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Institutional conditions for equitable access to higher education in Ecuador: a novel linked administrative data analysis

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ABSTRACT

The 2020 Global Education Monitoring Report finds that “the expansion of tertiary education has been unprecedented, but accompanied by persistent vertical and horizontal inequity.” (UNESCO, 2020). Higher education access policies play a crucial role within this, with school and higher education financing potentially affecting equitable outcomes via institutional resourcing and staffing. This paper contributes to the monitoring of SDG target 4.3 by using nationwide data to understand the institutional conditions (at school and higher education level) associated with students’ access to public universities in Ecuador in 2018. The study focuses on two units of analysis: students: their trajectories into public higher education; and institutional: schools and universities. The research explores how the distribution of resources to schools and public universities affect institutional material and human conditions and how this may be related to equitable access to public universities. The research design uses large-scale administrative data, linked together for the first time. The findings of the study illuminate the extent to which equitable access to higher education access has been implemented in Ecuador and serves as a blueprint for the monitoring of progress in other contexts.

Key words: equitable access, inclusion, school conditions, higher education, university financial behaviour.

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1. Introduction

According to the Global Education Monitoring Report 2020, “disadvantaged young people face multiple obstacles in gaining access to tertiary education, including finance, information, and networking barriers. Counsellors and advisers are particularly important for these learners, yet minorities, students with disabilities, those living in rural or poor areas and other disadvantaged students are often the least likely to receive adequate counselling on higher education opportunities” (UNESCO, 2020). Furthermore, the GEM Report informs that “student precarity is rising as the number of marginalized students in tertiary education grows. In late 2019, French students protested for more affordable housing, food, and health services (RFI, 2019). In the United States, around half of undergraduates are reportedly food insecure, and up to one in five are housing insecure (Broton and Goldrick-Rab, 2017). More than one-quarter of university students have dependent children (Institute for Women’s Policy Research, 2014) and less than one-third of single mothers graduate within six years of enrolment (Institute for Women’s Policy Research, 2018).” (GEM Report, 2020. P 241) Against this backdrop, this research project will contribute to the understanding of policies for equitable access to higher education in Ecuador, as relevant to Target 4.3 : “By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university”. The proposed research project seeks to understand the individual characteristics of students and their schools of origin as predictors to access the best public universities to later discuss the concentration of public funding in higher education in order to achieve equity and quality.

Contrary to the global trends, during the decade of the 2010s the government of Ecuador intensified public investment in higher education, becoming the country with the largest investment in higher education in Latin America as a percentage of GDP (average 2% of GDP for higher education) (Mountford-Zimdars, A., & Harrison, N., 2016). Ecuador’s increase in public investment in higher education was triggered by a constitutional reform in 2008 and a legal reform in 2010 promoting a knowledge-based economy as a development model for the country (Mantuano et al., 2019). Between 2012 and 2017, the country implemented five main strategies: 1) establishing, by a constitutional reform, fee-free public higher education for undergraduate level; 2) closure of 14 private universities of low quality and the creation of 4 new public universities; 3) the creation of a centralised admissions process to manage access to public higher education institutions based on student standardised test results; 4) scholarships and student loans schemes; 5) increase of universities budget distributed through a formula that rewarded quality (Higher Education Law of Ecuador, 2010) The aforementioned strategies paved the way for the expenditure of approximately USD 8 billion in six years (Benavides et al., 2019; Van Hoof et al., 2013).

The following study seeks to answer three research questions: (1) What is the relation between student personal characteristics and their access to the best public universities in Ecuador?; (2) What are the school conditions of students who access the best public universities in Ecuador? and (3) What is the financial behaviour of equitable universities? This study presents the results of an analysis of the year 2018 looking into the dynamics of access to higher education by examining students’ individual characteristics and school level determinants. For the individual level characteristics, I have used the total populations of applicants who accessed public universities in 2018 while for the school level characteristics I used a subsample where school information was available. For the first two questions, logistic regressions were performed using a classification of schools and universities by quintiles of quality based on official information from the Ministry of Education and the Council for Quality Assurance and Accreditation of Higher Education. For the third question, I will use results from the analysis of inclusion as well as financial information of public universities. This paper consists of a context section followed by a literature review, a section on methodology and section on findings per research question. Lastly the

conclusions and policy recommendations outline the contributions that this nation-wide study may represent in the context of global education monitoring.

Overall, the conclusions of this study evidence that students from ethnic minorities (especially indigenous), with disabilities or females as well as those from poorer schools have less chances of accessing the best universities in Ecuador. Along the same line, the most inclusive universities have less budget per student, yet quality and inclusion are not mutually exclusive. In fact, this study shows that there are “efficient” universities that manage to have high quality standards being inclusive at moderate costs per students. On the other hand, the best quality universities are the least inclusive and concentrate the most resources per student. In conclusion, this study provides an overview of individual and school level determinants for accessing public universities in the light of public investment. Overall, public funds are concentrated in institutions attended by the most privileged students (coming from best performing high schools and studying at more elite universities). Thus, this study illuminates inequalities at the student level as well as at the institutional level in schools and public universities.

2. Relevant literature review

The following section will cover the revision of relevant literature in three aspects that are key to this study: (1) inclusion of students in higher education systems, (2) different studies on trajectories of students from secondary to tertiary education as well as literature on (3) university’s budgets and expenditure behaviour to contribute to the final discussion.

1.1. On inclusion of students in higher education systems

The question of inclusion is long debated in higher education access policies, from different angles and by different socioeconomic characteristics; ethnic, gender and economic, amongst others (Cowan, C. D., Hauser, R., Kominski, R., Levin, H., Lucas, S., Morgan, S., 2012). Socioeconomic conditions of students in tertiary education are rarely a variable as strong as academic excellence which has proven to be a regressive variable when admitting students into universities (Rodríguez-Hernández et al., 2020). By definition, universities have developed as centres of elitist accumulation of knowledge where academic excellence is the scheme most likely rewarded (De Sousa Santos, 2017) (Ramburuth & Härtel, 2010). In this logic, the most benefited students are students with highest performance standards who do not belong to the most impoverished backgrounds (Rodríguez-Hernández et al., 2020). It is thus, from a sociological perspective, important shed light on the relevance of socioeconomically vulnerable students accessing and successfully completing higher education as a way of social mobility and social development with increased wellbeing opportunities for society as a whole (Thiele et al., 2016). Similarly, from an economic perspective, the access of more economically vulnerable students into higher education fosters economic development and allows countries to move towards or achieve a “knowledge society” that is more focused on services than primary goods with limited value added (Buckner, 2017). The big debate thus remains on the ways in which this is achieved in institutions such as universities where structural innovation is scarce. Moreover, the relevance of inclusion is almost contradictory to a more traditional admission practice at universities: academic excellence. (Cupito & Langsten, 2011).

Current policy debates focus on increased access in line with inclusion in different arenas; gender, ethnicity and socioeconomic background (Ramburuth & Härtel, 2010). The latter has been highly related to financial aid packages and other types of stipends that support mostly the demand side of higher education (Singsalasang et al., 2017)(Flannery & Cullinan John, 2017). In parallel, there is a growing interest in improving efficiency in higher

education based on institutional transformations undermining equitable access that have been systematised for example in initiatives such as the Universities for Strategic, Autonomous and Efficient Management (USTREAM) by the European University Association (EUA) (Kupriyanova et al., 2018). The question of who pays and how is central to the policy debate of inclusion of vulnerable students in tertiary education.

As discussed, inclusion is understood – in policy debates – as a way of reducing the distortions that may be generated due to the causal relation there is between academic performance and socioeconomic status (Hughes, 2015). It is broadly proven in literature that less economically favoured students tend to have lower academic performance due to limitations that are collateral to their conditions (O’Shea et al., 2016; Rodríguez-Hernández et al., 2020). Under such context, socioeconomic conditions of students may be understood from a multi-dimensional poverty perspective; where living standards, education and health are considered to generate a condition of vulnerability in students (Ramburuth & Härtel, 2010).

Overall, including vulnerable students holds benefits for individual mobility and for national economies. Promoting social justice by including vulnerable students in higher education represents a positive public policy outcome, with a clear role for education institutions. (Armstrong & Cairnduff, 2012; Ghosh & Kshitij, 2016; Hughes, 2015; Nohria et al., 2019; Pidgeon, 2016). Thus, the proposed research project places inclusion at the centre of the debate of access to higher education and embodies the spirit of SDG Target 4.3.

1.2. Student trajectories from secondary into tertiary education

Historically, universities were elitist spaces, reserved for those most privileged. The spread of universities through European-driven colonisation processes brought about similar structures of elitism to other world regions. With recent trends towards massification in a range of countries, university access models are still being revised and they are becoming more technocratic, as universities start to become more regulated by national institutions (De Sousa Santos, 2017). This model often leaves the most socioeconomically vulnerable students behind. Even if access is achieved, evidence shows that the probabilities of successfully completing university studies are still higher among more socioeconomically privileged students (Rodríguez-Hernández et al., 2020).

As the availability of datasets increases, so do the opportunities to understand student trajectories from secondary to tertiary education. Most of the implemented research up to date, has analysed student trajectories from the perspective of decision making and have aimed to reveal the situations of historically disadvantaged groups of society. Overall, the literature on student trajectories has become more valuable as higher education has become more diverse regarding the paths it offers students (Haas & Hadjar, 2020). Some of the literature that has started to focus on student trajectories is brought about by a sociological viewpoint where the disciplines and societal conditions of the student are analysed and linked in a longitudinal spectrum (Lemistre & Ménard, 2019).

1.3. Funding public universities

When looking into the trajectories of students from vulnerable backgrounds from high schools to universities, it is also important to understand the characteristics of such universities in terms of their funding sources and expenditure behaviour (Docampo & Cram, 2017). This is to understand who benefits from public universities and how.

Globally, research evidence focuses on funding sources for universities particularly in the higher education systems of Europe and North America where the role of universities is being challenged and funding mechanisms are evermore burdening students into debt, sometimes through the introduction of fees (De Sousa Santos, 2017). Funding mechanisms are often related to formulas or other distribution tools that allow to guide higher education

policy based on quality and institutional performance (Su, 2006). Relatively less attention is paid to the patterns of internal institutional resource allocation and how this may relate to students' outcomes upon access into the universities. What evidence is present focuses on universities' financial investments into achieving better (global) institutional rankings, yet not in supporting socioeconomically vulnerable students (Docampo & Cram, 2017). One reason for this limited evidence on universities' expenditure behaviours relates to institutional arrangements favouring autonomy and independence. Under this premise, it is often difficult to procure relevant data allowing for an understanding of how universities spend the budgets that have been allocated to them. (Kupriyanova et al., 2018).

3. Context

The following section presents a brief historical account of access to higher education in Ecuador, the policy overview of the higher education system in Ecuador in the light of access to higher education as well as the financial policy overview of public universities in Ecuador.

