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***Research paper***



# An Empirical Analysis of The Inward Export Structure of Mongolia's Higher Education

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**Abstract**

This study aims to examine the inward export structure of higher education services in Mongolia. The study emphasises the impact of different components on the performance of the inward export of higher education services in Mongolia. The research adopts a quantitative research design using correlation and modeling analysis methods. Data were collected from the Mongolian Ministry of Education and the China Education Statistical Yearbook. This study divides Mongolia's inward exporting countries of higher education services into two groups, China and non-China, and examines the relationship between Mongolia's inward export performance of higher education services and its inward export volume to China and to non-China countries. The result revealed that the number of international students in Mongolian higher education is highly positively correlated with the number of international students from China, and medium-strength positively correlated with non-China countries. The regression equation between the number of foreign students studying in Mongolian higher education and the number of students from China shows a significant positive impact. The study also shows that COVID-19 had a significant negative impact on the total number of foreign students in Mongolia. This study examines the inward export structure of Mongolia's higher education service trade and provides valuable reference directions for improving the inward export performance of Mongolia's higher education services. The inward export structure of Mongolia's higher education service trade was analyzed, and the impact of COVID-19 is included.

***Keywords***: *Mongolian higher education; inward export structure; China; Non-China countries; COVID-19.*

## 1. Introduction

The General Agreement on Trade in Services (GATS) classifies education services under Sector 5 of its classification system. GATS defines trade in education services through the following four modes of supply: cross-border supply, consumption abroad, commercial presence, and presence of natural persons. This framework formalizes education as a tradable commodity under international trade law. The inward export of higher education in Mongolia refers to in this article is the consumption abroad of other countries in Mongolia. With the further development of globalization, education, as a special form of service trade, has occupied an increasingly important position in international exchanges and cooperation. The flow of international students can increase business opportunities and build trade networks, and it plays an important role in the development of the green economy and the enhancement of higher education competitiveness. However, there are few studies on Mongolia's higher education service trade, and there is currently no research on the export structure of Mongolia's higher education. In recent years, Mongolia's higher education service exports have grown steadily, but the total export volume of education service trade is still relatively low, among which inward exports to China account for the highest proportion.

Mongolia is a landlocked country bordering only China and Russia. After the transformation, Mongolia's higher education service trade has become diversified. With the continuous strengthening of political, economic, and cultural cooperation between China and Mongolia, Mongolia's higher education institutions have gradually become more attractive to Chinese students. At present, China accounts for the highest proportion in Mongolia's higher education inward export structure, followed by Russia. The promotion of the education service trade is affected by pull factors and push factors. Pull factors depend on the competitiveness and comparative advantages of education in the destination country, and push factors depend on the availability, cost-effectiveness, labor market demand, and other factors of education in the source country. Therefore, analyzing the inward export structure of Mongolia's higher education is conducive to accurately positioning the target group of education exports and has important practical significance for improving the performance of Mongolia's higher education exports.

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## 2. Literature Review

The study of education services trade, particularly in the context of globalization, has evolved significantly over the past few decades. Research in this area emerged in response to the growing recognition of education as a tradable service in the global economy. The research on education services trade can be traced back to the late 20th century, particularly in the 1990s, when the world began to experience rapid globalization, technological advancements, and the liberalization of trade. Early studies were primarily concerned with how education could be framed as an international service under the General Agreement on Trade in Services (GATS) of the World Trade Organization (WTO). Education services were included in the GATS framework, which was established in 1995, and scholars began to explore the implications of this inclusion.

Philip G. Altbach critiques the commodification of higher education under international trade frameworks like the General Agreement on Trade in Services (GATS). He argues that viewing education as a market commodity undermines its societal value, diminishing its role in fostering civic responsibility and cultural identity. Altbach highlights the risk of prioritizing profit over quality, particularly in developing countries, where foreign providers may dominate lucrative fields, leaving local institutions underfunded and marginalized. He warns of a "new neocolonialism" driven by multinational corporations, leading to a loss of educational autonomy and increased inequality. Altbach emphasizes the need to preserve education as a public good rather than treating it as a tradable service.

In The Worldwide Trend to High Participation Higher Education: Dynamics of Social Stratification in Inclusive Systems, Simon Marginson discusses how international education services trade affects economies by fostering global competition and commodifying education. He argues that this trend, while increasing cross-border participation, often reinforces social inequalities and creates economic barriers to accessing elite education. The economic impact includes both the potential for economic growth through skilled labor and the risk of exacerbating economic disparities.

