Neighbourhood effects on exam outcomes and voucher attainment

A quantitative analysis of a census database from Tbilisi, Georgia

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Abstract

The study calculates the probability of success at the centralized university entrance examinations for applicants from different districts of the capital city of Georgia, Tbilisi. Through linear regression, binary logistic regression and multinomial logistic regression analyses of a government-collected census database of 10,000 entrants, the study examines the extent to which residential or school location, gender, school type or age of the applicants impact their probability of success. Because their scores at the exam determine their admission and the value of the study voucher that they receive, by uncovering major differences in the chances of success among applicants from different socioeconomic, educational and cultural backgrounds, the study brings our attention to the possible efficiency- and equity-related threats of merit-based vouchers and centralized merit-based entrance examinations.

A 3-stage analysis reveals a clear divide between the Western and Eastern parts of the capital city in terms of its affluence, average per-student school funding and outcomes at the exams. Students from the West, females, younger applicants and private school graduates have considerably higher scores and probability of success in obtaining vouchers. For example, linear regression analysis revealed that when keeping school status, gender and age category constant, applicants from the Western schools score 3.8 out of 80 points higher in the General Abilities Test. According to the results of logistic regression analysis, when keeping age category, gender and the status of the school constant, those studying in the West part of the city are 1.68 times more likely to obtain a voucher than those from the East. When keeping age category constant, female applicants from Western private schools have a 48% chance of obtaining a voucher while the probability of male applicants from Eastern public schools is almost 3 times lower – 17%. The study also suggests that the school location of the applicant has a slightly larger influence on outcomes than their residential origin.

Foreword and acknowledgements

> *In some cases, inequality may not be felt. One may be very well be satisfied with the territorial setting one is living in and not be aware of the peripheral situation one is in. To speak about "centre" and "periphery", things must be seen from higher up.*
>
> Alain Reynaud (Bret 2009, 3)

As someone who was born and raised in Tbilisi, Georgia, I have always been deeply aware of the socioeconomic or cultural inequalities among different parts of the city. In fact, most of my friends and I never even regarded the suburbs as part of 'the city' and we almost never travelled past the boundaries of the centre.

But besides the actual findings of the study, one of the biggest (and the most fascinating) discoveries I made while working on this project was that all my life I had failed to register the fact that the centre and the suburbs were in fact the West and the East parts of Tbilisi. Despite having lived in Oslo – a city where the Western-Eastern socioeconomic and cultural divide is very often discussed and debated – and despite having noticed the same dichotomy in a number of European cities where I had travelled, it took me months of work, dozens of regression models, and hours of scrutiny of the Tbilisi map to finally realize that the part of town that I considered the city centre (not only culturally, but also geographically) was in fact only the entire Right bank (the West) of the river Mtkvari, just as much on the geographic periphery as the Eastern districts.

As I shared my revelation with my friends, I received mixed responses. Those from the more privileged Western part of the city thought that my findings were fascinating. My Eastern friends scolded me for only now recognizing the West and East divide.

Regardless of how late I was to 'come to my senses', I am still very grateful to have been given the opportunity to robustly study the inequalities of my hometown. This study was my first

interaction with the world of statistics and I found it challenging, fascinating and powerful. When starting out, my biggest worry was that I would not be able to find statistically significant differences in exam outcomes between different geographic or demographic groups. Turns out, the inequalities are wide-ranging and dramatic. I hope my findings help ignorant Westerners like myself to become aware of their privilege.

I'd like to thank the NAEC (the National Assessment and Examinations Center) for assembling the unique and fascinating database of every national examinations applicant from Tbilisi at its own cost and for providing me with the rich data. The NAEC requested that I deliver my findings to the Center before the final submission of the thesis. I am therefore also hopeful that the findings of my study may be taken into account by the Center in the future.

A special thank you to my supervisor, Elisabeth Hovdhaugen, for guiding me through the fascinating, disorienting world of statistics and supporting me with encouragement and excellent advice. I am grateful to the University of Oslo and the Higher Education programme in particular for providing me with a thorough, inspiring introduction to the field of higher education.

I am very grateful to my colleagues at GiveInternet.org, Razmik and George, for giving me the room, the advice and the encouragement that I needed to complete my project and for expressing their interest in my findings every step of the way. I am also deeply grateful to the many people who helped me persist for months in trying to obtain access to the database. I'd like to thank my classmates, my friends and family who had to tolerate my constant complaints, revelations or fears and give me comfort and reassurance. A special thanks to Teona who was forced to spend hours (usually in the middle of the night) listening to (and mostly rejecting) every one of my dozen thesis proposals or ideas.

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Background and rationale

A growing body of literature examines the geographic effects on various forms of life chances and achievement. Studies on spatial disparities in education suggest that the geographic location of a student can be a powerful predictor of academic performance and access. According to one of the scholarly pioneers in the field of geographic inequality, Philip Foster (1977, 218), "the most serious form of educational inequality arises from regional disparities rather than from social, ethnic, or 'class' variables".

The consequences of spatial disparities can be even more dramatic when government funding or tuition aid is distributed based on indicators of academic performance. In such cases, students from disadvantaged backgrounds and locations may have much lower chances of enrolling into institutions and benefiting from the state funding while the more privileged students (who may have the financial ability to finance their own tuition anyway) may be the prime beneficiaries of government aid. Such systems can be argued to be inefficient and inequitable.

As a developing, socioeconomically unequal post-Soviet country that distributes Higher Education (HE) vouchers to university entrants based on their performance at the centralized entrance exams, Georgia offers a rich and informative context for understanding a) spatial disparities and b) vouchers in education – both of which are under-researched topics (as outlined in the Background section). Due to its peripheral location and small size, little previous research exists on this region (Dobbins and Khachatryan 2015). However, the Georgian setting also offers an outstanding opportunity for spatial disparity analysis due to its rich government-collected quantitative database on the demographic and geographic variables and the exam outcomes of university entrants. Because the database also contains information on both the location of the school and the residential origin of the student, the data also provides a unique opportunity to determine which of the following two factors can have a larger effect on outcomes in the Georgian setting – where the applicant goes to school or where they reside.

Problem and research questions

A 2012 study by Chankseliani (2013a, 2013b) has demonstrated the existence of spatial inequalities in Georgian HE admissions. Namely, through linear and logistic regression analyses, Chankseliani showed that applicants from rural areas scored considerably lower and were less likely to enrol into universities in the years of 2005-2009. The aim of my study is to zoom in and determine if the spatial inequalities exists within the capital city of Tbilisi by analysing a similar but a more recent database with a somewhat similar methodology. Namely, through linear and logistic regression analysis of the 2018 census database of all university applicants, I try to determine the association between spatial, educational and demographic characteristics on the one hand and exam outcomes on the other. In other words, my study examines if students from more advantaged neighbourhoods are more likely to score well at the exam and secure a merit-based voucher. Because only less than a third of the applicants manage to obtain a voucher (based on my analysis of the NAEC database) and only 5% receive a full grant, the existence of a biased distribution of vouchers can have major consequences for the equitability and the efficiency of the Georgian HE funding scheme.

My analysis allowed me to a) investigate whether spatial disparities can exist even within a relatively small city (1.5 million inhabitants) where certain schools, private tutors, libraries and other resources are at least geographically accessible to students from all backgrounds (which in turn allowed me to examine the extent of the inequity of the current HE admissions and funding system in Georgia) and b) compare the possible effects of the location of the school and the residential origin of the student. My study also shed light on the influence of other variables like the status of the school (private or public), gender, age and graduation year. As part of my study I also analysed a database of Tbilisi public school budgets to examine if some neighbourhoods are allocated higher average per-student funding.

My research questions were:

1. To what extent and how does *the residential location* of an applicant impact their exam scores, and thus their probability of obtaining a voucher?
2. To what extent and how does the *location of the school* of an applicant impact their exam scores, and thus their probability of obtaining a voucher?

The 2018 census data on all applicants from Tbilisi has been obtained from the NAEC (the National Assessment and Examinations Centre) after a series of formal requests. Information on the total funding for every month of the 2017-2018 academic year allocated to all public schools in the city has been obtained from the Ministry of Education after a series of formal requests for public information.

Based on previous studies on the Georgian context and relevant literature on neighbourhood effects (as discussed in the Background section), my hypothesis was that students from more advantaged neighbourhoods and/or private schools were more likely to score well and obtain merit-based vouchers at the exams.

Research background

The following part of the paper reviews relevant studies on a) spatial disparities and b) vouchers in HE in various national settings. It then introduces the Georgian HE landscape, offers a detailed account of the voucher allocation system, discusses the financial burden of attending a university in Georgia and the available support systems. It then reviews the scholarly literature that suggests the presence of spatial disparities and inequitable distribution of vouchers in Georgia. Finally, it examines the scope, the possible relevance and the utility of the current study.

Spatial inequalities in performance and access

A number of studies point to a gap in knowledge in scholarly research on geographic inequalities in educational performance and attainment (Wei et al. 2018; Brasington 2002; Hannum and Wang 2006; Roscigno, Tomaskovic-Devey, and Crowley 2006; Zhang and Cowen 2009). Gibbons and colleagues (2010) also point to a lack of empirical evidence specifically on neighbourhood

effects which, among other things, they attribute to the difficulty of defining the neighbourhoods.

Several studies point to the existence of spatial disparities in education in nations that are geographically and historically proximate to Georgia like Turkey (Dundar and Lewis 1999), Russia (Konstantinovskiy 2012), and Romania (Voicu and Vasile 2010).

While a number of studies focus on disparities between rural and urban locations (Brasington 2002; Lee 2002; Chankseliani 2013b, 2013a; Zhang 2006), others also focus on inequalities within urban districts and rely on methods similar to those utilized in my study, as detailed below.

The studies suggest different reasons behind geographic inequalities, all of which can be classified into the three components put forward by Chankseliani (2013a): a) socioeconomic (especially poverty-related) disparities among districts whereby more affluent neighbourhoods produce higher-achieving students (Zhang and Cowen 2009; Miller 2012; Roscigno, Tomaskovic-Devey, and Crowley 2006; Ainsworth 2002; Smith, Parr, and Muhidin 2018); b) educational disparities that result in schools in different districts offering different resources, quality and opportunities (Roscigno, Tomaskovic-Devey, and Crowley 2006; Miller 2012; Ainsworth 2002) and c) cultural factors like ethnicity and exposure to literacy-rich environments (Lee 2002; Jocson and Thorne-Wallington 2013). The following part of the paper reviews each study in more detail.

Through multiple linear regression analysis, Zhang and Cowen (2009) show that academic achievement is sensitive to poverty and the socioeconomic status of the neighbourhood in South Carolina. In other words, their findings suggest that schools with concentrated poverty are more likely to be deemed as requiring improvement in outcomes.

Through hierarchical linear and hierarchical logistic analyses, Roscigno and colleagues (2006) model inner city deficits in achievement in the United States. Specifically, they show that students from the suburbs (i.e. the better-resourced and more affluent parts of the city) exhibit higher levels of academic achievement.

Using geospatial analysis, Miller (2015) maps institutional assets in two urban neighbourhoods with the lowest poverty and educational attainment rates in Pittsburgh and shows that the school

graduates from the district with a lower poverty rate and lower institutional assets obtain a college degree 7 times more often than those from the district with a higher poverty rate.

In a longitudinal study, through multiple regression analysis of US census data at the ZIP code level, Ainsworth (2002, 131) matches indicators of family background, school and neighbourhood characteristics and educational outcomes. When taking neighbourhood poverty as an indicator of neighbourhood disadvantage, greater neighbourhood poverty becomes a predictor of lower mathematics and reading test scores. The author shows "not only that neighbourhood characteristics predict educational outcomes but also that the strength of the predictions often rivals that associated with more commonly cited family- and school-related factors" (Ainsworth 2002, 131).

Using regression analysis of Salt Lake Country students, Wei and colleagues (2018) find that over 60% of the variation in student performance can be explained by school resources, student background and neighbourhood environments.

Jocson and Thorne-Wallington (2013) examine the effects on educational outcomes of cultural factors like access to literacy-rich environments (or, in other words, the availability of materials, daily literacy routine, and layout conducive for reading and writing) in St. Louis. They uncover an uneven geography of opportunity and find that factors like the household income influence accessibility to such environments.

Through eight Asian country case studies, Lee and colleagues (2002) review the trends of inequity in education and reveal that gender, income, ethnicity and region are important determinants of educational success.

Smith and colleagues (2018) use a geographical information system to match schools' results with the relative advantage of suburbs in Australia and find that schools in advantaged suburbs (more central locations with higher education levels and incomes) predominately have better results.

Vouchers in education

The choice of the mechanisms for HE funding allocation depend on the relative importance of the three traditional goals of national HE systems – improving access, enhancing quality and encouraging efficiency (Jongbloed and Vossensteyn 2016). The predominant practice is to allocate subsidies to universities directly or via buffer institutions (Ziderman 2017). While the transfer could be based on political criteria or negotiations, more developed systems increasingly employ more transparent formula-based (especially performance-based) mechanisms which may be seen by universities as "fair" and can provide incentives for HEI (Higher Education Institution) competition and efficiency (Jongbloed and Vossensteyn 2016; Ziderman 2017). Such reforms can be seen in light of the general trend of neoliberalisation (Lynch 2006) and a move of the most developed HE systems towards the supermarket steering model and quasi-market mechanisms (Gornitzka and Maassen 2000). Such changes are suggested to be fuelled by the massification of HE and increases in HE expenditures (Teixeira et al. 2004), the establishment of the information economy (Slaughter and Cantwell 2012), globalization (Dill 2014), the rise of the New Right, neoliberal agenda (Lynch 2006) and other political pressures.

Instead of allocating subsidies directly to HEIs, governments can also channel subsidies through the consumers whereby students are provided with state vouchers of entitlement to university education which they use to pay for their tuition. There are a host of voucher definitions and proposed schemes, mostly developed for primary and secondary education. The earliest modern development of the idea is generally attributed to Milton Friedman (1962) and the most influential other variety is associated with Christopher Jencks (1970). In HE, both the implementation of vouchers and their scholarly examinations seem to be rare (Ziderman 2017).

In its "purest" form, "an education or training voucher is an earmarked payment made to a training consumer for use at the education or training institution of their choice" (West and Sparks 2009, 15) which makes it a form of demand side funding (Vossensteyn and Jongbloed 2007a). In the Friedman proposal (1962), vouchers have three characteristics: a) their value is the average cost of a place in a state school; b) 'topping-up' is allowed (if the voucher does not cover the full fee, students can top it up); c) students can spend the voucher at any institution, public

or private. In a more restricted form of student-based funding, vouchers are awarded based on merit or need by a central authority which is also the case in Georgia (Ziderman 2017).

West (1996) produced a "World Survey" of education vouchers and singled out four principles to explain the objectives of vouchers: a) increasing consumer choice; b) empowering individuals to choose their own path which will stimulate interest and dedication; c) promote competition and d) provide wider access to private education. In general, voucher schemes are argued to enhance the freedom of choice and consumer sovereignty, increase HEI efficiency by promoting competition, and incentivize HEIs to be more responsive to the consumers and the needs of the society (Barr 1998; Vossensteyn and Jongbloed 2007b). Since students are assumed to respond to the needs of the market, a system in which funding "follows the student" is expected to lead to a HE system which serves the economy better (Ziderman 2017).

The efficiency and the equitability of voucher schemes (or any quasi-market mechanism) is still debatable (Barr 1998). It is argued that students are not capable of making informed choices (Vossensteyn and Jongbloed 2007) due to information asymmetries or the difficulty for HEIs to measure outcomes and quality (Dill and Soo 2004). Furthermore, some of the characteristics that attract students (location, social life, surroundings, athletics) produce little benefit to society (Dill 2007) which can be a more enduring problem than information problems: if students do not choose programmes based on their quality and the needs of the labour market, the competitive market fails to motivate the providers to improve standards or serve the needs of the community (Arum and Roksa 2011).

HE merit-based vouchers and centralized examinations in other national settings

The implementation of vouchers in HE has been rare but according to Vossensteyn and Jongbloed (2007), the picture is changing. They describe voucher-like mechanisms implemented in Germany, Australia and Colorado (U.S.). West and Sparkes (2009) also argue that vouchers and related schemes have been introduced in the UK, Austria, Belgium, France and the US. Other cases mentioned in the literature are Colombia (Hillman, Tandberg, and Gross 2014; Saavedra 2009) and Italy (Agasisti, Cappiello, and Catalano 2008).

Since the focus of my study is the equitability of a meritocratic voucher allocation system, merit-based vouchers are of greater interest. Entrance-based examinations and vouchers that are allocated based on exam performance proliferated in the post-Soviet countries after the collapse of the Soviet Union.

Berthell and Zabulionis (2010, 8) report that over the past 20 years all former Soviet Republics (with the possible exception of Turkmenistan) "have established new institutions dedicated to the development and administration of examinations and, in some cases, other forms of assessment" and introduced centralized, standardized HE entrance examinations. These reforms were fuelled by economic depressions following the collapse of the Soviet Union, the HE funding crises and encouragement from organizations and donors including the World Bank, the European Union, USAID and the Open Society (Soros) Institute (Bethell and Zabulionis 2012).

In such systems, state funding was linked to examination results. According to Ziderman (2017), voucher funding that was based on entrance exam results has been adopted in a number of post-Soviet countries like Kazakhstan (introduced in 2001), Russia (2002), Georgia (2005), Hungary (2007), Lithuania (2009) and Azerbaijan (where voucher funding was extended to private universities in 2010).

The Georgian landscape

Georgia is a post-Soviet lower middle-income country with a population of 3.7 million (with 1.2 million in the capital city of Tbilisi). While 86% are ethnically Georgian (Geostat 2014), other large ethnic and language groups residing in the country include Armenians, Russians, Azeris, Abkhazs and Ossetians. Following the Rose Revolution in 2003 (a movement that culminated in the resignation of President Shevardnadze and the overturning of the old government), Georgia has made significant advances towards economic and social development and Westernization but still struggles with uncertainty due to political and socioeconomic policy transformations (Dobbins and Khachatryan 2015). With a GDP per capita of $4,068 (World Bank 2018) and a GINI index of 36.5 (World Bank 2016), it remains a poor and socioeconomically unequal country.

Since my study is focused on the capital city of Tbilisi, it is worth noting that the economy of the capital city is "far ahead of any other city in the region" (Chakhaia and Bregvadze 2018, 181) and the residents of rural areas are significantly over-represented among the poor (Andghuladze and Salmi 2012). The city is made up of 10 districts and the river Mtkvari divides Tbilisi into the Western and the Eastern parts.

As for the HE system, according to the website of the Ministry of Education of Georgia, the Georgian system accounts for 63 authorized HEIs (about 75% of which are in the capital city), 148 thousand students (Geostat 2017-2018) and a HE gross enrolment ratio of 57.53% (UNESCO, 2017). As of 2016 (the most recent data), government spending on HE as a percentage of GDP is 0.3% which is lower than the OECD average of 0.9% (OECD), while government expenditure per student as a percentage of GDP (11%) is also considerably lower than the OECD average (25%) (Ziderman 2017). The following part of the paper reviews the historical changes in the Georgian HE system.

