but also of being in the sample of public university graduates. This should not affect those enrollees whose decisions depend on scholarship availability since private universities had much fewer funding opportunities for their applicants during the time under consideration. However, this likely affects applicants who choose to pay for themselves, as the tuition fee is comparable at the national and

the majority of 'elite' private universities (with the exception of the most expensive among them). This will mean a relatively adverse selection in the state as opposed to national universities and bias returns to national up. Third, a possible selection issue might be driven by the sample consisting of only those students who have graduated from universities since there is no data on drop-outs. If one reasonably assumes dropping out students being those with relatively lower abilities, then the results computed on the data on survivors might be biased and it is difficult to predict the direction of the bias. Albeit to the best of my knowledge the drop-out rates are generally low in Kazakhstan, particularly at public universities, this possibility cannot be fully ruled out and should be taken into account. Thus the results should be interpreted with all these possible biases in mind.

Additionally, the data at hand only provides entry salaries immediately after graduation and for a short time thereafter, which are believed to be noisy and not the best indicator of the life-long earnings (Walker and Zhu 2018). Furthermore, as Solmon states, an institution's quality 'does affect later incomes more than it influences incomes immediately on entering the labor force' (Solmon 1975, 537), which is confirmed by some empirical observations (MacLeod et al. 2017 that found a certain correlation between earnings and college reputation increasing with experience) but rejected by others (Lemieux 2006 who found the returns to education to be constant over time). However, this might be reconciled by Arcidiacono, Bayer, and Hizmo (2010) who discovered the differences in the returns to the ability for American college graduates vs. high school graduates: for the first ones, the returns to ability are high from the beginning of their career and essentially do not change thereafter. In turn, MacLeod et al. (2017) tend to explain this evidence by the fact that (American) colleges thoroughly sort students in the first place according to their abilities, unlike colleges in Colombia and, possibly, other less developed countries with less established institutions. Therefore, it is still quite possible that graduates' later-life earnings diverge, reflecting the presumed better quality of more selective HEIs, and it could be advantageous to rerun the same computations for the future earnings of the same graduates to test this hypothesis. Additionally, there could be advantages other than wage returns to graduating from a better university, for instance, higher employability (which still could not be estimated accurately enough due to data limitations) or non-economic returns (like access to geographically more advantageous labour markets and more prestigious jobs).

The third alternative explanation comes from the fact that I have no other reliable indicators of university quality and selectivity at my disposal, such as the subjective indexes used by international studies (Solmon 1975; Brewer, Eide, and Ehrenberg 1999; Dale and Krueger 2014) or even a set of measurable indicators comparable across institutions, and can therefore only depend on the average test score which might not be the best measurement to sort students according to the qualities valued by employers. The previous research on developed economies' data suggest that 'more selective schools tend to accept students with higher earnings capacity' (Dale and Krueger 2002, 29). This might not be the case for Kazakhstan if the UNT only evaluates the ability to remember a large amount of information and to some extent to work hard, as discussed in Section 3. These qualities still might not be enough to be competitive in the labour market. Overall, any test score serving as an indicator of individual ability might not be a good measure for labour market performance – in the words of Griliches: "'ability", in the sense of being able to earn higher wages, other things equal, has little to do with IQ' (Griliches 1977, 7). Moreover, the study by Heckman and Kautz (2012) revealed that the standardised entry tests fail to assess students' soft skills or noncognitive abilities, which are an important determinant of their further labour market returns. Thus, had I access to other reliable indicators of institutional quality, I might end up with a completely different hierarchy in Kazakhstani higher education setting, which might appear more consistent with the results observed.

As a fourth explanation, it is hard to grasp how selective are in fact the selective national universities in the country context, and, further, in terms of international comparability. The national universities' entry threshold coincided with the country-level average test score in the year under analysis that comprised 70.91 UNT points with a cross-region variation between 64.05 and 84.67 (MES 2012). This minimum score is achieved by anyone who could correctly answer 56% multiple-

choice test questions. Though this is higher than 40% of correct answers enough to enter other institutions, it is hardly comparable with the selection to top universities in the developed countries. Moreover, such entry tests as SAT or A-Levels are normally much more comprehensive and include assignments evaluating reasoning and argumentation, problem-solving, clarity and organisational quality of writing, etc. On contrary, in Kazakhstan, as the OECD report states, 'the skills and abilities that students bring to higher education are on average weak and the Unified National Test […] is not well designed to encourage or recognise higher order competencies such as problem solving and innovative thinking' (OECD 2017). Furthermore, the most selective universities in many other countries in addition to formal test scores often consider personal statements and motivation, secondary school grades and courses taken by applicants, their extracurricular activities and recommendations and even conduct interviews. All these listed factors provide much more solid ground to sort applicants according to their capabilities. In Kazakhstan, however, in the vast majority of HEIs,[20] including national universities, selection to paid tuition is based on simple consideration of the entry test score. Therefore, a lack of selectivity of the more selective institutions might constitute a reason for no effect being observed by this study.