3.1. Historical overview of higher education in Ecuador

In the early 2000's, Latin America, mainly Ecuador, Venezuela, Bolivia, Argentina, Brazil, Uruguay and Paraguay saw the rise of left-wing governments that redesigned education policies under the premises of the Cordoba Manifesto (that in 1918 stood for tuition free and government higher education) (Mantuano et al., 2019; Remmer, 2012). The Cordoba Manifesto represents the initial sign of Latin American higher education re-thinking itself as a system with autonomy, co-government and fee-free schemes (Mantuano et al., 2019). These principles were combined to what many countries under such reform saw as the route towards development through the investment in human capital (Mendoza et al., 2014). During the decade of the 1990's Ecuador saw the proliferation of private universities that led to the deepening of social inequalities for which the Constitutional reform of 2008 put in place fee-free public education up to the undergraduate level with the intention of reaching more vulnerable sectors of the population (Post, 2011).

Ecuador is a prime example of this process and a good illustration of key trends in the Latin American region. After the Constitutional Reform of 2008, the Ecuadorian Higher Education Law of 2010 paved the way for a larger reform in the organisation of the higher education system (Van Hoof et al., 2013). The law created a quality accreditation system which closed universities due to deficient quality standards, it also created a state council for higher education in charge of higher education regulation as an alternative to historical Rectors Councils where university policies and politics were agreed amongst rectors (Benavides et al., 2019; Van Hoof et al., 2013). The idea of a system with checks and balances and centralised power on central government allowed the reform to close 14 universities in 2012 and to create four new universities that promised increased education levels for vulnerable students (Benavides et al., 2019). The reform however, favoured and focused on an understanding of quality that was rather conservative and focused on a standardised view (Van Hoof et al., 2013). The implications of this reform have not been fully understood and therefore require substantial investigation. The availability of data from administrative sources that can be for the first time linked together presents an opportunity to understand the individual level characteristics and school level characteristics that work as predictors for accessing the best public universities in Ecuador in 2018.

Contrary to the global trends, the Ecuadorian government intensified public investment in higher education during the decade of the 2010s becoming the country with the largest investment in higher education in South America, with an average of 2% of its GDP (UNESCO, 2015). Ecuador's increase in public investment

in higher education was triggered by the legal reform in 2010 where a knowledge-based economy was promoted as a development model for the country. Between 2012 and 2017 the country implemented five main strategies: 1) establishing, by a constitutional reform, fee-free public higher education for undergraduate level; 2) closure of 14 private universities of low quality and the creation of four new public universities; 3) the creation of a centralised admissions process to manage access to public higher education institutions based on student standardised test results; 4) scholarships and student loans schemes; 5) increase of universities budget distributed through a formula that rewarded quality mostly. The aforementioned strategies paved the way for the expenditure of approximately 8 billion dollars in six years (Benavides et al., 2019; Van Hoof et al., 2013).

Based on administrative information, by 2019 some of the outcomes of such investment were: 1) despite increased public investment, private higher education enrolment increased by 10% whereas public enrolment fell by 3%; 2) student loans schemes led to young professionals in default due to increased unemployment; 3) research in higher education institutions increased yet without a specific focus; 4) scholars were not institutionalised as professors of the national higher education system 5) presumed increase in quality of public universities.

The yearly budget for public universities in Ecuador derives from 12% of value added tax, 10% rent tax, and adding up to an average 1 billion dollars to be distributed among all public universities every year. Since 2012, a formula distributes the yearly budget moving away from a scheme of political negotiations in rector's conferences and aiming for a more "technical" policy instrument that rewarded institutional quality based on the indicators of the National Quality Assurance Agency. The strive for quality disregarded overall access as a concept to reward overlooking increased high school completion rates (97%) and demographic pressures on higher education access (since 2012 an average of 200 thousand students finish high school and seek to achieve a place that public higher education offers yearly through their scores on standardised tests) (Benavides et al., 2019; Van Hoof et al., 2013).

Under such circumstances, private higher education enrolment grew under the premise of student loan schemes for those who could afford it (Benavides et al., 2019). In contrast, access to public universities required high scores on a standardised test in order to compete for a place in most demanded degrees and institutions. The overall result of the combination of standardised testing to access public universities and increased private offer based on debt, presumably left the poorest students with limited opportunities to access higher education (Post, 2011).

In the context of the described reform, the Ecuadorian higher education system managed to institutionalise and organise access to university based on the students' performance on standardised test results. Such premise reduced subjectivity in selection, however it also deepened inequality of opportunities as is shown in this paper. It is then possible to propose as a hypothesis that the poorest students were structurally left aside in a system that promoted academic excellence with limited notions of equity. The case of Ecuador will allow us to see and contribute to the debate that post neoliberalism higher education reforms can still be regressive in policy implementations mainly when the values of a system continue being focused on traditional academic performance.

The quality of universities in Ecuador between by 2017 was understood as the efficiency in traditional academic standards; capacity to publish papers, produce research and academic degrees of professors (Acosta, 2016). The model created for the quality accreditation of universities published its first results in 2013 where universities (public and private) were classified between the letter A to D (CEAACES, 2014). By 2018, following improvement and re-evaluation processes all the universities that were D category were reclassified as C. This study takes into consideration the results of the accreditation process where quality is defined by academic success and knowledge production and dissemination in traditional means. Under such premises, the universities with the highest quality are polytechnic schools in the two main cities of the country – Quito (Escuela Politecnica Nacional)

and Guayaquil (Escuela Politecnica del Litoral). The universities with less quality are regional and local universities of regions and cities where structural poverty conditions are present: Esmeraldas, the Amazon Region, and specific areas of the Pacific Coast.

3.2. Policy overview of access to higher education in Ecuador

The most recent policy of access to higher education in Ecuador was implemented for the first time in 2012 deriving from the 2008 constitutional reform and 2010 creation of the Higher Education law and thus facing the challenge of administering three conditions: (1) demographic bonus and (2) fee-free public universities and (3) a newly reformed institutional relation with public universities. Regarding the latter, it is important to note that the abolition of the Rectors Conference (CONESUP) which regulated universities with important conflicts of interest, and the creation of SENESCYT (National Secretariat for Higher Education, Science and Technology), CEAACES (Council for Quality Assurance and Accreditation of Higher Education) and CES (Council for Higher Education) paved the way for new institutional arrangements between regulatory bodies and autonomous universities. These new institutional relations implemented a system that was characterised by more rigid regulation with a focus on quality standards yet scarce scrutiny on public resource administration in the case of public universities. Moreover, the overall institutional arrangement focused its energies on improving research and teaching yet not solving the access issue with a growing demand that by the year 2018 became undeniable for the higher education system. Here several questions arise; if equitable access were a priority, perhaps the access policy would have been designed differently and other policies for financial resources allocation could have also been aligned?

Under the abovementioned institutional arrangement, the access to higher education policy is entirely a competency of SENESCYT where the academic offer (places) from universities is regularly negotiated in line with the priorities set by the government as a centralised access system¹. By 2017, and at the beginning of a new government period (2017-2021), the newly arrived minister of SENESCYT positioned the notion of a demographic bonus at the centre of the issues of access, where he strongly criticised the emphasis on quality and excellence as factors that deepen stratification in Ecuador's public higher education. In the light of this new vision, efforts were made at the policy level in order to increase the number of places offered to students. An example of this effort is the inclusion of affirmative action points related to gender and ethnic background and vulnerable socio-economic conditions in the algorithm that allocates places to students based on their scores on the standardised test Ser Bachiller (SENESCYT, 2017). The instruments to implement this process are Ministerial Agreements that dictate the rules of each of the processes. It is important to note that the Ecuadorian schooling system has two school calendars (one ends in February and the other in June), this results in two exam dates and two access-application processes with approximately 300 thousand students graduating yearly nationwide.

Overall, access policy turned a shift with the change of government in 2017 where equitable access became more important as opposed to academic merit or excellence. A result of this is the increased number of places offered through negotiations with universities in relation to the budget allocated to universities as is described in this study.

¹ By 2022, SENESCYT decentralised the access to higher education. A transition system was put into place where each university has autonomy for its selection process.

4. Data and Methodology

4.1. Data

In order to address the issues of equitable access to higher education in Ecuador, administrative datasets were used and linked for the first time. As aforementioned, Ecuador has two institutions in charge of education; the Ministry of Education of Ecuador (for primary and secondary education) and the National Secretariat for Higher Education, Science and Technology (SENESCYT) (for tertiary education and upper). Both institutions provided anonymised datasets upon formal request in order to investigate the research questions posed in this document. In total, SENESCYT provided 10 datasets for the year 2018 where the administrative information of access was detailed with variables that describe the applicants' personal characteristics. Similarly, I used information from Universities based on the Report on the Formula for Budget Allocation of Public Universities in 2018 from SENESCYT. On the other hand, the Ministry of Education provided the dataset with the results of an index for "School conditions". The information of both institutions was linked for the first time at a nominal level looking at each of the applicants.

The focus on the year 2018 responds to the information available at the school level, the Index of School Conditions released as a policy tool by the Ministry of Education. Similarly, the data related to access, presents matching observations between access and the School Index information that will be treated as a subsample. In this sense, it will be feasible and realistic to use the year 2018 to find relevant trends on access to public universities based on the school of origin. The accreditation model suffered a change with the legal reform of 2018 established to be put in place by 2019. Selecting the year 2018 is also a relevant decision because it shows a somehow stable system that was introduced in 2012 and suffered many changes. In 2018 the Higher Education Law was reformed and the forthcoming years reflect changes particularly in access and resource allocation of public universities. Hereby the details of each of the datasets used for this study.

Research question one: individual level determinants

In order to target the first research question on "*What is the relation between student personal characteristics and their access in public universities in Ecuador?*" I analysed the characteristics (sex, ethnicity, disability and place of residence) of students who applied and accessed a higher education institution in 2018. In this case, the number of observations corresponds to the 168.984 participants who successfully accessed higher education at public universities (this excludes 48.134 participants who successfully entered TVET institutions² and 6.810 participants who accessed private universities through the quota policy mentioned previously in this document and participants who joined newly created universities that do not yet have results on accreditation). Overall, this question focuses on the total population who accessed a public university in terms of participants' individual characteristics in relation to accessing the highest quality universities (described as quintile 5 universities). The focus on high quality universities will allow us to see the educational opportunities within the group analysis. These considerations reflect the country's viewpoint on quality universities from a perspective in line with the National Policy for higher education. Given that the accreditation model classifies universities in letters A to D, for which a ranking is not in place. In order to create a ranking of universities and then classify them in quintiles, I have used the information from international rankings of Webometrics – also known as Ranking Web of Universities³. The following table describes the ranking of universities in Ecuador by 2018 used for this study:

² In Ecuador TVET institutes are part of the tertiary education level. There is also an academic offer on "Technical Bachelor" degree at secondary level which is not pertinent to this research on access to public universities in Ecuador.

³ The ranking is published by the Cybermetrics Lab, a research group of the Spanish National Research Council (CSIC) located in Madrid. The aim of the Ranking is to improve the presence of the academic and research institutions on the Web and to promote the open access publication of scientific results. The ranking started in 2004 and is updated every January and July. As of 2021 it provides Web indicators for more than 31,000 universities worldwide.