Hans de Wit emphasizes the growing significance of international education services trade in shaping global higher education. He highlights that the increasing cross-border delivery of education—through initiatives like offshore campuses, student mobility, and collaborative programs—reflects the globalization of higher education systems. De Wit warns that this trend can shift the focus from educational quality and inclusivity to market-driven goals, impacting national education policies and creating competitive pressures among institutions. He underscores the need for a balanced approach that integrates internationalization while preserving the educational mission beyond commercial interests. This perspective is discussed in detail in his works, particularly in a new view of internationalization: from a Western competitive paradigm to a global cooperative strategy (2022, pp. 142-152)

Jane Knight argues that the international trade of education services goes beyond mere economic activity, involving cultural exchange and international relations. She highlights that the internationalization of education is a key driver of economic globalization but cautions against potential negative impacts, such as cultural homogenization and unequal educational quality. Knight emphasizes the need for a balance between economic benefits and educational integrity, advocating for fair access and cultural diversity in international education. She also stresses that cross-border education should foster collaboration rather than competition. To achieve this, Knight calls for clear policy frameworks that ensure both quality education and respect for cultural differences. These scholars have adopted a variety of methods in their research on education service trade, including empirical research, case analysis, quantitative modeling, policy analysis, etc. Overall, the scholars' research mainly focuses on the following aspects: The impact of education service trade on national economy, employment and international competitiveness, student mobility, talent mobility, cultural exchange and educational equity, the international legal and policy environment of education service trade, especially how to balance marketization and education quality assurance, and the possibility that education service trade may aggravate the imbalance of global education resources, especially the gap between developed and developing countries, etc. These studies provide important theoretical support and policy recommendations for the theory and practice of global education service trade.

Research on the education trade by both domestic and international scholars primarily focuses on the economic, social, and cultural impacts of the education trade within the context of globalization. Key areas of study include international trends in education trade, the marketization of education, educational inequality, quality of education, higher education assurance and competitiveness, and brain drain. These studies address a wide range of topics. However, there is a noticeable gap in the literature when it comes to analyzing the structure of Mongolian higher educational inward export. Recent studies on post-COVID international student mobility highlight the pandemic's disruptive effects, with border closures and online shifts reducing flows by up to 50% globally in 2020-2021, particularly affecting Asian destinations (Mok et al., 2021). In China, push factors like prolonged lockdowns amplified outbound mobility intentions once restrictions eased, while pull factors in host countries such as Mongolia—affordability and regional proximity—facilitated quicker recovery (Di Pietro & Perez-Encinas, 2023). These trends underscore vulnerabilities in emerging markets like Mongolia, where non-China student declines persisted post-2021, emphasizing the need for diversified export structures (Goris, 2020).

### 2.1 Theoretical framework and hypotheses

General Agreement on Trade in Services (GATS) in Educational Services Trade

The General Agreement on Trade in Services (GATS) is a crucial agreement under the framework of the World Trade Organization (WTO), aiming to promote the liberalization of global trade in services. As an essential component of service trade, educational services are directly affected by GATS. I will summarize the basic framework of GATS, the classification of educational services trade, the impact of GATS on educational services trade, and related research.

Basic Framework of GATS and Classification of Educational Services Trade

GATS categorizes trade in services into four modes: Cross-border supply (Mode 1), Consumption abroad (Mode 2), Commercial presence (Mode 3), and Presence of natural persons (Mode 4). The trade of educational services primarily involves the following modes:

Cross-border supply (Mode 1)

This refers to educational services delivered remotely, such as online courses and distance education. Knight (2002), in the Journal of Studies in International Education, pointed out that Mode 1 plays a crucial role in the internationalization of higher education, particularly with the rise of online education (p.12).

Consumption abroad (Mode 2)

This involves students traveling to foreign countries for education, commonly known as study abroad services. Altbach and Knight (2007), in the Journal of Studies in International Education, emphasized that Mode 2 is the dominant form of educational services trade, influenced by national education and visa policies (p.34).

Commercial presence (Mode 3)

This occurs when educational institutions establish branch campuses or engage in joint ventures abroad. McBurnie and Ziguras (2007), in

Transnational Education: Issues and Trends in Offshore Higher Education, analyzed the growth of Mode 3, noting that cross-border education partnerships have become a key avenue for higher education internationalization (p.56).

Presence of natural persons (Mode 4)

This involves teachers, lecturers, or educational professionals providing services in other countries. Kelo et al. (2006), in the Journal of Studies in International Education, studied the role of Mode 4 in education trade, highlighting its importance in short-term teaching and academic exchange programs (p.78).

Push-Pull Theory

Push-Pull Theory is an important framework for explaining migration and international student mobility. The theory was first systematically introduced by Lee (1966) in Theory of Migration and later refined by scholars such as Bogue (1977). Push-Pull Theory posits that migration results from the combined effects of push and pull factors (Lee, 1966, p.47). Push factors refer to unfavorable conditions in the place of origin, such as economic underdevelopment and political instability, while pull factors refer to the attractions of the destination, such as job opportunities and educational resources (Bogue, 1977, p.23). Mazzarol and Soutar (2002) applied this theory to the study of international student mobility and proposed a framework of push and pull factors in the field of education (International Journal of Educational Management, p.83).

