Stay or Return?: Key Decision Factors of Foreign STEM Talents in Korea

Jungbu Kim* & Seong Soo Oh**

Abstract

Korea has pursued an aggressive policy of inviting more foreign-born students to its universities since the late 1990s in the wake of the globalization of education markets and its changing demographic structure. While increasingly more students from Asia come to Korea for study, more than half of the graduates return home upon graduation. Given the issues of brain drain, brain circulation, and knowledge transfer that are raised by such a high return rate, this paper examines the factors that frame the foreign students' decision on their post-graduation careers. By analyzing survey data, we report that Asian students majoring in science, technology, engineering, and mathematics (STEM) are more likely to return than non-STEM majors. This suggests that Korea's aggressive policies of inviting foreign-born students have contributed to brain circulation and knowledge transfer between Korea and the other Asian countries. We also find that scholarships from Korean sources and positive attitudes toward Korean culture and life increase their inclination to stay in the country upon graduation. These findings, however, raise more questions than answers, since it becomes obvious that their post-graduation decisions are highly affected by what Korea as a society provides.

Keywords
Korea, foreign talents, science and engineering, brain drain, post-graduate career

* Professor, Public Management and Policy Analysis Program, International University of Japan, Minami Uonuma-shi, Japan, j.kim@iuj.ac.jp
** Corresponding author, Assistant Professor, Public Administration/Graduate Program of Science and Technology Policy, Hanyang University, Seoul, Korea, ohseongsoo@hanyang.ac.kr

1. INTRODUCTION

Human capital developed through higher education, especially in the fields of science, technology, engineering, and mathematics (STEM) is widely recognized as the fundamental for a country's economic competitiveness (U.S. Congress Joint Economic Committee 2012; Wadhwa, Rissing, Saxenian, & Gereffi, 2007). As such, global competition for attracting highly skilled talent is getting increasingly fierce (Basri & Box, 2008; Douglass & Edelstein, 2009; Hawthorne, 2010). Since the late 1990s, the Republic of Korea (hereafter Korea) has joined this global competition for talent especially with the advent of the World Trade Organization (WTO) regime and the 1997 Asian financial crisis (Byun & Kim, 2011), by aggressively pursuing internationalization of Korean universities. This turn has also coincided with a changing population structure and an intensifying trend in losing brighter students to universities in developed countries.

In pursuit of the policy goal of internationalizing higher education, indexes of internationalization have been developed and utilized in evaluating universities, for example, by the Ministry of Education, Science and Technology and by *Joongang-Ilbo*, a national daily newspaper. The indexes consist of the numbers of foreign students enrolled in degree programs and exchange students sent to and invited from foreign universities.[1] University evaluation scores and their rankings are of critical importance in recruiting students and securing funding from the government. Accordingly, universities have scrambled to set up collaborative arrangements with foreign universities to improve scores on such measures and to advertise abroad to attract more students, which amounts to policy-induced distortions of university incentives.

With such policy initiatives, foreign students at Korea's universities around the country no longer present a new phenomenon. As of 2013, there are 56,715 foreign students in Korea enrolled in degree programs, the large majority (91%) of whom came from Asian countries, including China, Japan, Vietnam, and Mongolia, among others. More notably, about 24.3% of those Asian students are studying one in the STEM fields, more than half of who return home upon graduation with improved technical knowledge and relational capital. Those students from Asia can be messengers of S&T knowledge and cultural values from Korea, transforming Korea's role in the Asian neighborhood. Although Korea has aggressively pursued attracting foreign students over the past fifteen years, its potential for knowledge transfer to source countries of those students has drawn scholarly attention from neither the education nor science and technology (S&T) policy perspectives. This paper aims to fill this lacuna focusing on STEM-field foreign students in Korea and their post-graduation decisions on stay versus return-home. Specifically, it explores 1) what factors can explain this surge of foreign-born students over the last decade, especially in STEM fields and 2) why foreign students in Korea tend to return home upon completion of the degree rather than staying, focusing on the socio-economic and field-of-study factors with which those students are faced in Korea. In doing so, it resorts to theories and empirical evidence in international mobility of students.

[1] Ironically enough, research collaboration with foreign universities and their faculty is not part of such indexes.

For empirical analysis, we utilize a two-pronged approach. First, by reviewing previous studies and key policy documents, we identify key socio-economic factors that have driven the Korean government and universities toward internationalization including inviting more foreign students. Second, we conduct a survey of foreign students at Hanyang University to examine their intentions to stay in Korea or return home upon graduation, as conditioned by their field of study, their attitudes toward Korean people/culture, and policies/services provided by the Korean government and universities.

The remainder of this paper is organized as follows: the next section surveys Korea's internationalization policies regarding higher education and its aggressive pursuit of international students since the late 1990s. A brief review of international mobility of talent, especially as related to post-graduation decisions of foreign students, is provided in Section III. With a description in Section IV of our survey methodology, we present and discuss the survey results and analytical findings in Section V. Section VI concludes the paper and debates some policy implications.

2. POLICY DEVELOPMENTS

It was not until the late 1990s that the Korean government started to pay attention to incoming foreign-born students. In response to the establishment of the WTO in 1995, the Korean government introduced the May 31 Education Reform Plan of 1995 (the Plan), which aims to deregulate and marketize higher education (Byun & Kim, 2011). Coupled with this measure, the 1997 Asian financial crisis and the nation's declining birth rate served as a momentum to find a way to attract foreign-born students. The then-unprecedented foreign currency and financial crisis discouraged domestic students from studying abroad while making the government grope for a way to attract more foreign-born students to domestic universities. In addition, the government generously approved the establishment of new universities as well as additional slots for existing universities according to the Plan, even when the number of high school graduates has been decreasing over the last two decades because of the dwindling birth rate.

Under these circumstances, the Korean government introduced a series of policy initiatives to internationalize higher education and to attract more foreign students. One of the key policy initiatives is the Comprehensive Measures for Attracting Foreign-born Students which sought to increase the number of incoming foreign students to 50,000 by 2010. The other is a series of Study Korea Projects in 2004 and 2012. In an effort to strengthen the competitiveness of domestic universities and to improve declining competition in university entrance, the first Study Korea Project aggressively pursued to attract more foreign-born students and to build networks abroad through alumni population in different countries. The key measures of the project include 1) expanding scholarship and invitation programs, 2) building networks abroad, 3) providing better information systems and study fairs, and 4) updating student support services. The following Study Korea 2020 Project, introduced in 2012, aims to increase foreign-born students to 200,000 by 2020,[2] with an emphasis on nurtur-

[2] The project intends to increase the percent of foreign students from 2 percent in 2009 to 5.4 percent in 2020.

ing global Korea-friendly networks. Interestingly, unlike other countries such as the U.S., Canada, and Australia that seek foreign students to address skills shortages in the domestic market (Gribble, 2008), the Ministry of Education, Science and Technology[3] does not seem to ponder a possibility that the foreign-born students in Korea would eventually add to the domestic stock of skilled talent (Ministry of Education, Science and Technology, 2012a).

