



## The Importance of International Students in the United States

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## The Importance of International Students in the United States

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### Abstract

The overarching focus of this study is to gain a comprehensive understanding of how the admission of international students into institutions of higher education in the US, creates advantages to their college campuses and communities, apart from its concomitant liabilities. The US has been the most preferred study abroad destination for international students (IIE, Open Doors, 2023). In the 2022/2023 academic year, 1,057,188 international students enrolled in colleges and universities in the US representing about 25% of total international students enrollment worldwide (Bound et al., 2020). This study will be an exploratory attempt to understand the advantages that international students bring to higher education institutions in the US and their contributions to the country's economy overall. It is intended to provide a rich description of international students contributions over the years, in addition to the costs and benefits associated with admission of international students.

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### Introduction

Before World War II, international students were barely allowed into the United States (US). Children of affluent Americans studied in colleges and universities in Britain or Germany as this was deemed important for a well-rounded education (Okai, 2020). According to Bevis (2016), this however changed and the US opened its borders for international students to study in the country after World War II when a comprehensive understanding of nations was identified as critical in achieving peace and “international education exchange formed the strongest basis for fostering such understanding” (Bevis, 2016, pp. 29). Institutions have thus intensified efforts in recruiting international students and fostering international research and educational alliances in the US.

Countries greatly benefit from the presence of international students. Upon arrival in their host countries, international students travel extensively to acquaint themselves, contributing significantly to the airline and aviation industry of their host countries (Lim & Tkaczynski, 2017). Furthermore, international students spending on daily living expenses [i.e., food, housing, transportation, health insurance, etc.] contribute significantly to the net income of the host countries (Johnston, Baker, & Creedy, 1997., Esaki-Smith, 2023). A recent study in France by Kantar Public Institute to ascertain the impact of international students in the country provides further insights for the discussion. The study revealed that the country generated about 1.35 billion Euros from international students daily living and spending (campusfrance.org). Meanwhile, about two-thirds (62%) of international students' funding comes from external sources outside of the US, and 82.5% of undergraduate international students receive their funding from external sources (IIE, Open Doors, 2023, Statista 2023). Governments

additionally derive direct monetary benefits from international students through student's visa acquisition and SEVIS processing (Enslin, & Hedge, 2008). Institutions also enjoy economies of scale ascribable to an increase in the number of admitted students which results in a reduced cost of providing tuition (Baker, Creedy, & Johnson, 1996; Bound et al, 2016; Shen, 2017).

This desk research study explores, synthesizes and evaluates the costs and benefits that international students bring to institutions and the US. The financial and other implications of hosting international students are analyzed to ascertain their importance to their host institutions. Special attention is given to international students' source of funding their education in the US., jobs and revenue created by their presence. This study is important in providing relevant information to institutions of higher education about the value that international students bring to their college campuses and communities, as well as illuminating concomitant liabilities. This will be valuable for institutions in recruitment decisions, and for policy makers in enacting globalistic and pragmatic policies that enable international students to contribute their quota to the economy. The research objectives that this study aimed to explore are 1. There are economic benefits of hosting international students in the US 2. There are financial gains and costs of hosting international students 3. International students contribute to US science and innovation.

### **Who is an International Student?**

UNESCO defines an international student as “an individual who has physically crossed an international border between two countries with the objective to participate in educational activities in a country, where the destination country is different from his or her country of origin” (Institute of International Education, IIE, 2019).

### **Enrollment of International Students in the US**

The IIE reports the US as still the top destination country for international students (Okai, 2023; IIE, Open Doors, 2023). Out of the world's top 200 universities, 94 are in the US, and 20 in the UK (Ke et al, 2022). China remains the largest sender of international students (Okai, 2023) with 289,526 students studying in the US (Choudaha, 2017, UNESCO, 2020, IIE, 2023), accounting for about a quarter of international students worldwide followed by India. Bound, et al. (2020), echoes that students from China constitute the largest group of full fee-paying students, bringing significant financial and several other benefits to host countries and institutions (Bound et al., 2020, Guan et al, pp.1.2023). About 53% of all international students in 2022/23 were from China and India, comparable to the prior year. India, the second largest sending country, reached an all-time high of 268,923 international students in 2022/23, an increase of 35% (IIE, Open Doors, 2023).

In the 2022/2023 academic year, the US recorded a significant increase of international students enrollment with a record high of 12% increase from the previous year 2021/2022, surpassing pre-pandemic levels, and the highest increase for over 40years (IIE, 2023, US Bureau of Educational and Cultural Affairs, 2023). This is confirmed by Migration Data Portal Institute (MDPI), “the numbers of internationally mobile students are increasing and destinations diversifying” (MDPI, 2023). Out of 1,057,188 international students enrolled in the 2022/23

academic year, 198,793 were Optional Practical Training (OPT) (IIE, Open Doors, 2023, Statista, 2023), 347,602 were undergraduates, 467,027 were graduate students and 43,766 were non degree students. (IIE, Open Doors, 2023). The number of OPT students is an increase (+8) for the first time in three years.

Figure one below shows international students enrollment in the US by academic level (graduate, undergraduate, and non-degree) from 2004/2005 to 2022/2023 academic year. In 2022/2023, enrollment figures increased for the first time since 2014/2015 academic year across all levels. Non-degree students recorded a growth of 28%. Graduate student enrollment was the highest (+21%), and undergraduate at 1% for the first time in five years. The increasing graduate student enrollment scenario provides a robust argument for higher education institutions in the United States to consider global outreach for students, especially from a revenue generation perspective.

