

IDENTIFYING THE INFLUENTIAL FACTORS IN RECRUITING INTERNATIONAL STUDENTS WITH MULTIVARIATE ANALYSIS

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ABSTRACT. *This study aims to explore influential factors which can be used to recruit international students. Based on current international students in Taiwan, this study collected 1,005 valid questionnaires from students as the main data source. Factor analysis, multivariate analysis, and multinomial logistic regression analysis were used to interpret the data. The selected push-pull factors have been found useful to interpret the phenomena of international students' reasons to study in Taiwan. The differences of the study reasons among the international students have to be analyzed with multivariate analysis. The findings suggest that students who come from countries in Asia had stronger push factors than other areas. It also found that students within countries in Asia also had differences such as students from other countries in Asia had stronger pull factors than their peers from China. Based on the logistic regression, this study found specific pull factors can be used to reinforce recruitment in different areas. The findings are useful for higher education institutes that are engaging in maintaining and attracting international students.*

Keywords: Higher education, Internationalization, International students, Inbound students, Inbound mobility

1. Introduction. This study explores factors in recruiting and retaining international students by applying the method of time series analysis. Pursuing further degrees in higher education usually provides personal gains in knowledge or wealth, but we do not know whether that might be true for international students [1]. For example, changes in educational attainment and personal incomes in developing countries have been a major factor to study abroad or pursue post-secondary education overseas. The factors in influencing international students to pursue post-secondary education overseas reflect both changes and demand in overseas institutions and future career prospects after completing post-secondary degrees [2]. According to the European Migration Network's report, the main policy for recruiting and retaining international students includes the internationalization of HEIs and increasing financial revenue for the higher education sector. The report also cited that international students could also contribute to economic growth by increasing the national pool of qualified labor and addressing specific labor shortages as well as tackling demographic change. Tuition fees may also be an obstacle to recruiting international students, in particular, those coming from low- and middle-income households [3]. Western-centric internationalization also potentially limits the host countries of international students [4,5]. Rumbley and Altbach argue that the nexus between the

local and global is increasingly crucial to understand all kinds of international initiatives as well as to comprehend the increasingly complex nature of 21st century higher education internationalization [6]. Identifying factors among the potential new students could be a crucial recruitment strategy for international students.

Among the related theories, the push-pull theory has long been used to explain the mobility of international students. Ravenstein argued that migration was governed by a ‘push-pull’ process; that is, unfavorable conditions in one place ‘push’ people out, and favorable conditions in an external location ‘pull’ them in [7,8]. Lee focused on showing possible migration between a place of origin and destination which signified pull and push factors, respectively [9]. There are many factors in both origin and host countries, namely environmental, economic, and social factors. Environmental factors refer to climate, location, land and water resources. Economic and social factors refer to situations of living standards, income, employment situation, education facilities, medical services, and transportation. Intervening obstacles include the distance between country of origin and host countries as well as lifestyle changes, different daily activities, and possible language barriers. For personal factors, we mainly focus on the migrant’s age, gender, education, occupation, income, and living environments. This study will employ the notion of push-pull theory to explore the influential factors among international students.

During the COVID-19 pandemic, various studies have focused on the issues related to educational institutions, for example, impact on education [10-12], innovative learning technology issues [13-15], and even the impact on international higher education and student mobility [16]. The COVID-19 pandemic especially has been affecting countries with underfunded health systems as well as countries with a high percentage of the at-risk population. Furthermore, the pandemic has impacted the mobility of international students. For example, some higher education institutions shut down campuses to slow down the spread of the COVID-19 pandemic. Campus closures potentially affect more than 3.9 million international students studying in OECD countries [17]. The COVID-19 lockdown has severely affected educational systems around the world, especially international student exchange programs [18]. Moreover, the pandemic has not only significantly decreased the number of international students but also impacted the mobility of international students [16]. This study attempts to explore the factors for international students to pursue education overseas as well as develops long-term strategies to recruit and retain international students.