From 1918 to 1991

The first Georgian HEI was established in the year of the Georgian liberation from the Russian Empire (1918) which was quickly followed by Soviet annexation of Georgia in 1921. Just like in all communist countries (Dobbins and Khachatryan 2015), the Georgian HE system adopted a state-control model (Olsen 2007) in which the state had full centralized monopoly over the HE system and the role of the "academic oligarchy" and markets was limited (Clark 1986). HE was fully funded by the state, universities were regarded as propaganda instruments and the faculties were aligned with the national priorities (Andghuladze and Salmi 2012; Sharvashidze 2005).

From 1991 to 2004

After the collapse of the Soviet Union, the Georgian HE system transformed from a centralized, state-owned and state-financed system into an underfunded, poorly-managed, chaotic, haphazard structure (Ziderman 2017; Chakhaia and Bregvadze 2018; Dobbins and Khachatryan 2015) with a booming private HE market (Sharvashidze 2005; Pachuashvili 2011). By 2004, the number of HEIs reached 240 (Ziderman 2016) (an increase from 19 HEIs in 1989 (Andghuladze

and Salmi 2012)). Fuelled by the war in Abkhazia, financial hardship (and reductions in HE funding), inefficiency and corruption in the public sector ensued (Sharvashidze 2005; Chakhaia and Bregvadze 2018; Ziderman 2016; Dobbins and Khachatryan 2015). This included bribery in HE admissions: only a very small number of applicants were able to enrol into the free study places without paying bribes (Lorentzen 2000).

Dobbins and Khachatryan (2015) argue that compared to Central European countries, the Georgian HE system experienced the impact of Sovietization and the Russian influence more profoundly: since the foundation of the first HEI came only years before Soviet annexation, after the collapse of the Union the Georgian HE system "had no viable pre-communist traditions to draw on" (Dobbins and Khachatryan 2015, 192). Due to its precarious geopolitical position and the "power-seeking ambitions of the Russian Federation", the Georgian system is "only marginally included in the trans-European integration process" (Dobbins and Khachatryan 2015, 192) to this day.

From 2004

From 2004, following the Rose Revolution, Georgia started transitioning into the market economy. The new (liberally-minded) government of Georgia administered a wide range of reforms in the education sector as part of the wider governmental policy to Westernize Georgia and diminish Russian political and cultural influences (Ziderman 2017; Dobbins and Khachatryan 2015). The adoption of a new Law of Georgia on Higher Education in 2004 was followed with the introduction of new quality control, funding and management mechanisms and a move away from direct state allocations towards competitive, student-based funding and cost-sharing. This coincided with Georgia joining the Bologna Process in 2005 and therefore the changes were seen "not as the whim of the reformers but as justified to achieve the harmonization of the Georgian higher education system into the European higher educational arena, in turn as part of the national agenda of political, social, and cultural integration into Europe" (Ziderman 2016, 167).

The reforms were guided by the principles of the market economy and New Public Management and were aimed at eliminating corruption and enhancing transparency, deregulation,

competition and privatization (Andghuladze and Salmi 2012; Ziderman 2017; Chakhaia and Bregvadze 2018). With encouragement and pressures from the World Bank, the International Monetary Fund and other agencies (Dobbins and Khachatryan 2015), many public institutions were fundamentally transformed (Chakhaia and Bregvadze 2018). After introducing new HEI management, accreditation and quality control procedures, many universities merged or failed to receive accreditation and by 2014 the number of HEIs was reduced to 76 (Ziderman 2016, 167).

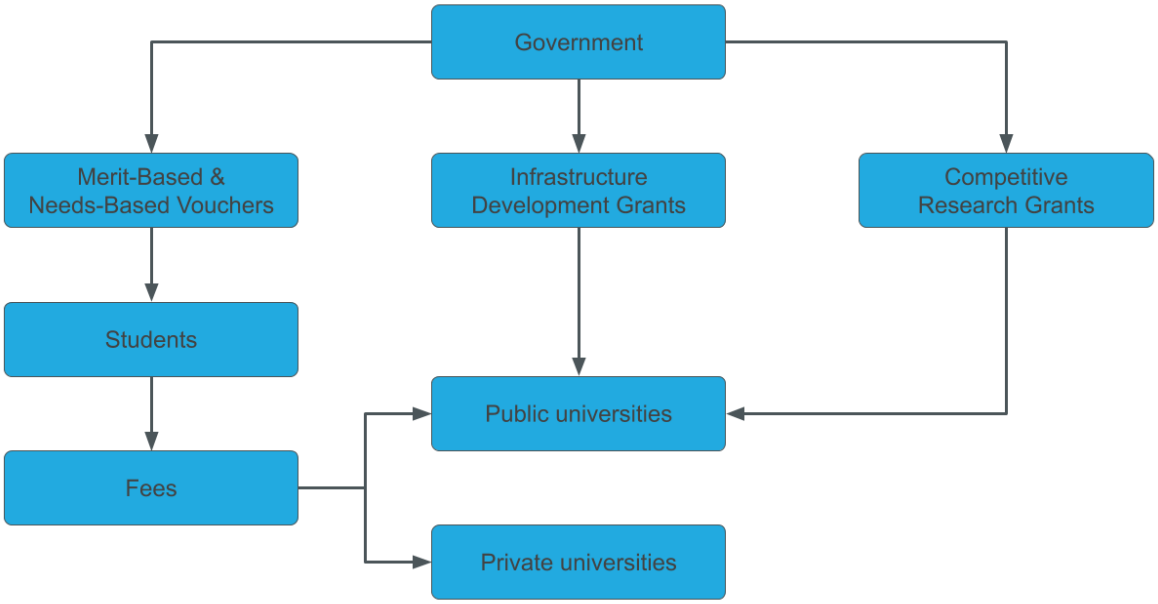
A new meritocratic admission and funding system

Two of the most important measures implemented as part of the reforms was a) the introduction of the standardized centralized university entrance examinations (Unified National Exams, UNE) administered by the NAEC (the National Assessment and Examinations Center) in 2005 with the aim of eradicating corruption, enhancing meritocracy and promoting equal access (Ziderman 2017; Chakhaia and Bregvadze 2018) and b) the introduction of merit-based HE vouchers which, "alongside improving transparency and efficiency… was designed to increase competitiveness among universities (both public and private), as attracting more students means receiving more funding" (Chakhaia and Bregvadze 2018, 194).

The two measures are still in place today. Students enrol into HEIs and receive study grants through the UNE. Student scores at the exams determine a) where they enrol and b) what type of a merit-based grant they receive. There are 4 types of grant outcomes: the state can cover 100, 70, 50 or 0 percent of the amount of the maximum tuition fee permitted at state universities, as discussed below. The state study grant can be 'cashed' at any accredited university (both private and public) and if the tuition fee at a private HEI is higher than the maximum value of the state grant, the study grant covers the portion of the fee that equals the ceiling price at public universities while the student is responsible for covering the rest. All of the above makes the study grant a merit-based education voucher in the classic sense (West and Sparkes 2009, Ziderman 2016).

In the first years of the reforms the Ministry also used to provide lump-sum funding to universities on an ad-hoc basis but such funding has been gradually eradicated (Ziderman 2017): according to the Education Strategy (The Ministry of Education 2017), the only direct funding it provides to HEIs is for infrastructure development (for which only state HEIs are eligible). State HEIs also apply for research grants. The rest of the state funding to both state and private HEIs is received through the study grants.

Figure 1: Government funding in Georgian HE



Sources: (Ziderman 2017; Andghuladze and Salmi 2012; The Ministry of Education 2017)

The examinations and the grant distribution system are widely supported by the public and their success in increasing transparency and eradicating bribery have been noted by several reports (Karosanidze and Christensen 2005; Orkodashvili 2009) but whether or not the system has promoted equal access or efficiency is unclear. As suggested by this study and other scholarly findings, there is reason to believe that the system still favours students from advantaged backgrounds. The Ministry of Education of Georgia itself (The Ministry of Education 2017) has expressed concerns regarding the equitability of the voucher distribution mechanism and is planning to address this issue as part of its 2017-2021 Strategy.

How exactly are merit-based vouchers allocated?

The enrolment and grant allocation system changes from year to year. According to the NAEC information booklet (2018), anyone who wants to enter academic programs, 1-year Georgian language preparatory programs, art, athletic, military or Christian seminary programs in a Georgian HE institution has to pass a certain number of tests at the Centralized University Entrance Examinations organized by the NAEC. The exams are held in various locations in 10 cities throughout Georgia and the anonymity of the applicants at the exams guarantees the transparency of the examination system. The students need to satisfy a minimum score requirement at every exam to be eligible for enrolment and they need to compete for available study places and government study grants. The amount of the study grant can equal 100%, 70% or 50% of the official tuition fee of state universities – the tuition fees of private universities are usually higher so the study grant can only cover a portion of the fee (NAEC 2018).

Students apply online for the exam and create a ranked list of the programs they want to apply to. Their enrolment is automatically determined by their grade (if they do not receive sufficient scores to be admitted in their first choice, the second highest ranking programme will be considered and so on).

The UNE offers a total of 12 subject exams. All students who apply to academic programs need to pass 4 exams: Georgian Language and Literature, Foreign Languages, General Abilities Test and a fourth elective exam. Each study programme has the authority to determine which foreign language(s) (English, German, French or Russian) and which elective exam(s) (Literature, Math, History, Geography, Chemistry, Physics, Biology, Art and Civil Education) the applicants need to pass to enrol. The study programme also determines the coefficients (and therefore the importance) of each of the four exams (which has a bearing on the cumulative score, as outlined below) and the number of study places for each of the elective exams (for example, a chemistry programme can choose to enrol 30 applicants who passed chemistry as their fourth exam and 20 applicants who passed biology; it is up to the applicant to decide which of the two exams to pass and they are free to pass both; the fourth exam does not need to be academically relevant to the programme).

As mentioned before, each applicant receives a cumulative score that determines their enrolment and the percentage of the study grant. A scaled score for the General Abilities Test is multiplied by 1.5 (to magnify the importance of the GAT test) and then the scaled scores of each of the four exams are also multiplied by the coefficients determined by the study programme after which all of the results are summed into a final, cumulative score. The applicants are then grouped by the fourth elective exam and ranked based on the cumulative score. For example, all applicants who enrolled into programs through passing history as their fourth subject compete with each other for the study grant. The amount of state funding dedicated to each fourth subject group is proportional to the amount of study places for each fourth subject requested by university programs. 25% of the money will cover the 100% study grants, 25% will cover the 70% study grants and the rest will cover the 50% study grants.

The tuition price varies and changes year by year. As mentioned before, there is a ceiling for tuition fees in state universities but private universities are free to set any price. For example, in 2018 on the Bachelor's level:

Table 1: Tuition fees in Georgia

Price of HEIs in national currency (GEL), Bachelor's level 2018	
The maximum fixed fee in public HEIs	2250
Average fee in all HEIs	2864
Range of fees for all HEIs	1000-19067

Source: The National Assessment and Examinations Center (NAEC)

The voucher can be 'cashed' at both public and private universities provided that they are accredited (only 5.1% of HEIs are non-accredited). After distributing the merit-based vouchers through the examinations system, the government also provides additional funding for select programs in public HEIs that it deems vital for the development of the country and covers the full tuition fee of such programs for any student who enrols. However, the list of such programs is announced after the students have submitted a priority list of programs that they would like to apply to (at that point the students can only reorder their priority list). Therefore, the additional funding may not drive students towards the programs prioritized by the government.

The disparities in the Georgian system

A number of studies (Chankseliani 2013a, 2013b; Andghuladze and Salmi 2012; Ziderman 2017) suggest that the current HE admission and state funding allocation system is favouring students from more privileged, urban backgrounds while poor students from rural backgrounds are likely to face high tuition costs, be less motivated to apply and have lower chances of enrolling and benefiting from the state vouchers.

The financial burden of attending a university in Georgia

The price of even the ceiling fee (the maximum tuition fee permitted by the Ministry at state universities) can be very high considering average household incomes according to the most recent data.

Table 2: Country indicators in 2016 - Georgia

Country indicators in 2016 in GEL (the national currency)	
GDP per capita	10,204.4
Price of the fixed fee as a percentage of GDP per capita	22%
Price of the mean fee as a percentage of GDP per capita	28%
Average yearly income per capita	11,988
Price of the fixed fee as a percentage of the average yearly income	19%
Percentage of people living under the national poverty line	22%
Percentage of people living under the Upper Middle Income poverty line ($5.50 a day)	46%

Sources: Geostat, World Bank

Student vouchers and accessible student loans are also very scarce. For example, only 30% of applicants who enrolled in Bachelor's programs in 2018 received merit-based vouchers and only 4.9% received a 100% voucher (i.e. studied for free given that they enrolled in a public HEI):

Table 3: Merit-based voucher distribution in 2018

Merit-based vouchers distribution among Bachelor's program applicants in 2018	
100% grant	4.9%
70% grant	7.0%
50% grant	18.2%
No grant	70.0%

Source: Own calculations based on admission results published by the National Assessment and Examinations Center (NAEC)

The government also provides a fixed amount of funding via needs-based grants (which can also be used to top up the merit-based vouchers). Disadvantaged students apply for such grants after they have enrolled in HEIs and they have no way of knowing if they will obtain the aid (which is why the needs-based funding may not incentivize poor students to apply). The needs-based grants are allocated to students from several socially disadvantaged groups and a fixed budget is determined for each group. If the number of applicants exceeds the quota for the particular group, the students with the highest scores at the entrance exams receive the needs-based grant. It is unclear how many needs-based vouchers were delivered in 2018 but in 2009 only 2.3% of the entire student population in accredited universities received student grants based on need only (Andghuladze and Salmi 2012). In 2018 needs-based vouchers only accounted for 15% of the overall vouchers at the Bachelor's level:

Table 4: All vouchers in 2018

Government vouchers in national currency 2018	
Government spending on **merit-based** vouchers on Bachelor's level	10,287,000
Government spending on **needs-based** vouchers Bachelor's level	1,920,000

Source: Own calculations based on admission results published by the National Assessment and Examinations Center and The Education and Science Strategy of 2017-2021

Student loans are only offered by commercial banks with quite strict and selective conditions.

Table 5: Student loans offered by commercial banks

Bank	Effective Interest rate	Maximum Amount	Duration (Months)	Minimum Monthly Salary	Minimum Age	Only for select HEIs
BOG	21.29%-23.72%		60	200	YES	
TERRA		17000	12			
TBC	26.74%	5000	12	200		
Credo	12.9%-20.90%		96		YES	YES
Basis	19.84% <	10000	24	400		
Liberty	19.39% <	40000	100			YES

Source: The websites of the banks

Out of 15 licensed banks, only 6 offer student loans. Half of the banks specify the minimum salary that the student needs to have (which constitutes almost half of the average salary in Georgia (Geostat 2017)) while others are less transparent about their selection criteria. The interest rate

of the student loans is approximately the same as the average interest rate of loans issued to individuals by commercial banks in September 2018 - 19.8% (National Bank of Georgia 2018).

Given that HE vouchers (especially needs-based vouchers) are scarce, student loans are not accessible or affordable and the tuition fees are inflated, the financial burden of attending a HEI in Georgia is very high and disadvantaged students may not even be motivated to apply. It is especially costly for students in rural areas who need to move to the cities which implies increased living expenses (and 75% of HEIs are located in the capital city which is associated with a high cost of living (Chakhaia and Bregvadze 2018)). The low government aid and a highly selective student support system does not even come close to promoting student access.

Inequalities in opportunities and education in Georgia

Just like the new government policies in Georgia may have benefitted solely the urban elite (Waal 2011), the current exam and voucher system is also much more likely to benefit students from higher socioeconomic and more urban backgrounds. Since students obtain the vouchers based on their performance at the national exams, because of gaps in school quality, unequal earlier learning opportunities, varied access to private tutors and other socioeconomic factors, poor and rural students are less likely to obtain the merit-based vouchers.

Most studies on unequal learning opportunities in Georgia focus on variations between urban and rural locations. They point to disparities in various conditions and indicators: school funding, infrastructure, teacher quality, educational material and internet access (Shapiro et al. 2007), attainment rates at all levels of schooling (Andghuladze and Salmi 2012, World Bank 2009), class sizes and student-teacher ratios (World Bank 2009), and access to private tutors (Machabeli, Bregvadze, and Apkhazava 2011, World Bank 2009).

Studies on socioeconomic variation in educational outcomes in the country are scarce. Andghuladze and Salmi (2012) for example estimate that only nine percent of the poorest quintile in the population is enrolled in tertiary education, compared to nearly forty percent for the highest quintile. A World Bank (2009) survey also points to socioeconomic variation in enrolment rates and school satisfaction.

Examinations of disparities in educational opportunities or outcomes among neighbourhoods in the capital city are almost non-existent which further justifies the narrow unit of analysis of my study. However, a qualitative study by Chakhaia and colleagues (2014) does suggest the existence of differences between Tbilisi neighbourhoods in terms of the school environment (teachers from a suburb tend to drive out students with a certain socioeconomic status and performance while schools from a central district are more encouraging).

Chankseliani's study

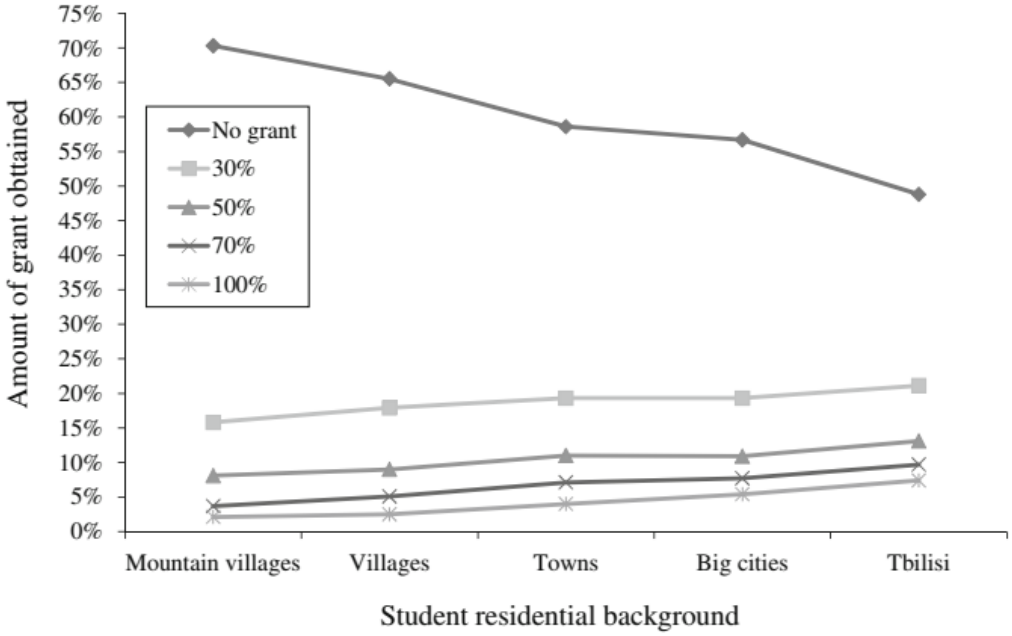
The theoretical framework, the assumptions and the methodology of my thesis are guided by a previous mixed methods study by Chankseliani (2013a, 2013b). Her quantitative work investigates the variation in admission odds between urban and rural students while her qualitative work she attempts to explore the types of location-specific characteristics that might be causing the variation.