To invite talented foreign-born students, the Korean government has been expanding the Global Korea Scholarship (GKS). Since it was introduced in 1967, more than 4,000 students have benefited from this program up to 2012 (Ministry of Education, Science and Technology, 2012b). The action plan of the Study Korea 2020 Project includes increasing the number of GKS beneficiaries to 1,000 per year by 2015. In 2012, about 31 percent of its beneficiaries were invited to study in a STEM field, all in graduate programs. In parallel, to improve the support system of each university for foreign students, the government introduced the International Education Quality Assurance System (IEQAS) in 2011. The IEQAS certifies the capacity of individual universities in managing and supporting foreign students based on a variety of criteria such as foreign students' dropout rate, diversity, and dormitory availability. According to the Ministry of Education, Science and Technology (2013), twenty-six universities and four technical colleges were certified in 2012.

Encouraged in part by these policy initiatives, Korean universities have aggressively sought after foreign students since the late 1990s. As shown in Table 1, the number of foreign students has markedly increased over the last ten years from 16,832 in 2004 to 85,923 in 2013 including students at language programs. The majority of them were from Asian countries, especially from China, taking up 68 percent of all the foreign students in 2013. Students from the U.S. and Canada have also increased by more than four times over the same period, but their share in the total has remained below 5 percent. Such high dependence on Chinese students may pose a policy challenge given that the Korean government originally intended to nurture a global network of alumni from Korean universities. It may also have further implications for the competition between two countries in industries like ship-building and electronics. As of 1 April 2013, about 90.8 percent of international students enrolled in the degree programs have come from Asian countries. This may reflect the reality that the internationalization efforts by Korean universities and the government are largely limited to Asian countries.[4]

[3] With the inauguration of the new Park Geun-hye Administration in February, 2013, the ministry was divided into two ministries: the Ministry of Education and the Ministry of Science, ICT and Future Planning.

[4] The predominance of Asian students is quite obvious in Japan as well. As of 1 May 2012 there are 137,756 international students in Japan, 92.4 percent of whom are from Asian countries, showing no substantial difference from 93.4 percent in 2004 (Japan Student Services Organization 2013).

Table 1. Number of Foreign Students in Korean Higher Education (2004–2013)

Origins	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Asia	14,563	19,969	29,227	46,652	59,375	70,853	76,483	80,766	77,639	75,288
	(86.52)	(88.65)	(89.77)	(94.69)	(92.84)	(92.47)	(91.22)	(90.20)	(89.37)	(87.62)
Africa	174	184	211	291	397	588	786	1,063	1,320	1,567
	(1.03)	(0.82)	(0.65)	(0.59)	(0.62)	(0.77)	(0.94)	(1.19)	(1.52)	(1.82)
Oceania	139	145	125	131	178	221	280	338	323	339
	(0.83)	(0.64)	(0.38)	(0.27)	(0.28)	(0.29)	(0.33)	(0.38)	(0.37)	(0.39)
North America	925	1,105	1,717	1,692	2,165	2,605	3,095	3,769	3,790	3,988
	(5.50)	(4.91)	(5.27)	(3.43)	(3.39)	(3.40)	(3.69)	(4.21)	(4.36)	(4.64)
South America	197	209	200	242	278	408	511	660	687	968
	(1.17)	(0.93)	(0.61)	(0.49)	(0.43)	(0.53)	(0.61)	(0.74)	(0.79)	(1.13)
Europe	834	914	1,077	1,262	1,559	1,944	2,687	2,941	3,119	3,773
	(4.95)	(4.06)	(3.31)	(2.56)	(2.44)	(2.54)	(3.20)	(3.28)	(3.59)	(4.39)
Total	16,832	22,526	32,557	49,270	63,952	76,619	83,842	89,537	86,878	85,923

* Percentages in the parenthesis.

Source: Korean Educational Development Institute.

Table 2 shows some statistics concerning incoming foreign students at higher education institutions by major, excluding those enrolled in language programs. About 68 percent of foreign students were studying in the liberal arts and social sciences, whereas only 25 percent of them were majoring in the STEM fields. Consistent with the overall trend of incoming foreign students, more than 90 percent of the STEM majors came from Asian countries such as China, Vietnam, Mongolia, and Japan. In particular, Chinese students took up 75.8 percent of Asian STEM undergraduate students. As of 2013, Chinese and Vietnamese students accounted for 37.8 percent and 16.7 percent of Asian graduate STEM majors, respectively. As shown in Table 2, Asian graduate students are much more likely to choose a STEM major than their undergraduate counterparts, and Asian STEM majors are much more likely to return to their home countries.

Table 2. Foreign Students in Korea's Higher Education by Major: 2012–2013

Year	Undergraduate				Graduate				TOTAL
	Liberal Arts & Social Sciences	STEM	Others (Arts)	Subtotal	Liberal Arts & Social Sciences	STEM	Others (Arts)	Subtotal	
2012									
Asia	27,709	7,805	2,992	38,506	10,821	5,915	901	17,637	56,143
China	24,442	6,268	2,739	33,449	7,346	2,340	816	10,502	43,951
Japan	762	108	64	934	330	68	15	413	1,347
Vietnam	402	92	14	508	398	979	4	1,381	1,889
Mongolia	707	315	45	1,067	1,238	298	28	1,564	2,631
Africa	172	103	3	278	451	266	1	718	996
Oceania	75	15	7	97	72	30	3	105	202
North America	737	284	75	1,096	699	224	52	975	2,071
South America	131	47	19	197	115	54	6	175	372
Europe	278	62	37	377	331	76	21	428	737
TOTAL	**29,102**	**8,316**	**3,133**	**40,551**	**12,489**	**6,565**	**984**	**20,038**	**60,521**

2013									
Asia	23,663	6,743	2,738	33,144	11,153	6,266	934	18,353	51,497
China	20,219	5,113	2,373	27,705	7,473	2,370	846	10,689	38,394
Japan	796	123	71	990	324	40	13	377	1,367
Vietnam	436	84	27	547	558	1,044	4	1,606	2,153
Mongolia	692	332	67	1,091	1,112	240	29	1,381	2,472
Africa	188	140	7	335	580	299	1	880	1,215
Oceania	83	19	9	111	76	26	4	106	217
North America	783	397	68	1,248	887	240	76	1,203	2,451
South America	146	62	24	232	133	64	3	200	432
Europe	305	93	35	433	364	88	18	470	903
TOTAL	**25,168**	**7,454**	**2,881**	**35,503**	**13,193**	**6,983**	**1,036**	**21,212**	**56,715**

Source: Korean Educational Development Institute.

