Economic Affects on Studying Abroad to the U.S.: Evidence from GRE Test-Takers

Wenyi Li [1, †], Zheng Zou [2, *, †]

[1] Shanghai Hongkou Experimental School, China

[2] Stanford Center at Peking University, China

*Corresponding author Email: peggyzou@stanford.edu

[†] These authors contribute equally.

Abstract. The increase of student mobility has gradually attracted the attention of scholars world-widely in recent years. This paper conducts a quantitative study on the national economy and the willingness of students to take U.S. as a destination for study abroad through the data of 187 countries in the GRE test which officially released by the U.S.. educational testing service, as well as, the per capita GDP of countries and national population published by the World Bank from 2017 to 2021. In addition, this paper divides the samples into developed countries, developing countries and underdeveloped countries for comparison. Push-pull theory is applied to analyze the relevance which the data display.

Keywords: student mobility, international higher education, push-pull theory.

1. Introduction

Against the backdrop of globalization and the transitioning towards knowledge economy, student mobility has become the one of most common-place practice in International Higher Education. Among them, U.S. has subsequently became the top destination. According to the 2022 World University Rankings released by QS, United States is home to the most top universities, with 27 schools in the top 100[1]. Studying in the United States is the first choice for most international students, even though the economy of their home country is different, and the corresponding nationals' educational level and willingness to study abroad are different as well.

Many factors may be taken into consideration before deciding to study in the U.S.. In this paper, it specifically ask whether the condition of their respective national economy makes a direct impact in the willingness of studying in the U.S.. National economy is measured by the national GDP per capita and the overall willingness to study in the U.S. is measured by the number of GRE test-takers in each counties. Graduate Record Examination (GRE) is s prerequisite to most post-graduate level studies in the U.S., which conducted by the Educational Testing Service (ETS). GRE is widely available to students from nearly all the countries. It has more than 1,000 offline test centers in more than 180 countries or regions around the world [2].Therefore its data is considered broadly enough for this paper and it intends to study by collecting data from the GDP per capita of respective home country and number of their GRE test-takers. Previous studies was mostly textual analysis from politics, economy and study abroad policies,etc,. This paper will provide more perspectives from statistic point of view.

The COVID-19 pandemic since December 2019 has made a significant impact on the economy of various countries, resulting in most countries GDP declining. According to the "2021 US Open Doors Report" released by the American Institute of International Education in November 2021, the number of new international students in US in the 2020-2021 academic year has dropped by 46% compared with the previous academic year. Similarly, during the 2008 economic crisis, a survey released by the Council of Graduate Schools in April 2009 showed that the number of students applying to master programs in 2009 plummeted by 17 percent. Hence, both global environment and national economy could make impact on studying in the US. The research on the correlation makes a lot of sense, while studying in the U.S. is the most representative in international student mobility.

2. Literature review

International higher education, through mobility of students, has grown considerably over the past 40 years. The number of students who study abroad has been steadily rising since 1970s.[3]In the existing literature, most of research on student mobility focuses on the phenomenon and trend of mobility, including the influencing factors of mobility and the advantages and disadvantages which it brought. More and more theoretical support has emerged to incorporate this research filed. Among them, Push-pull theory is the most widely used theoretical framework in analyzing the factors affecting student mobility. It has originated from the theory of analyzing migration in sociology [4], and was subsequently applied to the analysis of student mobility.

Since 1980s, a large number of scholars have conducted studies on the influencing factors of the flow of students from less developed countries to developed countries through push-pull analysis models. [5] The words "Push/pull" are used to describe the factors that affect student mobility in the sending and receiving countries respectively. Different scholars have different interpretations and classifications of "push" and "pull". The most common "pull" factors are from the receiving country, such as the education quality and reputation [6]; institutions or state funding [7];university ranking[8]; security level[9]; and political and economic reasons of other countries. The factors of "push" include the poor quality of education in the exporting countries[10]; popular "returnees" for employers; some specific disciplines[11], and other political and economic reasons. In earlier studies, the factors of "pull" mostly come from developed countries, while "pushing" comes from developing or undeveloped countries.