Taking Taiwan as an example, this study found that the number of international students, also called inbound students, are increasing rapidly as Figure 1 shows. It also shows that the number of students from Asia has increased rapidly compared to other continents, as it increased 11 times from 4,900 students in 1999 to 51,828 students in 2019. The COVID-19 pandemic has impacted the growth of international students due to lockdowns and policies in their native countries and Taiwan. Thus, we observed a decrease in 2020 and most of them were from countries in Asia.

According to the MOE in Taiwan [19], the majority of international students come from Asia (72%), then Americas (15%), Europe (9%), Africa (2%), and finally Oceania (2%), as shown in Figure 2. The percentage breakdown is the average from 1999 to 2020; thus, it might be different from the annual data. Based on the reasons to study abroad in Taiwan, this study could provide strategies to recruit international students from their places of origin. A survey was designed and used to explore the research questions of this study. Given this purpose, this study intends to address the following questions.

- a) What are the main reasons for international students to study in Taiwan?
- b) Do reasons to study abroad vary among international students?
- c) Which strategy can improve and reinforce the current recruitment policy?

The rest parts of the paper are organized as follows. Section 2 describes the methodology in this study which includes research design, sampling, factor analysis, multivariate

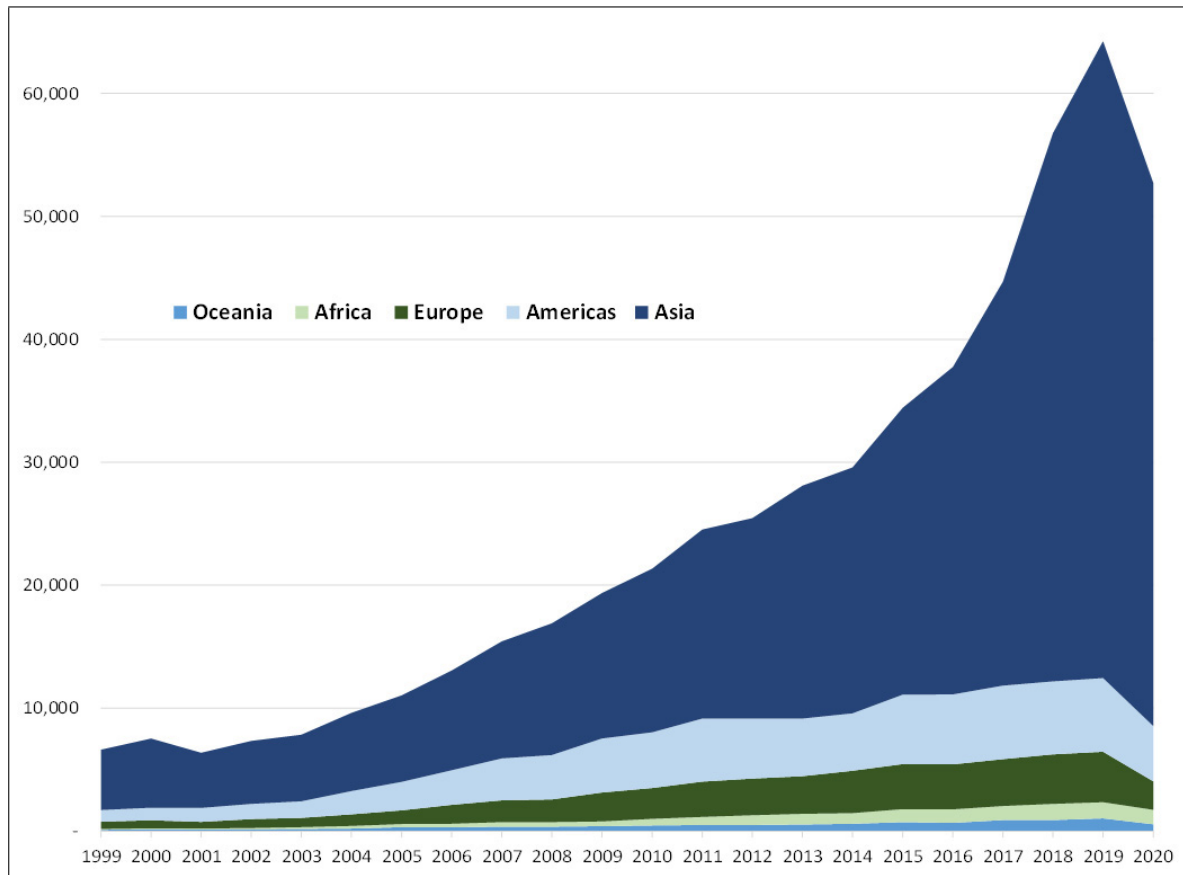


FIGURE 1. The trend of inbound students from 1999 to 2020

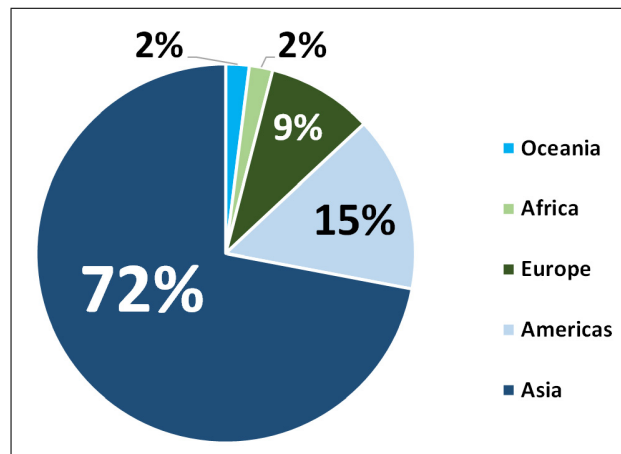


FIGURE 2. The places of origin for international students in Taiwan

analysis, and multinomial logistic regression analysis. Section 3 displays the results. Finally, Section 4 presents findings, recruitment strategies based on the findings, and directions for future study.

2. Method. This study designs a research questionnaire to conduct a survey of international students in Taiwan. The questionnaire includes demographic variables and push-pull factors of international study. By way of the views of living and study conditions, this study explores the influence factors which can be used for attracting international students in the future. We select seven factors related to push-pull factors. The factor analysis will verify the push-pull factors. The sampling technique and statistical analyses are displayed as follows.