In the context of Mongolian higher education, pull factors such as cultural proximity, affordable tuition, and strengthened Sino-Mongolian political ties (e.g., through scholarships and bilateral agreements) attract Chinese students, while push factors from China include intense competition for domestic university spots and limited availability in preferred fields like business and engineering (Li & Bray, 2007). This framework guides our hypotheses by linking China's push factors to the strong correlation observed in our data.

H1: There is a moderate positive correlation between the number of students from non-China countries and the total number of international students in Mongolia.

H2: There is a strong positive correlation between the number of international students from China and the total number of international students in Mongolia.

H3: The outbreak of COVID-19 had a significant negative impact on the number of international students in Mongolia.

H4: With every increase in the number of students from China, the total number of international students studying in Mongolia is expected to increase by about 0.962.

## 3. Status and Classification of Inward Exports of Higher Education in Mongolia

The higher education system in Mongolia is dominated by national universities, supplemented by private universities. According to statistics for the 2024-2025 academic year, there are 65 higher education institutions in Mongolia, including 17 national institutions, 45 private institutions, and 2 public and religious institutions, with a total enrollment of 150,282 students. Of the total number of students, 81,571 (54.3%) are enrolled in national schools, 60,111 (40%) are enrolled in private schools, and 8,600 (5.7%) are enrolled in public and religious schools.

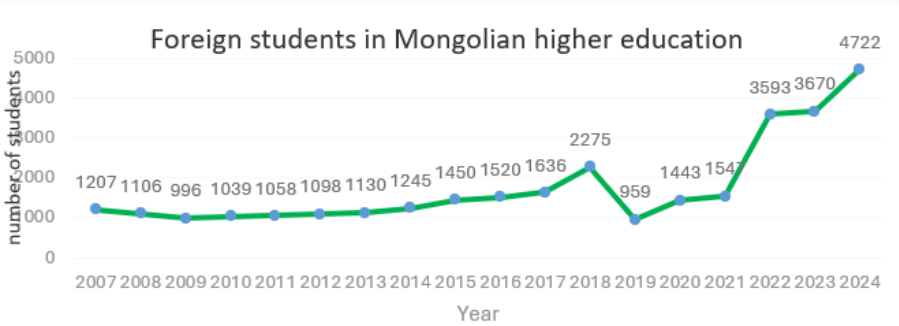



**Fig. 1:** Number of international students in Mongolian universities

Mongolian universities are constantly attracting international students. As shown in Figure 1, the number of foreign students studying in Mongolia has increased from 1,207 in 2007 to 4,722 in 2024, with an average of 1,761 students per year, an average annual growth rate of 8.3%. The number of foreign students studying abroad had dropped significantly from 2019 to 2021, and this period overlaps with the outbreak of COVID-19. During COVID-19, the closure of ports and the suspension of face-to-face teaching had a great impact on overseas study. Although the number of international students is increasing, the total number is not large. Compared with the number of university students in Mongolia, the proportion of international students is low. As shown in Figure 2, the proportion of foreign students increased from 0.80% in 2007 to 3.14% in 2024. During the study period, the proportion of foreign students was 1.14%, which is much lower than the internationalization indicator in the QS World University Rankings, in which the number of international students accounts for 5% of the weight.

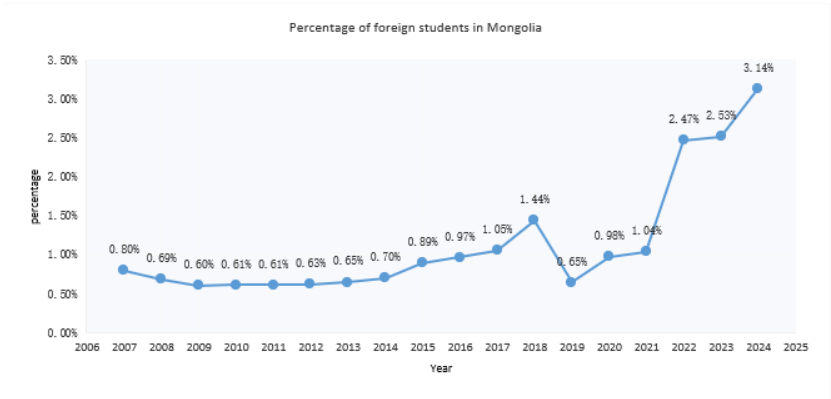



**Fig. 2:** The proportion of international students in the total number of students in Mongolian universities

According to the proportion of international students from different countries, international students in Mongolia can be divided into two groups, namely, students from China and students from non-China countries. Non-China countries refer to students from countries other than China studying in Mongolian universities. The number of countries changes every year, but the total number of students is less than that of Chinese students. Taking 2024 as an example, other countries include 31 countries, of which the top four are Russia with 473 people, South Korea with 72 people, Laos with 37 people, and Kazakhstan with 33 people. As shown in Figure 2, the proportion of international students from China in Mongolia's international students increased from 34% in 2007 to 86% in 2024. The average annual growth rate is 5.6%, the average annual number of students studying abroad is 1,163, and the average annual proportion is 56.72%. The percentage of students from non-Chinese countries studying in Mongolian higher education has dropped from 66% in 2007 to 14% in 2024, with an average annual number of 598 students, accounting for 43.3% of the annual average.