In the 1980s, a series of scholars, represented by Kiong h. Lee, analyzed the development of international student mobility in the Asia and Africa, which were relatively backward region. They focused on the "pull" part of developed countries and the impact of higher education opportunities to developing countries which brought by the international student mobility. However, their research did not fully explain the "push" role of educational facilities, teaching quality, human demand and geographical factors of developing countries in the phenomenon. [12]Since the 1990s, the forms of international student flows have become more diversified. Besides students from developing countries transferring to developed countries, there are also students from developed countries moving to another developed country, and some students from developed countries moving to developing countries. [13] A more complex push-pull model came into being to discuss these new phenomenon of student mobility. Moreover, the number of international students from China has been increasing dramatically. Although push-pull theory is widely used, it also has some defects. First, there are many related factors involved in the push-pull model, which is difficult to classify and summarize systematically. Second, only the external factors of "push" and "pull" are considered, and the subjective initiative of students is ignored.

It is not hard to find that in the existing research on the influencing factors of student mobility, the "pull" of the receiving country is discussed more than the "push" factor of sending country. More researches are emphasizing the pull factors of developing countries and objective factors, such as educational opportunities, economic development degree and political environment,etc,.The "pull" factors of developed countries and the subjective factors which affecting student mobility are less discussed. [14]As one of the leading country in the world's higher education system, the flow of international students to study in United States and the factors affecting it have always been particularly discussed. Most of the existing studies on studying in the United States also focus on the impact of the United States as a "pull" country.For example, it is more explained from the national economy, education and social situation of the United States. For example, the strong economic strength and multi-channel scholarships of the United States, the national strategy of international students, and diversified culture of the American society to encourage immigrants. [15]However, there is less discussion about the domestic factors which influence the students from the sending country .

Apart from the push-pull theory, the "culture capital" in sociology is also used to supplement the theoretical research of student mobility by analyzing the root cause behind the phenomenon of

international student mobility in different class, and emphasizing that education plays an important role in the inter-generational transmission of culture capital. [16] For example, some students choose to study abroad not because of the lack of domestic high-quality education resources, especially for those in developed countries. They pursue more distinctive "symbolic capital" to distinguish them from other classes by received education aboard. [17]International migration theory is also a theoretical framework for western scholars to analyze international student mobility. Some studies show the higher the educational level, the likelier he/she may migrate to a different country. [18]Also, it is an important reason for the students study abroad to obtain employment opportunities after studying in the receiving country[19] .

With the rapid changes of globalization, the determinate factors of students mobility have become more complicated. The traditional receiving and sending countries has been changed with time. [20]In terms of the overall trend, the attractiveness of American universities is declining in terms of the global total number of students studying in the United States. The outbreak of the epidemic in 2019 has brought about a sharp drop in student mobility. Students' willingness to go abroad is affected by some new factors such as country security.

The existing international mobility of students is mainly analyzed from the perspective of politics, economy and study abroad policy by qualitative research. The purpose of this paper is to measure the national economy of the sending countries and the data of the number of GRE test-takers, and to quantitatively analyze the impact of the economic strength of the sending countries on their students willingness of studying in the United States. This study will be a supplementary study of the recent changes in student mobility, and provide reflections and judgments on the trend of student mobility.

3. Data collection and research design

3.1 Data source and pre-processing

There are three sources of data for this study:

1) The official GRE test data by country published by ETS (Educational Testing Service)[21]. The original file is a PDF read-only encrypted file, and tools such as WPS cannot convert it into EXCEL. Since the current general software on the market is not mature for table OCR processing, this paper uses Python tools and Tesseract OCR (Optical Character Recognition) module to realize the data extraction and processing of read-only PDF. Based on machine learning technology, it can capture text in pictures and support multiple languages.