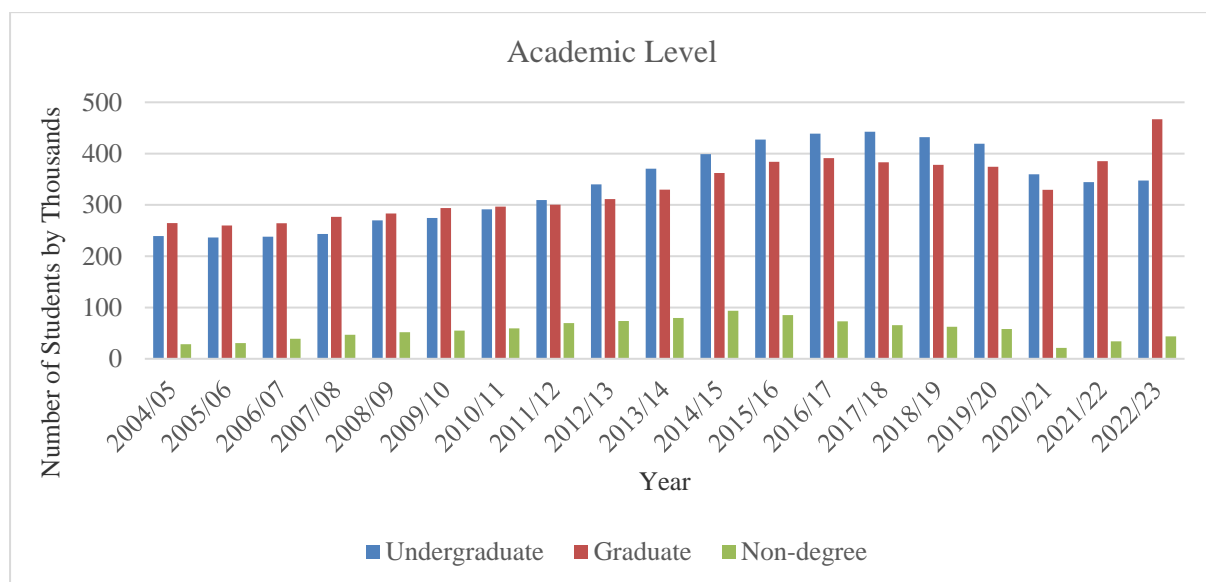


Figure 1. International Students in the US by Academic Level

## Benefits of International Students

### Economic Benefits

Enrollment and retention of international students is crucial for several institutions and countries (Redden, 2019; Marginson & Xu, 2022) as international students offer several benefits to the US. economy, and communities. The US government offers several resources to encourage international students to enroll in their colleges and universities, and a major reason for this according to Light (1993) and Forbes (2022) is for economic reasons. Chen (2008) confirms this argument and affirms that several countries including United Kingdom, Canada, and Australia, view international education from a trade focused model rather than an aid focused model which has led to the significant contributions to these countries.

In the year 2023, international students contributed a total of \$40.1 billion and supported 368,333 jobs (Table 1) to the US economy (NAFSA, 2023). International students revenue contribution and job creation is seen in all 50 states of the US (see Table 1). The state of California had the highest contributions of 138,393 international

students creating 55,167 jobs, and generating \$6.0 billion to the state in one single year (NAFSA, 2023, Statista, 2023). This is followed by New York with 126,782 international students creating 50,430 jobs and generating \$5.8 billion, Massachusetts is third with 79,751 international students creating 34,930 jobs and generating \$3.6 billion. Alaska is the least with 290 international students creating 60 jobs and generating \$9.8 million (NAFSA, 2023; Statista, 2023). Data from (NAFSA, 2023) shows that out of every three international students admitted, one US. job is created, “supported by spending occurring in the higher education, accommodation, dining, retail, transportation, telecommunications, and health insurance sectors (NAFSA, 2023).

Table 1. International Students Economic Contributions to States 2022/2023

State	International Students	US Dollars	Jobs
Alabama	9,022	305.3 million	2,259
Alaska	290	\$9.8 million	60
Arizona	30,054	\$986.4 million	9,685
Arkansas	5,680	\$146.6 million	947
California	138,393	\$6.0 billion	55,167
Colorado	9,920	\$359.2 million	3,617
Connecticut	16,727	\$698.2 million	6,228
Delaware	3,819	\$107.7 million	1,039
District of Columbia	11,457	\$525.5 million	4,306
Florida	42,590	\$1.4 billion	12,184
Georgia	26,450	\$951.7 million	8,842
Hawaii	3,939	\$133.6 million	869
Idaho	3,263	\$68.4 million	476
Illinois	55,337	\$2.1 billion	21,158
Indiana	26,739	\$890.2 million	8,297
Iowa	8,261	\$250.8 million	1,758
Kansas	9,353	\$246.5 million	1,764
Kentucky	9,765	\$308.9 million	1,854
Louisiana	6,626	\$246.7 million	2,251
Maine	1,703	\$69.8 million	441
Maryland	22,743	\$929.4 million	9,617
Massachusetts	79,751	\$3.6 billion	34,930
Michigan	33,501	\$1.3 billion	11,335
Minnesota	14,321	\$459.5 million	3,366
Mississippi	2,960	\$73.5 million	593
Missouri	24,260	\$827.9 million	7,589
Montana	1,241	\$40.6 million	314
Nebraska	4,097	\$112.1 million	812
Nevada	2,031	\$60.9 million	522

State	International Students	US Dollars	Jobs
New Hampshire	3,767	\$161.3 million	1,521
New Jersey	21,985	\$861.9 million	8,200
New Mexico	2,633	\$71.7 million	543
New York	126,782	\$5.8 billion	50,430
North Carolina	23,488	\$816.1 million	8,215
North Dakota	2,102	\$43.8 million	284
Ohio	34,204	\$1.2 billion	10,683
Oklahoma	7,651	\$218.9 million	1,582
Oregon	7,379	\$260.2 million	2,058
Pennsylvania	48,593	\$2.0 billion	21,956
Rhode Island	4,786	\$257.6 million	2,252
South Carolina	6,173	\$181.6 million	1,455
South Dakota	2,018	\$44.7 million	252
Tennessee	9,206	\$332.7 million	3,190
Texas	80,757	\$2.2 billion	21,568
Utah	10,019	\$302.6 million	2,692
Vermont	1,334	\$63.3 million	367
Virginia	19,365	\$702.4 million	7,054
Washington	23,100	\$830.3 million	6,415
West Virginia	2,494	\$77.1 million	564
Wisconsin	13,650	\$486.2 million	4,650
Wyoming	805	\$18.5 million	122
<b>TOTAL</b>	<b>1,057,188</b>	<b>\$40.1 billion</b>	<b>368,333</b>

The department of commerce confirms that international students have a positive impact on the economy. In the year 2018, international students made a significant contribution of \$45 billion to the national economy (IIE, Open Doors, 2023). Lamer (2019) adds that revenue received from international students education in the year 2017 was twice the revenue from top agricultural exports. He argues further that students' expenditure on cars, food, and clothes in addition to the revenue they contribute to the economy makes the total export value of education compete with that of pharmaceuticals at (\$51 billion) and automobiles (\$53 billion). He reckons that the increase in the number of international students over the years makes it America's most vital export. Meanwhile, a significant portion of international students' funding comes from external sources outside of the US (IIE, Open Doors, 2023). In school year 2021/2022, out of the total 948,519 of international students enrolled in the US., 525,633 students funding was from personal and family sources, (Statista, 2023). "Chinese families spend more money on education than on housing. Most education fees and related costs are financed by students' family members" (Nei, 2000 as cited in Townsend & Jun Poh, 2008).

The number of international students from India is likely to increase from 1 million in 2019 to 2 million in 2025. This is consequently expected to increase overseas education spending by India to \$70 billion by the year 2025

(Abroad Education Consultants, 2023). Local economies likewise benefit tremendously from international students through living expenses such as housing, health insurance, food, transportation, etc., especially international students with families, contributing significantly to the net income of the state (Chen, 2008, NAFSA, 2023). A study conducted by Rogers (1984) among international students in Indiana universities revealed that each year international students contributed an average of \$50 million to the Indiana economy. The study further revealed that the economic benefits derived from international students was far greater than the costs of hosting them, adding that apart from tuition international students paid, their expenditure on living expenses over a period of one year was a significant contribution to the export sector of the state (Apanda, 2000). In a similar report, the mayor of Ithaca elucidated to *USA Today Network* that the presence of international students generates significant income for both businesses and the local community. He expounds that within a year, international students at Cornell University supported 3,976 jobs and contributed \$304.2 million to the state (Myrick, 2020). Institutions that recruit international students enjoy reduced cost of providing tuition, economies of scale, and several other advantages (Patokina, 2020).