2.1. **Sampling.** The fitted samples are collected as the following formula [20]:

$$n = \frac{N}{N \left(\frac{2d}{Z_{\alpha/2}} \right)^2 + 1}$$

The population of international students in Taiwan was 52,714 in 2020. This study sets the confidence level of 95% ($Z_{\alpha/2}$) and controls the sampling error within the range of ± 0.03 degree of freedom (d). The suggested sample for this study is 1,066 based on the controlled degree of freedom. The survey was conducted by cluster sampling technique with constituted sectors of higher education institutions based on their locations. The data collection started in November 2020 and the final sample size was 1,005 students after deleting uncompleted questionnaires and those questionnaires from students who attended non-degree programs. The final sample size consists of 36% undergraduates, 39% master students, and 25% doctoral students. The gender ratio is almost balanced where male and female students accounts for 46% and 54%, respectively. Among these students, 80% of them come from Asia (7% from China), 8% from Americas, 5% from Europe, 4% from Oceania, and finally 3% from Africa. Although this percentage does not resemble entirely the 10-year average, it reflects a similar trend in recent years. When we compare the similar samples and population in different areas, the result reveals the Pearson Chi-square is .220 which means the distribution of samples is similar to the population.

2.2. **Factor analysis.** Factor analysis attempts to identify underlying variables that explain the pattern of correlations within a set of observed variables. Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance that is observed in a much larger number of manifest variables. In this study, we selected seven factors related to the push-pull theory to interpret the reasons to study in Taiwan among the international students. Factor analysis was used to determine which factors belong to push or pull dimension. This study will select fitted method for factor analysis with SPSS (Statistical Package for Social Science). Typically, the factor analysis procedure offers the following functions.