After data extraction and cleaning, there are data for 187 countries (select top 10 for example):

Table 1. Top 10 cleaned GRE testers by country

COUNTRY	CODE	2016	2017	2018	2019	2020
Afghanistan	AFG	35383028	36296111	37171922	38041757	38928341
Albania	ALB	2876101	2873457	2866376	2854191	2837849
Algeria	DZA	40551398	41389174	42228415	43053054	43851043
American Samoa	ASM	55739	55617	55461	55312	55197
Andorra	AND	77295	76997	77008	77146	77265
Angola	AGO	28842482	29816769	30809787	31825299	32866268
Antigua and Barbuda	ATG	94520	95425	96282	97115	97928
Argentina	ARG	43590368	44044811	44494502	44938712	45376763
Armenia	ARM	2936147	2944789	2951741	2957728	2963234
Aruba	ABW	104865	105361	105846	106310	106766

The average GDP (current US dollars) data published by The World Bank over the years [22]

Table 2. GDP per capita ($)

COUNTRY	CODE	2016	2017	2018	2019	2020
Afghanistan	AFG	512.01	516.68	485.67	494.18	516.75
Albania	ALB	4124.06	4531.02	5287.66	5395.66	5246.10
Algeria	DZA	3946.45	4109.70	4142.02	3989.67	3306.86
American Samoa	ASM	12038.25	11003.83	11521.61	11715.36	12844.90
Andorra	AND	37475.64	38964.90	41791.97	40897.33	
Angola	AGO	3506.07	4095.81	3289.64	2809.63	1776.17
Antigua and Barbuda	ATG	15198.74	15383.58	16679.59	17376.65	13992.74
Argentina	ARG	12790.24	14613.04	11795.16	10056.64	8579.02
Armenia	ARM	3591.83	3914.53	4220.54	4604.65	4266.02
Aruba	ABW	28452.17	29350.81	30253.28		

The population by country data published by The World Bank [23] (select top 10 for example)

Table 3. Population by country

COUNTRY	CODE	2016	2017	2018	2019	2020
Afghanistan	AFG	203	118	165	157	120
Albania	ALB	6	20	23	14	40
Algeria	DZA	42	47	46	26	29
American Samoa	ASM	17	8	0	31	611
Andorra	AND	0	0	0	0	0
Angola	AGO	13	4	4	9	8
Antigua and Barbuda	ATG	5	3	2	0	2
Argentina	ARG	374	415	335	320	162
Armenia	ARM	365	377	360	339	188
Aruba	ABW	0	0	0	0	2

The three sources of data are coded in a common national three-character code (for example, CHN for China), and the data from 2017 to 2021 is fully covered by the three data sources.

3.2 Variable Measurement

The explanatory variable of this study is the willingness of people in a country or region to study in the United States, which is measured by the ratio of the number of people who took the GRE test in that country to the total population in that year. The explanatory variable is the country's GDP per capita for that year. This study mainly studies the influence of a country's per capita GDP on the willingness of students to study abroad. The main variables are as follows:

Table 4. Descriptive statistics of the main variables

Category	Name	Mean	Std.
Explained variable	GRE test-takers ratio (test persons/population*1000)	0.039	0.087
Key Explanatory variable	GDP per capita	17601.47	25296.98

The explained variable in this study has a mean value of 0.039 and a standard deviation of 0.087, which is higher than the mean, indicating that the objective situation is that there is a large gap in the number of people who take the test in different countries. The per capita GDP of the core explanatory variable is 17,601.47 US dollars, and the standard deviation is 25,296.98 US dollars, which is also

higher than the average value, indicating that the objective situation is that the per capita GDP gap between countries is relatively large.

First, we use the 2019 data as a cross-section to calculate the histogram of GDP per capita in 2019: It can be seen that after LN processing, the per capita GDP variable is basically in a normal distribution. Second, we analyze the correlation between the explained variable and the explanatory variable

Table 5. Correlation analysis between the two

	Average GRE test takers as % of population	GDP per capita
Average GRE test takers as % of population	1.0000	
GDP per capita	-0.0666	1.0000

It can be seen that the correlation between the average GRE test-takers in the country's population ratio and per capita GDP is -0.0666, which is a negative linear correlation.

According to per capita GDP, countries are divided into high, medium and low levels of economic development: more than $30,000 is a high level of economic development (developed counties), $10,000 to $30,000 is a medium level of economic development(developing countries), and less than $10,000 is a low level of economic development(underdeveloped countries).