For the tourism and airline industry, international students travel around their host country to visit places of interest during holidays, making them tourists and contributing towards the tourism and airline industry as they spend on airfares, travel insurance and other travel related expenses (Johnston, Baker, & Creedy, 1997; Townsend & Lee, 2004; López, Fernández, & Incera, 2016; Gullace, & Griffin, 2021). This has however come at a significant environmental cost according to research by Shields (2021) which revealed that “greenhouse gas emissions associated with international student travel more than doubled between 1999 and 2014, to reach between 14.01 and 38.54 megatons a year, somewhere between the total annual emissions of Jamaica and Croatia” (Chronicle of Higher Education).

International students facilitate cross-cultural communication, contribute new ideas, techniques, and concepts which enhances the educational curriculum (Zimmermann, 1995; Tran & Pham 2016; Streitwieser & Madden, 2019, American Physical Society, 2020), and bring international perspectives into classrooms (Anelli et al. 2017, IIE, 2023). Their presence makes most institutions’ prestigious and their programs competitive (Wu, Garza, & Guzman 2015, Klimova et al. 2016). The interaction between international students and local students enables domestic students prepare for global careers (IIE, 2023), appreciate their own culture and that of other cultures as they realize the similarities and diversity in each culture, resulting in longer-term business relationships and economic benefits (IIE, 2023; Tran & Pham 2016; Hegarty 2014; Bier & Rota 1997; Wu, Garza, & Guzman 2015). This helps with application of learnings from global scenarios to address and work with issues at the local level. Johnston et al (1997) however contends that the presence of international students poses several hardships to institutions such as overcrowding in the classrooms and additional cost of providing immigration services, not to mention international students competing for scholarships with domestic students.

### **Intellectual Gains and Contribution to US Innovation**

International students contributions to science and innovation is significant (Okai, 2020). Most STEM programs offered by institutions in the US will be impossible to sustain without international students as the enrollment of

international students in these programs significantly surpass the enrollment of domestic students (Okai, 2020; Klimova et al. 2016, Rovito, Kaushik, & Aggarwal, 2021). International students make it possible for institutions to maintain high quality science programs and faculty, and provide adequate number of students and researchers crucial for conducting research (Okai, 2020; Beethika Khan, et al, 2020; NFAP, 2018; American Physical Society Office of Government Affairs, 2020). Foreign nationals studying at US universities have become a key source of researchers and entrepreneurial talent in Artificial Intelligence (AI). A 2022 National Foundation for American Policy (NFAP) study found immigrant entrepreneurs had started more than half of US billion-dollar companies, and which included several AI companies.

Kotkin (1993) asserts that out of every three engineers in Silicon Valley, one was a former international student (Okai, 2020) and “one out of every four researchers at IBM’s Yorktown Heights Laboratory was an international student, and two out of five students at the AT & T laboratories are international students (Okai, 2020, pp.16; Kotkin, 1993). Research conducted by NFAP in 2018 on startup companies with a minimum value of \$1 billion revealed that about 55% of startup companies in the US valued at \$1 billion or more were started by immigrants and continue to be key members in over 80% of the companies. The research further revealed that the founders of about a quarter of these companies were previously international students in the US. Each of these billion-dollar startup companies have created about 1200 jobs (NFAP, 2018).

### **Challenges and Costs of Hosting International Students**

There is paucity on literature on costs of hosting international students, but despite the tremendous benefits that international students bring to their host nations, their presence also comes at a cost to the institutions that host them and to the federal government. The costs associated with international student enrollment for academic institutions of higher education in the US are multifaceted, with key aspects comprising infrastructure and resources, scholarship and financial aid, administrative costs incurred for compliance with federal regulations governing international student recruitment, enrollment, and visa sponsorship, and other cultural and academic support expenses (NAFSA, 2023).

### **Educational and Administrative Cost**

This includes cost of hiring instructors and teachers to teach the various courses that international students are enrolled in, cost of developing and maintaining special courses tailor made for international students such as language testing and language support, congestion in classrooms and other educational facilities, laboratory costs, library costs, etc. The institutions that international students attend have an added responsibility of providing a comprehensive and new array of services purposely for them and an increase in their numbers has led to congestion and a high demand of existing limited resources which has consequently led to a drop in the quality of higher education (Johnston et al, 1997).

Government incurs administrative costs on international students. Recruiting and maintaining staff and offices that handle visa applications, visa regulations and restrictions, and other immigration related policies and issues



come at a huge cost to the government (Inside Higher Ed, 2020, Redden 2018). Administrative cost also includes governmental aid and scholarships that the government offers international students and the cost of administering and maintaining these aids and scholarships for international students (NAFSA, 2018). While it is difficult to measure the cost of capital items and their depreciation, it is worth mentioning other costs such as cost of recruiting and retaining personnel such as liaison officers, admissions officers, cost of utilizing non-academic facilities such as sports and recreational facilities, cost of advertising and marketing. Most universities and colleges have an international students' unit or department that offers immigration and other related services for international students which all comes at a cost to the institutions (Baker, Creedy, & Johnson, 1996).

### **Opportunity Cost**

This refers to the return or interest on investment forgone by opting to provide quality higher education for international students, even though universities are not usually known for maximizing profits but rather quality education being their hallmark. Displacement of jobs and opportunity cost also occurs as international students take up jobs that were previously being done by domestic workers. Quality of job intake is lowered for international students instead of increasing the intake of domestic workers which could consequently increase domestic earnings or revenue. A reduction in domestic revenue implies a decrease in tax revenue and forgone tax base increase.

### **Methodology**

The purpose of this desk research study is to explore, describe and analyze the costs of hosting international students in the US while evaluating the benefits they bring by utilizing secondary data sources. The focus is to ascertain whether it is worth the cost and effort, and time to recruit international students in US higher educational institutions. Hosting international students comes with intellectual, financial, and economic gains while also at a cost to the government and institutions. An evaluation of these costs and benefits of international students is important for policy makers, academic institutions, and key stakeholders in allocating resources to international students, and recruitment and retentions efforts. To address the research objectives of this study, secondary data obtained were analyzed. Doolan et al (2017) highlight that this method can facilitate results more quickly as compared to primary data collection where recruiting subjects are required. Most studies on international students utilize qualitative methods [online surveys] which are appropriate because such studies are specific to communities or institutions. It was however important for this study to use secondary data from national and credible sources such as the IIE, NAFSA, and NSF because this study captures the entire international students body as a whole and not specific to individual states or institutions. Consequently, online surveys will be impossible to administer to all higher education institutions in the US. Secondary data analysis methodology was a good fit for this research.