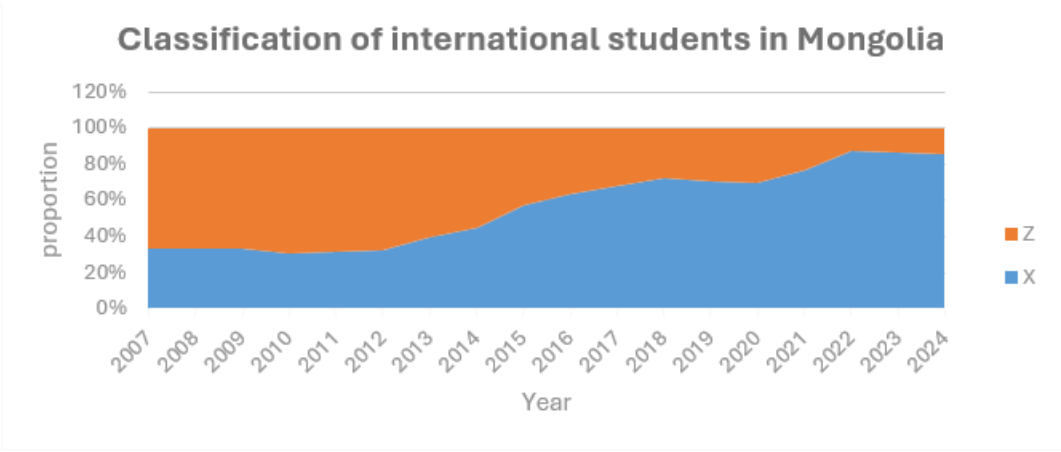



**Fig. 3:** Classification of Mongolian international students

In Figure 3, X represents the total number of Chinese students in Mongolia, and Z represents the number of students from other non-Chinese countries. The number of students from non-Chinese countries has dropped from 801 in 2007 to 670 in 2024, with the largest drop in 2019, a decrease of 357 compared to 2018. As shown in Figure 4, this is contrary to the growth trend of Mongolian higher education inward export. The number of students from non-Chinese countries has made a certain contribution to Mongolian higher education inward exports, but the degree of contribution is declining. We can conduct a correlation analysis to further confirm the correlation between the number of students from non-China countries and the number of foreign students in Mongolia.

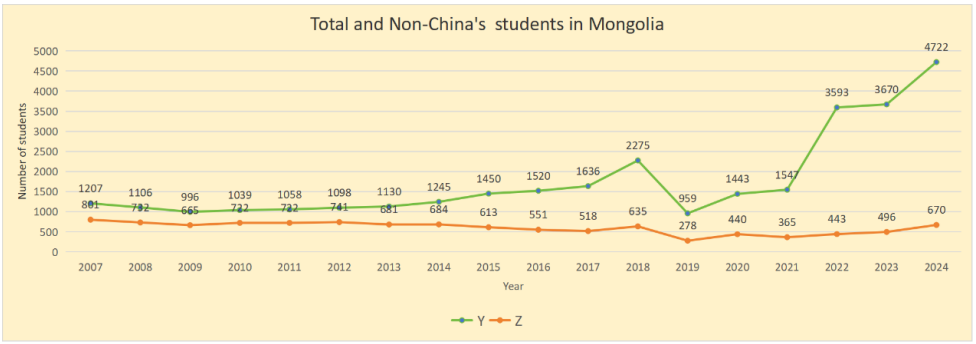



**Fig. 4:** The total number of foreign students in Mongolia and the number of students from non-China countries

# 4. Relationship between The Two Groups and The Total Number of International Students in Mongolia

## 4.1 Pearson analysis

Using the data in Figure 4 and the Pearson correlation coefficient analysis method, the linear relationship between the first group (the number of students from non-China countries in Mongolia) and the total number of international students in Mongolia is analyzed. Its value range is -1 to 1. 1 indicates a perfect positive correlation, -1 indicates a perfect negative correlation, and 0 indicates no linear correlation. The calculation formula of the Pearson correlation coefficient is:

$$r = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{[n\sum X^2 - (\sum X^2][n\sum Y^2 - (\sum Y^2)]}}$$

Where: X and Y are two variables (here, Y and Z), n is the number of data points, here 18. The calculated r≈is 0.45. The correlation coefficient r≈0.45 between Z and Y indicates that there is a moderate positive correlation between the two, that is, as the number of international students from non-China countries increases, the total number of students studying in Mongolia will increase, and vice versa, there is a moderate positive correlation between them. This result supported H1. Calculating the relationship between the second group (the number of international students from China) and the number of international students in Mongolia, the result is r=0.98, indicating that there is a very strong positive correlation between the number of international students from China and the number of international students in Mongolia. This result supported H2.