Ranking of Ecuador's public universities based on quality nationally and internationally in 2018

Public University	University ranking	Uni. Quintile
Escuela Superior Politecnica Del Litoral	1	5
Escuela Politecnica Nacional	2	
Universidad De Las Fuerzas Armadas (ESPE)	3	
Universidad De Cuenca	4	
Universidad Central Del Ecuador	5	
Universidad Tecnica De Ambato	6	4
Universidad Nacional De Loja	9	
Universidad Tecnica Del Norte	11	
Universidad Estatal Peninsula De Santa Elena	7	
Escuela Superior Politecnica De Chimborazo	8	
Universidad De Guayaquil	12	3
Universidad Estatal Amazonica	13	
Universidad Nacional De Chimborazo	10	
Universidad Tecnica De Machala	14	
Universidad Tecnica Estatal De Quevedo	16	
Universidad Estatal De Milagro	17	2
Universidad Tecnica De Manabi	18	
Universidad Laica Eloy Alfaro De Manabi	15	
Universidad Estatal De Bolivar	19	
Escuela Superior Politecnica Agropecuaria De Manabi	20	
Universidad Estatal Del Sur De Manabi	21	1
Universidad Politecnica Estatal Del Carchi	26	
Universidad Tecnica De Cotopaxi	22	
Universidad Tecnica De Babahoyo	23	
Universidad Agraria Del Ecuador	24	
Universidad Tecnica Luis Vargas Torres De Esmeraldas	25	

Source: CEAACES (2018), Webometrics (2018)

The data treatment for answering this research question consisted in coding, cleaning and translating the datasets provided by SENESCYT where eight different datasets of access were unified⁴. Similarly, we used the information from the Reports on Accreditation from CEEACES and information from international rankings of Webometrics to develop a ranking that later resulted in classifying universities in quintiles. Overall, the data available to answer question 1 focuses on combining applicants' individual characteristics with the following independent variables: sex, ethnic background, disability status and region of residence as predictors for accessing the best public universities (quintile 5 universities).

Research question two: school level determinants

Similarly, in order to understand the conditions of schools of origin of the students who successfully achieve a place in higher education (research question two) I used three groups of information available: 1) Index of Schools' Conditions from the Ministry of Education, 2) Access to public universities from SENESCYT and described above, 3) Quintiles of Universities derived from Quality Accreditation Reports.

The official Index of School Conditions designed in 2018 by the Ministry of Education includes 16.057 schools with 18 variables (5 related to students, 3 related to teachers and 10 related to schools). When looking at student-

⁴ Ecuador's policy of access in 2018 consisted of four rounds of applications to access and due to geographical conditions the country has two academic calendars depending on the region (Pacific Coast and Galapagos start classes in April each year while the Andes and Amazon regions start in September). Thus, there were four rounds per academic calendar reaching 8 datasets to be analysed.

related variables, the index includes enrolment, dropout, percentage of students with disabilities and percentage of students from ethnic minorities. Similarly, on the teachers' variables, the index focuses on teacher-student ratios and outcomes of teachers on standardised tests performed centrally by the National Evaluation Institute (INEVAL). The following chart describes the information represented in the Index of School conditions of 2018:

Summary of variables from the Schools' Conditions Index 2018

Student related variables	Teacher related variables	School related variables
<ul style="list-style-type: none"> • <u>Schools with students with more than 70% on the SerBachiller standardised test⁵</u> • <u>Schools with more than 7.8% of its students self declared as indigenous, montubios or black.</u> • <u>Schools with more than 0.5% of students with disabilities</u> • <u>Schools with a dropout rate higher than 2%</u> • <u>Schools with a non-promotion rate higher than 1,7%</u> 	<ul style="list-style-type: none"> • <u>Type of school based on teacher allocation (one-teacher schools, two-teacher schools, multiple teacher schools (no more than 5 teachers in the whole schools, Medium size schools with more than 500 students and large schools with more than 1.500 students)</u> • <u>Schools with teachers with more than 80% score in Ser Maestro evaluations⁶</u> • Average of students per teacher 	<ul style="list-style-type: none"> • Geographic location (urban/rural) • <u>Access to internet</u> • <u>Existence of a school library</u> • Flooding at the school • <u>Schools' water source</u> • <u>Schools' sewage service</u> • <u>Schools' access routes</u> • Schools' funding source (public, private, mixed) • <u>Status of sewerage service</u> • <u>Status of water provision</u>

Source: Schools' Conditions Index 2018 (Índice de Condiciones Educativas 2018), Ministry of Education, 2018.

The data treatment for answering question two has focused on consolidating one file where information about the school (in total 15 variables underlined in the table were used for the regression model), the student and the university is grouped to follow the trajectory due to data limitations on school information the administrative data was restricted to a subsample of 41.916 observations. The available school information is from participants who graduated in the year 2018 from high school and applied for a place in higher education the same year. Under this premise, the analysis is restricted to a part of the population; however, it provides interesting ideas on how the linkage of trajectories may work and how school conditions may be determining factors when entering higher education. For this, similar to the work done for universities to categorise them in quintiles of quality, I have used the Schools' Conditions Index to classify schools in quintiles based on their outcome on the index. In summary, in order to answer question two, based on the subsample of information available, the compiled dataset will look into 9.360 schools that coincide with the School Conditions Index. Similarly, it contains the quintile information of all 26 public universities. Overall, we will look at the trajectory (from secondary to tertiary education) of the 41.916 participants with school information who successfully accessed a public university in 2018.

Research question three: What is the financial behaviour of inclusive universities?

In order to answer the last research question, I have used the information generated in the research question one where all the population who accessed public universities was analysed in order to define "inclusive universities" based on the admission of ethnic minorities (Indigenous, Afro descendant and Montubio), female and disabled⁷ students. The analysis consisted of comparing the position that universities have on a quality ranking and an inclusion ranking (where the most inclusive universities are those with the largest percentages of disadvantaged students from the overall population of students accepted. Additionally, in order to understand the financial behaviour, the cost per student was calculated by each university based on the budget allocation reports from the Ministry of Finance in 2018. Overall, the information seeks to compare and contribute to the discussion of equity

⁵ Ser Bachiller is the standardised test introduced by INEVAL in 2014 as the test for high school final exam where the score may also serve to apply for a higher education institution. The test focused on five domains: Mathematical, Linguistic, Scientific, Social and Abstract Aptitude.

⁶ Ser Maestro is the standardised performance test performed in 2016-2021 by INEVAL. The test was focused on disciplinary domains.

⁷ The term disabled is used recognising the Social Model of Disability coined by Mike Oliver in 1983.

in the budget allocation of public universities. This section is based on descriptive statistics along with a discussion that seeks to integrate all the previously discussed concepts.

4.2. Methodology

In order to answer the first two research questions posed in this document, I have designed two regression models that will allow us to understand the individual and school level conditions that foster or hinder the access to the best quality universities in Ecuador in 2018. In the case of individual level conditions, the data available allows us to look into the complete population of applicants who successfully achieved a place in Ecuadorian public universities. On the other hand, the school level conditions are restricted to the participants who accessed public universities and who have information of their school of origin⁸. In both cases the chosen methodology combines different datasets from universities, access to universities and schools.

On first research question: individual level determinants

Once the dataset was prepared, the methodology proposed for this section uses a *logistic regression* to understand the probability of students entering the best quality universities based on their individual characteristics considering sex, ethnic background, disabilities condition, score on Ser Bachiller test and region of residence as independent variables. The following describes the model used:

$$P = \frac{e^{(\beta_{sex} + \beta_{ethnicity}x + \beta_{disability}x + \beta_{regionres}x)}}{1 + e^{(\beta_{sex} + \beta_{ethnicity}x + \beta_{disability}x + \beta_{regionres}x)}}$$

Where P is the probability of accessing the best public universities (quintile 5) and β_{sex} means the sex variable, $\beta_{ethnicity} x$ represent the ethnic background self-reported by participants, $\beta_{disability} x$ means a disability condition certified by the national competent authority (CONADIS⁹), $\beta_{SBscore} x$ means the standardised test scores used by participants to apply for a place at university and $\beta_{regionres} x$ means the region of residence of participants.

On second research question: school level determinants

The analytical approach to treat the mentioned subsample is to use the quintiles from the Index of School Conditions where students are allocated accordingly as it has been described in the tables above. Similarly, Universities were grouped in terms of their quality based on their position in the Quality Assurance report of 2015 updated in 2017 and international rankings where they were also grouped in quintiles. The first step (1) to answer this research question, is to use descriptive statistics of administrative data to unveil the access dynamics between schools and universities' quintiles. Secondly (2), an analysis of the distribution of students from a school quintile to a university quintile will be made to understand the logic of access in terms of inclusion. Lastly (3) a logistic regression was performed to understand the factors that foster access to the best quality public universities (quintile 5). All independent variables were set as dummy variables given that the Index established thresholds. For example, a variable is the schools that have more than 20% dropout rate. The following terms describe the logistic regression performed:

$$P = \frac{e^{(\beta_{drop} + \beta_{dis}x + \beta_{eth}x + \beta_{studentscores}x + \beta_{teacherscores}x + \beta_{prom}x + \beta_{sewage} + \beta_{internet}x + \beta_{library}x + \beta_{water}x + \beta_{accessroute}x)}}{1 + e^{(\beta_{drop} + \beta_{dis}x + \beta_{eth}x + \beta_{studentscores}x + \beta_{teacherscores}x + \beta_{prom}x + \beta_{sewage}x + \beta_{internet}x + \beta_{library}x + \beta_{water}x + \beta_{accessroute}x)}}$$

Where P is the probability of accessing the best public universities (quintile 5) and β_{drop} means the schools with a dropout rate higher than 20%, β_{dis} represent schools with more than 0,5% of students with disabilities; β_{eth} means schools with more than 7.5% of students self-identified as black, Motubio or indigenous, $\beta_{stscore}$ means

⁸ This restriction has been reported to SENESCYT.

⁹ Consejo Nacional de Igualdad para las Discapacidades de Ecuador.

schools with more than 70% of students reached a basic level at the Ser Bachiller standardised while β_{tscores} means schools with more than 80% of their teachers with a basic level (over 700 points) at the standardised test Ser Maestro. Similarly, β_{prom} means schools with more than 1.7% of non-promotion rate. β_{rural} means schools in the rural sector, β_{internet} means schools with access to internet, β_{library} are schools with libraries, β_{water} are schools with drinking water sources, $\beta_{\text{multigrad}}$ are schools that have a multigrade structure hence are one, two up to five-teacher schools.

Overall, as can be seen from the variables description, it was needed to choose how to establish the dummy variables in a coherent way where 0 represented unfavourable school conditions (such as no drinking water or high non-promotion rates) and 1 represented favourable school conditions.

As previously mentioned, the last research question is answered through descriptive statistics that contribute to the discussion, leading to the conclusion and policy implications.