- Seven methods of factor extraction are available.
- Five methods of rotation are available, including direct oblimin and promax for nonorthogonal rotations.
- Three methods of computing factor scores are available, and scores can be saved as variables for further analysis.

2.3. **Multivariate analysis.** The first step is to check the data to examine whether it is appropriate for the research design and analysis. For dependent variables, the data are a random sample of vectors from a multivariate normal population; in this population, the variance-covariance matrices for all cells are the same. Analysis of variance is robust in normality, even the data is not exactly symmetric. The homogeneity of variances tests is applied to examining the data. In this study, such a test is based on Box's test of equality of covariance matrices. The General Linear Model (GLM) multivariate procedure provides regression analysis and analysis of variance for multiple dependent variables by one or more factors or covariates. The population is divided into different groups by factors. The GLM is applied to examining the null hypotheses about the effects of factor variables on the means of various groupings of a joint distribution of dependent variables [21]. The multivariate analysis of variance uses Pillai's trace, Wilks' lambda, Hotelling's trace, and Roy's largest root criterion with approximate F statistic. The univariate analysis of variance for each dependent variable is also provided. After testing the significance of the overall F test, post hoc tests are applied to evaluating differences among specific means. The Turkey significant difference tests are commonly used to conduct multiple

comparison tests. The Turkey test enables all pairwise comparisons between groups and sets the experiment-wise error rate to the error rate for the collection for all pairwise comparisons. When the cell sizes are unequal, Dunnett’s T3 will be suggested.

2.4. Multinomial logistic regression analysis. Multinomial logistic regression is used to classify subjects based on the values of a set of predictor variables. This type of regression is more general because the dependent variable is not restricted to two categories. The dependent variable should be categorical. Independent variables can be factors or covariates. In general, factors should be categorical variables and covariates should be continuous variables. It is assumed that the odds ratio of any category is independent of all other response categories. In SPSS or Minitab, it allows the stepwise method to generate the logistic regression models. The odds ratio of the logistic regression equation can be addressed as follows:

$$p(\text{areas}) = \exp(Y') / (1 + \exp(Y'))$$

Y' refers to the independent variables, and in this study, it represents the push and pull factors; p represents the $\exp(B)$ in terms of odds ratio in different areas of international students. In general, the areas needed to be assigned one reference area to compare in the model. In this study, the area differences will be examined in the logistic regression models.

3. Results.

3.1. Factor extraction. Among the seven factors related to the push-pull factors, factor analysis indicated Kaiser-Meyer-Olkin’s measure of sampling adequacy is .686, and Bartlett’s test of sphericity shows approximately Chi-square is 908.396 ($p = .000$). The targeted 1,005 samples are fitted to conduct factor analysis. Table 1 demonstrates the result of factor analysis based on the principal component analysis. The result reveals that “for better living conditions”, “political reasons”, “family reasons”, and “difficulty of finding employment in home country” belong to the push factor; while “study or professional reason”, “fondness for life and culture” and “scholarship and funding” belong to the pull factor.

TABLE 1. Component matrix of principal component analysis

Factors	Component	
	Push_factor	Pull_factor
4. For better living conditions	.720	
6. Political reasons	.632	
5. Family reasons	.627	
3. Difficulty of finding employment in home country	.615	
1. Study or professional reason		.688
2. Fondness for life and culture		.538
7. Scholarship and funding		.510

3.2. Effects of push and pull factors. Six areas of international students’ country of origin will be combined into three regions, namely (1) Asia (730 cases), (2) Others (205 cases), and (3) China (70 cases), which include Europe, Americas, Oceania, and Africa, as the basis for multivariate analysis. The Box’s test of equality of covariance matrices shows Box’s $M = 5.505$, $F = 0.911$, $p = .486$. It implies that the observed covariance matrices of the dependent variables (three areas) are equal across groups. The result of multivariate analysis reveals that push and pull factors among the three areas are different. The Pillai’s Trace = 1.008 ($F_{(6,2004)} = 339.349$, $p = .000$), Wilks’ Lambda =

0.018 ($F_{(6,2002)} = 2158.601, p = .000$). Table 2 and Figure 3 show the results of multiple comparisons among the three different areas with their push and pull factors. The result reveals that areas including Asia and Others have significant differences in push factors. Within Asia, other countries in Asia and China also have differences in pull factor.