## 4.2 The impact of COVID-19 and Chinese students on Mongolian higher education inward exports

In recent years, Mongolian higher education institutions ' inward exports and the number of Chinese students studying in Mongolia have been growing. As shown in Figure 5, Y represents the number of students studying in Mongolian universities, X represents the number of Chinese students studying in Mongolian universities, the horizontal axis represents the year, and the vertical axis represents the number of students. From the graph, the number of students from China has increased from 406 in 2007 to 4052 in 2024, with an average annual number of 1235. The trend of Mongolian higher education inward exports is basically the same as that of the number of students from China. From 2007 to 2024, the average annual growth rates were 8.2% and 14.5% respectively, which shows that the trend of Mongolian higher education inward exports depends on the influence of China. This alignment reflects push-pull dynamics: From China, push factors like high domestic enrollment pressure and economic incentives for regional study (Mazzarol & Soutar, 2002) drive students outward, while Mongolia's pull factors—geographic proximity, lower costs compared to Western destinations, and cultural similarities—enhance its attractiveness (Bodycott, 2009). Our regression results (coefficient of 0.952 for Chinese students) empirically support this, indicating that increases in Chinese enrollment directly amplify total inward exports. The number of students studying in Mongolia from 2019 to 2022 can fully illustrate this impact. Due to the outbreak of COVID-19, from January 23, 2020, when Wuhan officially announced the lockdown, to December 5, 2022, when the epidemic was fully lifted, the number of students studying in Mongolia dropped significantly, but it did not return to zero. The reason is that many people continue to study through online courses, which can greatly reduce time and monetary costs. The China Education Certification Service Center recognizes the academic qualifications and degrees obtained through online learning during a special time. This move has stimulated the enthusiasm of those who intend to study in Mongolia. This is an important reason for the surge in the number of foreign students studying in Mongolia before the lockdown. China has the longest control period for COVID-19, and international students from other countries have also been affected by COVID-19, but from the Z curve in Figure 3, the number of students studying abroad has begun to increase. A model is established to analyze the impact of Mongolia's inward exports of higher education on China.

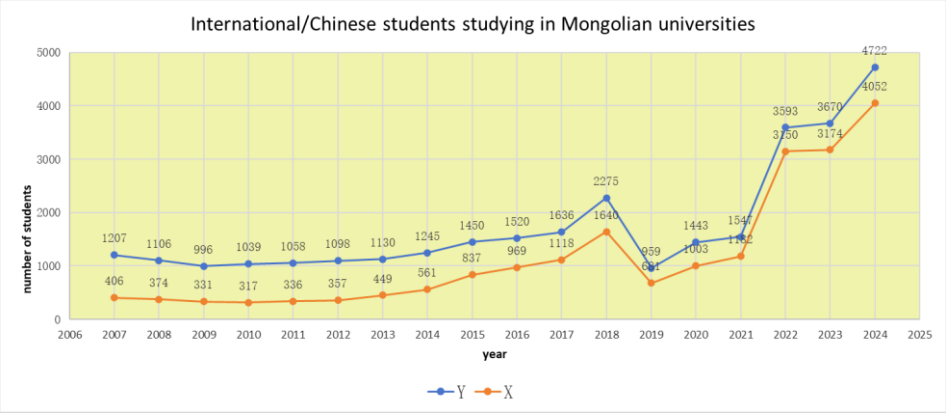



**Fig. 5:** The total number of foreign students in Mongolia and the number of students from China

## 4.3 Model building

According to the characteristics of the variables, a univariate linear regression model is built. Y represents the number of students studying abroad in Mongolian universities, which is the explained variable. X represents the number of Chinese students studying in Mongolia, which is the explanatory variable. C1 is the interception term, C2 is the coefficient of X, which indicates the impact of X on Y. COVID is a dummy variable, which indicates the outbreak of COVID-19 in 2019. C3 is the coefficient of COVID, which indicates the impact of COVID on Y.