5. Findings

The following section presents the findings of the quantitative analysis of administrative data to contribute to the understanding of equitable access to higher education in Ecuador in 2018. In both questions logistic regressions were performed to provide insights on the determinants that predict access to the best public universities at the individual level (with all the population who accessed a public university) and at the school level (with a subsample where school information matched the access datasets). From a public policy perspective, this allows to draw a larger discussion on the institutional performance of schools and universities in the light of public investment when looking at equitable access to the best public universities. Moreover, these findings may contribute to the discussion of equity based on institutional characteristics (given by resources) and individual student characteristics (attributed to social, economic and cultural conditions) The last part of this section on findings, presents a discussion where universities are classified by their degree of inclusion¹⁰ in relation to their budget per capita to draw attention on who is benefiting from public funds from public universities. Moreover, this analysis seeks to discuss efficiency in financial administration from a perspective of inclusion and ultimately equity.

5.1. Research Question 1: What is the relation between student personal characteristics and their access in public universities in Ecuador?

5.1.1. Descriptive statistics

For this section the information used will focus on the 168.984 participants who accessed public universities in 2018¹¹. This is the total population who accessed a public university in 2018. The following section details the descriptive statistics related to the individual-level determinants.

The representation of female and male in the population of participants who accessed the best universities present interesting results in terms of inclusion, mainly because the predominant sex is female as described on the table below:

¹⁰ Inclusion understood as institutions that accept students who would have less chances of accessing the best universities

¹¹ This population excludes the four newly created Universities that have not been included in the Accreditation and Evaluation process from CEAACES.

Sex	Percentage in relation to applicants who accessed public universities in 2018	Percentage in relation to the total population of Ecuador ¹²	Difference of access to public universities in proportional relation to national population
Female	44	50	-6
Male	34.9	49	-14.1
Not answered	21.1	-	-

Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018), National Census from Institute for National Statistics and Census (2010)

As described above, females have overall larger participation in higher education however, when analysing access to the best universities, the scenario is different.

- Individual level determinant: Ethnic background

Ethnic background is a key determinant for inclusion as Ecuador is a country with 14 indigenous nationalities and two other minorities (Afro descendants and Montubios). The country's ethnic diversity also brings along inequality and historical misrepresentation linked to systemic exclusion linked to multidimensional poverty. Thus, ethnicity is a relevant individual predictor for looking at the chances that applicants from different ethnic groups have to access the highest quality universities. The following table describes the proportions of underrepresentation and overrepresentation of ethnic groups in relation to national population distribution.

Comparison between ethnic background of applicants who accessed public universities with total national population

Ethnic group	Percentage in relation to applicants who accessed public universities in 2018	Percentage in relation to the total population of Ecuador ¹³	Difference of access to public universities in proportional relation to national population
Afro-descendant	4.24	7.19	-2.95
White	1.98	6.09	-4.11
Indigenous	3.53	7.03	-3.5
Mestizo	79.73	71.93	+7.8
Montubio	3.74	7.39	-3.65
Other	0.30	0.37	-0.7
No answer	6.51	Not an option in census information	

Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018), National Census from Institute for National Statistics and Census (2010)

As can be seen from the table above, all minorities (including the White) are underrepresented when accessing public universities if compared with the national population. This is not the case for Mestizos who are overrepresented by almost eight percentual points in public universities.

¹² The last National Census in Ecuador was performed in 2010 and the new census will have its results released in February 2023.

¹³ The last National Census in Ecuador was performed in 2010 and the new census will have its results released in February 2023.

- Individual level determinant: disabilities

Disabilities may represent an important barrier for accessing higher education thus negatively affecting the potential opportunities for employment and financial independence of people with disabilities. The effects of exclusion deepen poverty and dependence. In total, from the 171.537 participants who accessed public universities only 0.64% reported disabilities certified by CONADIS, the competent agency. It is worth mentioning that this overall percentage shows an underrepresentation in relation to the national percentage of 5.6% of the population with disabilities. The following section summarises the share of people with disabilities by type of disabilities based on the access to public universities in relation to the national representation based on the last Census information.

Comparison between ethnic background of applicants who accessed public universities with total national population

Type of disability	Percentage in relation to applicants who accessed public universities in 2018	Percentage in relation to the total population of Ecuador (estimate by 2018) ¹⁴	Difference of access to public universities in proportional relation to national population
Hearing	12.15	14.56	-2.41
Physical	38.08	42.11	-4.03
Intellectual	31.23	12.71	+18.53
Language	1.74	Not available	
Psychological	1.00	Not available	
Psychosocial	1.83	Not available	
Visual	13.97	22.80	-8.83

Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018), National Census from Institute for National Statistics and Census (2010)

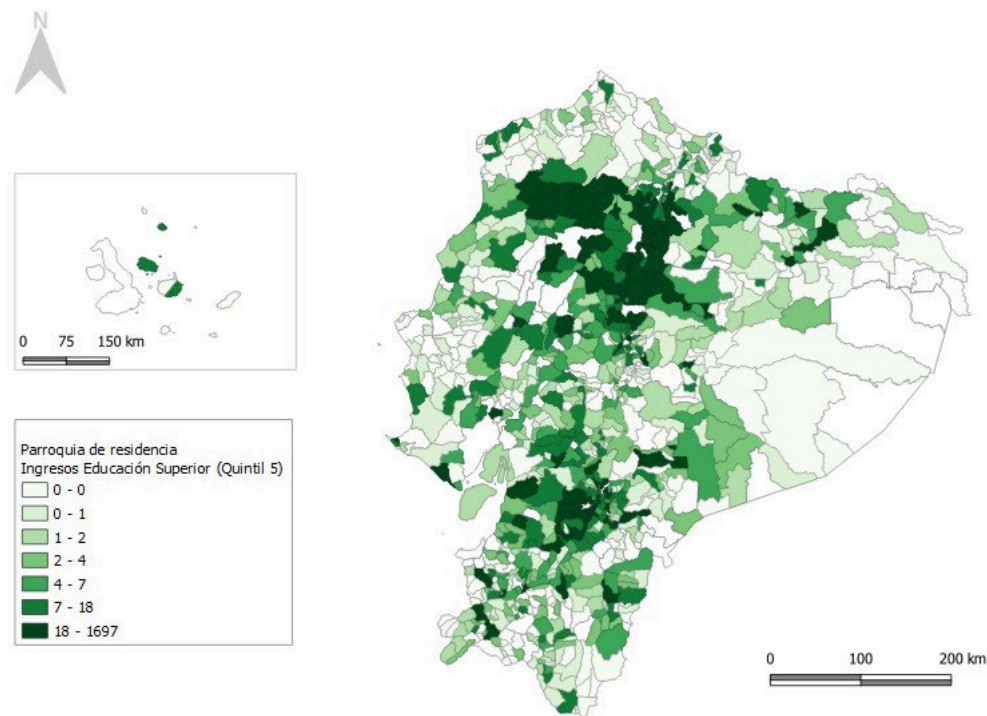
As can be seen from the description above, the only overrepresented type of disability is Intellectual which might be due to the factors that are considered intellectual disabilities in 2010 and in 2018. Overall, disabilities are underrepresented in access to public universities in 2018 in relation to the country's overall population with disabilities.

Region of residence

The following map summarises the parish of residence of each of all the participants accepted in the best public universities (quintile 5). Most of the students living in the surroundings of Quito and Cuenca accessed the best public universities. Most quintile 5 universities are in Quito and one in Cuenca and another in Guayaquil. In regional terms, we can see that the Amazon and Pacific Coast have lower representation of students at the best universities. Whereas the Andes region mostly focuses the north in Quito and the South in Cuenca leaving the central Andes with smaller representation.

¹⁴ The last National Census in Ecuador was performed in 2010 and the new census will have its results released in February 2023.

Distribution of students who accessed the best universities based on their parish of residence in 2018



Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018)

5.1.2. Regression

The following section presents the results of the logistic regression applied to understand the indicators and their probability of accessing the best quality universities (quintile 5). The independent variables taken into account were scores at the Ser Bachiller test, sex, ethnicity, disability and region of residence.

Logistic regression of individual level determinants for accessing best quality public universities:

Regression results for Access to the best quality public Universities in Ecuador (Quintile 5)

	uniquint05	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Sex	Male	.144	.014	10.60	0	.117	.171	***
	: base Female	0	.	.	.	.	.
	Not answer	.372	.023	16.43	0	.327	.416	***
Disability	: base No	0	.	.	.	.	.
	Si	-.284	.086	-3.31	.001	-.452	-.116	***
Ethnicity	Afro-descendant	-.6	.058	-10.31	0	-.714	-.486	***
	White	.121	.051	2.37	.018	.021	.221	**
	Indigenous	-.992	.032	-30.60	0	-1.056	-.929	***
	: base Mestizo	0	.	.	.	.	.
	Montubio	-.843	.061	-13.80	0	-.963	-.724	***
	Mulatto	.078	.061	1.28	.199	-.041	.197	
	Black	-.597	.119	-5.02	0	-.831	-.364	***
	Other	.003	.128	0.02	.982	-.248	.254	
Region of residence	NA	-.105	.053	-2.01	.045	-.209	-.002	**
	Not specified	-1.146	.059	-19.52	0	-1.261	-1.031	***
	: base Andes region	0	.	.	.	.	.
	Pacific coast region	-2.704	.018	-150.62	0	-2.739	-2.669	***
	Galapagos region	-.575	.155	-3.71	0	-.878	-.271	***
Amazon region	-1.429	.035	-40.77	0	-1.498	-1.36	***	

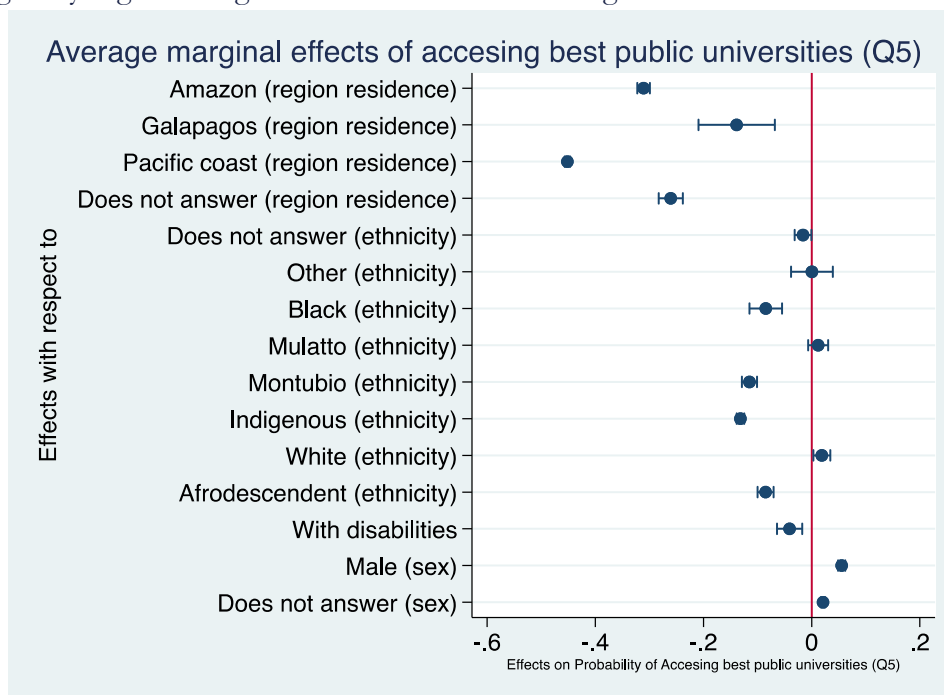
Constant	.044	.01	4.39	0	.025	.064	***
Mean dependent var		0.266	SD dependent var		0.442		
Pseudo r-squared		0.214	Number of obs		168984		
Chi-square		41947.765	Prob > chi2		0.000		
Akaike crit. (AIC)		153938.477	Bayesian crit. (BIC)		154099.078		

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018)

A logistic regression was performed to ascertain the effects of a participants' scores, sex, ethnicity, disability and region of residence on the likelihood that participants access the best public universities (quintile 5).