3. MIGRATION OF TALENT AND INTERNATIONAL STUDENTS

With ever increasing global competition for skilled workers and policy efforts to attract more international students in higher education, especially in STEM fields, retaining those students upon completion of study is also a key policy issue in most host countries. The U.S. is by far the strongest and largest magnet of international students, and accordingly most of the empirical studies on the graduates' stay versus return decisions have been on the American case (Alberts & Hazen, 2005; Bratsberg 1995; Finn, 1997, 2007, 2010; Rosenzweig, 2008).

Bratsberg (1995), utilizing a model developed by Borjas, Bronars and Trejo (1992), showed that there is skills sorting in effect where the different valuing of skills between source and host countries has an effect on the return probability of the international graduates from U.S. higher institutions, even after taking into account political and other economic factors. Similarly, Rosenzweig (2008) proposes an empirical model to examine how the returns to studying abroad affect both migration gains and the returns to domestic schooling, with a focal attention to skills price differences between source and host countries. According to his model, a higher quality of education in a country will increase the gains from schooling there, attracting more students from abroad. However, the probability of getting a foreign job there will also affect the gains from such schooling.

While international mobility of talent is increasingly affected by market demand and supply conditions as well as by perceived opportunities between source and host countries (D'Costa, 2008), the literature on the post-graduation careers of international students has framed them as a binary decision of either return or stay (Geddie, 2013). In such a frame, the factors that determine the return or stay decisions of foreign graduates in a country are categorized as either "pull" or "push" factors. The pull factors are those that pull back graduates to the home country such as strong family/social ties there and economic/political conditions, while the push factors are those that encourage them to stay in the host country such as better wage, job availability and employment stability, workplace culture, professional networks, welfare benefits, and other social and cultural considerations. Other than the differences in skills prices between the two countries, socio-economic and political factors are also found to be valid predictors of post-graduation migration decisions (Finn, 2007, 2010).

These factors include labor market conditions in both countries, political stability, inter-cultural experience, and legal framework for foreign workers, especially in terms of immigration policies (Agarwal & Winkler, 1985; Mahroum, 2000). For example, regarding the labor market conditions in the host country, those with specialties for which post-doctoral training is better available are more likely to stay (Johnson & Regets, 1998). In addition, the quality of institutions the students have been enrolled makes a difference in the post-graduation decisions (Lambert, 1992 as cited in Mahroum, 2010).

These push and pull factors can be of personal as well as of professional, social, and political dimensions (Alberts & Hazen, 2005). According to Alberts and Hazen (2005), professional factors refer to those that are related to wage, work conditions, job opportunities, and career advancement. How comfortable the graduates feel for living in a particular social, economic, and political environment is captured by social factors, whereas individual ties in terms of family and social networks are personal factors. Along the lines of these three types of factors, foreign-born students in a host country hear two competing voices of "returning home" and "staying in the host country" upon graduation. In further developing the pull-push model, Baruch, Budhwar, and Khatri (2007) combine it with the reasoned action theory of Fishbein and Ajzen (1975) and Ajzen and Fishbein (1980) such that the actual return vs. stay decision will depend on their inclination to do either. Their basic argument is that the individual's values, norms, and beliefs are affected jointly by personality on the one hand and culture and environment on the other, and that these values, norms, and beliefs affect inclination to stay or return, which in turn can effectively predict their post-graduation behaviors. The pull-push factors as identified in the previous studies are, then, reinterpreted in terms of how they affect the students' values, norms, and beliefs. Baruch, Budhwar, and Khatri (2007) pay attention especially to how well the foreign-born students adjust themselves to the new environment where the roles played by the hosting university, friends, and professors can be crucial. In the same vein, so can the social ties they have with their respective family members, friends, and colleagues both in the home and host countries. Accordingly, cultural differences/similarities and social ties are important factors in post-graduation decisions, in addition to, of course, labor market conditions and how they envision the career path.

In line with this expanded but more consistent research framework, recent studies began to pay attention to considerations of rather personal and relational dimensions. Geddie (2013) reports that career and professional concerns of international graduates are balanced against "social reproduction" considerations that involve family planning, familial duties, and even romantic relationships such that concerns about caring for aging parents, childcare, and social ties also come into play. Similarly, Korean graduate students of STEM fields in the U.S. consider various post-graduation career factors such as their children's education, family-friendly environment, workplace culture, and availability of quality jobs (Heo, 2010). This is why the stay rate of Korean STEM field doctorates in the U.S. increased substantially during the 1990s and 2000s (Finn, 1997, 2010).

The implicit assumption of these empirical studies on students' post-graduation decisions is that which country they end up in would make a big difference in terms of economic benefits or costs a country would bear. According to the alternative conceptualization of brain circulation (Johnson &

Regets, 1998; Saxenian, 2002, 2005), regardless of which country the graduates decide to stay at, the graduates can benefit both the host and source countries. This is due to the networking among professionals between source and host countries (Saxenian, 2002; Welch & Zhen, 2008). Ciumasu (2010) proposes brain networking strategies based on diaspora communities given the difficulties in reversing brain drain or brain circulation.

The brain circulation concept is particularly relevant to the foreign students attracted to Korea since the predominant majority of them tend to return home upon graduation rather than going somewhere else as shown in later sections. Then why do foreign-born students in Korea's higher education institutions tend to return home rather than stay after graduation? Of the many factors identified in the literature, we train our attention to only a subset of the various pull-push factors. Given our focus on Asian STEM students, we specifically aim to test whether or not the factors of *being Asian* and *specializing in a STEM field* can predict their return inclination. As indicated above, most of the international students are coming from Asia. Asian countries, especially China, Taiwan, and Korea share some key dimensions of culture such as collectivism and long-term orientation (Hofstede, 1980; Hofstede, 1991; Hofstede, Hofstede, & Minkov, 2003; Kim, 2013). Cultural similarities will help foreign students in the process of initial adjustment to Korean society, making them less uncomfortable than otherwise in their life-experiences in Korea. With higher cultural affinity, they will develop stronger and wider social ties in Korea. According to the same rationale, we expect that those students with more favorable views of Korean culture and/or with more social ties there will be more inclined to stay in Korea after graduation.

As for STEM majors, we conjecture that works requiring expertise/skills in STEM fields may be qualitatively different from those in the social sciences and liberal arts. A crucial difference is that technical skills in STEM fields do not necessarily require foreign-born graduates to speak Korean fluently. In addition, technical skills in STEM fields tend to be valued higher in the job market than in the other fields of study in Korea. Such difference is directly relevant to their Korean job market prospects. On this point, the Korean case is peculiar since even Korean graduates with advanced degrees are met with extreme difficulty in getting a decent job as evidenced by the daunting competition rate of 88 to 1 for positions at major domestic conglomerates (Kim, 2014). Even worse, the unemployment rate of college-graduated Koreans in their twenties is a remarkable 52.9% (Jung, 2013). Therefore, STEM-majored foreign students will be more confident in landing a job in Korea than their counterparts in the social sciences and liberal arts, given that the latter group must deal with mastering communication skills in Korean, which is especially challenging. In the same vein, if the foreign students expect tougher market competition in Korea, they will be more inclined to return home after graduation.