Chankseliani (2013b) demonstrates through cross tabulation of the NAEC data from 5 years (2005-2009) that 63.1 percent of urban and 46.2 percent of rural applicants gained admission. Through multiple regression analysis she shows that applicants from rural areas tend to score lower on the exams when holding gender, language minority status, birth date, school type (public/private), school graduation time, and exam year constant. Through binary logistic regression analysis, she demonstrates that the odds of urban school graduates of gaining admission are 1.22 times as high as the odds of rural school graduates and that older, private school graduates, and Georgian-speaking females seem to also have higher odds of gaining admission than younger, public school graduates and minority males when including only the General Abilities Test results in the analysis.

Chankseliani also finds that when rural and urban applicants of similarly controlled demographic characteristics obtain the same scores at the exams, rural applicants have higher odds of gaining admission. She demonstrates that this is due to the fact that rural students tend to apply to less prestigious or competitive universities: through regression analysis, she estimates the degree to which naming universities of different prestige as the first choice is predicted by applicant area

of origin (Chankseliani 2013b). To avoid the same confusion and focus only on the types of exam outcomes that are not mediated by performance-unrelated factors, my study will not examine the odds of gaining admission and only focus on scores and grant attainment.

Figure 2: State grant allocation by rurality



Source: Chankseliani 2013a, 318

Through in-depth interviews Chankseliani also tries to determine how "households in selected districts and national policy makers explain higher education admission opportunities for the rural poor" (Chankseliani 2013b, 425). She concludes that the spatial disparities are attributed first and foremost to the poor prior educational opportunities which are related to socioeconomic background and cultural factors.

Through her qualitative findings she defines the construct that she aims to measure in her quantitative analysis: 'rurality', "a composite, multidimensional construct that combines several educational, socioeconomic, and cultural features that applicants from different types of localities have" (2013b, 431). Therefore, she assumes that rural students have lower chances of success due to educational, socioeconomic and cultural factors.

She justifies the choice of using the composite construct by the need to establish "the cumulative detrimental impact of residential origin. It would have been useful to model relationships using

the components of this construct separately and to compare the two models. Unfortunately, this is impossible due to the unavailability of the data on each component of the construct" (2013b, 432).

The scope and the relevance of the thesis

Even though studies on the Georgian HE funding system and access are scarce, previous studies have established that the current merit-based voucher scheme is more likely to finance the study of urban rather than rural students (Chankseliani 2013a, 2013b). However, it is yet unknown if there are disparities in voucher attainment and exam performance among students within the capital city.

After reviewing the available scholarly literature from various national settings, it becomes apparent that there are gaps in our understanding of a) spatial inequalities in educational outcomes and attainment, especially city neighbourhood inequalities; b) HE vouchers and their equitability; c) centralized admission examinations and their equitability; d) the efficiency and the equitability of the Georgian HE system and e) the disparities in educational outcomes and attainments in the Georgian setting, especially disparities among city neighbourhoods. Since this thesis aims to touch upon all of the above topics and since these issues can be deemed relevant to a number of HE systems (especially post-Soviet countries with similar funding or admission mechanisms mentioned in the Background section), the study seems timely and relevant both academically and for policy considerations.

The study can also be deemed well timed because of the recently proposed changes in the Georgian HE system. The Ministry of Education and the NAEC are now planning to reform the admission and funding mechanisms (Medianews.ge December 6 2018) and the Ministry has expressed concern about the equitability of the current system (The Ministry of Education 2017) in its 2017-2021 strategy.

Theoretical framework

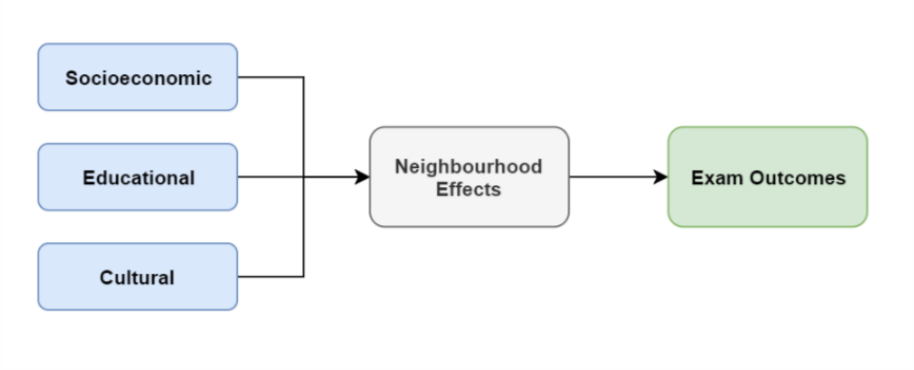
The following chapter will outline the theoretical lens for approaching the research questions and the data. It will mention some of the assumptions of my analysis and discuss its scope. It will also touch upon the definition of equity and describe the central construct of the study. The theoretical framework of the study is guided by the framework, the assumptions and the findings in Chankseliani's study (2013a, 2013b) and the studies on neighbourhood effects in education reviewed in the Background section.

While equality is usually defined as the equal treatment of all applicants, an equitable system treats applicants according to their prior educational opportunities (which, based on the studies reviewed in the Background section, can be related to factors like socioeconomic background and location (H. Zhang and Cowen 2009; Y. Zhang 2006; Ainsworth 2002; Lee 2002; Smith, Parr, and Muhidin 2018). The aim of my study is to examine the equitability of the Georgian setting – in other words, the extent to which the Georgian HE system favours students from advantaged backgrounds.

As detailed in the Background section, studies on spatial disparities in cities suggest a variety of reasons behind district inequalities, all of which can be further classified into the three factors used in Chankseliani's (2013a) theoretical framework: a) socioeconomic - a number of studies show that more neighbourhoods produce higher achieving students (Zhang and Cowen 2009; Miller 2012; Roscigno, Tomaskovic-Devey, and Crowley 2006; Ainsworth 2002; Smith, Parr, and Muhidin 2018); b) educational – higher-resourced school districts may produce higher achieving students (Roscigno, Tomaskovic-Devey, and Crowley 2006; Miller 2012; Ainsworth 2002) and c) cultural - factors like ethnicity and exposure to literacy-rich environments can also have an impact on outcomes (Lee 2002; Jocson and Thorne-Wallington 2013).

Due to a lack of data on the individual components, it is impossible to analyse the relationships and the effects of the three separate features. However, examining the composite neighbourhood effect will allow me to shed light on the possible cumulative impact of spatial disparities in educational outcomes and voucher attainment.

Figure 3: Conceptual framework



While in Chankseliani's study the residential location of the student and the location of the school of the applicant were assumed to be one and the same (it is highly unlikely that the students resided in a village and studied in a city or vice versa), my study will have access to information on both the residential district and the school district of the students. Therefore, my study will be able to compare the effects of residential and school locations.

A number of studies (Miller 2012; Smith, Parr, and Muhidin 2018; Roscigno, Tomaskovic-Devey, and Crowley 2006) suggest that students from more affluent neighbourhoods have higher odds of academic success. When doing analysis based on residential location, it will be assumed that more affluent (based on average real estate prices) districts are more privileged. In this scenario, it may be reasonable to assume that the socioeconomic component of the neighbourhood effects may have a stronger influence since wealthier students are more likely to reside in more affluent districts and are more likely to obtain higher scores (as suggested by the studies mentioned above). A number of studies (Miller 2012; Roscigno, Tomaskovic-Devey, and Crowley 2006; Jocson and Thorne-Wallington 2013) also suggest that higher-resourced school districts produce higher-achieving students. When analysing neighbourhood effects based on the location of the school, it will be assumed that school districts that on average obtain higher per-student funding (which I will calculate based on the school budget report obtained from the Ministry) are more privileged. In this scenario, the educational component of the centrality construct might have a stronger influence on the outcome since higher-resourced districts are more likely to produce higher achieving students (as suggested by the studies mentioned above).

Based on the findings of Chankseliani's study (2013a; 2013b), I will also assume that students from private schools have higher chances of success at the exams than those from public schools. Therefore, my study will treat the status of the school as a potentially influential variable. Based on her findings, my hypothesis will also be that female applicants, younger applicants or more recent might have higher chances of success at the exams.

Methodology

The aim of my study was to examine the neighbourhood effects on exam outcomes and study voucher attainment in Tbilisi. In other words, it aimed to examine if applicants from more privileged districts score higher at the exams and thus have a higher probability of obtaining study grants. However, it first had to determine which neighbourhoods can be deemed more privileged. The Methodology part of the paper explicates how this evaluation was done in 3 stages. It also outlines the data, the variables and the quantitative tools used in the paper.

The data

As mentioned, my study relied on already collected data. Namely:

- The census database (9775 cases) collected by the NAEC on all the national examination applicants in 2018 who graduated from Tbilisi schools. The database is anonymized and contains information about the date of birth, the gender, the school and the residential district, the graduation year, the status of the school (public or private), exam scores, the HEI of enrolment (if applicable), and the grant level of each applicant. In my analysis I included the entire database but excluded the students who did not pass either of the three compulsory non-elective exams (because such applicants would not have had a chance to enrol and compete for the grant anyway).
- The Ministry of Education monthly budget for each public school in Tbilisi in the academic year of 2017-2018.
- The results of a study by ISET (2018) on real estate prices of each Tbilisi district.

The variables

The variables used in my quantitative analysis and the results of their univariate analysis are presented below. The categorical variables used in my quantitative analysis were coded as dummy variables. Table 6 shows the distribution of independent demographic variables used in the regression analyses.

Independent variables

Demographic variables

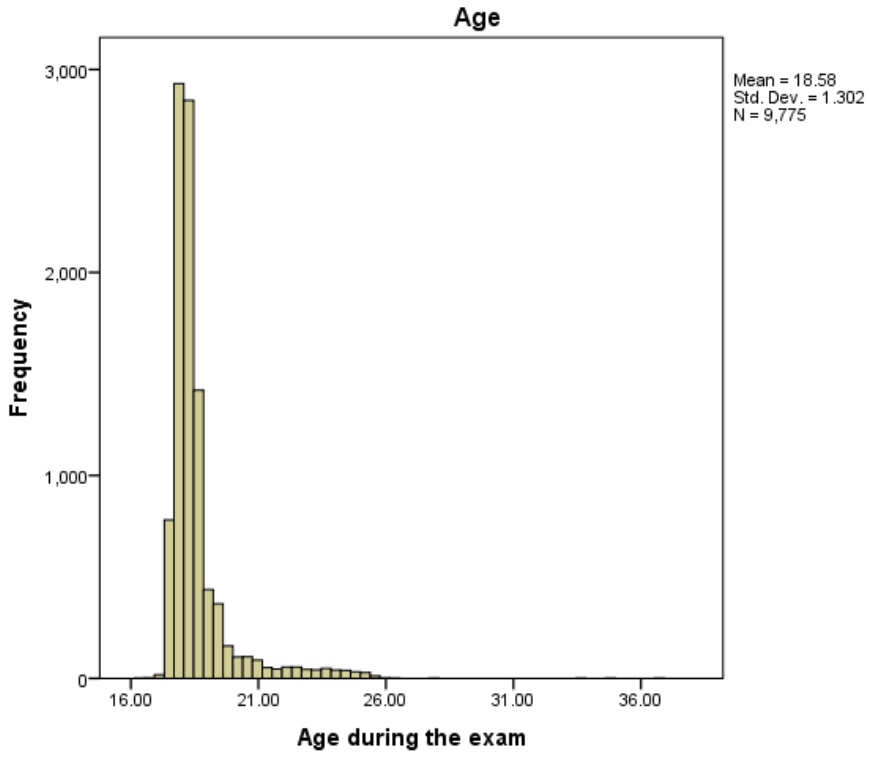
Table 6: Univariate analysis of demographic variables

	Frequency	Percent
Gender		
Male	4953	50.7
Female	4822	49.3
Age – two categories		
Younger than 18	3138	32.1
18 and older	6637	67.9
Graduation year – two categories		
Non-recent graduate	1507	15.4
Recent graduate	8268	84.6

Age

The age of the applicants in the census database ranges from 16 to 37. The age of the applicants at the time of the exam was computed from their birth date.

Figure 4: Age distribution



In some regression models, age is presented as a binary age variable and the applicants are grouped as younger than 18 and 18 and older.

In some regression models, applicants are grouped as recent or non-recent graduates. Those who graduated school in the year of the exam (2018) are considered as recent graduates and those who graduated in 2017 or earlier are considered non-recent graduates.

Status of the school

The status of the school is a binary categorical variable: private or public.

Table 7: Status of the school

Status	Frequency	Percent
Public	7973	81.6
Private	1802	18.4

Residential district

The entire NAEC database, the ISET study and the Ministry budget all rely on the Municipal classification of districts. Table 8 presents the frequencies of applicants from the districts.

Table 8: Residential districts

Residential districts								
10 categories	Frequency	Percent	**5 categories**	Frequency	Percent	**2 categories**	Frequency	Percent
Vake	1070	10.9	Vake-Saburtalo	2439	25.0	West	3274	33.5
Saburtalo	1369	14.0						
Mtatsminda	475	4.9	Old Tbilisi	835	8.5			
Krtsanisi	360	3.7						
Isani	1033	10.6	Isani-Samgori	2325	23.8	East	6501	66.5
Samgori	1292	13.2						
Didube	685	7.0	Didube-Chughureti	1348	13.8			
Chughureti	663	6.8						
Gldani	1460	14.9	Gldani-Nadzaladevi	2828	28.9			
Nadzaladevi	1368	14.0						

While the residential districts were given in 10 categories in the database, school districts were given in 5 categories where the 10 districts are assembled into groups of two. For example, Vake and Saburtalo are grouped as Vake-Saburtalo. Therefore, to match the 5-category classification of the Ministry of Education, I transformed the 10 Residential districts into a 5-category variable by combining districts in groups of two (with Old Tbilisi combining Mtatsminda and Krtsanisi). In the 1st and 2nd stages of analysis, I relied mostly on the 5-category grouping while in the 3rd stage I performed analysis on a binary variable (the Eastern and the Western districts).

School district

As mentioned, the NAEC database and the Ministry of Education budget report school districts in 5 categories and they also rely on the Municipal classification. Again, in my 1st and 2nd stages I analysed the districts based on 5 categories but in my 3rd stage I only performed analysis on a binary variable of East and West districts.

Table 9: School districts

School districts					
5 categories	Frequency	Percent	**2 categories**	Frequency	Percent
Vake-Saburtalo	2305	23.6	West	4306	44.1
Old Tbilisi	2001	20.5			
Isani-Samgori	2114	21.6	East	5469	55.9
Didube-Chughureti	917	9.4			
Gldani-Nadzaladevi	2438	24.9			

Through cross tabulation I examined the extent to which the residential and the school districts of the applicants overlap. 65% of applicants go to school in the same district where they reside:

Table 10: Overlap between residential and school district

		School district				
		Didube-Chughureti	Gldani-Nadzaladevi	Isani-Samgori	Old Tbilisi	Vake-Saburtalo
		Row N %	Row N %	Row N %	Row N %	Row N %
Residential district	Vake-Saburtalo	6.6%	2.7%	1.8%	17.1%	71.8%
	Old Tbilisi	2.6%	1.3%	22.3%	59.5%	14.3%
	Isani-Samgori	1.9%	2.3%	77.7%	14.2%	3.9%
	Didube-Chughureti	38.6%	5.9%	2.7%	39.6%	13.1%
	Gldani-Nadzaladevi	5.9%	78.8%	1.5%	7.9%	5.9%

The overlap is stronger when grouping the districts in two categories. 81% of students go to school in the same part of town (the East or the West) where they reside.

Table 11: Overlap Residential and School districts binary

		School district central	
		East	West
		Row N %	Row N %
Residential district central	East	76.6%	23.4%
	West	15.0%	85.0%

Because the residential and school districts correlate so highly, the two variables were never entered simultaneously in any of the analyses to avoid multicollinearity.

Dependent Variables

The scores

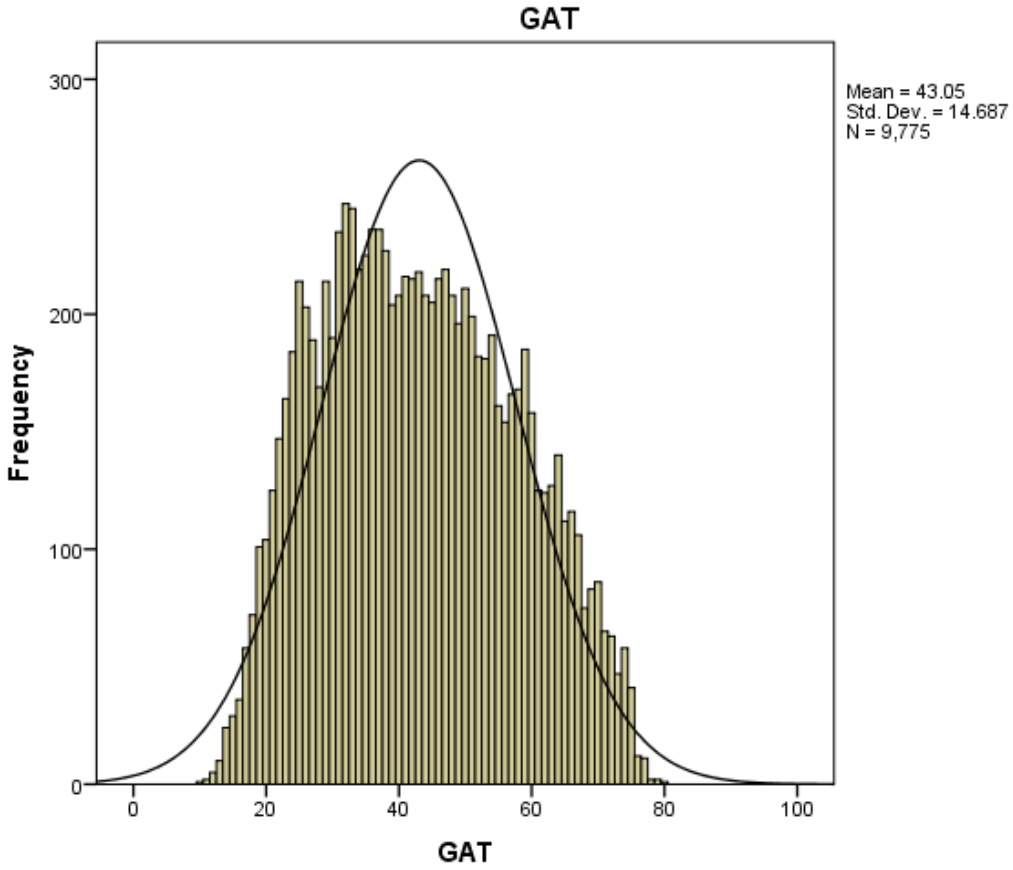
There are a total of 12 exams that can be taken at the UNE, 3 of which are mandatory and the rest of the 9 of which are elective (but each student needs to elect at least one of the 9 exams). The 12 exam scores have different maximum values. As part of my initial analysis, I performed cross tabulation of different applicant characteristics and scores at each of the 12 exams and reported each statistically significant result. In my 3rd stage I only focused on two compulsory

exams (the GAT and Georgian) and a cumulative score of all three compulsory exams. The test score variables used in the final stage all have normal distributions and are as follows:

GAT

The score of the General Abilities Test, compulsory for all applicants, had a maximum value of 80 points.