When performing analysing the margins of the aforementioned regression we obtain the following graph:



Source: Secretariat for Higher Education, Science and Technology of Ecuador (2018)

As can be seen on the graph, when the base is male, female have a higher chance of accessing quintile 5 universities. Similarly, when the base is mestizo, all other minorities have higher chance to access the best universities except for afro descendants and black participants who have considerable disadvantage (particularly the latter).

5.1.3. Discussion

The results presented on the descriptive statistics as well as on the logistic regression results and marginal effects graph show that in terms of sex, women have a less probability to access better universities than men. In fact, when looking at the absolute values of female/male ratios, more females accessed public universities in general. This may have an impact on the probability of accessing quintile 5 public universities. Similarly, when looking at condition of disability, a very limited number of participants with disabilities get to access public universities and their chances to access a place at a high-quality public university are lower than those without disabilities. When looking at self-reported ethnic background, the least likely to access the best universities are Indigenous students, followed by Montubio and Afro descendants. The only ethnic group that has higher chance of accessing the best universities in relation to mestizos are white students.

Female students have higher overall participation, yet fewer chances to access the best public universities. It is relevant to note that three of the top five universities are polytechnic universities and that in Ecuador only 20.7% of the graduates in Engineering, manufacturing and construction are women (UNESCO, 2018). Under such premise it is possible to note that female students are a majority studying education, art and humanities and management degrees in less quality universities. Moreover, a limitation of this study is the lack of information regarding the graduation rates of the students who access.

On the same note, Indigenous students have the lowest chances of accessing the best public universities, which is a result of historical exclusion, highly related to historical poverty conditions. By 2018, more than half of Indigenous children between 0-5 years old had chronic child malnutrition while 86% of the indigenous population live in poverty due to unsatisfied basic needs (INEC, 201). By 2018, 28% of indigenous women and the 14.1% of Indigenous men were illiterate and had an average of 4.8 years of schooling for women and 4.8% for men. Overall, Indigenous people are the worst performing ethnic group in all socioeconomic indicators. This phenomenon is not different when looking at access to the best public universities. Despite the measure of including affirmative action points for participants from ethnic minorities (Indigenous, Afro descendant or Montubio) lag considerably behind their Mestizo and White counterparts. The participation of students from ethnic minorities is largely influenced by existing poverty conditions where poor quality schooling affects the probabilities of accessing the best universities in the country. Moreover, in the case of Indigenous participants, the language barrier may also play an important role as there are 14 Indigenous nationalities that speak different languages. Furthermore, the role of Intercultural Education System and curriculum does not consider the K12 education level for which there is not continuity. Once students finish the Indigenous curriculum at age 16, they must switch to the Hispanic curriculum two years before graduation.

In the context of individual characteristics, participants with disabilities have fewer chances of accessing the best universities despite the additional points for “vulnerability conditions” provided by the access to higher education policy. Based on the analysis of participation of people with disabilities, the type of disability that is overrepresented in relation to the national percentages is intellectual disability. Overall, individual-level aspects of accessing public universities in Ecuador in 2018 show that females, people with disabilities and Indigenous, Montubio and Afrodesedant students are less likely to access the best public universities. Along with historical and structural poverty conditions that hinder ethnic minorities, people with disabilities and women to access the best public universities, the implementation of additional points scheme appears insufficient to tackle a structural issue of equity based on individual conditions.

5.2. Research Question 2: What are the school conditions of students who access higher education?

5.2.1. Descriptive statistics

This section summarises the key findings of this study when looking at equitable access to public universities in Ecuador in 2018. All the information provided in this section is part of the subsample of 41,835 participants who accessed public universities and information on their school of origin is available. The first section describes the characteristics of schools of origin of applicants who access public universities with descriptive statistics. The second section presents the findings on key school-level determinants of higher education access. Lastly, this section seeks to present a discussion on the findings and their implications in the public policy arena.

When looking at the characteristics of schools by quintile, we can see that overall indicators related to students’ performance, teachers’ performance and infrastructure conditions are limited. As expected, this progressively improves when reaching schools in the fifth quintile:

Characteristics of school conditions by school quintile in 2018

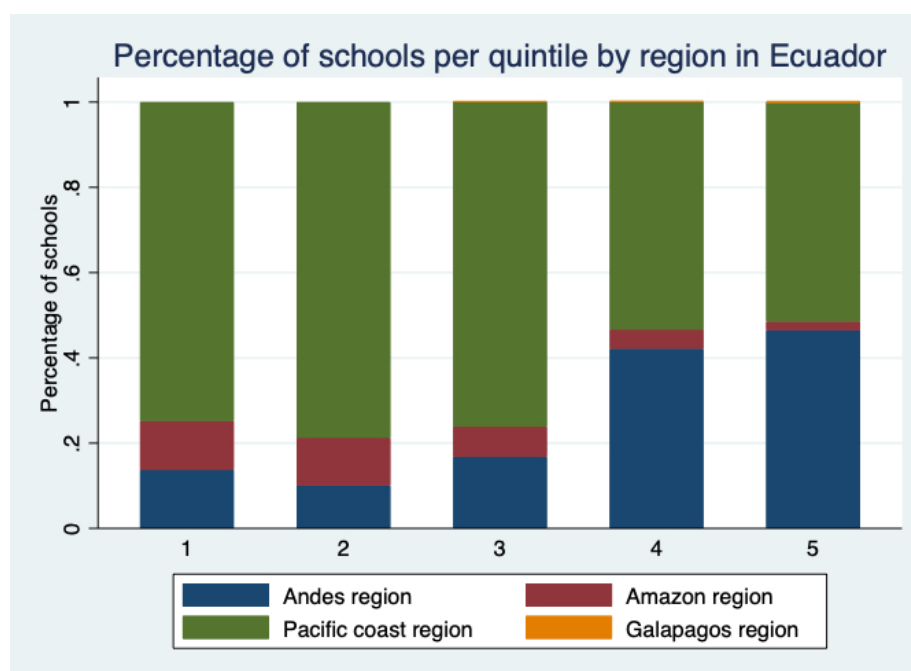
	School quintiles				
	Q1	Q2	Q3	Q4	Q5
Has library	4%	6%	12%	24%	54%
Has internet	3%	8%	18%	32%	38%
Has access street	2%	5%	12%	34%	48%
Has drinking water	2%	5%	15%	35%	44%
Has sewage system	1%	3%	13%	36%	47%
Standard size schools	3%	8%	18%	36%	36%
Has never been flooded	18%	20%	20%	20%	22%
Disability above 0.5%	20%	16%	18%	25%	21%
Ethnic minorities above 7.8%	51%	23%	14%	10%	2%
Drop out below 2%	17%	21%	21%	19%	22%
Non promotion below 1.7%	19%	21%	20%	18%	22%
SerBachiller less than 70% of students w/low scores	5%	13%	20%	24%	39%
SerMestro less than 80% of teachers w/low scores	3%	9%	19%	30%	40%

Source: Secretariat for Higher Education, Science and Technology of Ecuador, 2018. Ministry of Education of Ecuador, 2018

The poorest schools host the most students from ethnic minorities and present the worst results in standardised tests for teachers and students. Moreover, basic infrastructure conditions of the poorest schools are not meet. Similarly, dropout is larger in poorer schools with the worst conditions.

- Schools by region

According to the School Conditions Index designed by the Ministry of Education of Ecuador, where the criteria of teachers, students and infrastructure are analysed (Appendix 02), I have classified schools (public, mixed funded and private) by quintiles to understand their conditions and its relation to access to the best public universities. The following analysis looks at the complete schooling system of 2018 with the 16.057 schools:



Source: Secretariat for Higher Education, Science and Technology of Ecuador, 2018. Ministry of Education of Ecuador, 2018

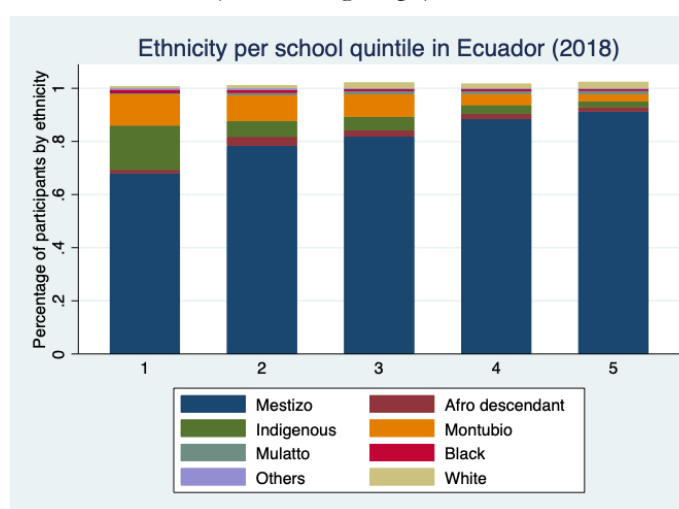
From the abovementioned graph it can be interpreted that most of the schools with the biggest needs are in the Amazon region. In fact by 2019 according to the Central Bank of Ecuador, the Amazon region had a 42.4% of national poverty incidence¹⁵ while the other regions are on Andes (22.3%) and Pacific Coast (25.3%) while the Galapagos region was not part of the report. In fact, this region contains the largest portion of rural schools that are primarily (72%) one-teacher to two-teacher schools. In terms of exclusion, the Amazon region hosts 75% of its schools with threshold established by the School Conditions Index with more than 7.8% of its student population from an ethnic minority (Indigenous, Afro descendants or Montubios).