Model equation:

Y = C1 + C2*X + C3*COVID

The result of the regression analysis using Eviews is:
Y = 702.34195229 + 0.95234744705*X - 295.817880039*COVID

Sample: 2007 2024
Included observations: 18

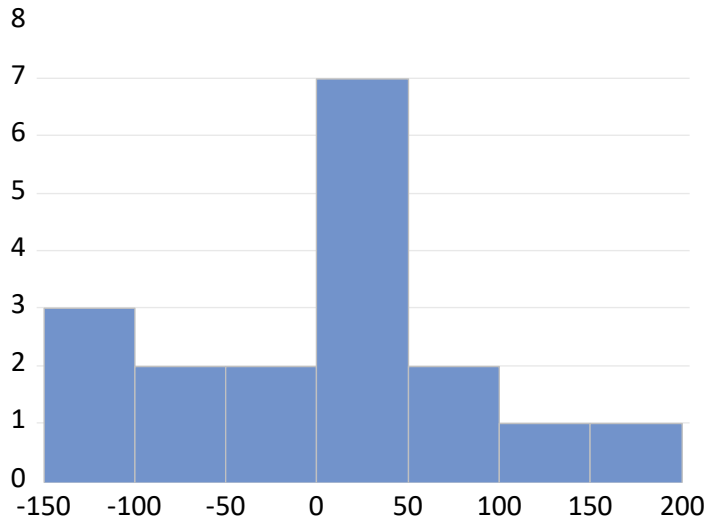
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 702.3420 | 31.31635 | 22.42732 | 0.0000 |
| X | 0.952347 | 0.018412 | 51.72468 | 0.0000 |
| COVID | -295.8179 | 54.34416 | -5.443416 | 0.0001 |

| | | | |
|---|---|---|---|
| R-squared | 0.994619 | Mean dependent var | 1760.778 |
| Adjusted R-squared | 0.993901 | S.D. dependent var | 1096.342 |
| S.E. of regression | 85.61837 | Akaike info criterion | 11.88869 |
| Sum squared resid | 109957.6 | Schwarz criterion | 12.03708 |
| Log likelihood | -103.9982 | Hannan-Quinn criter. | 11.90915 |
| F-statistic | 1386.225 | Durbin-Watson stat | 1.418035 |
| Prob(F-statistic) | 0.000000 | | |

Based on the results of regression analysis, we can analyze the total number of foreign students Y studying in Mongolia, the number of students X from China and the impact of COVID-19. The following is a detailed explanation of the results: The constant term coefficient is 702.3420. When the number of students X from China and the impact of COVID-19 are zero, the baseline value of the total number of foreign students studying in Mongolia is 702.3420. The coefficient of the number of students X from China is 0.962347, that is, for every increase in the number of students from China, the total number of foreign students studying in Mongolia is expected to increase by about 0.962. This shows that the number of students from China has a significant positive impact on the total number of foreign students in Mongolia. The t-statistic is 51.72468, and the p-value is 0.0000. The t-statistic is very high and the p-value is very small (less than 0.05), indicating that the impact of the number of students from China on the total number of foreign students in Mongolia is statistically significant. The coefficient of COVID is -255.8179, which means that the outbreak of COVID-19 has caused a decrease of about 295.82 students in the total number of foreign students in Mongolia. COVID-19 had a significant negative impact on the total number of foreign students studying in Mongolia. The t-statistic is -5.443416, and the p-value is 0.0001. The absolute value of the t-statistic is high, and the p-value is very small (less than 0.05), indicating that the impact of COVID-19 on the total number of foreign students in Mongolia is statistically significant. The model fit R-squared is 0.994619. Indicates that the model explains 99.46% of the variation in the total number of foreign students studying in Mongolia. This means that the model fits the data very well. The adjusted R-squared is 0.993901, and after considering the number of independent variables, the model still explains 99.39% of the variation. F-statistic: 136.225, Prob(F-statistic): 0.000000, the F-statistic is very high and the p-value is very small, indicating that the entire regression model is statistically significant, that is, the independent variable explains the dependent variable. The Durbin-Watson statistic is 1.418, close to 2, indicating that there is no obvious autocorrelation in the residuals.
In summary, the model shows that the number of Chinese students in Mongolia has a significant positive impact on the number of foreign students in Mongolia, while the COVID-19 outbreak had a significant negative impact on the number of foreign students. The model has a very high fit and can well explain the changes in the number of foreign students in Mongolia. These results show that the number of students from China is an important driver of the total number of international students in Mongolia, and the COVID-19 outbreak had a significant negative impact on the total number of international students in Mongolia.

### 4.4 Model test

To ensure the reliability, accuracy, and applicability of the model, the model is tested for residual normal distribution, heteroscedasticity, and autocorrelation.
Residual normality test