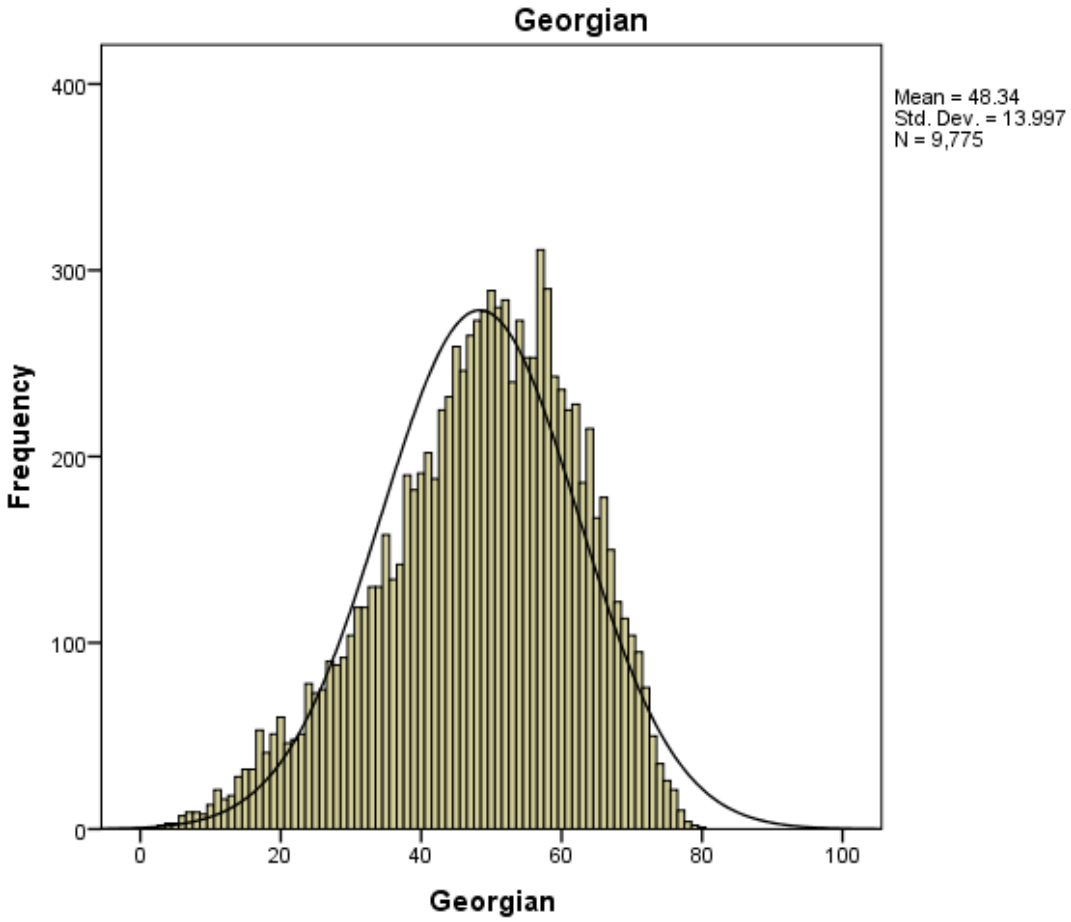
Figure 5: GAT score distribution



Georgian

The score of the Georgian Language and Literature, compulsory for all applicants, had a maximum value of 80 points.

Figure 6: Georgian Language and Literature score distribution



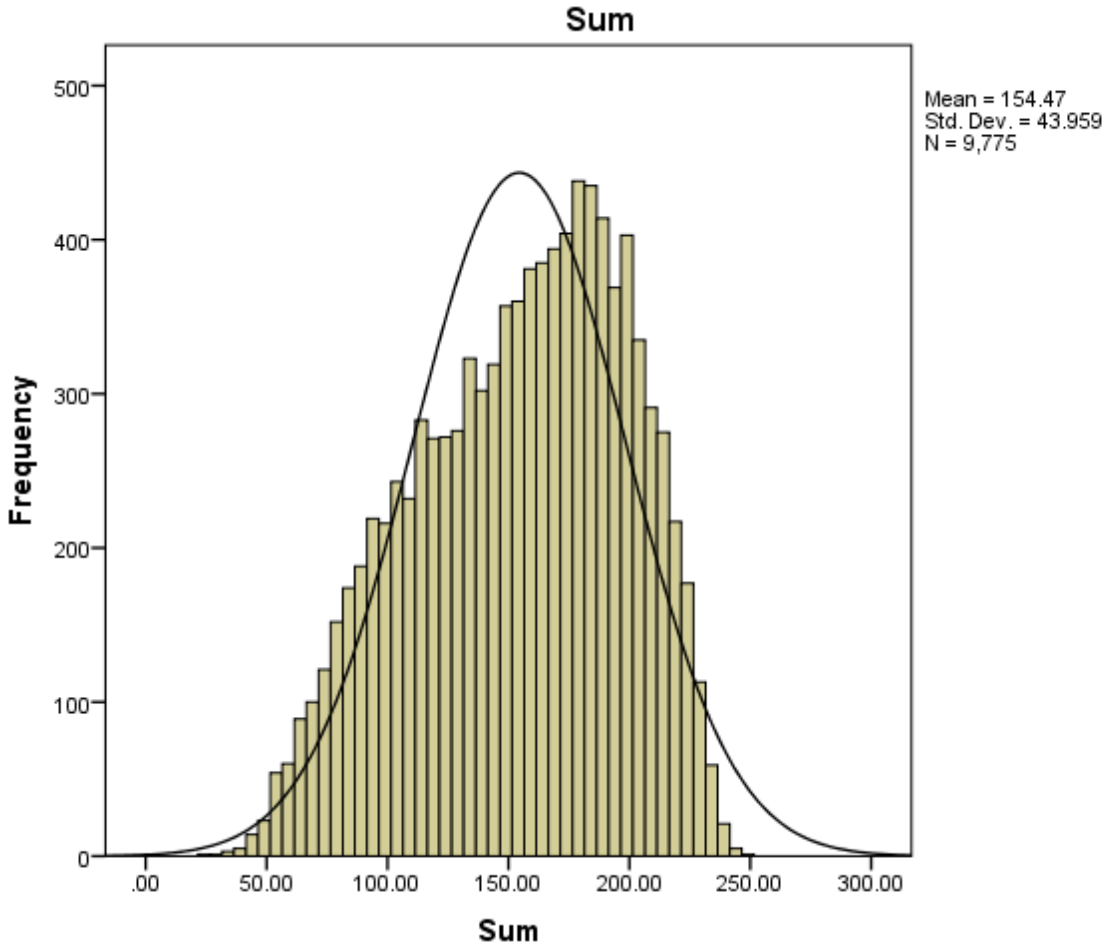
Sum (a cumulative score)

As mentioned in the Background section, all applicants need to pass 4 compulsory exams, the fourth of which is an elective. Students compete for study places and vouchers based on a cumulative score computed by the NAEC, wherein each test result is multiplied by coefficients assigned to each test by the HEIs.

In my analysis I computed a cumulative score simply by summing the unscaled test scores in three non-elective compulsory exams (GAT, Georgian Language and Literature, Foreign Language) to be able to compare the actual performance of the applicants before their scores were multiplied by coefficients that were irrelevant to my study. I omitted the fourth elective exam score as some

students (for example, art and music school applicants) took special types of fourth exams at their respective institutions and their grades are not given in the NAEC database and omitting such students created the risk of biasing the results. The maximum value of the Sum score is 250.

Figure 7: Sum score distribution



Grants

As detailed in the Background section, applicants can receive 50%, 70%, 100% grants or no grant. Less than 5% of students obtain the full voucher (i.e. study at public universities for free given that they enrolled in a state HEI):

Table 12: Grants 4 categories

Grant type	Frequency	Percent
100% Grant	482	4.9
70% Grant	680	7.0
50% Grant	1775	18.2
No Grant	6838	70.0

Analysis strategy

My study consisted of three stages. The first stage involved the operationalization of spatial inequality in Tbilisi whereby I ranked the five residential and school districts based on privilege in terms of real estate prices and school budgets. In the second stage I ranked them based on indicators of average exam performance. Since the first two stages revealed a dichotomy of privileged and non-privileged districts based on the two groups of indicators, in my third stage I was able to group the neighbourhoods into a binary category (the West and the East) and perform linear regression and logistic regression analyses on those two categories. In other words, in my third stage I determined if students from a more privileged part of the city (the West) had a higher probability of obtaining higher scores or grants. All data was processed in SPSS.

The detailed steps of each stage are as follows:

1. **The classification of the five districts:**

At this stage I calculated the average per student funding in Tbilisi public schools based on the data obtained from the Ministry of Education of Georgia and ranked the 5 districts by average funding. I then compared the results with the results of the ISET study on the average real estate prices in Tbilisi districts and assimilated the two results.

This phase allowed me to determine the relative privilege of each of the 5 neighbourhoods and operationalize neighbourhood inequality in Tbilisi. The analysis allowed me to determine if there was an overlap between real estate prices and average funding in schools among the districts and if a binary category of privileged and non-privileged neighbourhoods could be formed.

2. **Initial analyses:**

At this stage I analysed the means, frequencies, histograms, scatterplots, correlations and performed cross tabulation to investigate the differences between the applicants from different age and gender groups, districts and types of schools. The significance level of each difference was established.

This stage allowed me to investigate the demographic, geographic or performance variables and the mean results for applicants from each district, school type (public or private) or each demographic group. The analysis suggested that applicants from more affluent/better-funded districts produced better results at the exams. In other words, it showed that the results of my first stage overlapped with the results of my second stage. It also allowed me to examine if the districts could be classified into a binary category based on exam results or if the difference between the mean scores was larger when grouping applicants by residential or school district.

As a result of the first two stages of analysis, I obtained an understanding of the possible differences in privilege and outcomes among districts. At this point it became evident that all the districts on the West side of the river Mtkvari were considerably more privileged (higher average real estate prices, average per-student funding and higher mean scores at the exams) than the districts on the East.

3. **Regression analyses:**

Three types of regression analyses were performed. Multiple linear regression was used to establish the scores obtained by the applicants. Binary logistic regression was used to establish

the probability of obtaining a grant and multinomial logistic regression was used to calculate the probability of obtaining the different levels of grants.

In each case, predictor variables were added by forced entry (simultaneously) – a type of entry that is deemed by Studenmund & Cassidy (1987) as the only appropriate method for testing a theory. As mentioned before, based on the results of Chankseliani's study and my own analysis at the 2nd stage of my study, I had already developed a hypothesis on which of the predictors could possibly have had an influence on the outcome. When choosing the variables, the predictors that significantly lowered the goodness of fit of the model or violated the assumptions of linearity were rejected.

a. Multiple linear regression analysis

To predict test scores using the location and the other characteristics of the applicant, the Ordinary Least Squares (OLS) regression method was used - a type of linear least squares method for estimating continuous outcomes with multiple continuous or categorical predictors in a linear regression model.

6 multiple linear regression models were developed to predict 3 different continuous test score variables: two compulsory subject scores (Georgian Language and GAT) and a cumulative score (a sum of the three compulsory non-elective subjects - Georgian, GAT and Foreign language). For all three test score variables, regression was run twice, once with only the residential district (the East or the West) as a predictor and once with only the school district (the East or the West) as a predictor. This allowed me to compare the effects of residential origin and school location. Similar to Chankseliani's analysis, the other predictors were the status of the school, the gender, and the school graduation date.

As mentioned in the variables section, the school graduation date was turned into a binary categorical variable (recent and non-recent graduates – recent being those who finished school in 2018) and was used as a proxy for a) the age of the applicant and b) the period of schooling (this may be deemed relevant as a number of nation-wide school reforms might have resulted in a better or a worse school system in the years leading up to 2018). Based on Chankseliani's study

and the 2nd stage of my study, I theorized that younger applicants and recent graduates were more likely to obtain better results. As recommended by Field (2013), the continuous age variable was not included along with the recent graduate variable in these models as a) it was too closely correlated with the school graduation date variable, raising concern for multicollinearity and b) when included, the model became a poor fit of the data, resulting in standardized residuals higher than 3 and lower than -3.

The goodness of fit and the bias of the model and the significance of each predictor were assessed. The histogram and the normal probability plot of the data and case-wise diagnostics verified that the standardized residuals were normally distributed. As suggested by Cook and Weisberg (1982), the possibility of influential cases was eliminated as none of the cases had a Cook's distance above 1.

The underlying assumptions of the linear model had also been met. Namely, a plot of standardized residuals against standardized predicted values revealed that the outcome variable was linearly related to the combined effect of the predictors (linearity and additivity) and that the variance of the residual terms was constant (homoscedasticity). The Durbin-Watson test statistic verified that the residual terms were uncorrelated (independent). Collinearity diagnostics revealed no prefect linear relationship between two or more of the predictors (multicollinearity) - VIF values were close to 1 which suggests no multicollinearity (Bowerman and O'Connell 1990).

b. Binary logistic regression

To determine the probability of obtaining a grant for applicants from different school districts, types of schools and demographics, binary logistic regression was used – a method for estimating the probability of two outcomes based on the values of continuous and/or categorical predictor variables.

A single model was run with a binary outcome – receiving or not receiving a study voucher. The predictors were gender, the age, the status of the school (private or public) and the school districts (the West or the East) of the applicant. When using age as a continuous variable or when

using the school graduation (recent or non-recent) binary variable, the model was a worse fit of the data and resulted in standardized residuals higher than 3 and lower than -3. Therefore, age was transformed into a binary categorical variable – as explicated in the Variables section, the two groups of applicants were either younger than 18 or 18 years and older – and included in the model.

After interpreting the goodness of fit of the model and examining the effect size of the model, the probability of obtaining a grant for applicants falling in different categories was calculated manually from the unstandardized beta values.

The goodness of fit of the model and outliers or influential cases were examined using the same methods as for multiple linear regression. The linearity of the logit was tested by running regression again and including predictors that are the interaction between each predictor and the log of itself, verifying that the interaction variables for all variables had significance values greater than .05. Finally, multicollinearity was tested by running a linear regression analysis using the same outcomes and predictors and by verifying that the VIF statistic value was close to 1.

c. Multinomial logistic regression

To examine the probability of obtaining different levels of grants for applicants from different residential districts, types of schools and demographics, multinomial logistic regression was used - a method for estimating the probability of more than two outcomes based on the values of continuous or categorical predictor variables.

The four outcome categories were the types of vouchers obtained at the exam: No grant, 50%, 70% and 100% grants. No grant was chosen as the reference category as it represented failure. The predictor variables were gender, the residential location (the West or the East) and the status of the school. Adding more predictor variables was avoided as it threatened the goodness of fit or the significance of the model. The model was a good fit of the data and the predictors were significant. The probabilities of obtaining the 4 types of outcomes were calculated manually based on the unstandardized beta values. The linearity of the logit and the multicollinearity of the model were checked in the same manner as for the binary logistic regression model.

Quality considerations

For the purposes of my study, it is important to reflect upon the validity and the reliability of my measures. According to Bryman (2012), reliability is concerned with whether or not a measure or its indicators are consistent while validity is concerned with whether or not a measure of a concept measures what it was designed to measure.

As noted in the Background section, Gibbons and colleagues (2010) attribute a lack of empirical evidence on neighbourhood effects to the difficulty of defining neighbourhoods which is also a challenge for my thesis. The aim of my study is to examine the relationship between two concepts: a) the level of privilege of neighbourhoods on the one hand and b) exam performance (which includes the type of vouchers they obtain) of the students on the other. The validity and the reliability of the study therefore depends on a) whether or not the measures of these concepts are consistent and b) whether or not the measures are measuring the intended concept.

When it comes to the reliability of the neighbourhood privilege, in the case of my study, all three stages of analysis point to a clear gap between the West and the East which suggests that my indicators (real estate prices, the school budgets and exam performance) all measure the same thing – relative privilege. As described in the Analysis section, districts from the West are a) more expensive judging by real estate prices; b) obtain more average per-student funding; c) produce applicants with better scores and better probability of obtaining vouchers. Therefore, there does not seem to be much cause for concern for the reliability of the measure.

When it comes to validity, the theoretical framework of my study assumes that the privilege of the neighbourhood is reflected in socioeconomic, cultural and educational advantages for the students. The real estate prices and the differences in school funding are being used as proxies for neighbourhood affluence (socioeconomic and cultural) and financial resources (educational). In the absence of more information on other possible indicators, my analysis is unable to fully ascertain the exact degree of the privilege of a district.

All variables represent a census population, are not self-reported and provide direct measures which eliminates the possibility of measurement errors and sampling bias.

Because the anonymized database contained no personal information, there are no ethical concerns for the study.

Analysis

The aim of my thesis was to determine the extent and the ways in which the residential or the school location of an applicant can impact their exam scores, and thus their probability of obtaining a voucher. The following chapter presents my findings at the three stages of analysis where I first classified the districts based on indicators of privilege, performed initial analyses of various groups of applicants and performed regression analyses.

1. The classification of the districts

The purpose of this stage was to rank each neighbourhood based on socioeconomic or educational privilege. I relied on two different types of measures: a) average real estate prices calculated by ISET (2018) and b) my own calculations of average per-student school funding based on a report obtained from the Ministry of Georgia on monthly budgets of all public schools in the city in the academic year of 2017-2018.

a) Real estate prices

As mentioned before, the real estate prices were presented for 10 Municipal district categories which I then grouped into groups of two to match the Municipal 5-category grouping of the Ministry.

Table 13: Real estate prices

District (10 categories)	Average real estate price	District (5 categories)	Average real estate price
Mtatsminda	$1012	Old Tbilisi (Mtatsminda + Krtsanisi)	$910
Vake	$924		
Krtsanisi	$809	Vake-Saburtalo	$889
Saburtalo	$855		
Chughureti	$756	Didube-Chughureti	$735
Didube	$715		

Isani	$660	Isani-Samgori	$608
Samgori	$556		
Nadzaladevi	$568	Gldani-Nadzaladevi	$551
Gldani	$535		

Source: ISET 2018, 12

The analysis revealed that Old Tbilisi (Mtatsminda and Krtsanisi) and Vake-Saburtalo – i.e. the only districts that happen to be on the West side of the river Mtkvari – are considerably more expensive in terms of real estate prices.

b) School budgets

According to the №476 decree of the Government of Georgia (2015) on school budget distribution, the Ministry relies on a voucher system whereby each student obtains a fixed amount of funding that can be 'cashed' at the school of their choice. Therefore, the amount of funding that each school receives depends on the number of students in that school. However, it can also depend on "per-hour workload and administrative and other costs of the school" (The Government of Georgia 2015) which is why it is possible for schools to obtain different levels of per-student funding.