- Schools and ethnic minorities

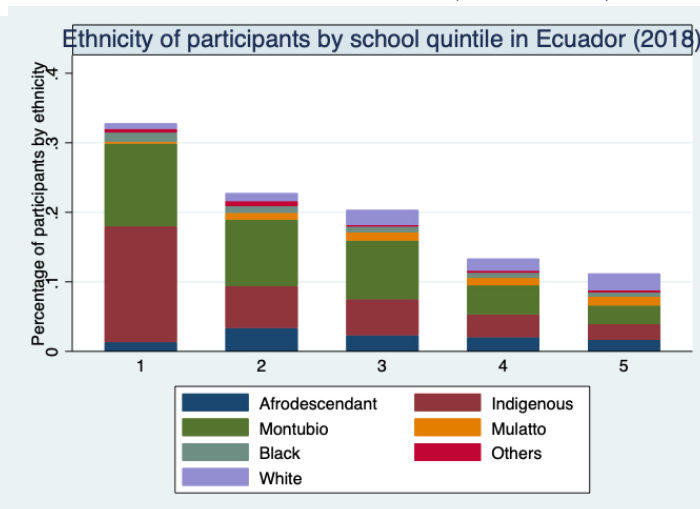
As established in the Education Law (2022), the Ecuadorian education system has two parallel schooling systems: the “Hispanic” schools and Intercultural Bilingual Schools (IBS) here each one has a pedagogical model and curriculum (LOEI, 2022). By 2020, the Secretariat of Intercultural Bilingual Education was created with the autonomy to organise the administrative and pedagogical strategies of the 1713 intercultural bilingual schools from which 79% are rural schools. In fact when looking at the graph below, we can see that most IBS are in the lowest quintile in rural areas as opposed to Hispanic schools.

Similarly, when looking at the ethnic background of students, it is again clear that most students who come from indigenous, mulatto or black backgrounds attend schools of quintile 1 where IBS are prominently indigenous with more that 7.8% of its students enrolled who are indigenous mirroring the 7% of the total population who belong to one of the 14 indigenous nationalities (in the Andes and Amazon region).

Pedal A (all ethnic groups)



Pedal B (no mestizos)



Source: Secretariat for Higher Education, Science and Technology of Ecuador, 2018. Ministry of Education of Ecuador, 2018

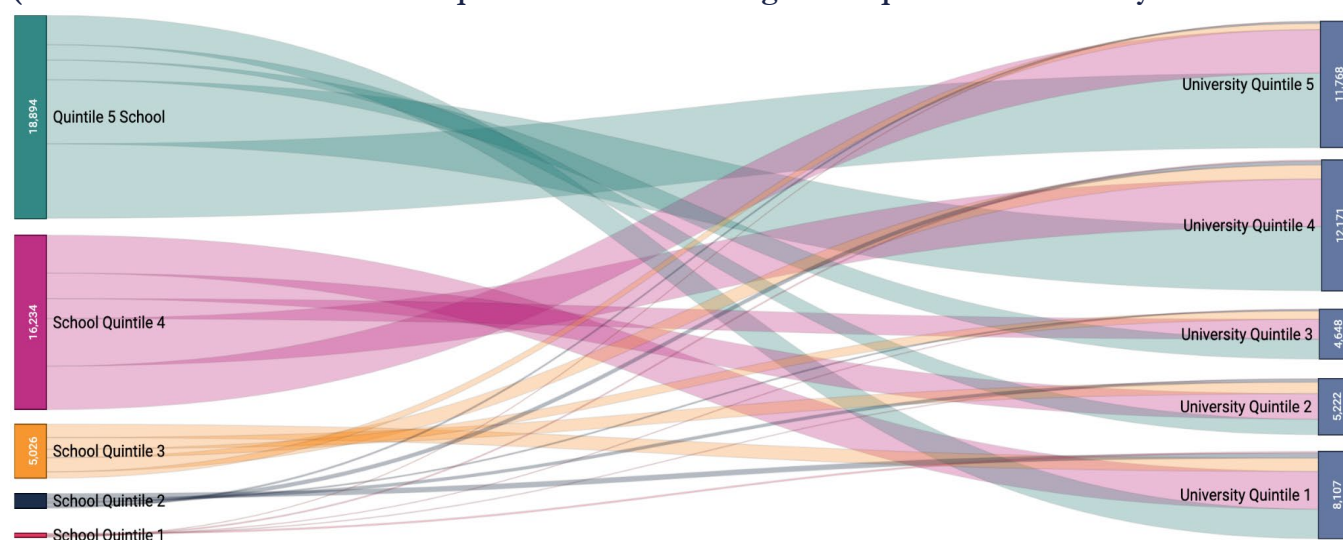
Having looked at the inequalities (geographical and ethnic) in the overall schooling system, allows us to see how stratification dynamics work in the access to public universities in Ecuador in 2018.

When analysing the overall dynamics of access, it is possible to see that most participants who access public universities at all come from school quintile 4 and 5. Similarly, most individuals who graduate from the best schools tend to have a smoother transition to top universities as the graph explains. The following chart describes the distribution of students based on their school of origin’s quintile and their university of destination’s quintile:

¹⁵ La incidencia de pobreza nacional se calcula la proporción de pobres frente al total de la población.

Distribution of students who accessed public universities in 2018

(based on subset information of quintile of school of origin and quintile of university of destination)



Source: Ministry of Education of Ecuador (2018) and Secretariat for Higher Education, Science and Technology of Ecuador (2018)

As can be seen, most students who access higher education at all come from the highest school quintiles. Thus, the majority of students who access the “best” public universities (highest universities quintiles) belong to school quintiles 4 and 5. This graph clearly shows how stratification of access to higher education (public universities) works where inequalities are reproduced and maintained.

5.2.2 Regression

The following section discusses the impact of individual school characteristics and their impact on access to the highest quintile quintiles focusing on the subset where school information is available. When looking at school level determinants, the Index of School Conditions was used in a disaggregated way to understand the school conditions that foster (or not) accessing the best (fifth quintile) universities:

School determinants to access in higher education in 2018

Logistic regression model

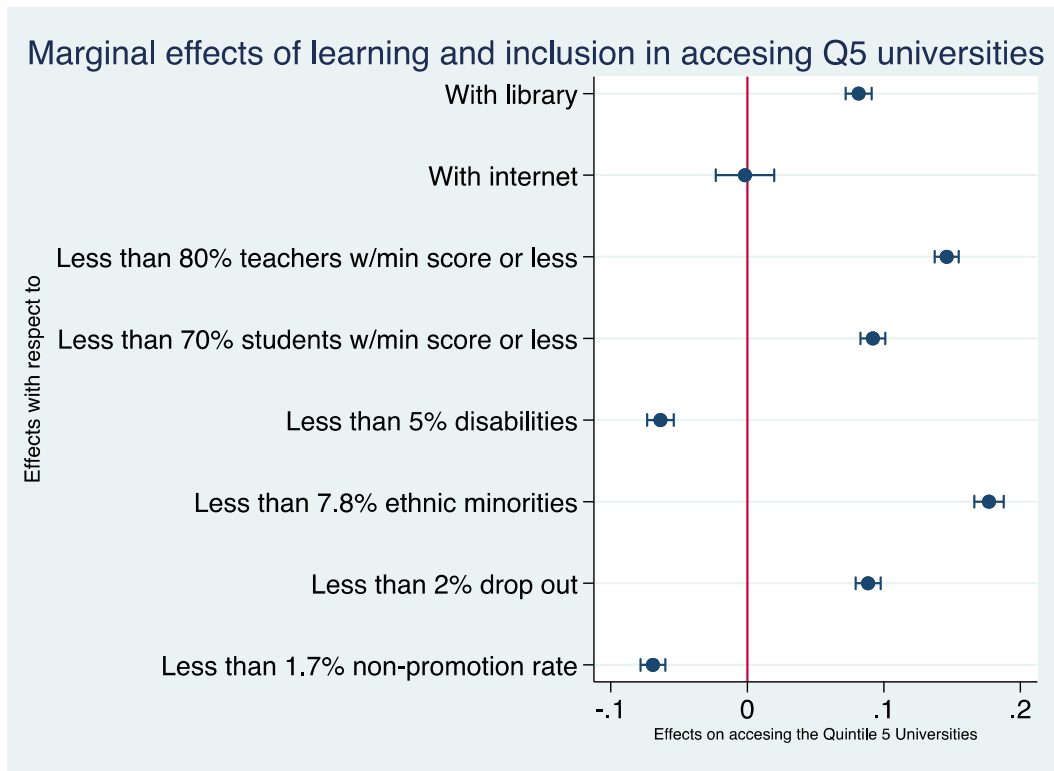
Access best Universities	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Non promotion rate less than 1.7%	-.363	.024	-14.98	0	-.411	-.316	***
Dropout less than 2%	.474	.026	18.55	0	.424	.524	***
Less than 7.8% students from ethnic minorities	1.128	.046	24.73	0	1.039	1.218	***
Less than 0.5% students with disabilities	-.329	.025	-13.08	0	-.378	-.279	***
More than 70% students above minimum score	.493	.026	19.27	0	.443	.543	***
More than 80% students above minimum score	.809	.027	29.99	0	.756	.862	***
Has internet	-.009	.058	-0.16	.873	-.122	.104	
Has library	.449	.028	15.94	0	.393	.504	***
Constant	-2.984	.078	-38.47	0	-3.136	-2.832	***
Mean dependent var		0.293	SD dependent var			0.455	
Pseudo r-squared		0.079	Number of obs			41831	
Chi-square		3971.199	Prob > chi2			0.000	
Akaike crit. (AIC)		46624.910	Bayesian crit. (BIC)			46702.683	

*** $p < .01$, ** $p < .05$, * $p < .1$

Source: Ministry of Education of Ecuador (2018) and Secretariat for Higher Education, Science and Technology of Ecuador (2018)

As can be seen when looking at school conditions, there is a negative association with the percentage of non promotion above 1.7%¹⁶ and with a high number of students with disabilities. On the other hand, the other variables that present a positive correlation are those where standardised test scores of their students and teachers are above average in 70% and 80% of their populations respectively. The variable with the highest positive association is the variable that describes if the school has a limited number of students from ethnic minorities (less than 7.8% of its total enrolment). The following graph illustrates the marginal effects of learning and inclusion as well as infrastructure in accessing the best public universities in 2018:

Marginal effects of learning and inclusion conditions when accessing the best public universities in 2018

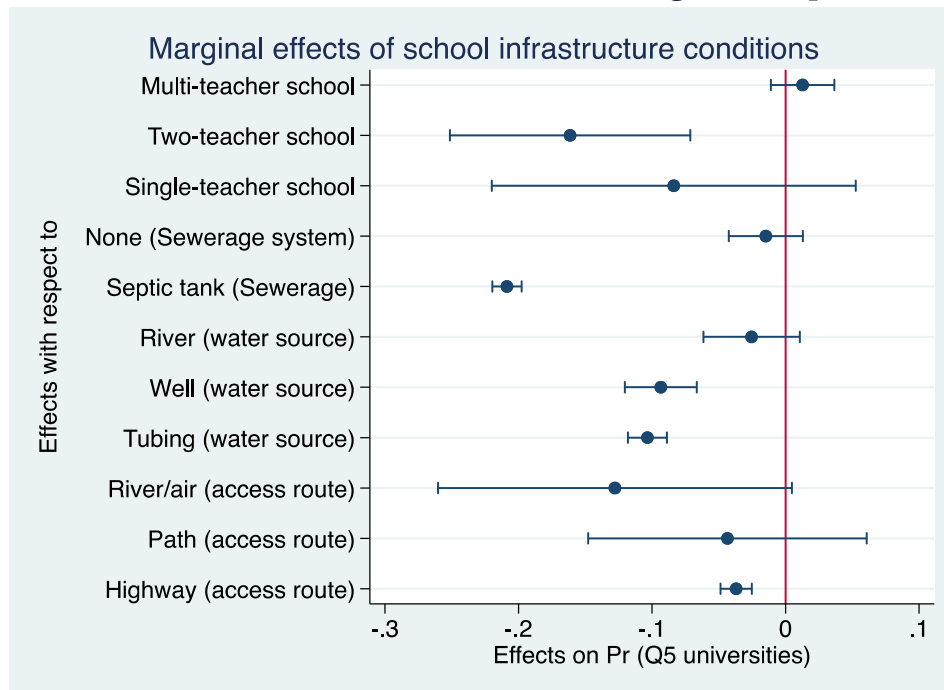


Source: Ministry of Education of Ecuador (2018) and Secretariat for Higher Education, Science and Technology of Ecuador (2018)

Similarly, the analysis of the marginal effects of infrastructure in accessing the best public universities, illustrates the relevance of appropriate infrastructure.

