Migration Letters
September 2021
Volume: 18, No: 5, pp. 499 – 506
ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)
journals.tplondon.com/ml

Received: 15 April 2021 Accepted: 23 July 2021
DOI: https://doi.org/10.33182/ml.v18i5.1490

Why Do Foreign PhD Students Return Home?

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Abstract

Amid concerns about a "brain drain" from less-developed to developed economies, one issue that arises is the role of doctoral students from these countries enrolling in universities in developed economies and then staying (as opposed to returning and bringing their enhanced human capital home). Developed economies may also be concerned with their young scholars remaining abroad post-PhD. Examining confidential micro-data from the National Science Foundation's Survey of Earned Doctorates from 2001-2016, this paper explores the determinants of the return decision, based on a sample of more than 100,000. There is clear support for the view that new PhDs with large amounts of graduate student debt and limited family resources are more likely to return home. Financial considerations seem especially important in the return decision facing students from developing countries not graduating from the most elite US institutions.

Keywords: *Doctoral studies; human capital; migration*

Introduction

In both academic and popular discussions, amid concerns about a "brain drain" from less-developed to developed economies, one issue that arises is the role of doctoral students from these countries enrolling in universities in developed economies and then remaining (as opposed to bringing their enhanced human capital home). Similar concerns may come from PhDs arriving from developed economies as well. While recent work has acknowledged (see, e.g., Bhandari (2019)) that "brain circulation" and "brain gain" may in some cases better explain the implications of migrating human capital, this paper explores the determinants of the "return-home" decision, analyzing a sample of more than 100,000 from the National Science Foundation's Survey of Earned Doctorates between 2001and 2016. While limited to examination of the first employment move post-doctorate, we are able to observe the influence of demographics, academic quality, and financial variables, including the role of student debt.

Prior Literature

There is a long literature on the "brain drain" – the migration of highly-skilled individuals from less- to more-developed economies. While more recent work has suggested that the potential for movement from less-developed economies for education abroad may provide incentive for institutions in the home market to upgrade (Beine et al., 2001), the evidence is somewhat mixed on the issue. The possibility of educational migration raises the return to human capital in the source country, promoting growth, though the loss of the most educated

[1] Robert M. Feinberg, Professor of Economics, American University, Washington, DC 20016 I thank Mary Hansen, Mahmud Yesuf, and anonymous referees for helpful suggestions on earlier drafts. I also thank the National Science Foundation for providing access to the confidential data used here from the annual Surveys of Earned Doctorates. The use of NSF data does not imply NSF endorsement of the research, research methods, or conclusions contained in this report.
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group of individuals reduces growth. The net effect is ambiguous in general.[2] On the incentives facing students educated abroad in deciding whether or not to return to their home country, there is little previous large-scale quantitative work. Soon (2010) examined the return decision of 623 university students surveyed in 2008 in New Zealand (at undergraduate through doctoral levels), finding that doctoral students in general are less likely to return, while greater "skill-use opportunities" at home make students more likely to return home. Wang and O'Connell (2018) focus on both social capital and human capital in explaining the return decision of foreign students (again at BA through PhD levels) in Ireland – with a small sample (325) of graduates in the 2014-2016 period. STEM graduates were more likely to stay in Ireland (interpreted as more human capital making one more employable in a developed economy), while social capital – in terms of networks either in the host or home country influenced the stay-or-return decision in expected ways.

Closer to the focus of this paper, several papers have looked at the return of foreign students studying in the US. Huang (1988) examines the period 1962-76, using a 25-country panel of home-country-level data, finding that employment prospects in the US relative to the home country and the stringency of US immigration laws against citizens of that country influence the non-return outcome. Adverse political conditions at home, and characteristics of financial support (US university and family – as opposed to foreign government – support) also tended to favor non-return. No distinction is made between levels of education pursued in the US, and the focus seems to be on the experience of BA/BS graduates. Bratsberg (1995) broadens the analysis to 69 source countries, relying on a single cross-section – so simply 69 observations (40 in an analysis that contains all the relevant explanatory variables) – but finds that proxies for income differences and employment opportunity differences between the home country and the US have the expected impacts. As with Huang (1988), no distinction is made by level of education pursued in the US. An additional problem with Bratsberg (1995) is the comparison of early 1970s student visas with permanent resident status by 1986 – some students could have returned home for as much as ten years before then emigrating to the US.

There have been several qualitative studies conducted of intentions of foreign doctoral students to return home, based on surveys and small focus groups.[3] However, no studies have examined the question raised here, using a large sample of micro-data on new US PhDs from other countries to explain their decision to return home by field, demographic, financial, and academic quality data. In particular, the role of student debt in this decision has never been considered.