### **Data Collection**

Data on the financial gains and contributions from international students were gathered from the Institute of

International Education's (IIE) database. Data on the economic impact of international students was obtained from Association of International Educators (NAFSA). Data on international students' contribution to innovation and science was gathered from the National Science Foundation (NSF), and NFAP databases. Data on international students' contributions to tax, health insurance, and tourism, and the costs of hosting international students, were unavailable through the databases of IIE, Organization for Economic Co-operation and Development (OECD), Statista, Inter-university Consortium for Political and Social Research (ICPSR), Data.gov, Bureau of Education and Cultural Affairs, Institute for Higher Education Policy (IHEP), and the Chronicle of Higher Education.

## Results

### Research Objective 1. There are Economic Benefits of Hosting International Students in the US

To ascertain the economic benefits of hosting international students, the impact of international students' enrollment on job creation, and revenue generated from international students were used. Figure 2 shows an analysis of data obtained from NAFSA on international students enrollment, and total jobs created from 2007/2008 to 2022/2023 academic year. On average over the last 15 years (2007-2023), about 350,318 jobs were created yearly because of enrollment of international students in US universities. In 2007, it was 238, 469 and steadily increased to 368,333 in 2022/2023 which is a jump of about 130, 000.

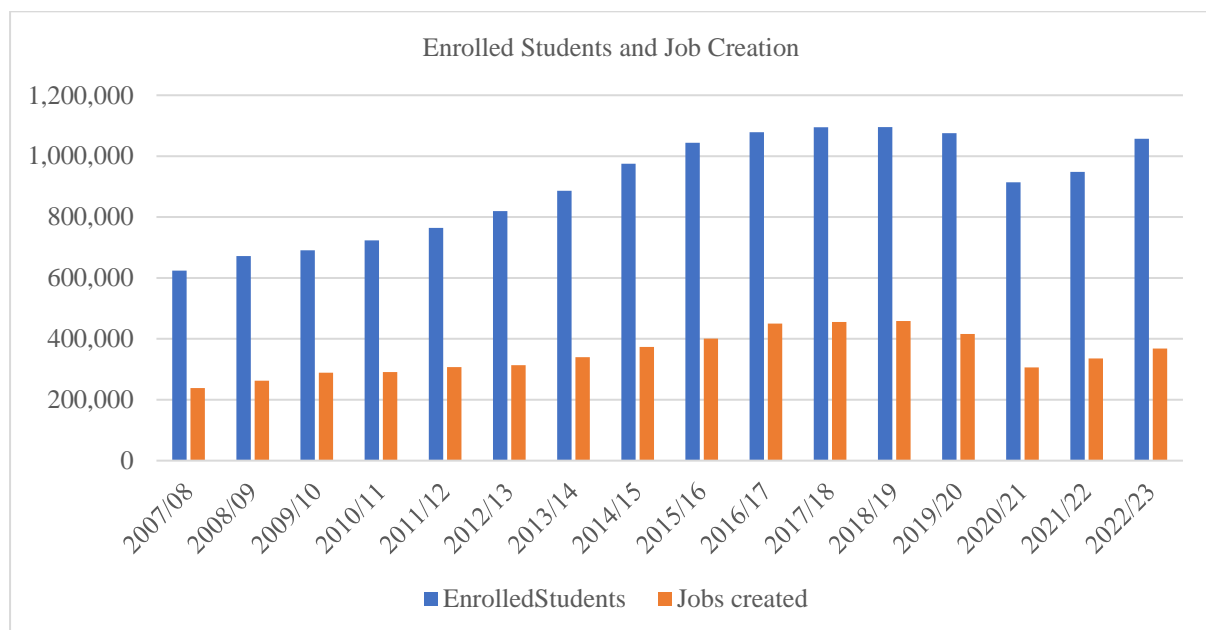


Figure 2. International Students Enrollment with Job Creation

From Table 2, the robust correlation score of 0.937 represents a strong positive relationship between international student enrollment at US institutions of higher education and jobs creation in the US economy, and is highly significant at the  $P < 0.01$  level. Substantively, this means international student enrollment at US universities contributes directly to job creation. As the enrollment of international students increases, so does the potential pool of skilled workers available to US employers, thereby positively impacting job creation.

Table 2. Correlation of Student Enrollment with Job Creation

		student enrollment	Jobs Created
student enrollment	Pearson Correlation	1	.937**
	Sig. (2-tailed)		0.000
	N	16	16
Jobs Created	Pearson Correlation	.937**	1
	Sig. (2-tailed)	0.000	
	N	16	16

\*\* . Correlation is significant at the 0.01 level (2-tailed).

Table 3. Descriptive Statistics for International Students Enrollment with Job Creation

	Mean	Std. Deviation	N
student enrollment	903924.2500	167447.53453	16
Jobs Created	350318.3125	70027.41717	16

The descriptive statistics above highlight the fact that international students often bring diverse perspectives, skills, and entrepreneurial aspirations to the US as reflected by the number of jobs created on an average in a year. The NFAP confirms that each foreign student earning an advanced degree in a STEM field from a US university is associated with 2.62 jobs created in the US. This figure accounts for both direct employment and indirect job creation resulting from innovation and entrepreneurship.

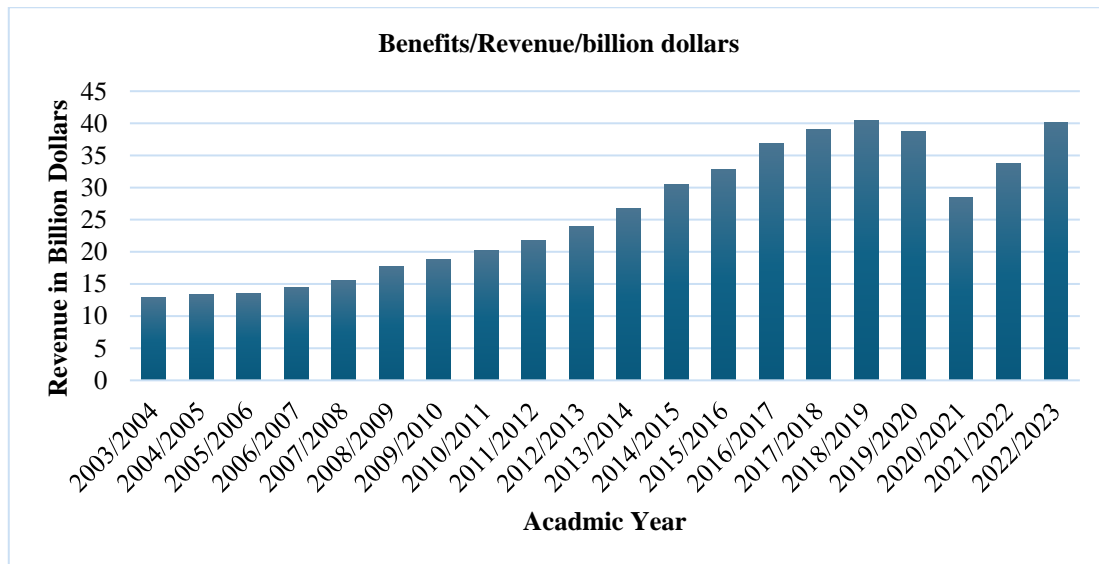


Figure 3. Revenue Generated from Hosting International Students

Figure 3 shows revenue generated from international students from the 2003/2004 academic year to 2022/2023 academic year. The revenues generated by international students are calculated after factoring in their costs of living including costs of living for their dependents. As highlighted in the above graph, revenue generated steadily increased from 12.9 billion dollars in 2003 to a record high of 39 billion dollars in the 2018/2019 academic year. Revenue however decreased slightly in the 2019/2020 academic year but decreased significantly in the 2020/2021

academic year due to the COVID—19 pandemic. In the 2021/2022 academic year, revenue increased again to 33.8 billion and a whopping upbound to 40.1 billion in 2022/2023. Overall, this exploratory study elucidates that international students make significant contributions to job creation, revenue generation and economic growth in the US, supporting a diverse range of industries and sectors.