The Ministry of Education provided me with a database of the full monthly budgets of every public school in Tbilisi. I first summed the monthly budget into a yearly budget for each school. Next, by dividing the full budget of each school on its number of students, I obtained per-student funding and I then calculated the average of that value for each of the 5 districts of interest.

Table 14: Average yearly per-student budget

Districts	Mean	N	Minimum	Maximum
Old Tbilisi	765.25	36	513	3600
Vake-Saburtalo	667.29	30	506	2039
Gldani-Nadzaladevi	620.07	48	514	2081
Didube-Chughureti	595.48	13	519	724
Isani-Samgori	587.89	48	511	918
Total	647.38	175	506	3600

Out of 175 schools, 3 schools (№202 in Isani, №200 in Gldani and №203 in Saburtalo) had considerably larger (higher than 2000 Georgian Lari) average yearly per-student funding. As all three of these schools serve children with special needs, I considered them as outliers. I reran my analysis once again while excluding these three schools to avoid the risk of having cases that have undue influence on the results. In this case, the gap between the West and the East widened.

Table 15: Average yearly per-student budget without outliers

Districts	Mean	N	Minimum	Maximum
Old Tbilisi	684.26	35	513	1309
Vake-Saburtalo	619.98	29	506	1619
Didube-Chughureti	595.48	13	519	724
Gldani-Nadzaladevi	588.98	47	514	1266
Isani-Samgori	587.89	48	511	918
Total	613.78	172	506	1619

To sum up, both in terms of the average real estate prices (a proxy for affluence) and average per-student budgets (a proxy for school resources), Old Tbilisi and Vake-Saburtalo (the only districts on the West part of the city) scored higher than the districts on the East of the river, with or without the outliers.

2. Initial Analyses

The purpose of the 2nd stage of my study was to obtain insight into the distribution of my cases across different groups, and to rank districts, school types (public or private) and genders based on average exam performance. I performed Pearson Chi-Square tests to ensure that the difference between the groups was significant.

a) Residential district

Grants

As mentioned before, unlike school districts, the residential district of the applicant was initially given in 10 categories which I then grouped into 5 categories to match the school districts.

Therefore, I first examined the difference between the 10 districts and then the 5 districts to see the distribution of the applicants in the 4 grant categories.

Table 16: Grants obtained in 10 residential districts

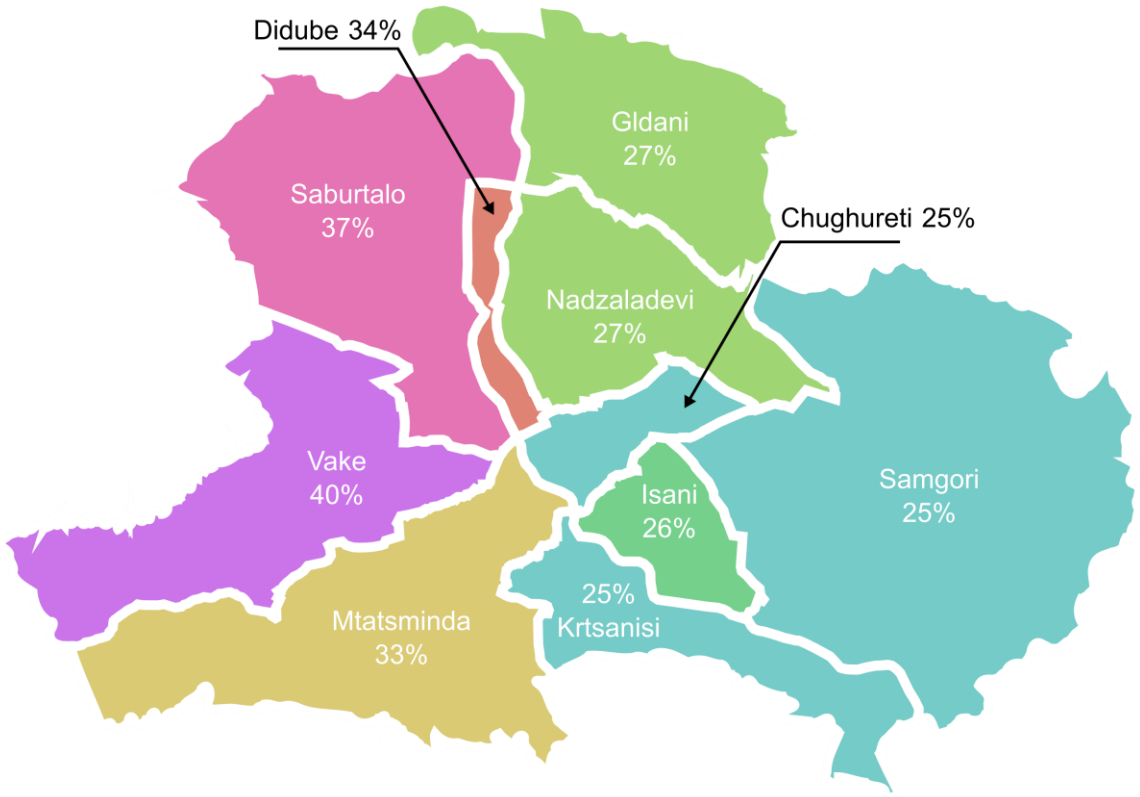
		Grant type			
		No Grant	50% Grant	70% Grant	100% Grant
		Row N %	Row N %	Row N %	Row N %
Residential District	Vake	60.0%	23.8%	9.4%	6.7%
	Saburtalo	63.2%	21.4%	8.4%	7.0%
	Mtatsminda	67.4%	19.4%	8.2%	5.1%
	Didube	65.8%	19.9%	7.7%	6.6%
	Isani	73.8%	15.6%	6.7%	4.0%
	Krtsanisi	75.3%	13.9%	6.7%	4.2%
	Gldani	73.2%	15.8%	6.1%	4.9%
	Chughureti	75.0%	15.2%	5.9%	3.9%
	Nadzaladevi	72.7%	18.0%	5.8%	3.6%
	Samgori	74.8%	16.3%	5.6%	3.3%

p. < .01

When transforming the 4 types of grants into a binary variable (grant or no grant), I also visualized the results on the map of Tbilisi (as depicted on figure 8 below).

As we move from the East to the West, the percentage of those who obtained a grant increases, with Vake, Saburtalo and Mtatsminda (the most geographically central of the four Western districts) having the highest scores. Krtsanisi (a district on the West side of the river) scored lower than Didube (a district on the East side). Krtsanisi (which is part of Old Tbilisi when grouping districts into 5 categories) is the third most expensive district to live in in terms of real estate prices but it's also geographically far away from the central neighbourhoods and located in the mid-Southern part of the city (slightly more to the East than Didube). Therefore, when comparing average outcomes in terms of grant attainment, it seems that the districts that are geographically located more to West and closer to the centre have the highest-achieving applicants.

Figure 8: A map of Tbilisi showing the percentage of applicants who obtained a grant

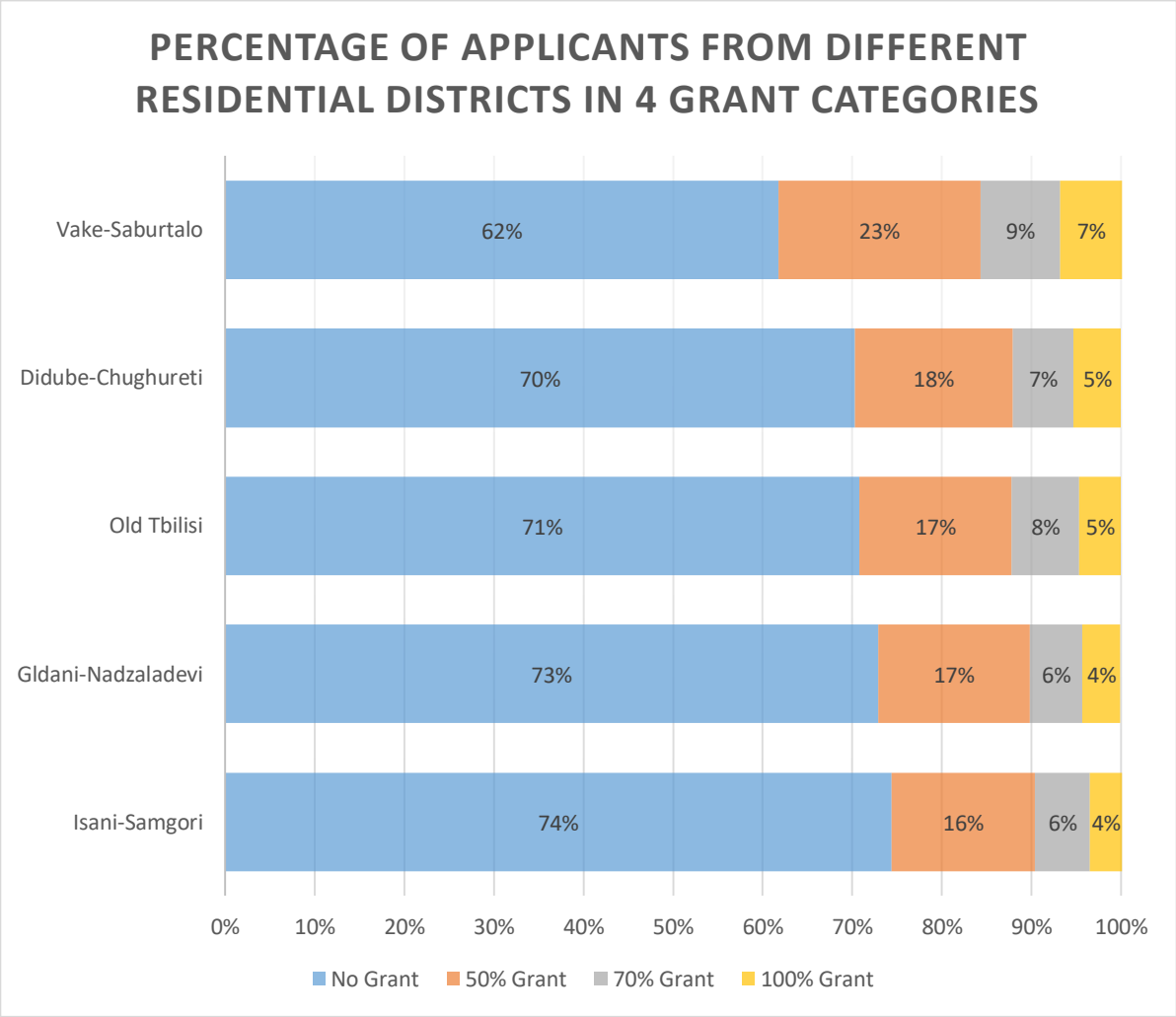


Since the school districts were only given in 5 categories in the NAEC database, I decided to also group residential districts into 5 categories on the later stages of my analysis to be able to compare the effects of residential and school origins. This meant grouping Krtsanisi together with Mtatsminda (resulting in Old Tbilisi) which might have lowered the average relative privilege of Old Tbilisi. However, the West and the East dichotomy was still present at all stages of the analysis despite including Krtsanisi in the West category and Didube in the East.

I then calculated the percentage of applicants from each district falling into each grant category. The hierarchy of districts was aligned with the ranking of districts at the 1st stage of analysis.

While 61.80% of applicants from Vake-Saburtalo were left without a grant, 72.90% of applicants from Gldani-Nadzaladevi failed to obtain a grant (a 11 percentage point difference).

Figure 9: Percentage of applicants from each residential district falling into 4 grant categories

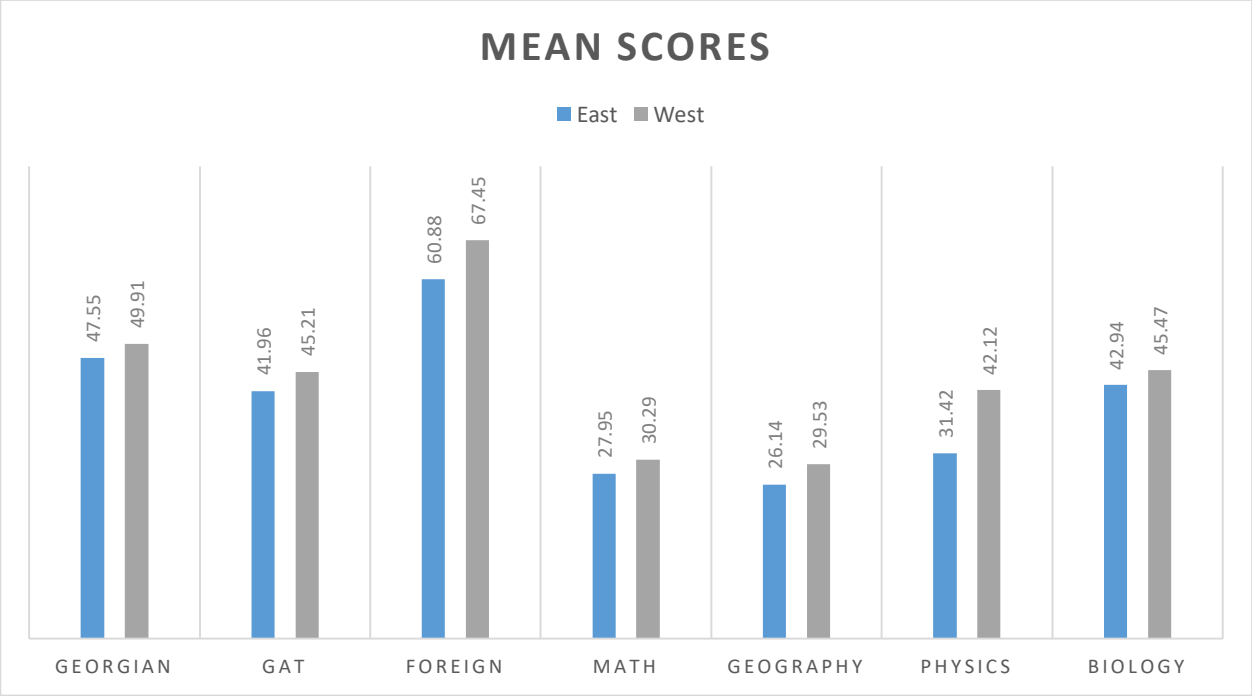


p. < .05

Scores

I then calculated the mean scores in all the exam subjects for applicants from the West or the East. Figure 13 reports the results for the seven exams where the difference between the West and the East was significant at the .01 level.

Figure 10: Mean exam scores for Western and Eastern residential districts



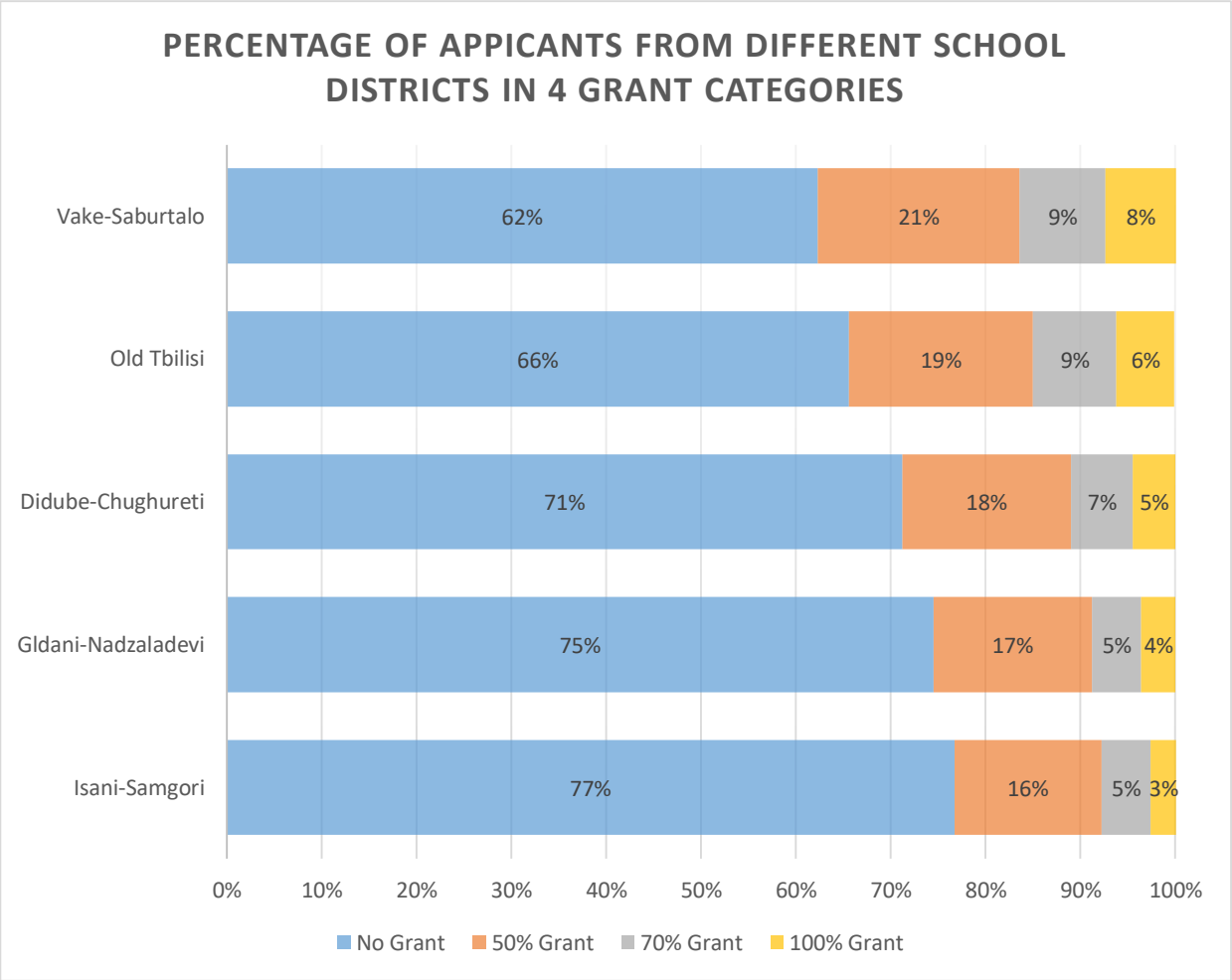
P < .01

The biggest difference in mean scores between applicants from the West and the East is in foreign languages (6.6 points) and physics (10.7 points).

b) School district

I also analysed the possible disparities between applicants from 5 different school districts. When grouping the applicants based on school rather than residential district, the difference between the groups appeared more pronounced. While 7.50% of applicants from Vake-Saburtalo received a full grant, only 2.70% from Isani-Samgori received the 100% grant.