Based on these theoretical and empirical considerations, we propose to test the following hypotheses:

Hypothesis 1: Foreign students from Asian countries will be more likely to want to stay in Korea after graduation than those from the other continents;

Hypothesis 2: Foreign students of STEM majors will be more likely to want to stay in Korea after graduation than those of non-STEM majors;

Hypothesis 3: Foreign students who have a favorable view of Korean culture will be more likely to want to stay in Korea after graduation than those who do not;

Hypothesis 4: Foreign students who have more social ties in Korea will be more likely to want to stay in Korea after graduation than those with less social ties; and

Hypothesis 5: Foreign students who feel a tougher job market will be less likely to want to stay in Korea after graduation than those who do not.

4. METHODS

To test these hypotheses, we conducted a survey of foreign-born students at Hanyang University in Seoul, Korea. As of 2012, there are around 2,000 foreign students in Hanyang University, out of which about 440 (29.3%) are enrolled in various graduate programs. Regarding their major, about 47% of those at the graduate level are studying in one of the STEM fields. The number is lower at 33.3% for undergraduate foreign students (Ministry of Education, Science & Technology, 2013).

To conduct a survey of these students, we resorted to convenience sampling. Convenience sampling is non-random, with samples being drawn from readily available ones from the population. The reason is that surveys of foreign students through the University's official communication channels have turned in very low response rates even over extended periods of time, which questions the validity of the responses collected. Given such circumstances, convenience sampling, if as comprehensive as it gets, may offer a better sample than otherwise available. The survey was conducted early March, 2004. A research assistant and one of the authors of this research visited various places across the campus of Hanyang University, and much effort was made to get as many responses from graduate STEM students as possible. To appreciate their responses and time, we provided a coupon for an on-campus coffee shop after they completed the survey. Furthermore, since we were aware of the typical low response rates from foreign students, we made sure to get consistent answers by asking several similar questions scattered across the survey.

Through the efforts over two weeks, we managed to collect 103 responses in total. Out of the respondents, about 58% were Asian. About 48% of students were studying at the graduate program. About 53% of the respondents were majoring in one of the STEM fields. Given the characteristics of the foreign student population at Hanyang University, our sample is highly over-representing the students in STEM fields at the graduate level. We believe this overrepresentation even better serves our research purposes since our study is focused on the post-graduation decisions of those in the STEM-field graduate programs.

To test our hypotheses, we utilized three dependent variables as summarized in Table 3. The first variable measures if the respondents want to stay for a while (at least one year) in Korea after graduation. If they wanted to leave Korea upon graduation, their responses were coded as zero, and otherwise as one. The second and third dependent variables were only slightly different in the

wordings. The one asked if respondents *wanted* to have a job in Korea, while the other asked if they *planned* to work in Korea. The former was more about their wish, and the latter involved a certain degree of specificity and intention. The Spearman's rank-order correlation coefficient is expectedly high at rho = 0.80. Because of such measurement of the dependent variables, we use logit for the dichotomous dependent variable and ordered logit for rank-order dependent variables.

Table 3. Dependent Variables

Variables	Descriptions	Measure (coding)	Empirical model
StayKorea	How long do you want to stay in Korea after graduation?	- 0 if "I want to leave Korea upon graduation" - 1 if the respondent want to stay at least some time after graduation	Logit
WantJobKorea	I *want* to have a job in Korea after graduation	- 1 Strongly disagree - 5 Strongly agree	Ordered logit
PlanJobKorea	After graduation, I *plan* to work in Korea	- 1 Strongly disagree - 5 Strongly agree	Ordered logit

Our independent and control variables are summarized in Table 4. The first set of the dichotomous variables measures their countries of origin, STEM major, undergraduate/graduate program, and scholarship sources. Asian, STEM major, graduate, and Korean scholarship sources are all coded as 1, and if otherwise as 0. The next four variables measure their experiences in and attitudes toward Korea.[5] The *LoveKorea* variable is a composite measure of the respondents' opinion of Korean life/culture and her people, based on six highly related items of 5-point Likert scale whose inter-item reliability index (Chronbach's alpha) is 0.86.[6] The next variable, *KoreanTies*, measures how intensively the respondents engage Korean people, especially classmates and other friends, and it is also based on four Likert-type measures. *UnivSatis* and *GovtSatis* measure how satisfied the respondent is with services provided by the university and the Korean government for foreign students in Korea, respectively. These variables are also a composite measure based on two sets of Likert scale items. By adding the variable of *MarketKorea*, we also consider how the respondent feels about the Korean job market. As stated earlier, if the respondents feel the market is very competitive, they may consider returning home a matter-of-the-fact choice. On the other hand, given that their post-graduation choice may be affected by their individual characteristics, we control gender and age in the models. Descriptive statistics of these variables are provided in Table 5. The correlation matrix for the variables is in Appendix 2.

[5] We performed exploratory factor analysis (principal component analysis with varimax rotation) on the thirteen items and the results indicate four factors (Appendix 1).

[6] While not reported in the model, we also created a variable measuring the respondent's educational experiences focusing on class instructions and interactions with professors and advisors. This variable is, however, highly correlated with *LoveKorea* (at r= 0.75). Considering the multicollinearity issue, we decided to drop this variable from the models.

Table 4. Independent and Control Variables

Variables	Descriptions
Asian	Foreign students from Asian countries - 1 if the respondent is from an Asian country, and 0 if not
Stem	Respondent who is enrolled in a program in science, technology, engineering, or mathematics - 1 if the respondent is majoring a STEM field, and 0 if not
Graduate	Respondent who is studying graduate program or is being trained after completion of advanced degree - 1 if the respondent is studying graduate program, and 0 if he or she is an undergraduate
ScholarKorea	Respondent whose fund source is Korea - 1 if the fund source is either the Korean government or Korean university, and 0 if not
LoveKorea	A composite measure of how the respondent feel about Korean culture and people, based on six items on a 5-point Likert scale (Chronbach's alpha: 0.86)
KoreanTies	A composite measure of respondent's Korean social capital (ties), based on four 5-point Likert scales (Chronbach's alpha: 0.67)
UnivSatis	A composite measure of respondent's satisfaction with services provided by the university, based on two items on a 5-point Likert scale (Chronbach's alpha: 0.80)
GovtSatis	A composite measure of respondent's satisfaction with services provided by the Korean government, based on two items on a 5-point Likert scale (Chronbach's alpha: 0.78)
MarketKorea	A 5-point Likert scale of how tough Korean job market is: - It is not really difficult to get a job in Korea after graduation
Male	Respondent's gender - 1 if male, and 0 of female
Age	Respondent's age in years