### Research Objective 2. There are financial gains and costs of hosting international students

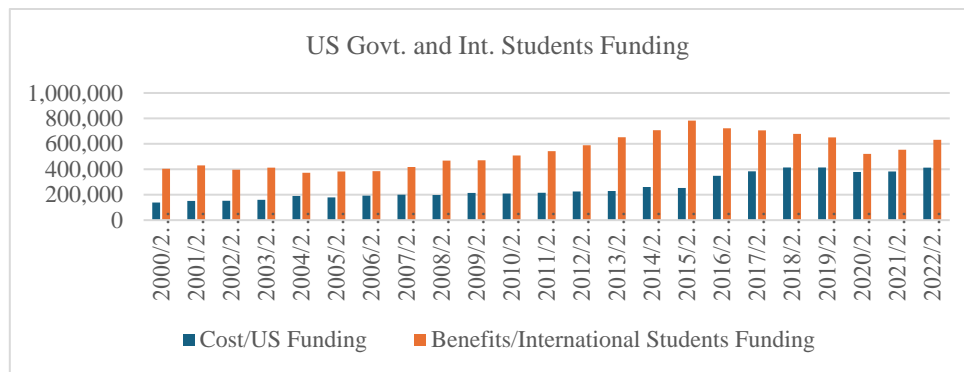


Figure 4. International Students Funding Compared with US Government Funding

The goal of this analysis is to determine the costs of hosting international students and the financial contributions they make to the US. economy. Funding from the US government includes federal research grants, teaching and research assistantships, funding from private sponsors in the US, and current employment. International students funding sources includes funding from private or family sources, funding from foreign government or university, foreign private sponsors, and international organizations. Figure 4 shows the source of funding for international students from 200/2001-2022/2023 academic years. Over the entire period, funding from international students have been fluctuating but still significantly higher than funding from the US government with its highest contribution (\$782,852) in the 2015/2016 academic year which was more than triple the funding from the US government (\$253,653) . Noteworthy, funding from the US government has been increasing over the entire period with its highest funding of \$413,906 in the 2019/2020 academic year, a time when funding from international students was declining. Despite fluctuating funding from international students, the figures are still significantly higher than funding from the US, denoting a net gain or benefit (Statista, 2023; NAFSA, 2023; IIE, Open Doors, 2023).

Table 4. Descriptive Statistics of International Students and US Government Funding

Cost/US Funding		Benefits/International Students Funding	
Mean	256687.2609	Mean	538602.1
Standard Error	20058.95532	Standard Error	27126.46
Median	215505	Median	521403
Mode	#N/A	Mode	#N/A
Standard Deviation	96199.37027	Standard Deviation	130093.9
Sample Variance	9254318841	Sample Variance	1.69E+10
Kurtosis	-1.183385189	Kurtosis	-1.29987

Cost/US Funding		Benefits/International Students Funding	
Skewness	0.651264509	Skewness	0.311839
Range	275151	Range	410087
Minimum	138755	Minimum	372765
Maximum	413906	Maximum	782852
Sum	5903807	Sum	12387849
Count	23	Count	23
Largest(1)	413906	Largest(1)	782852
Smallest(1)	138755	Smallest(1)	372765

The above descriptives highlights the average amount (in US \$) for a year spent by US higher education institutions towards tuition assistance and external funding for international students. Specifically, on an average, it costs US academic institutions about \$ 256,687 per year to educate international students, with amounts varying from the lowest level at \$138,755 per year to the highest level at \$413906 per year indicating a wide range of costs across institutions of various sizes located in the different parts of the country. Juxtapose to that, the benefits indicate that enrollment of international students at these institutions, results in benefits averaging \$538,602 per year with variations amounts ranging from the lowest level at \$372,765 per year to the highest level at \$782852 per year [significantly higher than the cost], indicating a wide range of benefits across different types of institutions located in different parts of the country. The benefits associated with international student enrollment for academic institutions of higher education in the US are varied with key aspects comprising tuition revenue, impacts arising from fostering a diversity and global perspective for students in an increasingly interconnected world, effect of research and innovation endeavors that impact the reputation of these academic institutions creating opportunities for attracting funding and other potential collaborative opportunities, alumni networks and global outreach activities that promote the academic institution's reputation and attract prospective students and collaborators from around the world, and the economic impact in terms of supports to local businesses, creation of jobs and stimulation of economic growth in the surrounding community (www.nafsa.org). Investing in international student enrollment is not only a sound educational strategy but also a wise economic decision that yields substantial returns for the US economy, driving innovation, entrepreneurship, and cultural exchange while bolstering America's leadership in the global knowledge economy.

Table 5. US Funding (Costs) and International Students Funding (Benefits)

		Benefits	US Cost
Benefits	Pearson Correlation	1	.689**
	Sig. (2-tailed)		0.000
	N	23	23
US Cost	Pearson Correlation	.689**	1
	Sig. (2-tailed)	0.000	
	N	23	23

\*\* . Correlation is significant at the 0.01 level (2-tailed).

As seen in Table 5 above, the benefits of having international students at US institutions of higher education [as viewed through the lens of funding sources of the international students] has consistently indicated a growth pattern by outweighing the costs [as viewed through the lens of costs incurred by the US government] in providing quality education to these students. This is also validated by the robust correlation score of 0.689 that is highly significant at the  $P < 0.01$  level, underscoring a strong positive relationship between the two variables, i.e., costs and benefits of international student enrollment at US institutions of higher education. This bolsters the argument that the higher the investment in enrollment of international students in US institutions of higher education, the larger the benefits reaped by these institutions.

### Research Objective 3. International Students Contribute Significantly to US Science and Innovation

In answering research objective three, a descriptive approach was used. Data from NFAP shows that international students enrollment in the STEM fields is significantly higher than that of local students (Figure 5). International students disproportionately earn doctoral degrees in fields underlying critical and emerging technologies relative to other fields (National Science Board, 2022). Despite a decline in graduate international students enrollment over the last few years in electrical engineering (19.5%) and computer and information sciences (9.5%), their enrollment in these courses and most science fields still significantly surpasses that of local students in same fields (NFAP, 2021).