¹⁶ As established in the School Conditions indicator from the Ministry of Education of Ecuador

The marginal effects of infrastructure conditions when accessing the best public universities in 2018



Source: Ministry of Education of Ecuador (2018) and Secretariat for Higher Education, Science and Technology of Ecuador (2018)

5.2.3. Discussion

When running a marginal effects model of the learning and inclusion conditions of schools (see results in Appendix 3) to see the impact of each variable of school characteristics we can see that schools with libraries, with good results on standardised tests, low dropout rates and few students from ethnic minorities have higher probability of accessing the best public universities. The determinant that shows the highest negative correlation is the participation of more than 7.8% ethnic minorities in schools, thus we may infer that schools with more ethnic minorities have fewer chances of accessing the best universities. Bearing in mind that this section derives from a subsample analysis is relevant to note that this is congruent with the findings from question one where indigenous students have the least chances to access the best universities, followed by Montubios and afro descendants. Moreover, the idea of limited access to elite universities is highly linked to the overall socioeconomic conditions that come along with Indigenous, Montubio and Afro descendant students.

Similarly, when looking at the infrastructure conditions, the individuals who come from schools with septic tanks have the worst probabilities of accessing the best universities. This is also the case for water provision where tubing water has the highest negative correlation. In fact, according to UNICEF, proper hand washing with soap and clean water may reduce on a 42% the chances of diarrhoea (which is one of the biggest concerns and threats for kids worldwide) (UNICEF, 2012). Similarly, the accessibility of schools is also a predictor for accessing the best public universities, where schools that have the most difficult accessibility by air or river (mainly in the Amazon region) have the least probabilities of accessing the best universities. This issue of accessibility is highly linked to the discussion on geographical factors in the findings of question one. Schools with street access (as the base of the marginal effects model) are usually urban schools with the best accessibility.

Lastly, the size of schools in terms of the teachers they have is a classification created by the Ministry of Education of Ecuador that allows to understand schools in their diversity. There are one and two-teacher schools that represent 40% of the total schools in the country and are mainly based in rural areas, in many cases are intercultural bilingual schools attending Indigenous communities. When compared with standard size schools (major y minor

schools, according to the Ministry’s classification), schools that are single teacher schools and two teacher schools have considerably lower chances of having their students achieve spaces at the country’s best universities. This however, is not the case for “pluri-teacher” schools which are more likely to have their students accessing the best public universities. This may be a point for further analysis given that it may provide hints about the best size schools based on access to higher education particularly considering that between 2010 and 2017 the government focused public investment on creating standard size schools (Plan de Desarrollo para el Buen Vivir 2009-2013 and 2013-2017).

Overall, the findings presented in question two (analysing the school level conditions for equitable access to the best university) are congruent with the findings presented in question one (analysing the individual level determinants). Despite the data availability, the subsample for question two provides an input on the relevance that school conditions may have when looking at equitable access to higher education. In fact, the analysis of student trajectories from secondary into tertiary education may provide a proxy for quality of school conditions not only with the aim of accessing higher education but guaranteeing learning. The methodology presented in this section shows that if available, it is possible to link administrative information to understand determinants for accessing elite universities at the individual level as well as at the school level. Both levels of analysis, the individual and the institutional may provide information for policy makers in terms of focusing efforts and targeting with budgets. The next section presents the last question of this study and builds on the information from questions one and two.

5.3. Research question 3: What is the financial behaviour of inclusive universities?

The following section uses information reported in the findings of research question one of this study to rank Ecuador’s public universities in terms of inclusion to answer on the financial behaviour of inclusive universities. For this ranking, I analysed the average participation of females, ethnic minorities and disabled participants in access to public universities in 2018. The result of this exercise allowed to establish the “inclusion ranking”. Similarly, the “quality ranking” was taken from the methods used in question one for classifying universities in quintiles based on their position in national and international rankings (from CEAACES and Webometrics). Lastly, the information of budget per capita was calculated from the overall university budget by the overall student enrolment.

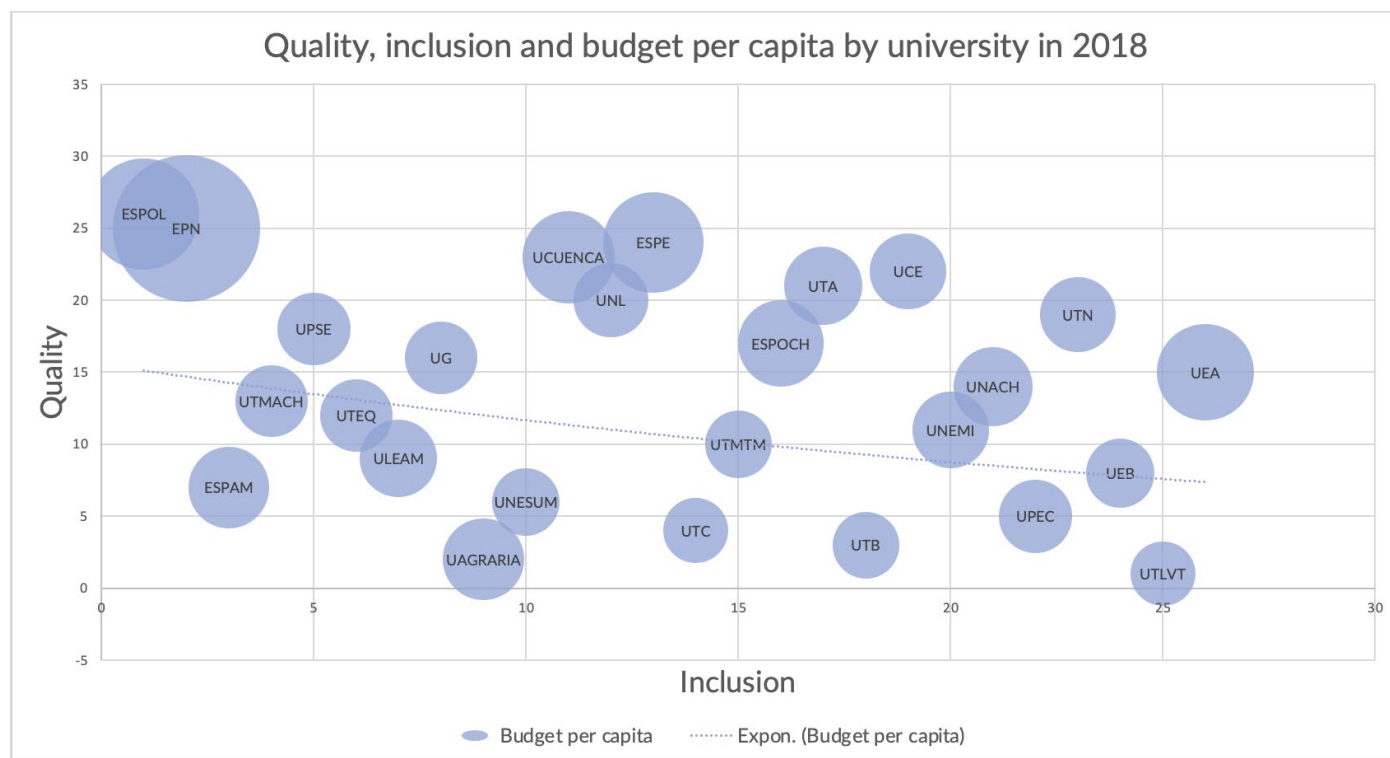
5.3.1. Descriptive statistics

PUBLIC UNIVERSITY	Inclusion ranking	Quality ranking	Budget per capita
Universidad Estatal Amazonica	1	12	\$ 5.179,56
Universidad Tecnica Luis Vargas Torres De Esmeraldas	2	26	\$ 2.305,27
Universidad Estatal De Bolivar	3	19	\$ 2.607,21
Universidad Tecnica Del Norte	4	8	\$ 3.114,73
Universidad Politecnica Estatal Del Carchi	5	22	\$ 2.957,00
Universidad Nacional De Chimborazo	6	13	\$ 3.402,86
Universidad Estatal De Milagro	7	16	\$ 3.264,81
Universidad Central Del Ecuador	8	5	\$ 3.215,44
Universidad Tecnica De Babahoyo	9	24	\$ 2.453,50
Universidad Tecnica De Ambato	10	6	\$ 3.363,00
Escuela Superior Politecnica De Chimborazo	11	10	\$ 4.045,92
Universidad Tecnica De Manabi	12	17	\$ 2.479,71
Universidad Tecnica De Cotopaxi	13	23	\$ 2.361,23

Universidad De Las Fuerzas Armadas (Espe)
 Universidad Nacional De Loja
 Universidad De Cuenca
 Universidad Estatal Del Sur De Manabi
 Universidad Agraria Del Ecuador
 Universidad De Guayaquil
 Universidad Laica Eloy Alfaro De Manabi
 Universidad Tecnica Estatal De Quevedo
 Universidad Estatal Peninsula De Santa Elena
 Universidad Tecnica De Machala
 Escuela Superior Politecnica Agropecuaria De Manabi
 Escuela Politecnica Nacional
 Escuela Superior Politecnica Del Litoral

14	3	\$ 5.536,72
15	7	\$ 3.083,55
16	4	\$ 4.687,52
17	21	\$ 2.511,83
18	25	\$ 3.683,23
19	11	\$ 2.855,75
20	18	\$ 3.306,28
21	15	\$ 2.869,62
22	9	\$ 2.948,79
23	14	\$ 2.878,89
24	20	\$ 3.642,26
25	2	\$ 11.870,84
26	1	\$ 6.832,81

Derived from the information above, we can see the following graphical representation for illustrating the types of universities when analysing equity, quality and funding:



Universities with the highest quality concentrate the largest budgets but lag behind in terms of equitable access (understood as accepting students from ethnic minorities, with disabilities and females). As can be seen from the dotted line, budget per capita and quality decrease as universities are more inclusive. This trend, however, is challenged by institutions that manage to keep mid-high quality and equitable inclusion (graphed as “inclusion”).