TABLE 2. Multiple comparisons among the three areas with push and pull factors

Variable	(I) group	(J) group	Mean (I-J)	Std. Error	Sig.	95% confidence interval	
						Lower bound	Upper bound
Push_factor	1. Asia	2. Others	.3601*	.06301	.000	.2090	.5112
		3. China	.1289	.09974	.589	-.1103	.3681
	2. Others	1. Asia	-.3601*	.06301	.000	-.5112	-.2090
		3. China	-.2312	.11035	.109	-.4958	.0334
	3. China	1. Asia	-.1289	.09974	.589	-.3681	.1103
		2. Ohters	.2312	.11035	.109	-.0334	.4958
Pull_factor	1. Asia	2. Others	.0364	.04650	1.000	-.0751	.1479
		3. China	.1902*	.07360	.030	.0137	.3667
	2. Others	1. Asia	-.0364	.04650	1.000	-.1479	.0751
		3. China	.1538	.08144	.178	-.0415	.3491
	3. China	1. Asia	-.1902*	.07360	.030	-.3667	-.0137
		2. Ohters	-.1538	.08144	.178	-.3491	.0415

Note: *The mean difference is significant at the .05 level.

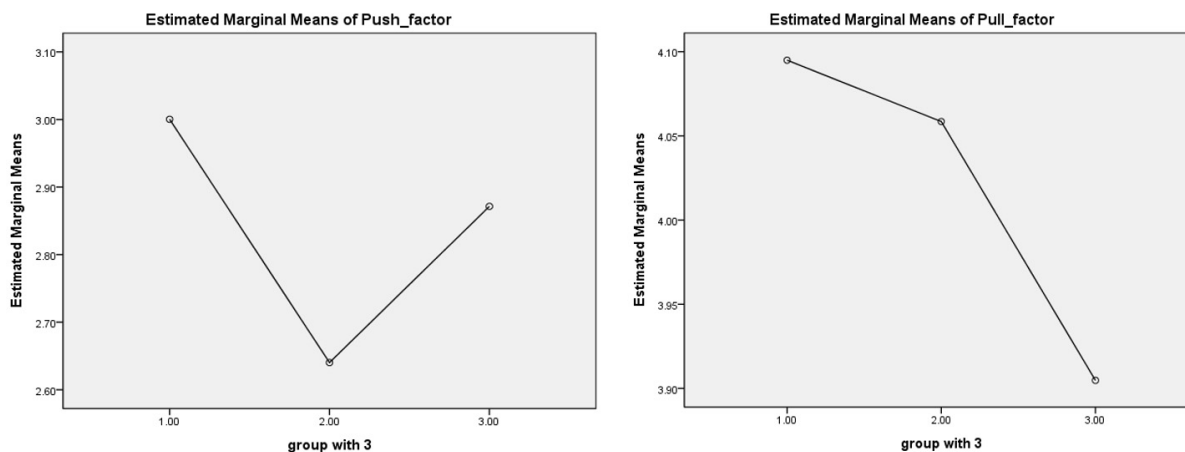


FIGURE 3. Comparison of push-pull factors among Asia (1), Others (2) and China (3)

3.3. Selecting the main impact factors. The result of multinomial logistic regression reveals that the proposed model is fitted based on the final criteria AIC, BIC, and -2 Log-likelihood. The likelihood ratio test shows that both push and pull factors are significant. The parameter estimates of multiple logistical regression are displayed in Table 3. The pull factor of China, Asia, as well as push-pull factors of Others are significant. The $\exp(B) = 1.631$ (Odds ratio) in Asia’s pull factor, implies Taiwan with a stronger pull factor for inbound students from countries in Asia compared to that of China. In this sense, the Others shows a negative B ($B = -.421, p = .012$) in push factor and positive B ($B = .560, p = .000$) in pull factor. The negative push factor in Others (2) indicates the

reasons for students from those places of origins to leave their home countries to Taiwan are different from their peers who come from China. The result reveals that the inbound students who come from other areas have stronger pull factors than their peers who come from China.