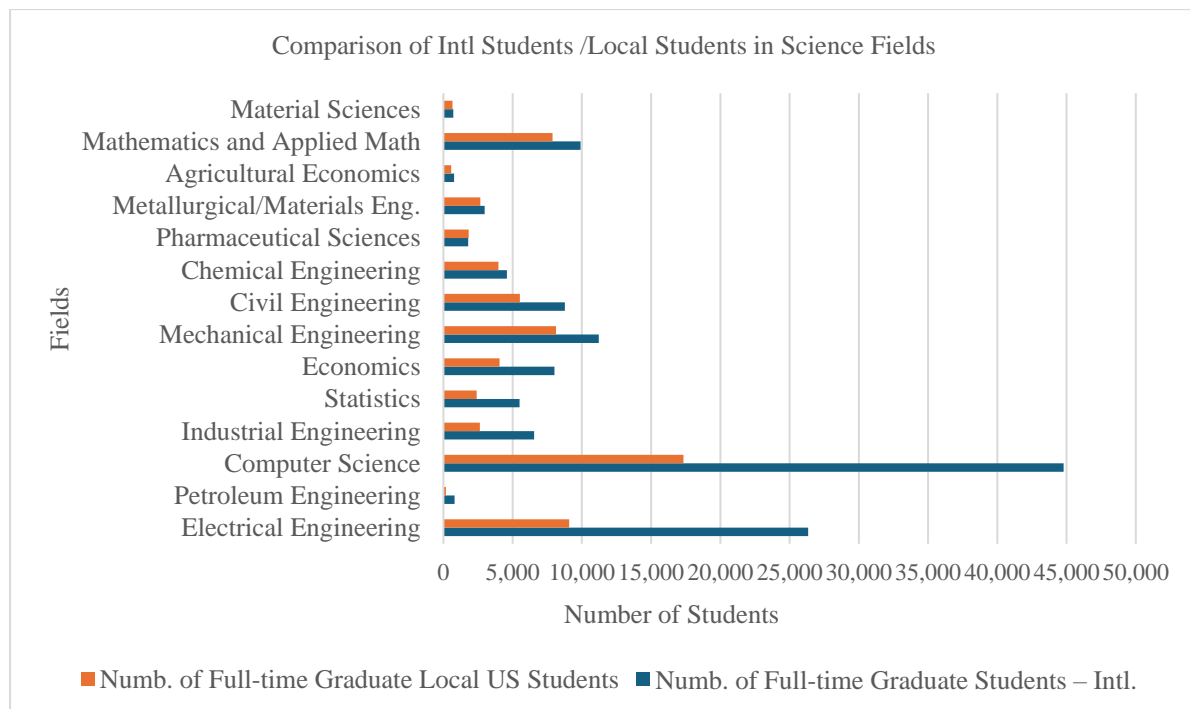


Figure 5. Graduate International Students in Science Field (2019)

From the figure above, the major with the highest number of international students is computer science (44,786-72%), followed by electrical engineering (26,343-72%), and mechanical engineering (11,215-71%). The major with the most significant difference between local students (181) and international students (803) enrollment is

petroleum engineering (NFAP, 2021).

Table 6. Graduate Programs in the US with most international students in 2019

Field	US Universities with More Than 50% Intl. Students in Graduate School Programs	Percentage of US Universities with a Majority Intl. Students in Graduate School Programs
Electrical (and Electronics and Commercial) Engineering	149	88%
Industrial/Manufact. Engineering	65	86%
Economics	86	80%
Statistics	60	79%
Computer and Information Sciences	211	78%
Civil Engineering	93	76%
Mechanical Engineering	101	67%
Metallurgical and Materials Eng.	36	63%
Pharmaceutical Sciences	29	63%
Chemical Engineering	55	61%
Mathematics/Applied Math.	83	54%

In the year 2019, 88% of graduate students enrolled in electrical engineering in most universities in the US were international students (Table 6), 86% for industrial engineering, 80% for economics, and 79% for statistics (NFAP, 2021, NSF). In that same year, 211 universities had more than 50% of their enrolled students in computer and information sciences as international students, and about 149 universities had more than 50% of their enrolled students in electrical engineering as international students. The National Science Board 2022 report highlights that STEM disciplines including engineering and computer science and mathematics fields which underlie many critical and emerging technologies, currently award more doctoral degrees to international students (i.e., temporary visa holders) than to citizens and permanent residents, largely owing to the excellence of US.-based doctoral programs.

**Comparison of Local and International Students Enrolled in Graduate Programs from Selected Universities in the North/Northeast, South/Southeast, West, California and Texas**

The following graphs (Figure 6, 7, 8, and 9) highlight a common theme of increasing presence of international students vis-à-vis local students in STEM disciplines at institutions of higher education as represented by the various geographic zones in the country including the northern and northeastern regions, southern and southeastern regions, western region and also exclusive focus on the states of California and Texas. This is a clear demonstration of how American colleges and universities strive to attract top international students to pursue and obtain STEM degrees both at the undergraduate and graduate levels in order to remain globally competitive.