Table 5. Descriptive Statistics

Variables	Observations	Mean	Std. Dev.	Minimum	Maximum
StayKorea	101	0.52	.50	0	1
WantjobKorea	101	2.91	1.20	1	5
PlanjobKorea	102	2.71	1.12	1	5
Asian	101	0.58	0.50	0	1
Stem	101	0.53	0.50	0	1
Graduate	100	0.48	0.50	0	1
ScholarKorea	84	0.21	0.41	0	1
LoveKorea	100	21.81	4.46	8	30
KoreanTies	102	12.26	2.97	4	19
UnivSatis	100	6.18	1.70	2	10
GovtSatis	101	5.86	1.50	2	9
MarketKorea	97	2.62	0.88	1	5
Male	101	0.51	0.50	0	1
Age	103	24	2.78	19	35

5. ANALYTICAL FINDINGS AND DISCUSSION

While our survey findings indicate that about half of the respondents do not want to return home as soon as they graduate (Table 5), official statistics report that as of 2012 only about 7% of foreign students get gainful jobs in Korea after graduation and about 16% of graduates enroll for further study (Korean Educational Development Institute [KEDI], 2012). This means that less than 23% of graduates stay in Korea after graduation. The statistics by KEDI also show that almost half of the graduates returned in 2012.[7] Two of the key summary observations are: 1) the majority of the foreign graduates have left Korea and 2) only a tiny minority of the graduates has stayed in the country while employed. Then, why do foreign students upon graduation tend to return home?

In testing the hypotheses, we adopted a three-stage strategy to examine how different sets of the independent variables explain the staying propensity of foreign students in Korea. We first regress the dependent variables only on Asian, STEM, Graduate, and Korean scholarship along with two control variables of gender and age and then add the other set of independent variables regarding their Korean experience (*LoveKorea, KoreanTies, UnivSatis, GovtSatis* and *MarketKorea*) to the models. Lastly, by interacting Asian and STEM, we examine if there is any difference in Asian students' staying propensity between STEM and non-STEM majors.[8] Our logit and ordered logit estimation results are provided in Table 6. Based on the Pseudo R2, we focus mainly on the first dependent variable of *StayKorea* in interpreting the results.

First of all, the first round of results indicates that Asian students are more likely to want/plan to stay in Korea upon graduation for a certain period of time. However, when it comes to their inclination to stay with gainful jobs (*WantJobKorea* and *PlanJobKorea*), we could not find any significant difference between Asians and others. The other three independent variables (STEM, graduate, and Korean scholarship) are not valid predictors of the probability of the respondents' planning or wishing to stay in Korea, when we do not take into account the respondents' socio-cultural views of Korea. These results indicate that except for being Asian, the foreign students' decision to stay in Korea is much complicated by other factors mainly related to their experiences in and perceptions of Korea.

The second set of results without the interaction term show that Asian students are much more likely (odds ratio = 11.6) to want to stay for a while in Korea after graduation, holding the other variable constant. This is most likely due to the presence of thirty-eight Chinese students, thirty-two of whom want to stay. One key reason that these Chinese students consider staying in Korea may be because they are ethnic Koreans who can speak Korean and share Korean culture. Those with scholarships of Korean sources are more likely (odds ratio = 6.75) to consider staying in Korea

[7] Almost 30% of those graduates' whereabouts are not known to KEDI. It would be fair to conjecture that the majority of the unknown might have returned home or are working while undocumented.

[8] We checked for multicollinearity but the problem of multicollinearity did not exist. No variance inflation factor was higher than 4.8.

Table 6. Estimation Results

	StayKorea			WantjobKorea			PlanJobKorea		
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Asian	1.93***	2.45***	3.87***	0.30	1.00*	2.19***	0.42	0.57	1.09
STEM	-0.29	-0.48	0.84	0.46	0.20	1.43*	0.48	0.39	0.94
Graduate	0.62	0.44	0.23	0.20	-0.04	-0.23	-0.26	-0.67	-0.74
ScholarKorea	1.06	1.91**	1.95**	-0.23	0.93	1.04	0.56	1.40**	1.42**
STEM*Asian			-2.41*			-2.25**			-0.96
LoveKorea		0.18*	0.20*		0.21***	0.22***		0.14*	0.14*
KoreanTies		-0.03	-0.04		0.07	0.05		0.12	0.11
UnivSatis		-0.04	-0.04		0.03	0.05		0.04	0.05
GovtSatis		-0.02	-0.03		0.07	0.09		-0.01	-0.00
MarketKorea		-0.64	-0.73*		-0.72**	-0.81**		-0.56*	-0.58*
Male	-0.13	-0.09	0.20	-0.37	-0.40	-0.19	-1.14**	-1.35***	-1.29**
Age	-0.02	-0.03	0.00	0.12	0.13	0.10	0.25**	0.33***	0.31***
Model sum.									
Observation	77	71	71	77	72	72	77	71	71
LR chi2	19.42***	20.48**	23.79**	4.88	17.44	22.51**	17.25***	25.76***	26.70***
Pseudo R^2	0.18	0.21	0.24	0.02	0.08	0.10	0.08	0.13	0.13

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

after graduation. A comparable effect is not found with STEM and Graduate even when controlling for their experiences in Korea, gender and age. However, our extended full models show richer detail on the interaction effect between Asian and STEM. The result indicates first that Asian foreign students whose major is not in the STEM fields are much more likely to consider staying in Korea after graduation (odds ratio = 47.98). If they are non-Asian students, there is no difference between STEM majors and others in their intention to stay in Korea. However, when it comes to Asians, STEM majors are more likely to intend to get back home upon graduation as indicated by negative coefficients on the interaction term from the models for *StayKorea* and *WantJobKorea*, $p<0.1$ and $p<0.05$, respectively. Only for Asian students, ceteris paribus, there is a higher propensity to return among STEM majors than non-STEMers. In our data, thirty-eight out of fifty-four STEM majors (70.4%) are Asians. Out of those thirty-eight STEMers, twenty students (52.6%) indicated that they consider staying in Korea for a while after graduation. On the other hand, seventeen out of twenty Asian non-STEMers (85%) consider delaying return home upon graduation. This may be due to skills sorting as suggested by Borjas, Bronars and Trejo (1992) and Rosenzweig (2008) such that the relative difference in valuing skills in STEM fields between Korea and the countries of origin of Asian foreign students may be not as great as in non-STEM fields. If that is the case, then Asian foreign STEM students in Korea can expect relatively higher wages back home compared to those in non-STEM majors.

If we limit our findings to Asian students of STEM majors, they are more likely to return than their non-STEM counterparts. This is especially noteworthy, given that many developing countries have

experienced brain drain (Adams, 1968; Bhagwati & Rodriguez, 1975). When it comes to Asian countries that are sending students to Korea, they are obviously less subject to brain drain due first to the high return rate of all foreign students in Korea and second to the even higher return rate of science and engineering students, compared to other majors. However, caution is due against the rather rosy picture of brain circulation as suggested by the recent literature (Saxenian, 2002, 2005; Johnson & Regets, 1998; Welch & Zhen, 2008). Of course, those who return bring home relational capital as well as S&T human capital, but the peculiar issue with the Korean case is that those returners may not be as happy about Korea as when they first came to Korea as evidenced below.