TABLE 3. Parameter estimates of multiple logistical regression

Group with 3 ^a		B	Std. Error	Wald	df	Sig.	exp(B)	95% confidence interval for exp(B)	
								Lower bound	Upper bound
1. Asia	Push_factor	.132	.152	.753	1	.386	1.141	.847	1.538
	Pull_factor	.489	.114	18.275	1	.000	1.631	1.303	2.041
2. Others	Push_factor	-.421	.168	6.244	1	.012	.657	.472	.913
	Pull_factor	.560	.123	20.590	1	.000	1.750	1.374	2.229

Note: ^aThe reference category is: 3. China

Regarding the pull factors that were provided by the host countries, this study found that professional development could be an important strategy to recruit and retain students from countries in Europe, Americas, Oceania, and Africa. In order to recruit and retain students from countries in Asia, the findings suggest that both institutional programs and scholarship/funding are influential factors. The details of influential factors to recruit and retain international students are listed in Table 4.

TABLE 4. Logistic regression analysis for pull factors

Predictor	Coef	SE Coef	Z	P	Odds ratio	95% CI	
						Lower bound	Upper bound
Logit 1: (2. Others/3. China)							
Constant	-0.821566	0.951995	-0.86	0.388			
1. Study or professional reason	0.625620	0.193243	3.24	0.001	1.87	1.28	2.73
2. Fondness for life and culture	-0.221212	0.198766	-1.11	0.266	0.80	0.54	1.18
7. Scholarship and funding	0.0500133	0.144714	0.35	0.730	1.05	0.79	1.40
Logit 2: (1. Asia/3. China)							
Constant	0.432954	0.841774	0.51	0.607			
1. Study or professional reason	0.537026	0.169845	3.16	0.002	1.71	1.23	2.39
2. Fondness for life and culture	-0.331218	0.180571	-1.83	0.067	0.72	0.50	1.02
7. Scholarship and funding	0.283966	0.132387	2.14	0.032	1.33	1.02	1.72

For gender differences, the logistic regression demonstrates $P(female) = \exp(Y') / (1 + \exp(Y'))$ as follows:

$$Y' = 0.1032 (2. Fondness for life and culture) - 0.1444 (4. For better living conditions) + 0.2562 (5. Family reasons) - 0.1781 (6. Political reasons)$$

Based on the stepwise method, the result of odds ratios for continuous predictors in the proposed logistic regression model is displayed in Table 5.

4. Conclusions. This study explores the influential factors which can be used for recruiting international students. The sample size consists of 1,005 international students, and their responses were used to address the research questions of this study. The selected push-pull factors were verified by factor analysis and were used to interpret the reasons of international students to study in Taiwan. Multivariate analysis was used to examine

TABLE 5. The odds ratios for continuous predictors in the stepwise model

Push-pull factors	Odds ratio	95% CI
2. Fondness for life and culture	1.1087	(0.9991, 1.2304)
4. For better living conditions	0.8655	(0.7707, 0.9719)
5. Family reasons	1.2920	(1.1418, 1.4620)
6. Political reasons	0.8369	(0.7387, 0.9480)

the differences among students' reasons to study abroad. Based on the logistic regression, this study found that specific pull factors can be used to reinforce recruitment strategies for international students based on their places of origin. The findings are useful for universities in Taiwan to recruit and retain international students. This study provides an example to explore similar issues in different higher education settings. The selected influential factors can be extended to the other settings, for example, immigration policy and employment opportunities. The COVID-19 pandemic might decrease students' willingness to study abroad due to the uncertainty of obtaining student visas and difficulty of travel. The COVID-19 pandemic might also decrease the effectiveness of recruitment policies for international students. For further studies, it is recommended to examine the effectiveness of implementing the related inbound recruitment policies in Taiwan.

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