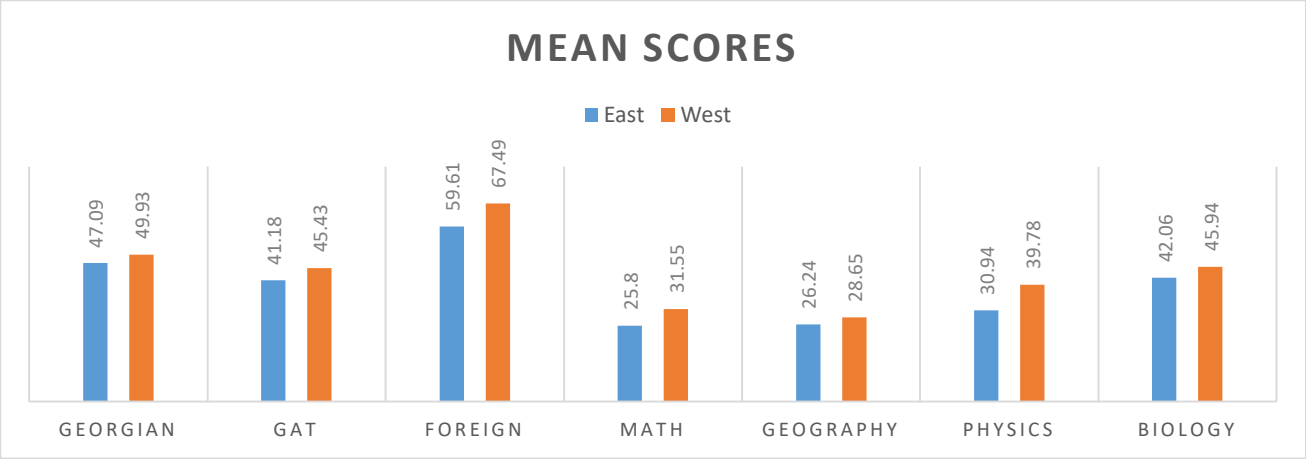
Figure 11: Percentage of applicants from each school district falling into 4 grant categories



$p < .01$

I then calculated the mean scores for all subjects for students from the West and the East. Again, the difference between the groups was more pronounced for applicants from different school districts than residential districts. While applicants from the Western residential districts on average scored 4.4 points higher, those from Western school districts scored on average 5.1 points higher in all subjects displayed in the graphs.

Figure 12: Exam scores in Western and Eastern school districts

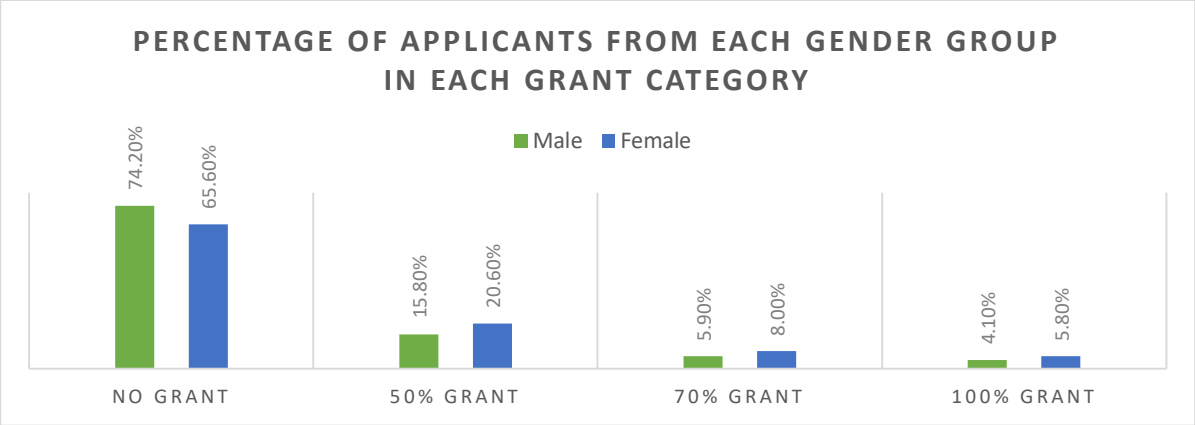


$p < .01$

c) Gender

When grouping applicants by gender, females on average obtained better grants.

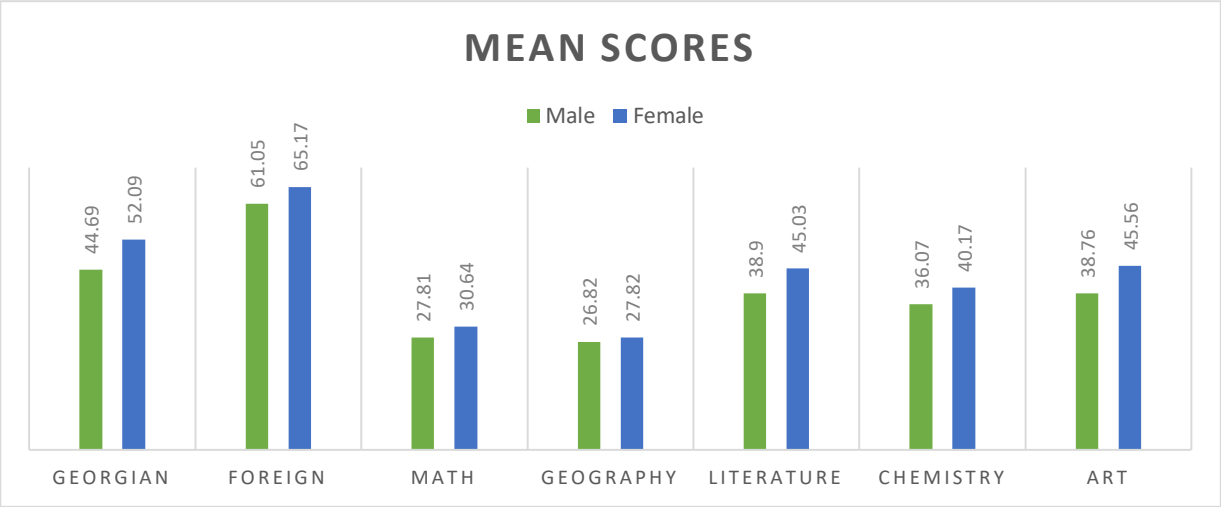
Figure 13: Percentage of males and females who fell into 4 grant categories



$p < .01$

Females also scored higher in all subjects where the difference between the two groups was statistically significant. They scored especially higher in Georgian (7.4 points), Literature (6.1) and Art (6.8) but the difference was less pronounced in the sciences. The average difference between the two groups in all subjects is 4.6 points.

Figure 14: Exam scores by gender

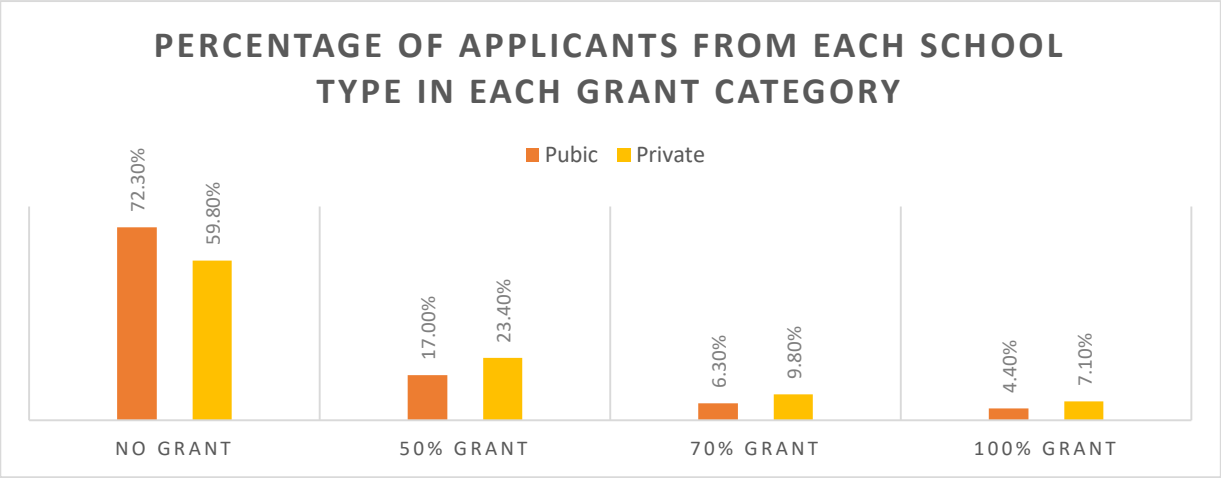


$p < .01$

d) School type

When comparing applicants from public and private schools, those from public schools obtained grants less frequently. While only 4% of public school graduates and 7% of private school students obtained a full grant which makes the difference between the two groups more pronounced than the difference between girls and boys.

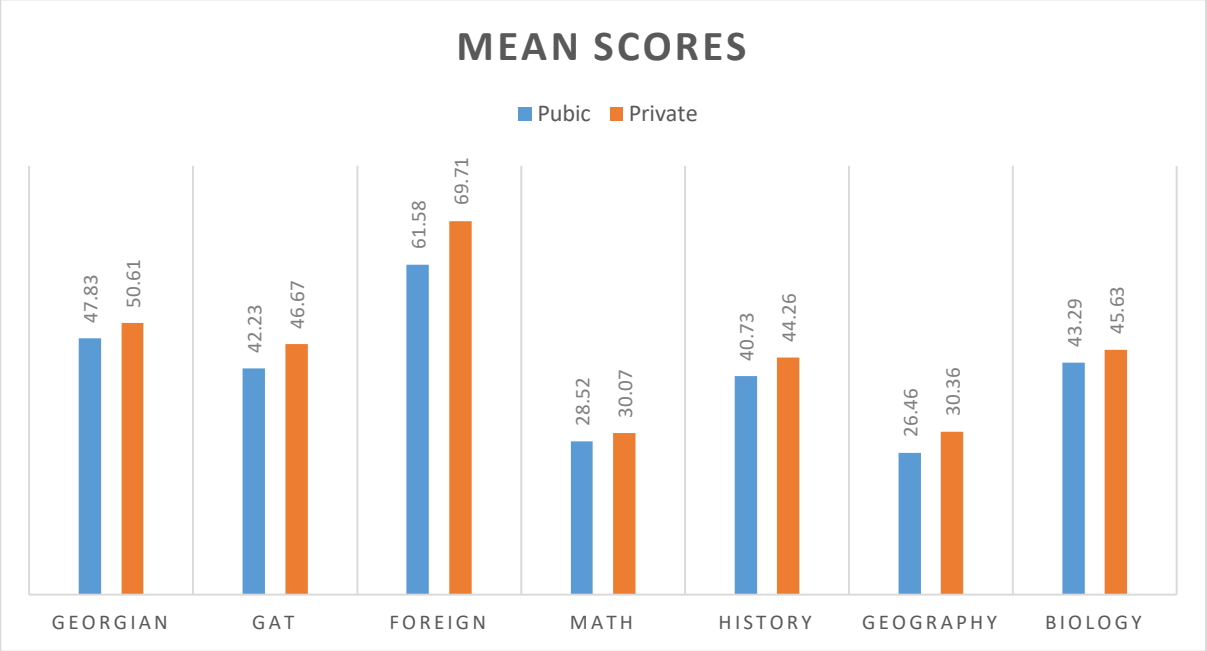
Figure 15: Percentage of private and public school graduates who fell into 4 grant categories



$p < .01$

When it comes to differences in scores, the gap between the two groups of students from public and private schools is not more pronounced than the difference between girls and boys. The biggest divide between private and public school graduates is in Foreign Languages (8 points). The average difference between the two groups in all subjects is 3.8 points, lower than the average difference between men and women.

Figure 16: Exam scores by school type



$p < .01$

e) Age and graduation year

I then analysed the different age-related variables: age as a continuous variable, a dichotomous variable (younger than 18 and 18 and older) and the graduation year as a continuous variable and as a dichotomous variable (recent graduates i.e. those who graduated in the year of the exam and non-recent graduates).

Table 17: Age and graduation year correlation with scores

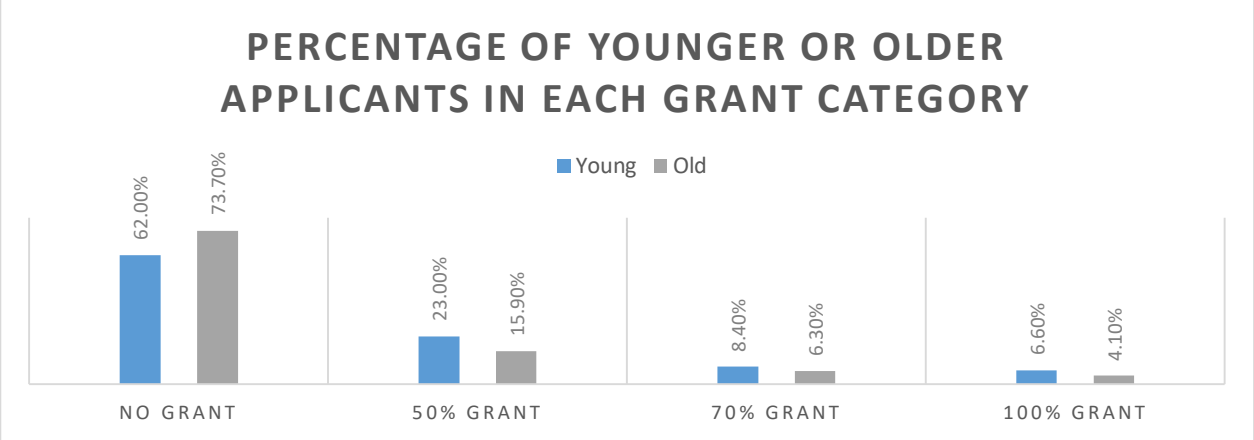
		Age during the exam	Georgian	GAT	Sum	Graduation Year
Age during the exam	Pearson Correlation	1	-.175**	-.145**	-.187**	-.900**
Graduation Year	Pearson Correlation	-.900**	.127**	.083**	.125**	1

p < .01

It is not surprising that the age and graduation year variables correlate almost perfectly. While age correlates negatively with the scores, graduation year correlates positively. This means that older applicants who graduated earlier on average obtained lower scores. The year of graduation and age correlated more strongly with the Georgian exam and the sum score and it had a weaker association with the GAT score.

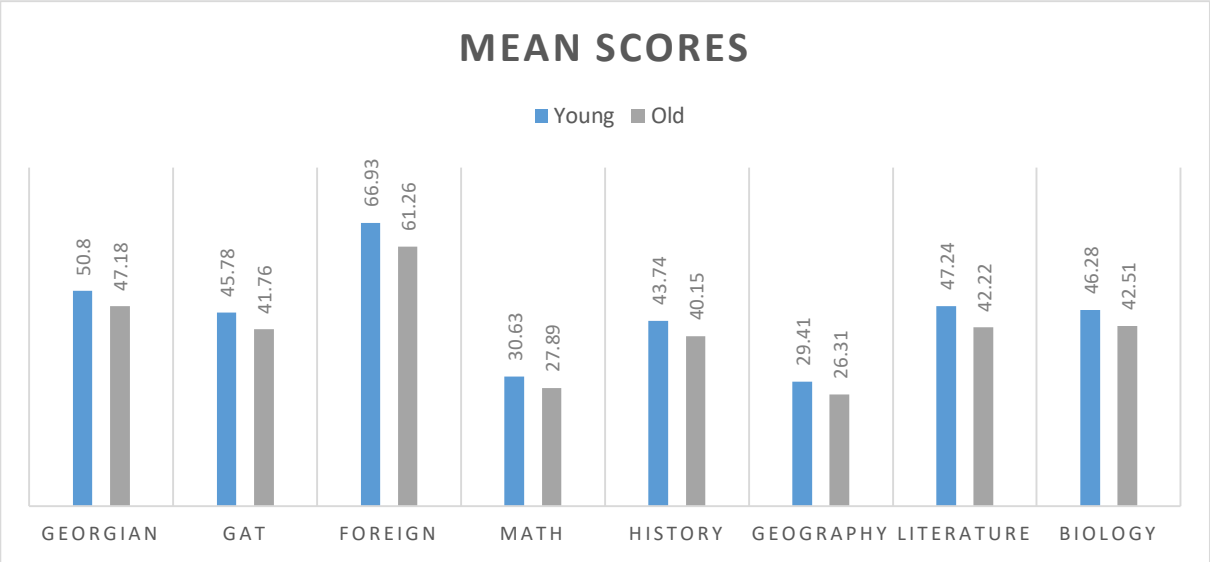
When analysing the dichotomous age variable, it becomes evident that the applicants that were up to 18 years old during the exam obtained grants more often and on average received higher scores. The average difference between the two groups in all test scores is 3.9, almost the same as for private and public school graduates.

Figure 17: Percentage of younger or older applicants who fell into 4 grant categories



p <.01

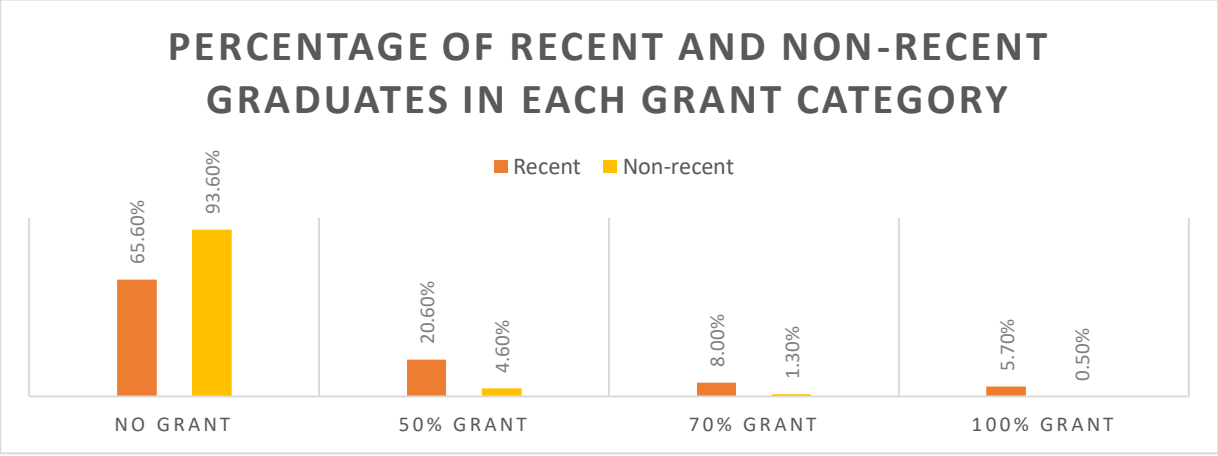
Figure 18: Mean exam scores for younger and older applicants



$p < .01$

The difference between recent and non-recent graduates seems more pronounced. 15% of the total applicants graduated in 2017 or earlier and among them, only 0.5% obtained a full grant and a vast majority – 93.6% – failed to obtain any grant.