As expected, those who have more favorable views of Korea and its people consider staying in Korea more positively. The positive relationship between attitudes toward Korean culture/people and their propensity to consider staying in Korea is obvious enough to belie a rather "inconvenient" reality: the more they stay in Korea, the less favorable their attitudes tend to be toward Korean people and culture (Lee, 2011). That is, an extended exposure to Korean society and its education system can lead to a disillusionment of their initial positive impressions, which is also supported by our own survey. The longer they have studied in Korea, the less likely they believe that their decision to study in Korea was the right one (rho = -0.53), the less likely they recommend studying in Korea for their friends (rho = -0.57), and the less likely they feel that their first impression of Korea gets better during their sojourn in Korea (rho = -0.42). Furthermore, a longer time in Korea for studying is associated with higher feelings of discrimination (rho = 0.38). Even though the respondents' general attitudes toward Korean society is slightly positive as indicated by its mean (21.81), bigger than the neutral value of 18, it seems obvious that foreign students' initial positive impressions get undermined through extended exposure to Korean people and culture. In addition, our finding shows that such degradation may eventually affect their willingness to stay in Korea after graduation.

On the other hand, our results indicated that neither university or government foreign students services nor Korean ties affect their willingness to stay in Korea. This finding of no significant relationship regarding policy (and university) support is rather out of sync with what is considered in the previous studies (Baruch et al., 2007), especially regarding Korea's immigration policies. Specifically speaking, they are arguably discriminatory especially against ethnically non-Korean [9] workers in Korea. Since the early 1990s when Korea began to introduce policies regarding low-skilled foreign workers, discrimination based on citizenship has gradually decreased, but discrimination based on ethnicity has increased (Kim, 2008), favoring foreign-born ethnic Koreans over ethnically non-Korean foreign workers. This is a discriminatory dimension of the Korean job market for foreign graduates from domestic universities. If foreign graduates decide to return home because they cannot find jobs or they are disillusioned of Korean society and its immigration policies, this will eventually hurt, not boost, Korea-friendly networks in their respective countries.

[9] Ethnically Korean foreign workers refer to those members of the Korean diaspora in foreign countries whose citizenship is not Korean and who come to Korea for work. They are mostly from China.

Another interesting finding is that the less difficult they feel getting a job in Korea is, the less likely they plan to stay, which is quite the opposite to what was hypothesized. There are two explanations, both of which deserve careful attention. One possibility is that when answering the question, respondents may not have been as honest as desired by the authors. Being left with no alternatives to going back home may bring up cognitive dissonance (Festinger, 1962). Believing and concurring that the job market condition in Korea is not really tough may offer a logical and cognitive justification that they consider returning home on the basis of non-market factors. Related to this issue, the other possibility is that the causality may flow both ways. Those who decide to go back home may find it convenient to identify reasons other than their job market competitiveness in Korea.[10]

Notwithstanding their reasoning regarding job market conditions and post-graduation decisions, their perceptions of the Korean job market reflect that it is becoming increasingly difficult even for Korean nationals. The mean of *MarketKorea* is 2.62, lower than the neutral value of 3, and there are more respondents who disagreed with the statement of "not really difficult to get a job in Korea" than those who agreed. Korean graduates with degrees in STEM as well as other fields are thrown into the toughest competition, which is related to the so-called "education fever" of individual investment in human capital. The most recent enrollment rate in higher education in Korea is 81.9%, which is among the world's highest, and every year more than 10,000 doctorates are produced. However, the domestic job markets for these skilled workers are too small to accommodate new graduates. Accordingly, more and more domestic students cannot find positions upon graduation. STEM majors are not an exception. Every year, more than 10–15% of new advanced degree holders in STEM fields cannot find jobs in either domestic or international markets (Korean Research Institute for Vocational Education & Training [KRIVET], 2012). Furthermore, 17 percent of currently employed STEM majors are holding non-permanent positions. Even Koreans who obtained doctoral degrees in the U.S. are reported to stay in the U.S. in part because it gets increasingly more difficult to find positions in Korea (Song & Jin, 2009).

Our findings above reveal that the stay-versus-return decisions are affected by their country of origin, major, attitudes toward Korea, and scholarship sources. We also report that Asian STEM students are more likely to return than their non-STEM counterparts. This let us conjecture that this may lead to better knowledge transfer from Korea to other Asian developing countries. However, we caution that the higher return rate of foreign students in Korea may not lead to higher ensuing knowledge transfer since their return decisions are largely framed by their increasingly negative experiences in and attitudes toward Korea.

Such a higher return rate of foreign students in Korea poses in turn an interesting policy concern in that Korea sees a substantial number of students of higher education leave the country to study

[10] Admittedly this may raise a concern about the validity of the survey responses. However, since we are dealing with human subjects, we cannot help but depend on their subjective statements that are vulnerable to social desirability bias. This may constitute a valid limitation of the research along with the rather smaller sample size.

abroad while their return rate gets increasingly lower. The Ministry of Education, Science and Technology (2012b) calculates the Brain Drain/Gain Index of *graduate* students in Science and Engineering by dividing the total number of outbound students by the total number of their incoming counterparts. The index has improved from 6.43 (= 10,842÷1,686) in 2003, 3.63 (= 10,866÷2,996) in 2006 to 2.05 (=12,240÷5,978) in 2011 since the incoming graduate students in STEM fields have increased much faster than the outgoing students have. For the STEM *undergraduate* majors, the index has improved from 11.50 in 2003 to 2.84 in 2011. Although the MEST has presented these figures to argue that its policy has some effect in keeping more talent within the country, this simple index is much oblivious to the cold reality that more and better qualified brighter minds tend to decide to go abroad to pursue degrees in STEM fields than those who are coming in. First of all, the stay rate in the U.S. by Korean doctorates in the STEM fields has increased substantially from 11% in 1995 to 41% in 2007 (Finn, 1997, 2010), which is larger than those of Japan (33%) and Thailand (7%).[11] Over the last three decades, the percentage of Korean doctorates who returned from the U.S. has decreased from 38.1% during the 1980s to 23.0% during the 2000s (Kim, Bankart & Isdell, 2011). Furthermore, the majority of incoming students are attracted by second- or third-tier universities located outside of the Seoul metropolitan area. And, even so, they tend not to stay in Korea after graduation.

6. CONCLUSION

The issues of foreign students in Korea, especially those from Asia in STEM fields, have never drawn serious attention either from education policies or from the literature of S&T policy in terms of technology/knowledge transfer across Korea and Asian countries. This research, with particular attention to such potential channels of knowledge transfer, examined why some foreign students intend to stay in Korea, while others do not.