The fifth factor possibly driving results revealed by this study is that I observe only the first cohort affected by the selectivity-forcing policy. It might well be the case that the effect of the policy appears later, with later cohorts, if one assumes the academic quality improves gradually with the improved student body. In other words, increased selectivity might very much need to take time to produce returns premium. Furthermore, as shown by Figure 1, though the national universities get an advantage of relatively better public funding in all depicted years, the difference in funding is not that substantial during the year under examination as it becomes later on. A soaring gap in funding, as observed from 2014 onwards, could additionally contribute to possible increased returns to graduating from a national university for these later cohorts.

Finally, as Kirkeboen, Leuven, and Mogstad (2017, 1061) note, 'the effects of institution may be larger in settings with more private financing of higher education'. As noticed in Section 3, higher education funding in Kazakhstan is predominantly private, however, this is disproportionally more the case for private HEIs, therefore, comparison across public institutions historically receiving more public funding, even despite the cross-type gap in public funding, might not provide estimations informative enough. In Kazakhstan setting, overall, the highest returns are provided by the most expensive and heavily market-oriented 'elite' private universities, while the lowest returns -- by the least prestigious and least selective private HEIs, while higher education from the public institutions yields somewhat average returns.[21]

However, considering all these possible biases and alternative explanations, it could be in fact the case that a national university diploma in and of itself does not create value or lead to any reputational effect that is clearly distinguishable from a state university diploma, as is signalled and perceived by the labour market, at least for entry wages and during the period under consideration. It is worth noting that this result appears regardless, even, of the national universities' locations in the cities with the highest wages, in contrast to the provincial state universities. The question which arises then is why do better students (as measured by their UNT score) choose to study at national universities? The answer seems to be hidden in the existing funding scheme, which forces them to do so by increasing their chances of gaining a publicly funded scholarship. Furthermore, this stipend scheme might distort HEIs' incentives to invest in their quality since they end up getting the best students anyway.

Thus, accounting for possible inaccuracies caused by data shortcomings or methodology limitations, the current study provides a revealing snapshot analysis which might be helpful in terms of relevant policy reconsideration. This is particularly important for the policies aimed at evaluating and ranking universities based on raw averaged data about the salaries of their graduates. It is important to stress that, first, entry wages might depend on many factors, of which selectivity is one of the most crucial and, second, simple comparison across universities likely leads to biased conclusions when selectivity (and other factors) are not accounted for. Specifically, for Kazakhstan, this sort of

comparison was one of the rationales for the current policy of privatisation and – consequently – restricting access to public funding for state universities. The results from this study might question the long-term efficiency of this policy as it might lead to an ineffective redistribution of public resources.

Notes

1. Excluding the Baltic countries.
2. In 2014, the proportion of full-time students studying at non-public HEIs was 41%, while the share of those on distant-learning programmes was 57% (computed from the data in IAC (2015b)).
3. This was extensively driven by the soaring distant-learning (extramural) enrolment which further declined, mostly due to the newly introduced restrictive government policies aimed at improving the quality of the degrees awarded; however, the higher education enrolment in Kazakhstan is still among the highest for post-Soviet world.
4. https://www.oecd.org/pisa
5. The Nazarbayev University -- an independent internationalised public university established in 2010 – excluded from this analysis due to data unavailability and different regulations.
6. There are different types of HEIs, depending mostly on the number of subjects offered: university, academy and institute; for simplicity they are interchangeably referred to as 'university' or 'HEI' in this study.
7. Independent Agency for Quality Assurance in Education, https://iqaa.kz; Independent Agency for Accreditation and Rating, http://www.iaar.kz.
8. The data on tuition fees for 2018 is provided by the MES upon request.
9. Data on public funding is provided by the authorities on request.
10. The Committee on Statistics of the Republic of Kazakhstan, www.stat.gov.kz
11. Such as the State Programme for Industrialization.
12. The Depository of Financial Statements of the Public Interest Entities, https://opi.dfo.kz/p/
13. Aggregated data on private funding is unavailable.
14. Few elite private universities run their programmes entirely in English and admit international examinations in addition to the UNT.
15. Outbound mobility ratio for tertiary education was 14.3% in 2015, UIS.Stat UNESCO data, http://uis.unesco.org/en/uis-student-flow. Detailed statistics are unavailable.
16. The Committee on Statistics of the Republic of Kazakhstan, www.stat.gov.kz.
17. Computed on the aggregated data reported by the Labour Registry Office of The Ministry of Labour and Social Protection -- enbek.kz.
18. With *aweight* option in Stata.
19. No detailed data on migration of young people from Kazakhstan is available.
20. With a notable exception of Nazarbayev University not included in this analysis and few most westernised and expensive private universities).
21. According to the author's estimations not presented in this study and available upon request.

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