Residual analysis is an important step in evaluating the goodness of fit of the regression model and hypothesis testing. The following is an explanation and analysis of the various statistics: The mean value is -2.07e-13, and the mean of the residuals is close to zero, which is a good feature of the regression model, indicating that the average difference between the model's predicted values and the actual values is very small. The median value is 9.599682, and the median of the residuals is positive, indicating that the residual distribution is slightly right-skewed, but overall, it is still concentrated around zero. The maximum value is 160.7462, the minimum value is -131.0664, and the range of residuals is from -131.07 to 160.75, indicating that there is a large difference between the model's prediction and the actual value in some observations. The standard deviation is 80.42446, and the standard deviation indicates the degree of dispersion of the residuals. This value is large, indicating that the model's prediction error is large. The skewness value is 0.093387, and the skewness is close to zero, indicating that the residual distribution is basically symmetrical and there is no obvious skewness. The kurtosis value is 2.357368, and the kurtosis is less than 3, indicating that the tail of the residual distribution is lighter than the normal distribution, that is, there are fewer extreme values. The statistic of the Jarque-Bera test is 0.335895, p-value: 0.845398, and the Jarque-Bera test is used to test whether the residuals follow a normal distribution. The p-value is 0.8454, which is much larger than 0.05, indicating that we cannot reject the null hypothesis that the residuals follow a normal distribution. This means that the residual distribution is close to a normal distribution, which is consistent with the basic assumptions of the regression model.

Overall, the residual analysis shows that the regression model has a good fit and the residual distribution is close to a normal distribution, but there are large prediction errors on some observations. This may suggest that we need to further check whether the model has omitted important explanatory variables or whether there are other factors that affect the total number of foreign students.

Heteroskedasticity test for residuals

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

| | | | |
|---|---|---|---|
| F-statistic | 2.200032 | Prob. F(4,13) | 0.1258 |
| Obs*R-squared | 7.266118 | Prob. Chi-Square(4) | 0.1225 |
| Scaled explained SS | 3.424583 | Prob. Chi-Square(4) | 0.4894 |

According to the results of the heteroscedasticity test (White test), we can analyze whether there is heteroscedasticity in the regression model. Heteroscedasticity refers to the variance of the error term changing with the change of the independent variable, which may affect the validity of the regression coefficient and the accuracy of statistical inference. The following is the explanation and analysis of each statistic: The p-value of the F-statistic is 0.1258, which is greater than the commonly used significance level of 0.05, indicating that we cannot reject the null hypothesis (that is, the model has homoscedasticity). The p-value of Obs*R-squared is 7.266118, and the p-value is 0.1225, which is also greater than 0.05, further supporting the conclusion that the null hypothesis cannot be rejected. The p-value of Scaled explained SS is 0.4894, which is much greater than 0.05, again indicating that we cannot reject the null hypothesis, that is, the model does not have significant heteroscedasticity.

Since there is no significant heteroscedasticity, the coefficient estimation of the regression model is valid, and the statistical inference is reliable, and no further heteroscedasticity correction is required.

Autocorrelation test of residuals

Sample: 2007 2024
Included observations: 18

| Autocorrelation | Partial Correlation | | AC | PAC | Q-Stat | Prob |
|---|---|---|---|---|---|---|
| | | 1 | 0.110 | 0.110 | 0.2570 | 0.612 |
| | | 2 | -0.091 | -0.104 | 0.4432 | 0.801 |
| | | 3 | 0.077 | 0.102 | 0.5870 | 0.899 |
| | | 4 | 0.100 | 0.071 | 0.8466 | 0.932 |
| | | 5 | -0.132 | -0.141 | 1.3268 | 0.932 |
| | | 6 | 0.129 | 0.184 | 1.8224 | 0.935 |
| | | 7 | -0.167 | -0.277 | 2.7341 | 0.908 |
| | | 8 | -0.197 | -0.089 | 4.1266 | 0.846 |
| | | 9 | -0.245 | -0.280 | 6.5208 | 0.687 |
| | | 10 | -0.130 | -0.146 | 7.2780 | 0.699 |
| | | 11 | -0.104 | -0.031 | 7.8385 | 0.728 |
| | | 12 | -0.042 | -0.123 | 7.9440 | 0.789 |

According to the results of autocorrelation and partial autocorrelation analysis, we can perform the following analysis on the autocorrelation of time series data: Autocorrelation (AC) and partial autocorrelation (PAC): The AC and PAC columns in the table represent the autocorrelation and partial autocorrelation coefficients, respectively. These coefficients reflect the correlation of time series data at different lags. The Q statistic is used to test whether the autocorrelation is significant. The corresponding probability value (Prob) indicates the probability of observing the current Q statistic assuming that there is no autocorrelation. The probability values (Prob) corresponding to the Q statistics for the lag period of 1 to 12 periods are all greater than the common significance level (such as 0.05), indicating that we cannot reject the null hypothesis of no autocorrelation. This means that the time series data has no significant autocorrelation within the lag period of 1 to 12 periods.

In summary, the results of autocorrelation and partial autocorrelation analysis show that the time series data have no significant autocorrelation within the lag period of 1 to 12 periods. Therefore, the residuals of the model are independent, there is no autocorrelation problem, and the regression results of the model are reliable.