Our key findings are as follows: First, Asian students revealed more intention to stay in Korea. This can be explained by cultural affinity and more respondents of ethnically Korean Chinese. Second, STEM does not make a significant difference in their return intentions, but when it is interacted with Asian, it tends to increase the intention of going back home. Asian STEM majors are more likely to return than their non-STEM counterparts. We suspect that the difference in STEM skills valuing between Korea and other Asian countries may be smaller than in non-STEM fields. Third, the respondents' attitudes toward Korean culture and people increase their positive consideration of staying after graduation. This is well expected from the empirical literature, but the catch here is that longer stays in Korea for study tend to undermine their initial positive views of Korea. This is specifically evidenced by the negative correlation (rho = -0.42) between "first impression of Korea

[11] This stay rate of Korean doctorate is comparable to Taiwan's 43%, but much lower than China's (92%) and India's (81%).

getting better" and their time in Korea. Fourth, scholarships from either the Korean government or universities tend to increase their intention to stay. This is understandable given that their academic performance would be better than the others and that they are not bound by a contract with the government or other sponsors of their home country. On the other hand, we do not find any meaningful effect from university or government service quality for foreign students.

These findings together with the high return rate, we cautiously argue, imply that the much-debated brain drain issue does not pose a serious problem for Asian countries vis-à-vis Korea. Even if they want to stay in Korea for a certain period of time, only 11 out of 101 valid responses want to stay more than four years. Furthermore, STEM majors from Asian countries are even more likely to return than other majors. Considering that the satisfaction level with class instruction is relatively high at 3.37 against the 5-point scale, those students acquire and bring home a good command of S&T knowledge. The real policy problem for the Korean government is that even with such improved technical skills, they are not as satisfied with their Korean experience as is desired. When the Korean government launched aggressive policies of inviting foreign students, its key policy objective was to nurture Korea-friendly communities in different corners of the globe. Our findings suggest that such policy objectives may be more elusive than initially envisioned. Another implication is that such reasons that drive foreign graduates back home may place a speed bump in post-graduation collaboration based on relational capital built from degree programs. This may jeopardize further knowledge transfer down the road, thwarting brain circulation.

Lastly, but certainly not least, inviting foreign students to the country's universities has obviously not dealt with Korea's deficit in talent mobility, notwithstanding the so-called improved Brain Drain/Gain Index. Korea is not effective in keeping brighter minds, Korean or foreign. Accordingly, a balanced approach to retaining more foreign students upon graduation is much needed.

REFERENCES

Adams, W. (Ed.). (1968). *The brain drain*. NY: Macmillan.

Agarwal, V. B., & Winkler, D. R. (1985). United States immigration policy and indirect immigration of professionals. *Economics of Education Review, 4*(1), 1-16.

Alberts, H. C., & Hazen, H. D. (2005). "There are always two voices…": International students' intentions to stay in the united states or return to their home countries. *International Migration, 43*(3), 131-154.

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.

Baruch, Y., Budhwar, P. S., & Khatri, N. (2007). Brain drain: Inclination to stay abroad after studies. *Journal of World Business, 42*(1), 99-112.

Basri, E., & Box, S. (2008). *The global competition for talent: Mobility of the highly skilled. Paris*, France: Publications de l'OCDE.

Bhagwati, J., & Rodriguez, C. (1975). Welfare-theoretical analyses of the brain drain. *Journal of Development Economics, 2*(3), 195-221.

Borjas, G. J., Bronars, S. G., & Trejo, S. J. (1992). Self-selection and internal migration in the United States. *Journal of Urban Economics, 32*(2), 159-185.

Bratsberg, B. (1995). The incidence of non-return among foreign students in the United States. *Economics of Education Review, 14*(4), 373-384.

Byun, K., & Kim, M. (2011). Shifting patterns of the government's policies for the internationalization of Korean higher education. *Journal of Studies in International Education, 15*(5), 467-486.

Ciumasu, I. M. (2010). Turning brain drain into brain networking. *Science and Public Policy, 37*(2), 135-146.

D'Costa, A. P. (2008). The international mobility of technical talent: Trends and development implications. In A. Silmano (Ed.), *The international mobility of talent: Types, causes, and development impact* (pp. 44-83). New York, NY: Oxford University Press.

Douglass, J. A., & Edelstein, R. (2009). *The global competition for talent: The rapidly changing market for international students and the need for a strategic approach in the US.* Berkeley, CA: Center for Studies in Higher Education, University of California, Berkeley.

Festinger, L. (1962). *A theory of cognitive dissonance*. Stanford University Press.

Finn, M. G. (1997). *Stay rates of foreign doctorate recipients from U.S. universities, 1995*. Oak Ridge, TN: Science Education Programs, Oak Ridge Institute for Science and Education.

Finn, M. G. (2007). *Stay rates of foreign doctorate recipients from US universities, 2005*. Oak Ridge, TN: Science Education Programs, Oak Ridge Institute for Science and Education.

Finn, M. G. (2010). *Stay rates of foreign doctorate recipients from U.S. universities, 2007*. Oak Ridge, TN: Science Education Programs, Oak Ridge Institute for Science and Education.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Geddie, K. (2013). The transnational ties that bind: Relationship considerations for graduating international science and engineering research students. *Population, Space and Place, 19*(2), 196-208.

Gribble, C. (2008). Policy options for managing international student migration: The sending country's perspective. *Journal of Higher Education Policy and Management, 30*(1), 25-39.

Hawthorne, L. (2010). Demography, migration and demand for international students. In W. G. Tierney, & C. Findaly (Eds.), *Globalisation and tertiary education in the Asia-Pacific: The changing nature of a dynamic market* (pp. 93-120). Singapore: World Scientific Company.

Heo, D. Y. (2010, December). *Determinants of brain drain and gain and strategies for attracting international talent*. Proceedings of the 2010 Winter Conference of the Korean Association for Policy Studies, Ewha Womans University, Seoul, Korea.

Hofstede, G. (1980). *Culture's consequences*. Beverly Hills, CA: Sage Publications.

Hofstede, G. (1991). *Cultures and organisations-software of the mind: Intercultural cooperation and its importance for survival.* New York, NY: McGraw-Hill.

Hofstede, G., Hofstede, G. J., & Minkov, M. (2013). *Cultures and organisations-software of the mind: Intercultural cooperation and its importance for survival* (3rd ed.). New York, NY: McGraw-Hill.

Johnson, J. M., & Regets, M. C. (1998). *International mobility of scientists and engineers to the United States - brain drain or brain circulation?* (Issue Brief No. NSF 98-316). Washington, DC: National Science Foundation.

Jung, C. Y. (2013). Youth unemployment and its implications for Korea. In M. Kim (Ed.), *Decoding Korean identity through 38 codes: Who the Koreans are* (pp. 470-481). Paju, Korea: 21st Century Books.