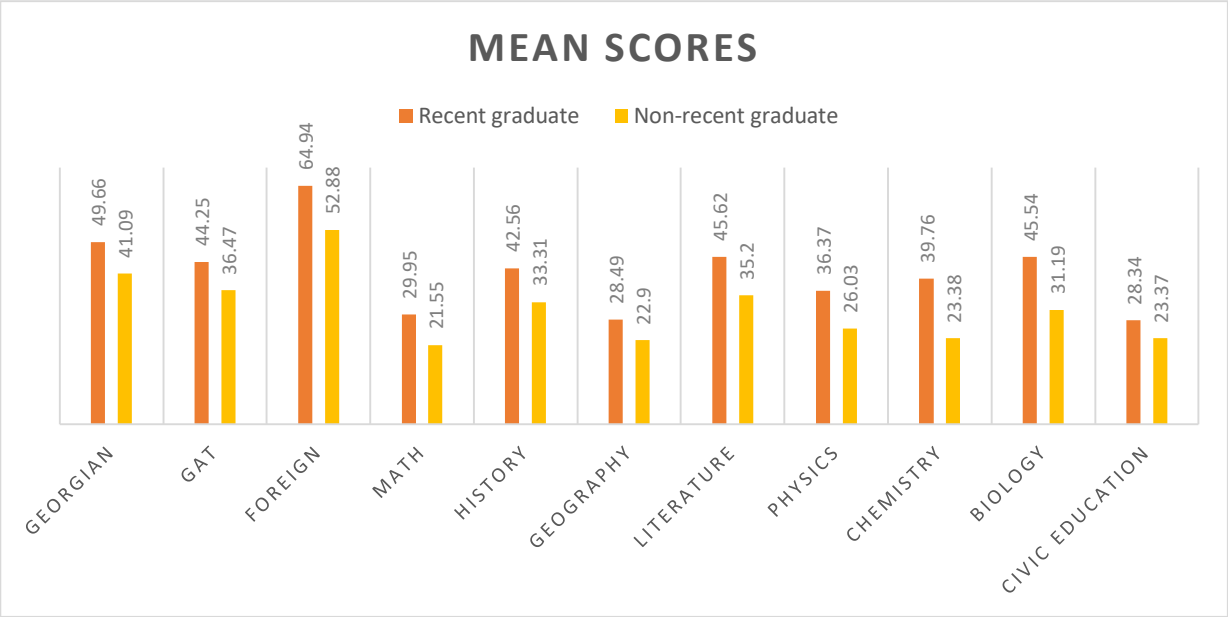
Figure 19: Percentage of recent and non-recent graduates who fell into 4 grant categories



$p < .01$

The difference between the mean scores of the two groups is also more pronounced and averages 9.8 (much higher than for all the other dichotomous variables).

Figure 20: Mean exam scores for recent and non-recent graduates



$p < .01$

Summary

Through initial analysis (cross tabulation, correlation and graphs) I examined if applicants from different districts, school types (public or private) and demographics on average produced different outcomes in terms of a) how frequently they obtained the 4 types of grants and b) their average scores at the various exams. As a result, I gained an understanding of the variables that could possibly impact grant attainment and scores which then allowed me to proceed to my final stage.

I discovered that all variables of interest – residential and school districts, gender, status of the school (private or public), age and graduation year – had an association with grant attainment and scores. Those from the Western part of the city, females, private school graduates and younger, more recent graduates performed better.

School location had a slightly stronger association (those from the West scoring on average 5.1 points higher) than residential district (an average difference of 4.4) which suggests that where the applicant goes to school might have a stronger relationship with exam outcomes than where

they live. While the difference in mean scores between boys and girls was considerably high (women scoring on average 4.6 points higher), the difference between the two groups in grant attainment was much lower. The status of the school and age also had a significant and similar association with both scores and grants, with younger and private school graduates having better outcomes on average. The year of graduation was suggested to have the strongest association – those who graduated in the year of the exam scored on average 9.8 points higher in all exams. 93% of those who graduated in 2017 or earlier failed to obtain a grant (which is 23% higher than the entire census average).

3. Regression analyses

In my 1st and 2nd stages I a) grouped all the city districts into a binary category based on privilege and b) determined that applicants with certain characteristics produced better outcomes on average. Based on these results, in my final stage I tried to predict outcomes with the possible predictor variables that surfaced in the 1st and 2nd stages.

a) Multiple linear regression

First I developed 6 linear regression models to predict exam scores. In each model I included one of the three outcome variables: a) the GAT; b) the Georgian exams and c) the Sum score (the cumulative score of 3 compulsory exams that every applicant passes). For each of the three outcomes I ran two different models, one including only the residential district and the other including only the school district. For all 6 models, the underlying assumptions of the linear model were met and there was no cause for concern for influential cases and outliers biasing the model.

1. Residential district

Table 21 presents the results of the linear regression analyses predicting scores when including the residential district as a predictor.

Table 18: Multiple linear regression analyses predicting scores with residential districts

	GAT			Georgian			Sum		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	B	B	Std. Error	B	B	Std. Error	B
(Constant)	**35.351**	**.398**		**37.425**	**.366**		**121.538**	**1.166**	
Status private	**3.766**	**.376**	**.099**	**2.705**	**.346**	**.075**	**13.676**	**1.100**	**.121**
Residential West	**2.626**	**.308**	**.084**	**2.026**	**.284**	**.068**	**10.259**	**.903**	**.110**
Female	-.493	.291	-.017	**7.038**	**.267**	**.251**	**10.332**	**.851**	**.118**
Recent graduate	**7.528**	**.402**	**.185**	**7.411**	**.370**	**.191**	**25.870**	**1.179**	**.213**
Dependent Variable: GAT, R^2=.056, p < .001				Dependent Variable: Georgian, R^2=.12, p < .001			Dependent Variable: Sum, R^2=.095, p < .001		
Bold means p < .001									

a) GAT

When predicting the General Abilities Test scores, all predictors except for gender are statistically significant. The model overall explains 5.6% of variance in the data. Graduation date seems to be the strongest predictor as recent graduates score 7.5 points higher (out of a total of 80 points). Those from the West score 2.6 points higher. Private school graduates score 3.8 points higher.

b) Georgian

When predicting scores in the Georgian Language and Literature exam, the model explains more of the variance (12%) and all predictors are significant. Gender seems to be the most influential predictor judging by the standardized beta values. Females score 7 points higher. Overall, female applicants who graduated recently from private schools and reside in the West score higher.

c) Sum

When predicting the Sum score (a cumulative of GAT, Georgian and Foreign Language), the model explains 9.5% of variance and all predictors are significant. Graduation year is the strongest

predictor, with recent graduates scoring 26 points higher. Again, Female candidates who graduated recently from private schools and reside in the West score higher.

2. *School district*

Table 19 presents the results of multiple linear regression analyses with the same predictors and outcomes with the only exception that school district is being used instead of the residential district.

Table 19: multiple linear regression analyses predicting scores with school districts

	GAT			Georgian			Sum		
	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	B	B	Std. Error	B	B	Std. Error	B
(Constant)	**34.592**	**.403**		**36.940**	**.372**		**119.004**	**1.179**	
Status private	**3.837**	**.372**	**.101**	**2.780**	**.343**	**.077**	**14.040**	**1.088**	**.124**
School West	**3.805**	**.290**	**.129**	**2.676**	**.268**	**2.676**	**13.757**	**.849**	**.155**
Female	-.428	.289	-.015	**7.080**	**.267**	**.253**	**10.549**	**.846**	**.120**
Recent graduate	**7.430**	**.400**	**.183**	**7.352**	**.369**	**.190**	**25.558**	**1.171**	**.210**
Dependent Variable: GAT, R^2=.065, p < .001				Dependent Variable: Georgian, R^2=.12, p < .001			Dependent Variable: Sum, R^2=.11, p < .001		
Bold means p < .001									

a) GAT

When predicting GAT results with the same variables as in 1a) and replacing the residential district with the school district, the model explains a larger proportion (6.5%) of the variance and gender is again an insignificant predictor. The influence of all predictors is the same but the school district seems to have a stronger effect than the residential district: those studying in the West score 3.8 points higher.

b) Georgian

When predicting the scores in Georgian Language and Literature, similar to 1b), all predictors are significant and the model explains the same proportion of variance. Where the applicant studies has a slightly larger effect than where they live – those who go to school in the West score 2.68 points higher. Gender is, again, the most influential predictor.

c) Sum

Again, when predicting the cumulative score, the direction and the strength of the relationships remain the same as in 1c). When including school rather than residential district, the model explains a slightly bigger proportion of variance in the data (11%) and the district becomes a stronger predictor. Those studying in the West score 13.8 points higher.

Summary

Judging by the results of the linear regression analyses, female applicants from the West who graduated recently from private schools score higher in the Georgian Language and Literature and receive a higher total score in the three compulsory exams (GAT, Georgian, Foreign Language). While applicants who reside in the West score 2.6 points higher in the GAT (out of a total of 80 points), those who study in the West score 3.8 points higher. Models that include school district rather than residential neighbourhood explain a larger proportion of variance. Overall, the school location seems to have a slightly larger effect than the residential location.

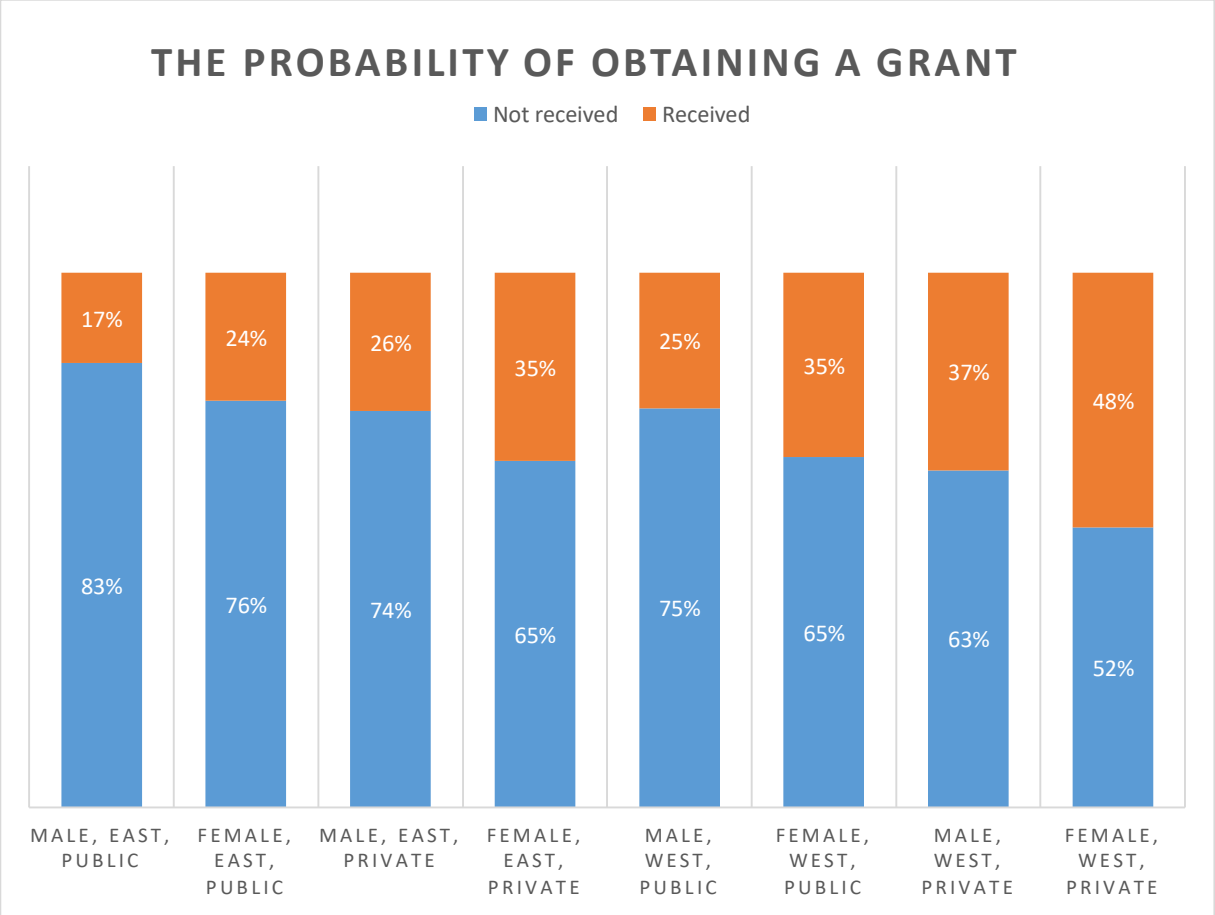
b) Binary logistic regression

The purpose of the binary logistic regression analysis was to calculate the probability of obtaining a voucher for applicants studying in public or private, Western or Eastern schools, younger or older applicants, and boys and girls. No cause for concern for outliers, influential cases, non-linearity of the logit or multicollinearity were found.

Table 20: Binary logistic regression predicting whether an applicant obtained a grant

	B	Std. Error
Age Young	**0.515**	**0.047**
Female	**0.442**	**0.046**
Status Private	**0.547**	**0.056**
School West	**0.516**	**0.045**
Constant	**-1.599**	**0.046**
R2=.064 (Nagelkerke), Model $\chi 2(4) = 453.59$, $p < 0.001$. Bold means $p < .001$		

Figure 21: Binary logistic regression – the probability of obtaining a grant



P < .001

The effect size of all predictors is relatively similar but the status of the school seems to be the most influential predictor, followed by district and age.

According to the model, younger females from private schools in the West are more likely to obtain a grant. When keeping age category constant, female applicants from Western private schools have a 48% probability of obtaining a grant while the chances of male applicants from Eastern public schools are almost 3 times lower – 17%. For applicants from a similar age group and Western public schools, the chance of obtaining a grant increases by 10% when we move from males to females. For males from the same age category and private schools, the chance of obtaining a grant increases by 11% as we move from the East to the West. For females, there's a 13% increase. When keeping age category constant, females who go to public schools in the West and females who go to private schools in the East have the same probability (35%) of obtaining the grant but it increases by 13% if they go to both a private *and* a Western school. When keeping age category, gender and the status of the school constant, those studying in the West part of the city are 1.68 times more likely to obtain a voucher than those from the East.

c) Multinomial logistic regression

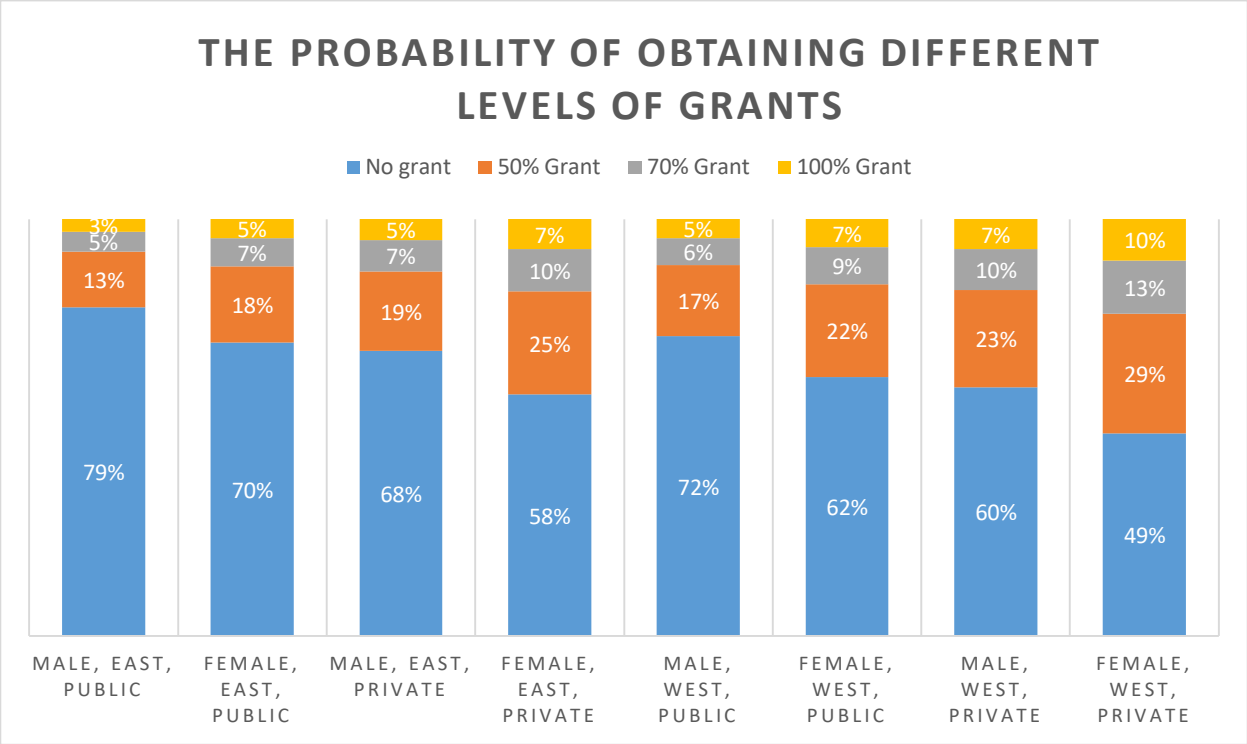
The purpose of the multinomial logistic regression model was to calculate the probability of falling into one of the 4 grant categories for applicants who reside in the West or the East, males and females and students from public or private schools.

Table 21: Multinomial logistic regression predicting probability of obtaining different levels of grants

Grant type[a]		B	Std. Error
50% Grant	Intercept	**-1.78**	**0.05**
	Female	**0.42**	**0.05**
	Residence West	**0.33**	**0.06**
	Status private	**0.50**	**0.07**
70% Grant	Intercept	**-2.82**	**0.07**
	Female	**0.47**	**0.08**
	Residence West	**0.41**	**0.08**
	Status private	**0.61**	**0.09**
100% Grant	Intercept	**-3.23**	**0.09**
	Female	**0.52**	**0.10**
	Residence West	**0.49**	**0.10**
	Status private	**0.64**	**0.11**
The reference category is: No Grant. R2=.033 (Nagelkerke), Model $\chi 2(9) = 272.14$, $p < 0.001$. Bold means $p < .001$			

All coefficients were significant at the .001 level and there was no cause for concern for outliers, influential cases, non-linearity of the logit or multicollinearity.

Figure 22: Multinomial logistic regression - probability of obtaining different levels of grants



P < .001

The effect size of the predictors seems to be similar but the status of the school stands out as the most influential predictor, followed by gender.

According to the model, females residing in the West and going to private schools have a much higher probability of obtaining a good outcome than males from the East graduating from public schools. For private school graduate females from the West, the probability of obtaining a full grant is 11% - more than 3 times higher - than the probability of public school graduate males from the East. For private school females, the chance to obtain a full or a 70% grant increases by 3% when we move from the East to the West. For both males and females, those who go to private schools but reside in the East and those who go to public schools and reside in the West have an equal probability of obtaining a full grant.