Residual autocorrelation test 2

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

| | | | |
|---|---|---|---|
| F-statistic | 0.299063 | Prob. F(2,13) | 0.7465 |
| Obs*R-squared | 0.791746 | Prob. Chi-Square(2) | 0.6731 |

According to the provided Breusch-Godfrey serial correlation LM test results, we can conduct the following analysis: F-statistic is 0.299063, and the corresponding probability (Prob. F (2,13)) is 0.7465. Since the probability value is greater than the common significance level of 0.05, we cannot reject the null hypothesis that the model does not have serial correlation within the second-order lag. Obs*R-squared is 0.791746, and the corresponding probability (Prob. Chi-Square (2)) is 0.6731. Similarly, since the probability value is greater than 0.05, we cannot reject the null hypothesis. The test results show that the model does not have significant serial correlation within the second-order lag. This means that the residuals of the model are independent, and there is no autocorrelation problem.

In summary, the results of the Breusch-Godfrey serial correlation LM test support the assumption of independence of the model residuals, indicating that the regression results of the model are reliable and do not need to be further dealt with the serial correlation problem.

According to the above test results and analysis, it can be concluded that the model is stable and reliable. The model is highly statistically significant, and the residual distribution is close to a normal distribution, and there is no significant heteroscedasticity problem. The model does not have significant serial correlation within the second-order lag, and the autocorrelation and partial autocorrelation analyses also show that the residuals have no significant autocorrelation within the lag period of 1 to 12. This shows that the model fits the data very well and can explain about 99.46% of the variation of the dependent variable.

## 5. Conclusion

This study aims to analyze the structure of international students studying in Mongolian higher education and provide a basis for further improving the performance of Mongolian higher education service trade inward exports. In the study, international students studying in Mongolian higher education are divided into those from China and those from other countries. The number of international students in Mongolian universities is highly positively correlated with the number of international students from China, with a Pearson coefficient of 0.98. The correlation between the number of international students from other countries and the number of international students in Mongolia is 0.45, which is a medium-strength positive correlation. These results supported H1 and H2. The regression equation between the number of foreign students studying in Mongolia and the number of students from China shows a significant positive impact. For every additional student from China, the total number of foreign students studying in Mongolia is expected to increase by about 0.952. This shows that Mongolia's inward exports of higher education are largely exported to China. The study also shows that COVID-19 has a significant negative impact on the total number of foreign students in Mongolia. The outbreak of COVID-19 has led to a decrease of about 295.82 in the total number of foreign students in Mongolia each year. The two results supported H3 and H4.

This study relies on aggregate data from official sources, lacking disaggregation by discipline, university type, or student level, which could provide deeper insights into mobility patterns (e.g., STEM vs. humanities). Additionally, the regression model demonstrates strong correlations but does not fully establish causality due to potential endogeneity (e.g., omitted variables like visa policies). Future research could employ instrumental variables or panel data to address these. The time frame (2007-2024) captures pre- and post-COVID trends but may not reflect long-term post-pandemic recovery.

## 6. Discussion

During the study period, the volume of inward exports of Mongolian higher education continued to increase, and the incremental part was mainly inward exports to China. There are two reasons for the increase in inward exports to China. The first is the pull factor, that is, the improvement of the competitiveness of Mongolian higher education has a strong attraction to international students from China. If it is due to the pull factor, then the number of international students from China and other countries should increase. But in fact, the number of international students from other countries is showing a downward trend. The impact of the pull factor can be analyzed by the relationship between the competitiveness of higher education and inward exports. The second is the push factor. The incremental volume of Mongolian higher education inward exports mainly comes from China. Therefore, it can be analyzed from the relationship between the push factors, such as the degree of demand for higher education, availability, employment pressure, and cost of Chinese students, and the volume of Mongolian higher education inward exports to China.

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## 7. Suggestions

First, the degree of internationalization of Mongolian universities is not high, and the proportion of international students is an important indicator of internationalization. The average proportion of international students during the research period was 1.14%, and the highest proportion reached 3.14% in 2024. Mongolian universities should improve the competitiveness of their educational services and continuously expand the scale of inward exports of higher education by investing in English-medium programs and faculty training (Gantogtokh, 2020). Second, the proportion of exports to China in Mongolia's inward export of higher education service trade is very high, and there is a high positive correlation. Therefore, it is necessary to comprehensively and accurately locate the target market based on the characteristics of the export structure, provide competitive and cost-effective services, and further promote the development of higher education in Mongolia. Policymakers could establish bilateral scholarship funds with China to sustain this flow while diversifying to non-China markets like Russia and Central Asia through regional MOUs. Third, to mitigate COVID-19-like disruptions, the Mongolian government should develop contingency plans, including hybrid learning infrastructure and visa flexibilities for international students, drawing from Asian post-pandemic recoveries (Mok et al., 2021). Universities can partner with tech firms for online platforms to maintain enrollment during crises. Fourth, enhance data collection on student demographics (e.g., by discipline and level) to inform targeted marketing, addressing gaps in current aggregate reporting (Baasanjav et al., 2003).

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