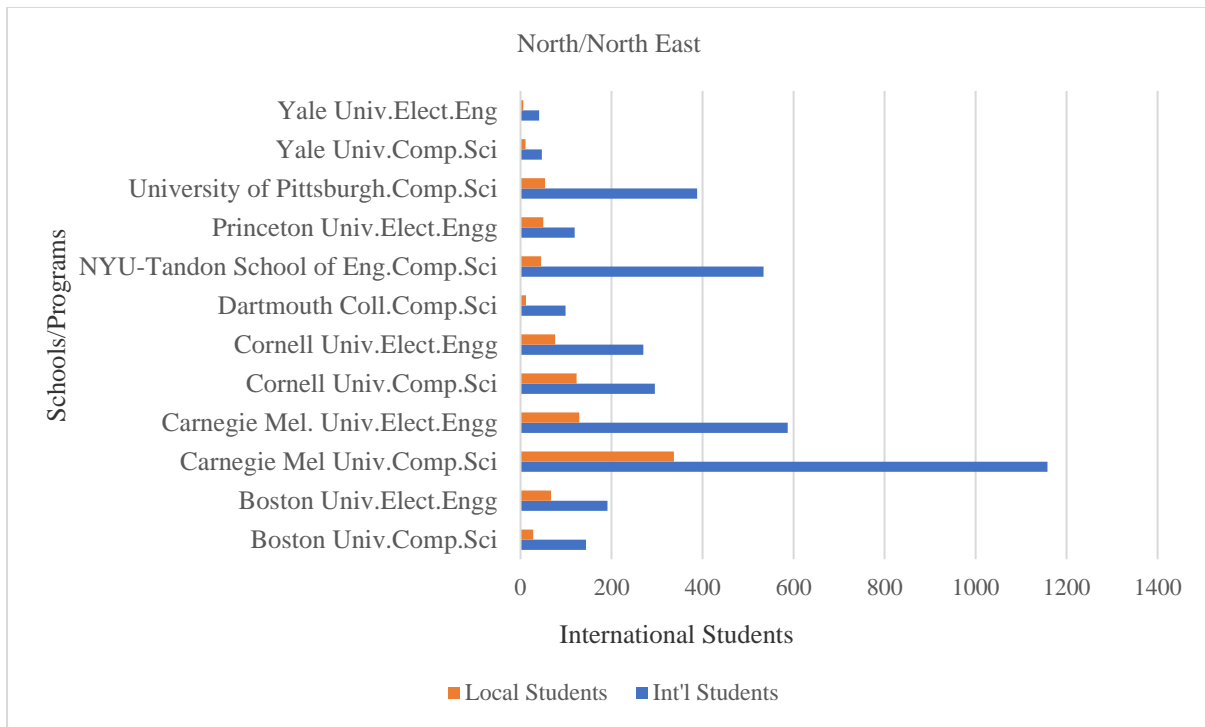


Figure 6. Graduate Programs from Selected Universities in the North/Northeast

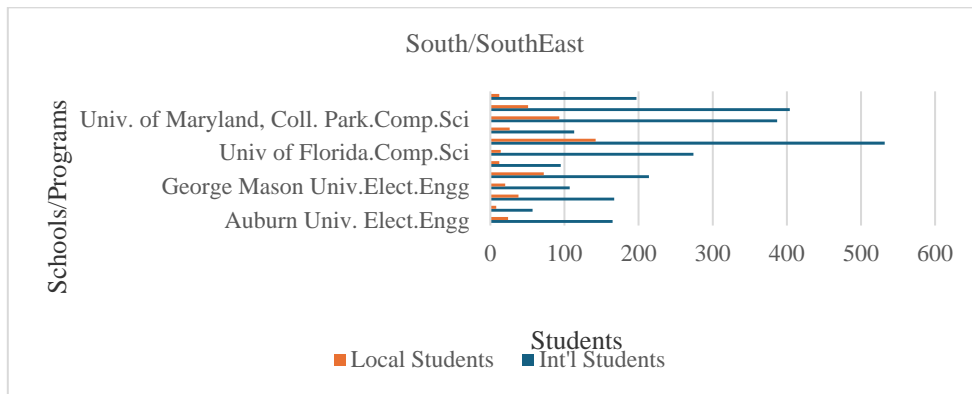


Figure 7. Graduate Programs from Selected Universities in the South/Southeast

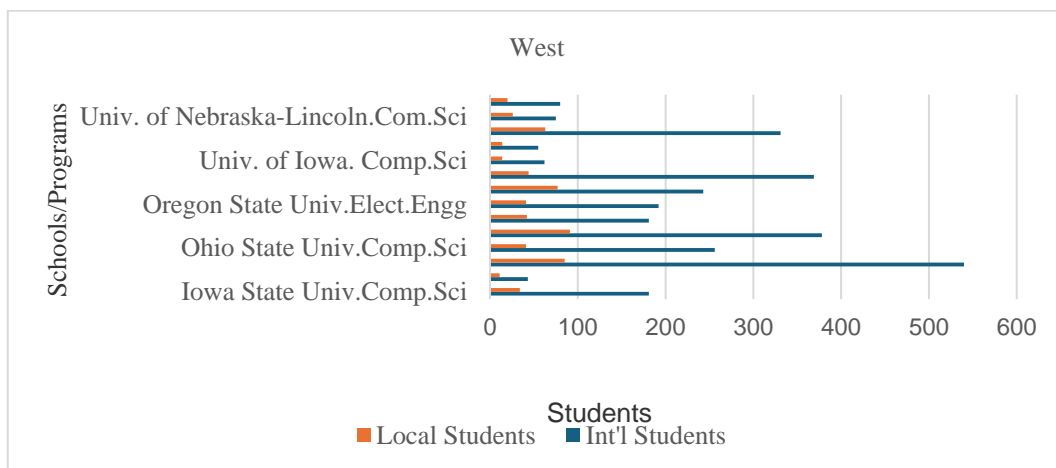


Figure 8. Graduate Programs from Selected Universities in the West



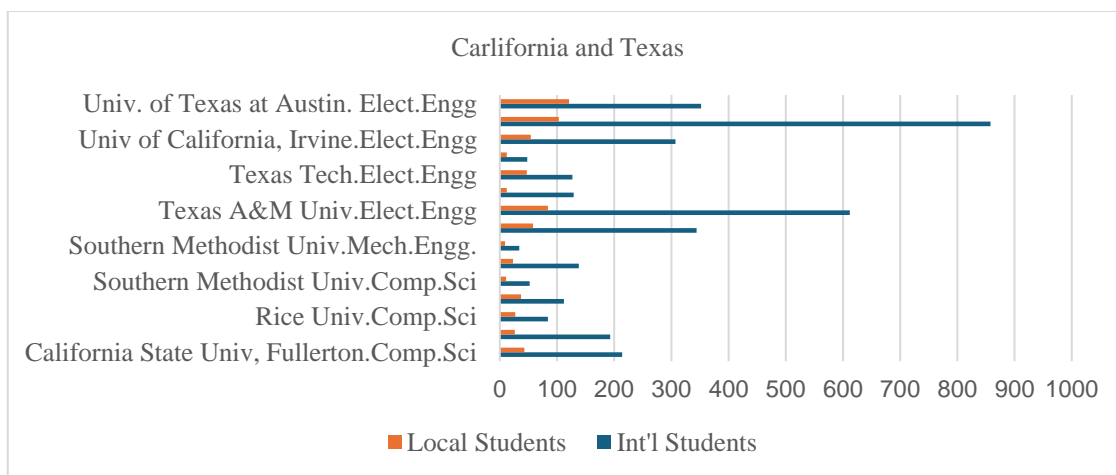


Figure 9. Graduate Programs from Selected Universities in California and Texas

The above figures (6,7,8,9) illustrate how international graduate students enrollment in science and STEM fields outpace that of local students, validating, that international students contribute significantly to US science. In the North/Northeastern region, New York University's Tandon School of Engineering, 92% enrolled students are international students and 89% of students enrolled in Dartmouth College's computer science program are international students (Figure 6). In the South/Southeast, 95% of enrolled students in University of Florida's computer science program are international students, and 94% of University of North Carolina's computer science program are international students (Figure 7). In the West, 89% of University of Cincinnati graduate students in electrical engineering are international students, and 86% of Ohio State University's computer science program are international students (Figure 8). In California and Texas, 92% of Texas State Technical College's computer science program are international students, and 89% of University of South Carolina's electrical engineering program are international students (Figure 9). It is worth mentioning that "at the graduate level, international students do not crowd-out, but actually increase domestic enrollment." (Shih, 2017, pp.23). International students essentially make it possible for institutions to increase enrollment of local students due to *cross subsidization* (cross subsidization- reincrease in local students' enrollment in graduate programs enhanced by international students enrollment (Shih, 2017).