5.3.2. Discussion

According to Bourdieu (1988), there are two types of institutions in a system of higher education (1) selective institutions with high prestige and (2) demand-driven mass institutions with low prestige which “build on volume to maximise their revenues and social presence” (Marginson, 2017). In the table above, we find four scenarios; (1) where the overall concept of quality shows that in the most radical cases quality is opposed to inclusion (the two best universities are the least inclusive and concentrate the largest budgets – Escuela Politecnica Nacional and Escuela Politecnica del Litoral), (2) the cases of high quality and high inclusion and budget close to the

national average (Universidad De Las Fuerzas Armadas (ESPE) and Universidad Central del Ecuador); (3) low quality and low inclusion universities with budgets above average (Escuela Superior Politecnica Agropecuaria De Manabi) and; (4) low quality and high inclusion with lowest budgets (Universidad Técnica Luis Vargas Torres De Esmeraldas). Understanding efficiency as an equilibrium between budget, inclusion and quality, universities in scenarios 1 and 3 are inefficient whereas those universities in scenarios 2 and 4 are efficient.

As mentioned in the section on Context, the funding formula for distributing resources in public universities rewards quality mainly based on research variables. Public funds concentrate in high quality, low inclusion universities, as the formula highly rewards research outcomes (such as publications). Similarly, universities with low quality and low inclusion have medium size enrolment for which the formula also allocates more funds. It is evident, however, that universities that have the highest inclusion levels have the lowest budgets as they are in low quality levels. This regressive distribution of resources to public universities inhibits investment for improving quality generating inequalities between universities. In this sense, the policies implemented through the formula for distributing resources are fundamental for gearing the incentives for universities.

6. Conclusion

In conclusion, the findings of this research inform on equitable access to public universities in Ecuador in 2018 by tackling the three research questions posed. In terms of research question one, the findings of this study conclude that at the individual level students who are female, from ethnic minorities (especially Indigenous), come from the Pacific Coast region and have disabilities are less likely to access the best public universities that are mostly concentrated in the Andes region. In terms of research question two at the school level, the schools with the best learning conditions and infrastructure and with the least students from ethnic minorities have higher probability of reaching the best public universities. In terms of research question three, the findings of this study conclude that inclusive universities may have “efficient” and “inefficient” budget expenditure behaviour when analysing their budget per capita against their degree of inclusiveness and quality. In here, we find four scenarios based on quality, inclusion and budget. Understanding efficiency as an equilibrium between budget, inclusion and quality, universities in scenarios 1 (high quality, low inclusion, high budget), 3 (low quality, low inclusion, low budget) and 4 (low quality, high inclusion, low budget) are inefficient. On the other hand, universities in the scenario 2 (high quality, high inclusion, average budget) are efficient.

Overall, this study has presented results on the general characteristics of participants who public universities in Ecuador in 2018. Additionally, a characterisation of schools by quintile was made as well as logit regression models considering the probabilities of accessing the best universities (quintile five universities). Having analysed the dynamics of stratification in access to higher education, it was possible to move forward with the analysis of universities and their budgetary behaviour. In this analysis, resource accumulation at the school and university level has positive impact in institutional quality, however in some cases a negative effect in terms of inclusion. When analysing the budget per capita of universities versus quality and inclusion we conclude that quality and inclusion are not always mutually exclusive or in detriment of one another. In fact, this study proposes an approach of efficiency of universities based on the equilibrium they may present between budget, inclusion and quality. Such approach would radically incorporate the notions of equity in the higher education agenda. This would help mitigate the challenge identified by the Global Education Monitoring: “the expansion of tertiary education has been unprecedented but accompanied by persistent vertical and horizontal inequity.” (UNESCO, 2020). This study has presented the extent to which inequalities are present on an individual and institutional-level analysis.

RECOMMENDATIONS

Derived from the conclusions, the policy recommendations are based on a systemic understanding of the Ecuadorian education system and its transition from secondary to tertiary education. In this sense, the following policy recommendations take into consideration the recent reforms of the system to access higher education in 2023 where the process of admissions was decentralized to public universities:

- **Trajectories matter:** Consider high school conditions as key elements to accessing higher education. High school conditions (infrastructure, teachers knowledge as well as students outcomes in high school) can hinder or enhance opportunities for its students when seeking a place at a public university. From the findings presented we shed light on the relevance of teacher and students scores in standardised evaluations. Considering that in the case of teaching the evaluation Ser Maestro focused on disciplinary knowledge and in the case of students Ser Bachiller focused on aptitudes. Access to the best universities is also enhanced when schools of origin have low drop out rates and have libraries. Similarly, in terms of infrastructure, the relevance of access routes with a street, sewerage systems and drinking water can predict higher chances of accessing the best public universities. This information may be the base for further analysis and policy decisions in terms of prioritizing teacher training in disciplinary aspects as well as infrastructure priorities in schools that still don't have sewerage systems or drinking water supply.
- **Affirmative action points are not sufficient:** based on the results described at the individual level determinants, we can see that points awarded as affirmative action in the access policy by 2018 were not sufficient to assure that high quality universities are inclusive. In fact, regardless of the affirmative action points, some of best public universities remain the most exclusive as additional points cannot even structural inequalities in terms of points. Exploring quota policies may be an alternative to assure that a number of students are accepted and assumed by public universities. This however, must go in line with further support for guaranteeing successful completion
- **Formula for distributing resources should include equity:** based on the results described in the last research question, opportunities are not only unevenly distributed among students who access public universities but also funds are unevenly distributed among universities themselves. In this context, the formula is a policy tool for distributing resources equity must be put in place when considering students and institutions. At the student level, in order to promote and reward inclusive institutions, the number of students from ethnic minorities, who have disabilities and who reside in underrepresented territories must be overall considered. In the case of higher quality universities, females must also be considered¹⁷. Similarly, at the institutional level, universities that show high or medium degrees of quality with high or medium degrees of inclusion could also be rewarded within the resource distribution formula to promote a balance between quality and inclusion. Moreover, the formula for distributing resources must consider universities with the lowest quality standards that serve the most vulnerable students as institutions that need support (technical and academic) as well as resources to improve its quality. If this is not tackled, then vulnerable groups mainly attend poor quality institutions reproducing inequalities.

¹⁷ Not included in the overall access as more females access universities, yet females have less chances of accessing the best public universities.

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APPENDICES (EXTRA TITLE EXAMPLE)

Appendix 1: Ranking based on Report for Formula for Budget Allocation of Public Universities 2018 from SENESCYT

Public University	Int. ranking (20%) + local category (80%)	Uni. Quintile
Escuela Superior Politecnica Del Litoral	8,4	5
Escuela Politecnica Nacional	8,2	5
Universidad De Las Fuerzas Armadas (Espe)	8	5
Universidad De Cuenca	7,8	5
Universidad Central Del Ecuador	6,8	5
Universidad Tecnica De Ambato	6,6	4
Universidad Nacional De Loja	6	4
Universidad Tecnica Del Norte	5,6	4
Universidad Estatal Peninsula De Santa Elena	5,6	4
Escuela Superior Politecnica De Chimborazo	5,4	4
Universidad De Guayaquil	5,4	3
Universidad Estatal Amazonica	5,2	3
Universidad Nacional De Chimborazo	5	3
Universidad Tecnica De Machala	5	3
Universidad Tecnica Estatal De Quevedo	4,6	3
Universidad Estatal De Milagro	4,4	2
Universidad Tecnica De Manabi	4,2	2
Universidad Laica Eloy Alfaro De Manabi	4	2
Universidad Estatal De Bolivar	3,2	2
Escuela Superior Politecnica Agropecuaria De Manabi	3	2
Universidad Estatal Del Sur De Manabi	2,8	1
Universidad Politecnica Estatal Del Carchi	2,6	1
Universidad Tecnica De Cotopaxi	2,6	1
Universidad Tecnica De Babahoyo	2,4	1
Universidad Agraria Del Ecuador	2,2	1
Universidad Tecnica Luis Vargas Torres De Esmeraldas	2	1

Appendix 2: Predictive margins for accessing quintile 5 public universities in Ecuador based on individual level determinants

Predictive margins

Number of obs = 171,537

Model VCE: OIM

Expression: Pr(quintile5), predict()

	Margin	Delta-method					[95% conf. interval]
		std.	err.	z	P>z		
gender							
Male	0.320	0.002	168.070	0.000	0.316	0.324	
Female	0.366	0.002	209.490	0.000	0.363	0.370	
Not answer	0.236	0.002	104.460	0.000	0.231	0.240	
ethnicity							
Afro-descendant	0.242	0.007	36.250	0.000	0.229	0.255	
White	0.313	0.008	38.950	0.000	0.297	0.329	
Indigenous	0.320	0.006	54.850	0.000	0.309	0.332	
Mestizo	0.319	0.001	253.430	0.000	0.316	0.321	
Montubio	0.394	0.006	64.290	0.000	0.382	0.406	
Mulatto	0.302	0.010	31.060	0.000	0.283	0.321	
Black	0.191	0.012	16.240	0.000	0.168	0.214	
Other	0.288	0.020	14.530	0.000	0.249	0.327	
NA	0.383	0.005	84.450	0.000	0.374	0.392	
disabilities							
No	0.323	0.001	287.790	0.000	0.320	0.325	
Si	0.355	0.014	24.560	0.000	0.326	0.383	

Appendix 3: Predictive margins for accessing quintile 5 public universities in Ecuador based on school level determinants

Average marginal effects

Number of obs = 41,835

Model VCE: OIM

Expression: Pr(acceso_UEP5), predict()

dy/dx wrt: percentage_promotion_17 percent_dropout_20 percent_stud_test_80 percent_eth_min_78 percent_disability_05

student_teacher_ratio_25 percent_teacher_test_70 area_rural access_internet

library flooded_school drinking_water multigrade_school

	Delta-method						
	dy/dx	std.	err.	z	P>z	[95% conf.	interval]
percentage_promotion_17	0.013	0.005	2.550	0.011	0.003	0.023	
percent_dropout_20	-0.093	0.005	-18.140	0.000	-0.103	-0.083	
percent_stud_test_80	0.084	0.005	16.750	0.000	0.074	0.094	
percent_eth_min_78	-0.083	0.007	-11.640	0.000	-0.097	-0.069	
percent_disability_05	0.051	0.005	9.300	0.000	0.040	0.062	
student_teacher_ratio_25	0.051	0.006	8.050	0.000	0.038	0.063	
percent_teacher_test_70	0.075	0.005	14.640	0.000	0.065	0.085	
area_rural	0.038	0.007	5.560	0.000	0.025	0.052	
access_internet	-0.043	0.011	-3.850	0.000	-0.064	-0.021	
library	-0.073	0.005	-13.400	0.000	-0.084	-0.063	
flooded_school		0		(omitted)			
drinking_water	0.149	0.006	23.820	0.000	0.137	0.162	
multigrade_school	0.045	0.012	3.660	0.000	0.021	0.069	