Summary

Linear and logistic regression analyses revealed that in general females, younger applicants, private school graduates and applicants from the West are more likely to obtain good outcomes (both in terms of scores and grants). When keeping age category constant, female applicants who go to Western private schools have a 48% chance of obtaining a grant while the probability of male applicants from Eastern public schools are almost 3 times lower – 17%. For private school graduate females residing in the West, the probability of obtaining a full grant is 11% - more than 3 times higher - than the probability of public school graduate males from the East. Again, based on the results of the linear regression models, the school district seems to have a larger influence on the outcome than the residential district.

Discussion

The aim of my study was to determine the association between the geographic location of a student or their school and their university entrance exam performance and access to university vouchers in the capital city of Georgia, Tbilisi. The objective of this analysis was to examine the possible extent of the inequity of the Georgian HE funding system – or in other words to see if students from more privileged neighbourhoods were more likely to obtain government funding – and to compare the effects of residential origin and school location. The Discussion chapter will review the findings of the study, the possible reasons behind the spatial inequalities, and the shortcomings of the current Georgian HE funding system. It will offer policy suggestions based on the findings of this study and scholarly literature and suggest future avenues for research.

The results of the study

Neighbourhood disparities

By analysing a similar database with somewhat similar variables and methodology, Chankseliani (2013a, 2013b) uncovered important spatial and demographic disparities among UNE applicants in the years of 2005-2009. Because of the difference in the variables and the models, the results of our two studies are not directly comparable. However, it is evident that the spatial, educational and demographic disparities are still prevalent today, 10 years later. The strength of the neighbourhood effect is similar to that of the 'rurality' effect. This finding is especially surprising given large socioeconomic, cultural and educational gaps between rural and urban locations as opposed to the relative socioeconomic homogeneity of income and educational opportunities in Tbilisi. In a city of 1.5 million inhabitants, many educational resources (like private tutors, libraries, the Internet) are at least geographically accessible to the entire population of applicants. Yet, those from privileged districts are considerably more likely to perform well and obtain a study voucher.

A 3-stage analysis revealed a clear distinction between the West and the East. Districts on the West side of the river Mtkvari a) on average boast higher real estate prices; b) obtain slightly higher average per-student school funding from the Ministry and c) produce better-performing applicants in terms of both their exam scores and grant attainment. When keeping age category, gender and the status of the school constant, those studying in the West part of the city are 1.68 times more likely to obtain a voucher than those from the East.

As discussed in the Background section, the neighbourhood effects can be attributed to socioeconomic, cultural and educational differences between the districts.

Residential origin or school location – which is a more powerful predictor?

Thanks to the rich quantitative database, I was able to separately analyse the effects of residential and school locations on exam outcomes. A comparison of mean results and linear regression analyses revealed that the location of the school is a slightly stronger predictor than the residential location.

The school districts were initially ranked in terms of their relative advantage based on average per-student school funding (which speaks to a relative lack of resources and therefore lower educational opportunities in the East) while the relative advantage of the residential districts was determined based on average real estate prices (which speaks to the general affluence of the districts and therefore lower socioeconomic and cultural backgrounds in the East). Therefore, since the school district has a stronger relationship with outcomes, it can be argued that the educational features of the neighbourhood effect can be assumed to have a slightly stronger effect than the socioeconomic and cultural components, which is in line with Chankseliani's (2013a) qualitative findings.

Non-spatial disparities

While the focus of my study was geographic inequalities in education, it is important to discuss the other demographic or educational sources of privilege.

Gender

Females demonstrated higher average results and probability of success in almost all subjects – especially the Georgian Language and Literature - with the exception of the GAT. The reasons behind the gender differences warrant further investigation. However, it can be noted that while the Georgian test can be argued to be more oriented towards testing the applicant's knowledge of grammar rules and literature and their writing skills, the GAT is more math-based and logic-oriented.

School Status

In a school system with under-resourced public schools which are likely to be more representative of students from lower socioeconomic backgrounds, the relative privilege of private schools is not surprising. The status of the school was a statistically significant predictor of exam outcomes on all levels of analysis and was the most influential predictor in the logistic regression models.

Age and year of graduation

The study uncovered a significant negative correlation between the age of the applicant or their year of graduation and their exam outcomes. This means that those who graduated from school more recently had higher probability of success. While the reasons behind this require further investigation, two possible explanations can be discussed: a) the possible advances in opportunities in the years leading up to 2018, related to school resources, improvements in teaching quality due to a number of educational reforms, etc.; and b) older applicants having a less 'fresh' memory of the knowledge and the skills to be demonstrated at the exams. The latter explanation makes sense especially because the correlation between the graduation year/the age and exam outcomes was stronger with the Georgian exam than the GAT. While the Georgian exam can be argued to be more focused on testing the applicant's knowledge, the GAT is more skill-oriented.

Why the West and the East?

As someone who grew up in Tbilisi, I was deeply aware of the relative prestige of the neighbourhoods that my study singled out as more privileged. However, surprisingly, it was only as a result of the three stages of analysis that I discovered that all of the more privileged districts were situated on the Western part of the city.

Explaining the reasons behind the West-East dichotomy goes beyond the scope of this thesis. However, upon reviewing the available literature, it becomes evident that the urban plans during the Soviet Union era might have fuelled the Western and Eastern divide.

Mass migration and active constructions in Tbilisi started in the 4th century and the boundaries of the city did not expand beyond the proximity of the river Mtkvari until the Russian annexation in 1801 (Okuashvili 2011). From 1801 the city expanded Northward along the river (Ibid.).

The city outline changed during the "Kruschev thaw" from the 1950s with "a rapid proliferation of low-quality, standardized apartment blocks under the popularly applied name of 'khrushchevka'" (Mathema, Salukvadze, and Budovitch 2016, 20) – a type of housing that cannot be found in the central and older parts of the cities (Tbilisi Architecture 2018). Such housing was mainly built to accommodate a fast growing wave of working class migrants from rural areas (Tabidze 2011). The flats remained under State ownership and was leased to the citizens in need (Mathema, Salukvadze, and Budovitch 2016). While several population groups (artists, scholars, etc.) had a right to bigger housing units, the provincial working class mainly populated the smaller flats near the industrial centres (Ibid.).

The new projects were mainly undergone in the more industrial, Eastern part of the city (Okuashvili 2011). As a result of a number of land use violations, the crammed construction of the massive, homogeneous, unattractive buildings resulted in dense populations and the absence of cultural or shopping centres and recreational areas (Ibid.).

To sum up, the Eastern, more industrial districts experienced an influx of the rural working class, a proliferation of low-quality housing and a lack of room for recreational areas and service centres.

Shortcomings of the Georgian HE funding system

As mentioned before, the choice of HE funding allocation mechanisms usually depends on the relative importance of the three traditional goals of improving access, enhancing quality and encouraging efficiency (Jongbloed and Vossensteyn 2016). According to the literature reviewed in the Background section, the introduction of the UNE and the voucher scheme in Georgia was aimed at eliminating corruption and enhancing transparency, access and competition.

Upon reviewing the available scholarly literature and the results of this study, it becomes evident that due to very limited government funding, high tuition fees, an absence of affordable student loans and the general poor economic conditions in the country, the financial burden of attending a university is very high.

The findings of my study suggest that strong disparities in access to HEIs and vouchers exist even within the capital city. Those from more affluent, highly resourced neighbourhoods and private schools are more likely to score well and obtain government aid. Therefore, the system clearly benefits those who might have been able to support themselves in the absence of a grant anyway while the less privileged applicants are required to struggle to pay large tuition fees and may be discouraged from applying. Privileging private school graduates and wealthier applicants makes the current admissions and funding system inequitable. By directing the funds towards those who need it less and because of the danger of excluding talented students from underprivileged backgrounds who would have contributed to the economy, the system is also inefficient.

When it comes to enhancing competition and efficiency, as argued in the Background section on vouchers, the efficiency and the equitability of voucher schemes is also debatable. In the Georgian setting, as outlined by some researchers, due to a very limited number of study grants, the voucher system itself may not have a substantial effect on competition among HEIs – universities compete for voucher students only because they are the most qualified applicants, not because of the income derived from the study grant (Andghuladze and Salmi 2012; Ziderman 2017).

Furthermore, it is assumed that such a competitive system will boost the economy as students respond to the needs of the market and the economy but according to Ziderman (2017), in Georgia's case the students pursue private advantages which do not correlate with the needs of the economy: their majority enrols in the Social Sciences, Business and Law instead of Engineering, Agriculture and education which are deemed more crucial for the economy by the government. As noted by Ziderman, according to Friedman (1962), "any subsidy should be granted to individuals to be spent at institutions of their own choosing provided only that the schooling is of a kind that it is desired to subsidize." The Ministry tries to steer students towards preferable programs by topping up study grants for students who enrolled in select programs in certain universities, but as mentioned before, since the students do not know in advance which programs will receive such treatment, they are not incentivized to apply to such study fields.

The Ministry of Education itself recognizes the shortcomings of the current system (The Ministry of Education 2017). According to the 2017-2021 strategy, on the one hand, the voucher scheme and the national examinations were successful in eradicating corruption and promoting a more transparent and effective funding mechanism. On the other hand, they do not ensure improvements in teaching and research quality and equal access.

Policy suggestions

To improve access (widen student participation in the interests of equity and national economic performance), quality and efficiency (for its own sake and for national competitiveness), two changes can be proposed based on the findings of the study and other scholarly literature:

1. Directing government funding towards needs-based vouchers

As displayed in Table 4, in 2018 only 15% of government vouchers for Bachelor's students were needs-based. 30% of applicants who enrolled in HEIs received a merit-based study grant and as discussed above, the beneficiaries of the grant are more likely to come from privileged backgrounds and thus be able to afford to finance their studies even in the absence of merit-based vouchers while less privileged students are less likely to secure funding and choose to enrol or might be discouraged from applying in the first place. Therefore, abolishing the merit-based

voucher (and demanding a full fee) and redirecting all government vouchers towards needs-based grants could prove to be a more equitable solution.

This would entail that even the highest performing applicants would need to cover the tuition costs themselves, unless deemed in need. Introducing tuition fees for the entire applicant population is usually justified by the following arguments. Firstly, the private return from HE tuition is greater than the social return; therefore, those who benefit should pay (Barr 1998; Jongbloed 2003; Johnstone 2003). The introduction of a tuition fee is also believed to make students and families "more discerning consumers and the universities more cost-conscious providers" (Johnstone 2003, 356). According to Vossensteyn and Canton (Canton et al. 2001, 53), with public subsidisation "less talented individuals would calculate a positive net present value of participating in higher education" which could lead to "a reduction of the average quality of student population" but tuition fees would promote self-selection and only the most able students would apply. Tuition fees can also motivate students to work hard and demand value for money (Canton et al. 2001; Johnstone 2003). Finally, studies demonstrate that price elasticity of HE is usually low for students from more affluent backgrounds (Ibid.) so those who usually receive the merit-based grant may not be discouraged to apply.

Because of the existence of spillover effects of HE to the society (Jongbloed 2003; Barr 2002, 1998) and because of the danger of excluding talented students from poor or rural backgrounds who would have contributed to the economy (Johnstone 2003), taxpayers can share the costs of HE in the form of needs-based vouchers. However, the students need to understand their chances of obtaining the needs-based voucher in advance so that they are not discouraged from applying (as mentioned above, in the current system students apply for the needs-based grant after they have enrolled into HEIs and have accepted the obligation to pay the tuition fee and possibly move to a city).

Furthermore, in the scheme proposed in the thesis, HEIs also have less incentives to specifically attract affluent students (and various international data suggests that cream-skimming is prevalent in universities (Dill 2007; Barr 1998)). Firstly, in the absence of empirical data, we can only assume that currently universities might be tempted to target private and urban school

graduates and well-off students (because they are more likely to have received better pre-tertiary schooling). However, if the amount of needs-based grants is substantial enough, HEIs might be motivated to recruit students from rural and poor backgrounds which could produce better-informed students in such income groups and therefore expand access.

There are two main challenges to the proposed change: 1) students might have difficulty understanding the scheme and calculating the amount of aid they are entitled to which might impede access (Barr 2002); and 2) due to the absence of a tradition of revealing incomes, tax evasion tendencies and the prevalence of non-monetary income, determining financial need may be difficult (Johnstone 2003). It might be argued that the applicants may also be discouraged from preparing for the exam in the absence of a merit-based study grant but since they will still need to compete for the study places, it may be unreasonable to expect such an outcome.

It is also worth noting that a needs-based funding system could, instead of a voucher system, also be implemented through a formula-based funding scheme through which the HEIs would receive government funding based on the amount of enrolled students that qualify for the aid. However, Jongbloed (2000, 30) suggests that the benefit of a voucher system is that it can "make students realise that the choices they make imply that the government is investing on behalf of them and – in return for that – the educational institution is supposed to deliver a service."

2. A universal income-contingent student loan system

According to Johnstone (2003, 354), the objection that introducing tuition fees might exclude potential students from disadvantaged backgrounds is usually met by the promise of universal student loans that do not depend on creditworthiness (unlike the current system in Georgia).

Barr (1998) and Johnstone (2003) argue that such a loan system is expected to 1) expand access and 2) restore quality through channelling more funds, both private and public. According to them, to ensure access, reduce parent-dependence and make HE free to consume, such student loans should be income-contingent and therefore affordable. Unlike the current Georgian scheme, the loans should also be adequate to cover both living costs and tuition fees to address student poverty and expand access (Barr 2002). To make the system easier to understand and

administer, the repayment of the loans could be automatically collected by tax authorities. Because the repayments would be income-contingent, they could start at a lower income and reduce deferment. Such a strong repayment stream and a low default rate would thus attract the private sector and allow savings to the taxpayers (Barr 1998). As for the interest rate, Barr (1998, 2002) argues for an interest rate equal to the government's cost of borrowing. However, even with such an automated and equitable system, students from disadvantaged backgrounds might still be resistant to borrowing (Johnstone 2003).

It is worth noting that Barr (2002) also argues against imposing government-sponsored interest subsidies based on empirical data. To sum up his arguments (2002, 15), interest subsidies are "a costly, non-transparent and ineffective way of promoting access, and benefit exactly the wrong people."

Limitations of the study and avenues for future research

My study relied on a fully quantitative methodology and it modelled the relationships between only a small number of variables. The proportion of variance that the models explain is very small. In other words, the reality is much more complex. Educational outcomes depend on considerably more than the geographic location of the applicant.

One of the biggest challenges of the study was the ranking of the city districts based on privilege. On the one hand, I was unable to find a larger number of more informative indicators of privilege. On the other hand, because of the nature of the database on which I relied and due to having limited time, I was only able to group an entire city of 1.5 million inhabitants into 5 districts and then further distinguish between two parts of the town. This resulted in grouping a small number of seemingly less privileged districts together with more affluent neighbourhoods in some cases and disregarding the possible differences within some of those 5 categories. Performing analysis on smaller units would have provided a fuller picture.

As I relied on previous quantitative and qualitative findings, I was able to make assumptions on the reasons behind the neighbourhood effects and attribute the difference between the groups to socioeconomic, cultural and educational characteristics. However, zooming in and exploring

those features separately would provide a richer understanding of the possible educational stratifiers. To obtain a fuller picture on the educational component, it would be prudent to analyse school characteristics like teacher qualification, approaches to teaching and learning, school resources, etc.

Furthermore, my study was only able to focus on the students who chose to apply to universities and it had no information on the spatial or other disparities for the school graduate population as a whole. To understand inequalities in student access (and not just admission) to HE, tendencies in aspirations, student choice, application, preparation, and program completion also need to be taken into account, as suggested by Chankseliani (2013a).

Due to time limitations, I was unable to delve into the reasons behind the relationships between the variables in the study. A possible area for future research would also be to explore the reasons behind the effects of location, gender, age and school status.

Conclusion

By analysing a government-collected census database of 10,000 university entrance exam applicants from Tbilisi, Georgia and by modelling the relationships between indicators of geographic, educational and demographic privilege and exam outcomes, the study has made a contribution to both scholarly debates on spatial disparities and HE vouchers and policy-related questions on mechanisms for HE funding.

Through 3 stages of analysis, the study uncovered major inequalities in the probability of success among the Unified National Examinations applicants from different neighbourhoods. Because the results of the exams determine admission and the value of the voucher that the applicant receives, the study also provided insight into the degree of the inequity of the Georgian HE admissions.

The analysis revealed a clear divide between applicants from the West and the East part of the capital city. Districts on the West side of the river Mtkvari a) on average boast higher real estate prices; b) obtain slightly higher average per-student school funding from the Ministry and c) produce applicants with better scores and higher probability of obtaining study vouchers. According to the results of logistic regression analyses, when keeping age category, gender and the status of the school constant, those studying in the West part of the city are 1.68 times more likely to obtain a voucher than those from the East.

The major stratifiers affecting the outcomes, apart from geographic origin, include gender, age and school type. According to the linear and logistic regression models, females residing or studying in the West and attending private schools have a much higher probability of scoring well or obtaining vouchers than males from the East graduating from public schools. When keeping age category constant, female applicants from Western private schools have a 48% chance of obtaining a grant while the chances of male applicants from Eastern public schools are almost 3 times lower – 17%. For males from the same age category and private schools, the chance of obtaining a grant increases by 11% as we move from the East to the West. For females, there's a 13% increase. For private school graduate females from the West, the probability of obtaining a

full grant is 11% - and more than 3 times - higher than the probability of public school graduate males from the East.

The study also suggested that the school location of the applicant has a slightly larger influence than their residential origin. When keeping age category, gender and the status of the school (public or private) constant, while applicants who reside in the West score 2.6 points higher in the GAT (out of a total of 80 points) than those from the East, those who study in the West are predicted to score 3.8 points higher. The models that include the school rather than residential district also explain a larger proportion of variance.

While the quantitative analysis only explains a small proportion of the variance in the data and is unable to examine the reasons behind the disparities, based on the available literature, it assumes that the socioeconomic, cultural and educational features of the applicants from the various geographic locations influence their outcomes.

By uncovering major differences in the chances of success among applicants from different socioeconomic, educational and cultural backgrounds, the study brings our attention to the possible efficiency- and equity-related threats and repercussions of merit-based vouchers and centralized merit-based examination admissions.

On the one hand, the findings can be deemed relevant for policy-related debates on the Georgian education system. Since the Ministry is in the midst of reforming the admissions mechanisms and attempting to enhance its equitability, the results of the study may warrant further investigations into the variance between the geographic, demographic or school-specific features that may impact educational outcomes.

On the other hand, because the study brings our attention to the possible threats of exam-based admissions and grant attainment, the findings can be relevant for other national settings debating the merits of centralized examinations (introduced in nearly all post-Soviet countries) and merit-based vouchers (introduced in countries like Hungary, Lithuania, Azerbaijan, Kazakhstan and Russia). While studies on HE vouchers and spatial disparities, especially in post-Soviet settings, are scarce, voucher-based mechanisms are becoming increasingly common.

Upon reviewing the findings of the study and the available scholarly literature, the main recommendations for the Georgian HE system are to direct all voucher funding towards needs-based grants and introduce an income-contingent, accessible loan scheme to enhance access, equitability and efficiency.

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