Kim, D., Bankart, C. A., & Isdell, L. (2011). International doctorates: Trends analysis on their decision to stay in US. *Higher Education, 62*(2), 141-161.

Kim, J. D. (March 4, 2014). Job competition during the second half of the last year for big conglomerates was 85 to 1, four times as high as for SMEs. *Mail Business Newspaper*

Kim, M. (Ed.). (2013). *Decoding Korean identity through 38 codes: Who the Koreans are*. Paju, Korea: 21st Century Books.

Kim, N. H. (2008). Korean immigration policy changes and the political liberals' dilemma. *International Migration Review, 42*(3), 576-596.

Korean Educational Development Institute (KEDI). (March 6, 2012). *Policy Statistics: High school graduates, college applicants, and enrollees relative to college entrance slots by year.* Retrieved from http://edpolicy.kedi.re.kr/EpnicDb/Epnic/EpnicDb01 Viw.php?PageNum=1&LstCary=B00806&ContCate=B008060202&Classify=Stat&LstNum1=2829

Korean Research Institute for Vocational Education & Training (KRIVET). (2012). *Human resources development indicators in Korea 2012.* (Policy Document No. 2012-38). Seoul, Korea.

Lee, I. Y. (2011). *An analysis of the current status of the foreign students and a study on effective supporting methods for them - focusing on Seoul National University.* (Unpublished Master's Thesis). Korea National University of Education, Chung-Buk, Korea.

Mahroum, S. (2000). Highly skilled globetrotters: Mapping the international migration of human capital. *R&D Management, 30*(1), 23-32.

Ministry of Education, Science and Technology. (2012a). *Press release on the investigation of brain drain and gain in science and engineering in 2012.* Seoul, Korea.

Ministry of Education, Science and Technology. (2012b). *Press release on the Study Korea Project 2020 action plan*. Seoul, Korea.

Ministry of Education, Science and Technology. (2013). *Press release on the certification of 30 universities/colleges for IEQAS.* Seoul, Korea.

Rosenzweig, M. R. (2008). Higher education and international migration in Asia: Brain circulation. *Annual World Bank*

Conference on Development Economics (pp. 59-100). Washington, DC.

Saxenian, A. (2002). Brain circulation: How high-skill immigration makes everyone better off. *Brookings Review, 20*(1), 28-31.

Saxenian, A. (2005). From brain drain to brain circulation: Transnational communities and regional upgrading in India and China. *Studies in Comparative International Development, 40*(2), 35-61.

Song, C. Y., & Jin, M. S. (2009). Analysis of Korean doctorates obtained abroad and their career characteristics, focusing on those in the U.S. *The HRD Review, Winter*, 31-46.

U.S. Congress Joint Economic Committee. (2012). *STEM education: Preparing for the jobs of the future*. Washington, D.C.

Wadhwa, V., Rissing, B. A., Saxenian, A., & Gereffi, G. (2007). *Education, entrepreneurship and immigration: America's new immigrant entrepreneurs, part II*. Retrieved from http://www.kauffman.org/~/media/kauffman_org/research% 20reports%20and%20covers/2007/06/entrep_immigrants_2_61207.pdf

Welch, A. R., & Zhen, Z. (2008). Higher education and global talent flows: Brain drain, overseas Chinese intellectuals, and diasporic knowledge networks. *Higher Education Policy, 21*(4), 519-537.

APPENDIX

Appendix 1

Factor Analysis of the Survey Items (Principal Component Analysis, Varimax Rotation)

Items	LoveKorea	KoreanTies	UnivSatis	GovtSatis
Korean people are in general kind and nice	**0.7716**	0.0566	0.0044	0.2838
Korean people are in general taking good consideration of foreigners	**0.8102**	0.1824	0.1518	0.0636
Korean people are in general very polite	**0.7659**	-0.0697	0.1991	0.2061
Korean people are in general open to foreigners	**0.5306**	0.3129	0.2747	0.0406
My impression of Korea has been getting better since I came to Korea	**0.8457**	0.097	-0.0021	0.1522
Living in Korea is in general convenient and enjoyable	**0.6405**	0.2303	0.3011	0.2022
I have made many Korean friends	-0.0396	**0.7115**	-0.2351	0.3035
I frequently get help from my Korean friends when I do class assignments	0.1017	**0.6302**	0.2876	0.1484
I frequently do assignment together with Korean friends/classmates	0.2481	**0.5873**	0.3198	-0.2066
I frequently spend time with my Korean friends	0.1895	**0.7887**	-0.0706	0.0689
The University Administration pays careful attention to foreign students	0.1624	-0.1071	**0.7874**	0.2644
My Department or Program Administration pays careful attention to foreign students	0.0869	0.0555	**0.9029**	0.062
I am in general satisfied with the policies/services of the Korean government for foreign students	0.205	0.0076	0.1075	**0.8486**
The Korean government pays careful attention to foreign students	0.2757	0.2411	0.2048	**0.7861**
Eigenvalue	4.9730	1.7648	1.4325	1.2102
Percent of common variance	0.3552	0.1261	0.1023	0.0864

Appendix 2

Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Stay_Kor (1)	1													
WantJobKorea (2)	0.47**	1												
PlanJobKor (3)	0.56**	0.83**	1											
Asian (4)	0.49**	0.21*	0.30**	1										
STEM (5)	0.11	0.14	0.16	0.27**	1									
STEM*Asian (6)	0.23*	0.11	0.18	0.67**	0.72**	1								
Graduate (7)	0.31**	0.22*	0.26**	0.29**	-0.12	-0.02	1							
ScholarKorea (8)	0.23*	0.03	0.23*	0.12	0.39**	0.30**	-0.05	1						
LoveKorea (9)	-0.08	0.12	-0.04	-0.33**	-0.24*	-0.36**	0.16	-0.50**	1					
UnivSatis (10)	0.02	0.09	0.07	0.02	-0.19	-0.14	0.18	-0.22	0.34**	1				
GovtSatis (11)	-0.04	0.14	0.03	-0.18	-0.20	-0.18	0.09	-0.28**	0.48**	0.30**	1			
MarketKorea (12)	-0.01	0.00	0.04	0.02	-0.05	-0.09	0.16	-0.10	0.30**	0.31**	0.21*	1		
KoreanTies (13)	0.03	0.05	0.03	0.12	-0.10	-0.06	0.13	-0.12	0.37**	0.16	0.29**	0.34**	1	
Male (14)	-0.09	0.03	-0.13	-0.14	0.23*	0.19	-0.02	0.08	-0.03	0.07	-0.03	0.05	-0.13	1
Age (15)	0.16	0.20	0.27**	0.31**	0.03	0.14	0.53**	0.06	-0.09	0.04	-0.07	-0.12	-0.02	0.20*

** p < .01 and * p < .05.