Table 6. Results of different types of countries

Country Type	Average GRE test takers as % of population	% of global students
High level of economic (developed counties),	0.0760%	6.79%
Medium level of economic (developing countries),	0.1164%	38.81%
Low level of economic (underdeveloped countries)	0.0234%	54.40%

According to the final analysis results, from the perspective of the proportion of GRE candidates in the country's population, developing countries, that is, countries with a per capita GDP of 10,000 to 30,000 US dollars, have the strongest willingness to study abroad, while developed countries, that is, countries with a per capita GDP of more than 30,000 US dollars Countries with strong willingness to study abroad, less developed countries, i.e. countries with a per capita GDP of less than US$10,000, have the lowest willingness to study abroad.

From the perspective of the total number of GRE test-takers, the number of applicants with low economic development level is the largest, the number of applicants with medium economic development level is second, and the number of applicants with high economic development level is the least.

Table 7. Regression result between GRE test-takers and GDP per capita

Number of obs		180		
F(1,278)		29.72		
Prob>F		0.0000		
R-squared		0.1431		
GRE test-takers ratio	Coef.	Std.Err.	t	P>|t|
Ln(GDP per capita)	.0000229	4.20e-06	5.45	0.000

To sum up, although GDP is not the whole factor of a country's willingness to study abroad, they are strongly correlated, and it is the significant variable.

After our regression analysis on the 2019 data, the Prob value is less than 0.5, indicating that the core explanatory variables have a significant impact on the explained variables.

4. Conclusion

The main conclusions are as follows: in developing countries, students are most willing to study in the United States; in underdeveloped countries, the willingness is the lowest. The developed

countries is in the middle comparing to the other situations. This conclusion is basically consistent with the conclusion of previous studies. The economic situation of a country has a significant impact on the willingness of its students to study in the United States, which to a certain extent proves the direct role of the "pushing" force of the sending countries.

Based on this conclusion, this study draws the following applications: firstly, the economy of the sending countries, as a "push" driving force, directly affects students' willingness to study in the United States. The economy of a country reflects the strength of the country in many directions, which directly affects the educational opportunities, social forms, scientific and technological levels, etc. The willingness of developing countries to study in the United States is stronger than that of developed countries, which is related to the fact that people in developing countries are more eager to seek better education opportunities and obtain better life and employment opportunities. While the people of the underdeveloped countries are also willing to improve their own conditions through education, they have the less opportunities to do so due to their own economic conditions. With the development of the society, the traditional countries receiving studying abroad are undergoing adjustment, and the "pull" factors are more dispersed. Therefore, under such circumstances, we should strengthen the research on the push force, which the domestic economy is a big factor.

Secondly, the factor of personal economic conditions in student mobility needs to be considered. The students' ability to pay on study in Untied States in developing countries is higher than that in underdeveloped countries, which is also consistent with the result of this paper that the willingness of developing countries to study in United States is stronger than that in underdeveloped countries. Besides, apart from the regular discussion of tuition fees, cost of living and scholarship system, etc.,the GRE test itself, as an expensive test, should also be taken into account in terms of economic expense. In recent years, the education sector in the United States has also been undergoing internal reforms. Some universities attempted to cancel the mandatory GRE test for post-graduate program enrollment in the United States. Such as, University of Michigan, Brown University and Duke University, announced that GRE would be canceled as an unnecessary condition for the application of master's and doctoral programs in application season of 2022-2023. The background of this measure is also pointed out that the GRE test is not beneficial to students with poor financial conditions. These students may lose the opportunity to enter the school because of the high examination fees. This is consistent with the results of this paper that the poor ability of students in underdeveloped countries to pay is reflected in the lowest willingness of underdeveloped countries to go to the United States. With the cancellation of the GRE test, whether it will bring changes to the willingness of the less developed countries to go to United States is a question that worth of continuing observation.