## Summary

The purpose of this study was to explore and evaluate the costs and the economic, financial, and intellectual benefits of hosting international students in the US. The data analysis revealed the following findings in step with the research objectives:

### Research Objective 1. There are Economic Benefits of Hosting International Students in the US

1. *One Job is Created with the Enrollment of Every Three International Students.* NAFSA (2023) asserts that with the enrollment of every three international students, one US job is created/supported (Figure 2). Table 2 and 3 prove that there is a high correlation between international students enrollment and

number of jobs created, the number of jobs increased every year as international students enrollment increased. In 2022/203 368,333 jobs were created with the enrollment of 1,057,188 international students.

2. *International students Economic Contribution is Significant in All 50 States.* Lamer (2019) reiterates that revenue gained by the US government from education in 2017 is about twice the revenue from its top agricultural exports. What makes the financial gains even more advantageous to the US is that the revenue generated is distributed in all 50 states of the US as shown in Table 1. Chen (2008) highlights in the literature that international students contributed significantly to the local economy of the state of New York through living expenses such as housing, transportation and other related expenses especially international students with families. Lewin (2007) echoes that international students contributed \$1.5 billion to New York City alone which was more than the combined contributions received from sports franchises such as the Nicks, The Yankees, The Rangers, The Mets, and The Giants. ). The US department of commerce acknowledges that international students are an economic resource for the US and make significant contributions to the local economies, state, and the nation.

### **Research Objective 2. There are Financial Gains and Costs of Hosting International Students.**

1. *There is a Strong Relationship Between International Students Enrollment and Revenue Gained by US Government/institutions, and that Revenue Generated Increases Steadily with the Increase in International Students Enrollment.* The US gains financially from international students as about 60% of their funding comes from external sources outside the US and 87% of international undergraduate students' funding comes from outside the US (IIE, 2023).
2. *The US Government Contributes Financially about 35% Towards International Students Education.* Data on international students' source of funding (Table 4) underscores the US government's financial contribution towards international students tuition. The data bears that US funding sources which includes funding from private sponsors in the US, teaching and research assistantships, and federal research grants constitutes about 35% of international students funding. From the table, US government's funding towards international students education increased continuously over the entire period except for the 2005/2006, 2008/2009, 2010/2011, 2015/2016 and the 2020/2021 academic years. Notably, US government's funding for international students increased even during periods where international family funding sources decreased. International funding sources decreased in the 2002/2003 to 2004/2005 academic years while US government funding sources increased in those same years. This recurs in the 2016/2017 -2017/2018 academic years. This corroborates the assertion by Light (1993) that the US government offers several resources to encourage international students to enroll in their colleges and universities.
3. *The US Government/institutions Gain More in Revenue Despite Increase in Supporting International Students.* The US government/institutions gain more revenue despite increased financial support for international students. Government/institutions support international students education by providing teaching and research assistantships, and federal research grants. Some private organizations have also supported international students, however support from international funding sources substantially

exceeds funding from the US.

### **Research Objective 3. International Students Contribute to US Science and Innovation**

1. *International Students Make it Possible for US Universities to Offer and Maintain High Quality Science and Engineering Programs.* In the data analysis, selected universities representing almost all the regions of the US (North/Northeast, South/Southeast, West, California and Texas) were analyzed, illuminating the number of international students in science fields as compared to local students enrolled in same. The analysis supports the statement made by NFAP that “At many US universities, both majors and graduate programs could not be maintained without international students” (NFAP, 2017). The data reveals how majority of universities and colleges in the US rely heavily on international students to maintain their graduate programs and majors.
2. *US Science and Innovation will Suffer without International Students.* The NFAP (2017) reports that international students provide the adequate number of students crucial for conducting research and retaining high profile faculty in the US. This is supported by the analysis in this study (Table 7, Figure 5,6,7,8, and 9). International students represent more than 50% in all STEM fields with 88% in electrical engineering, 78% in computer science, 86% in industrial engineering, 79% in statistics, 80% in economics, 67% in mechanical engineering, 76% in civil engineering, and 63% in pharmaceutical sciences (Table 7). These findings confirm earlier discussions in this literature of the tremendous benefits international students bring to the US and institutions, especially international students’ significant contribution to science and innovation. Most STEM or science programs are sustained by international students. More importantly, data from NFAP shows that international students enrollments in science fields have not been high only in 2019 but has been higher than local students and progressively increasing since 1995. Professor Stuart Cooper, department chair of chemical and biomolecular engineering at Ohio State University is right by declaring in the NAFP (2017) report that “to get tenure and perform research, professors require a significant number of graduate students and there are not enough domestic students alone in certain fields”.

### **Conclusion**

This study elucidates clearly that international students offer more gains to their host institutions than presenting costs. Overall, the study concludes that despite government’s effort in providing assistantships, grants, scholarships, and funding for international students, the benefits of international students far exceed the costs of hosting them. “The benefit these international students and researchers provide to the United States is clear and measurable”, (American Physical Society, Office of Government Affairs, 2020, pp.3). Jobs generated by international students far exceed jobs they have taken over implying that they help reduce unemployment in the country.

Not only do international students have a positive impact on the US economy but also to science, technology, and innovation of this great country. “International students are a significant source of talent for US employers and

allow US universities to offer high quality academic programs in science and engineering for American students” (NFAP 2021). Without international students the number of students pursuing graduate degrees (master’s and Ph.D.) in fields such as computer science and electrical engineering would be small, given the size of the US economy. The ability to recruit and retain faculty, and attain mission goals in institutions is made possible by the large number of international students enrolled (NFAP, 2021, Anderson, 2013). According to the NFAP, institutions in the US lose about \$210 billion in patents value and \$1 billion in tuition with the decline of every 1,000 PhD students visas over 10 years (NFAP, 2021). In 2017, Joachim Frank, a German born professor at the Columbia University was the sole winner for America for the Nobel Prize in Chemistry (NFAP, 2017). “In 2016, all 6 American winners of the Nobel Prize in economics and scientific fields were immigrants” (NFAP, 2017).

## **Recommendation for Practice**

Mazzarol & Soutar (2002) asserts that students are motivated to study abroad by attractive opportunities and promotional activities offered by institutions abroad. Institutions are encouraged to engage in promotional activities through social media and digital marketing tools to attract more international students. Institutions’ websites can be enhanced with interactive maps for students abroad to have a “real feel” of campus, giving them a foretaste of campus life. Virtual communities and virtual admission events should be offered by institutions to make the admission process less cumbersome for international students.

The data analysis (Table 5 and 6) highlighted the strong positive relationship between the costs and benefits of international student enrollment, validating the need for higher investment in enrollment of international students. Choudaha (2015) adjoins that institutions can support the visa process for international students, enhance institutional policies to support international students, increase scholarships, and improve recruitment strategies to attract international students. The US is seen as the center for technological innovation and it is important that it maintains a welcoming policy for international students to preserve this role. It is essential for the US to preserve STEM, OPT, improve H-1B visa processing, and enhance current visa policies to encourage international students to work in the US after graduation with the skills and knowledge acquired.

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