Thirdly, the balance of students mobility is important to all the counties. Student mobility is not only related to students themselves, but also has a significant impact on both sending and receiving countries. Research shows that international student mobility can bring benefits to both countries[24], but it may also cause brain drain in sending countries. The flow of students brought by economic differences may cause further economic disparities. Talent is an important asset for a country's sustainable development , and also the core advantage of a country's competitiveness. Developed countries are paying more and more attention to the development of international students and vigorously attracting and retaining high-level international talents. It is worth exploring that how exporting countries use their "pushing" power to balance their own exports. Therefore, the conclusions of this study can provide empirical support for predicting the trend of studying abroad in the United States under different economies，as a microcosm of overall talent flow.

However, this study also has some shortcomings, which need further in-depth research. For example, this paper does not classify the data by years, which may not take into account the data change caused by the special events in that year. For example, the changes in US international study policy brought by the epidemic in 2019. In today's accelerating global changes, the consideration of time variables can make this research more timely.

References

[1] Quacquarelli Symonds. QS World University Ranking,2021. Retrieved from: https://www.qschina.cn/university-rankings/world-university-rankings/202.

[2] ETS. About the GRE General Test, 2022. https://www.ets.org/gre/revised_general/about

[3] M.Beineab, R. Noëlc, L. Ragot. Determinants of the international mobility of students. Economics of Education Review, 2014: 41, pp40-54.

[4] E.G. Ravenstein. The laws of migration. Journal of the Royal Statistical Society, 1889:52(2),pp 241-305.

[5] Y. An, S. Duan. The development and innovation of push-pull theory in the field of student international mobility. Journal of Beijing Normal University (Social Science Edition), 2020: (4)

[6] W.K. Cummings, Going going over sea's higher education: the Asian Experience,Comparative Education Review, 1984:28,pp 241-257.

[7] A. J. Albien. A Systematic Review and Conceptual Model of International Student Mobility Decision-Making.Social Inclusion,2021:9 (1).

[8] A. V. Oleksiyenko，S. Chan，S. K. Kim，William, Y. W. Lo. World class universities and international student mobility: Repositioning strategies in the Asian Tigers.Research in Comparative & International Education.The Education University of Hong Kong.2021

[9] T. Ling. Research on the phenomenon of international exchange in China's higher education. Ethnic press, 2003: pp200-204.

[10] G.N. Soutar, J.P Turner. Students preferences for university: a conjoint analysis.The international Journal of Educational Management, 2002(16),pp 40-45.

[11] L. Lin, What are Student Education and Educational Related Needs. Marketing and Research, 1997: 25(3), pp 199—212.

[12] K. H. Lee, J. P. Tan.International flow of third level lesser developed country students to developed countries: Determinants and implications, higher education,1984:13(6), pp 687-707.

[13] P.G. Altbach. Comparative Higher Education: Knowledge, the University and development. The University of Hong Kong, 1998: p240.

[14] X. Bai, B. Yuan, X. Yang. Research on international student mobility: analytical framework, research topics and influencing factors - based on the perspective of foreign scholars. Higher Education Exploration, 2018: (10).

[15] S. Marginson. Dynamics of National and Global Competition in Higher Education. Higher Education，2006 :(52),pp 1-39.

[16] Y. Yue. Theoretical explanation of the motivation of international student mobility: a review. Foreign Education Research 2017:44(2),pp240.

[17] H. Lei, F. Li. Economics of international talent migration. Education Research of Tsinghua University, 2008: 29 (3), pp14-19.

[18] B. Suter, M. Jandl. Comparative Study on Policies towards Foreign Graduates : Study on Admission and Retention Policies towards Foreign Students in Industrialized Countries. International Center for Migration Policy Development, 2018.

[19] C. R. Glassand, N. I. Cruz. Moving towards multipolarity: shifts in the core-periphery structure of international student mobility and world rankings (2000–2019)，High Education .2022 : pp21–21.

[20] ETS. GRE volumes by country, 2022. https://www.ets.org/s/gre/pdf/gre_volumes_by_country.pdf.

[21] The World Bank Group. GDP (current US$), 2022. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

[22] The World Bank Group. Population, total, 2022 https://data.worldbank.org/indicator/SP.POP.TOTL.

[23] J. E. Crossman, M. Clarke. International Experience and Graduate Employability: Stakeholder Perceptions on the Connection. Higher Education. 2010 (59): 599-613.