In considering why foreign students choose to return home or remain in the US after earning their PhD, clearly there are many motivations. Rakovcova and Drbohlav (2021), in a small qualitative study, find that feelings of family responsibility and ties to their country of origin

[2] Dustmann et al. (2011) brings in the possibility of "return migration" as a mitigation for a brain-drain from developing countries, utilizing a two-skill dynamic Roy model, where skills may be more efficiently obtained in developed economies, but are more highly valued at home. Bound et al. (2021) briefly discusses these issues in a broader discussion of the role of international students in US higher education.

[3] See, for example, Alberts and Hazen (2005), Hazen and Alberts (2006), and Baruch et al. (2007). Dreher and Poutvaara (2011) find foreign student inflows into the US leads to permanent migrations in the same direction. Bijwaard and Wang (2016), looking at return-home decisions after higher education more generally, find employment prospects and marriage are especially important for students from less-developed economies. Toader and Dahinden (2018) focus on the role of gender and family relationships in longer-term post-PhD transnational academic mobility.

play important roles over time in inducing return. In addition, political considerations at home as well as the relative economic opportunities for new PhDs there vs. in the US market should play important roles. And the economic opportunities are likely related to the quality reputation of the US doctoral institution as well as a student's ranking within that institution's graduates. Financial considerations, including both family wealth and student debt, should make the relative economic opportunities a more important part of the decision.

Data

Data from the National Science Foundation's annual Surveys of Earned Doctorates form the basis of this study;[4] students are surveyed soon after completing their doctorate (and the response rate is quite high – in the range of 90 to 93 percent for the 16-year period studied here). While data are available from much earlier periods, the 2001-2016 data are examined here, as earlier surveys did not include all the variables of interest (student debt in particular). Only PhD recipients who are not US citizens, are from one of the top 20 source countries for US PhD programs, and have definite employment plans for the next year (including post-docs) are included. The dependent variable explained is the decision to immediately choose employment in the individual's country of citizenship.

Below we present descriptive statistics on the sample of 102,000 individuals (with PhDs received from 2001 to 2016). Table 1 presents the share of these doctoral graduates by source country, gender, marital status, race, parental educational attainment, field, university, and year, along with characteristics of the student's program, and the levels of both undergraduate and graduate student debt. Clearly the identity of the best PhD programs in the country differs across fields (and perhaps over the 16-year period studied here); nevertheless, here a "Top 10 School" is defined as one of Harvard, Yale, Princeton, Columbia, MIT, Stanford, Berkeley, University of Pennsylvania, University of Michigan, and University of Chicago.

[4] These data were used in a study of career pursuits by new PhDs who are US citizens in Feinberg (2020).

Table 1. Mean Values (n= 102,000)

Return Home	0.149	Developing Country	0.322
On Fellowship	0.517	Brazil	0.015
Carnegie-1	0.847	Canada	0.050
Top 10 School	0.123	China	0.354
Female	0.341	Colombia	0.014
Black	0.005	Egypt	0.010
Married	0.594	France	0.013
Graduate Degree Father	0.243	Germany	0.024
Graduate Degree Mother	0.141	India	0.160
Graduate Student Debt ($2001)	4.604	Iran	0.023
Undergraduate Student Debt ($2001)	1.738	Italy	0.015
STEM	0.694	Japan	0.023
Ag	0.029	Mexico	0.020
Bio	0.144	Romania	0.013
Health	0.028	Russia	0.017
Humanities	0.046	South Korea	0.108
Engineering	Spain	0.010	0.296
Computer & Info Sci	0.065	Taiwan	0.049
Math	0.052	Thailand	0.026
Physical Sciences	0.137	Turkey	0.043
Psychology	UK	0.014	0.018
Social Sciences	0.095		
Education	0.026		
Business	0.047		
Communications	0.009		

The STEM fields are defined as Biological Sciences, Engineering, CIS, Mathematics, and Physical Sciences. And the group of countries (within the 20 top source countries for US PhDs) identified as Developing included Brazil, Colombia, Egypt, India, Iran, Romania, Taiwan, Thailand, and Turkey.

The NSF surveys provide information on both graduate and undergraduate student debt, however these are reported (separately) within ranges – somewhat problematic is that these ranges have changed over time. The solution adopted here is to impute actual debt at the midpoint of the ranges; as for the top – open-ended – ranges, these were "over $35,000" from 2001-2003, "over $50,000" from 2004- 2006, "over $70,000" from 2007-2009, and "over $90,000" from 2010 -2016, and the imputed values used for these are $42,500, $60,000, $80,000, and $100,000, respectively. While obviously this truncates high-end debt, only about five percent of survey participants have debt above those thresholds. The debt figures are adjusted by the Consumer Price Index to express them in real terms, in 2001 dollars.

Looking at Table 1, we see that on average 15 percent of foreign PhDs in the US returned home, 52 percent received fellowship support, 34 percent were female, less than one percent were Black, and a significant percent had parents with advanced degrees – 24 percent having a father with a graduate degree, 14 percent a mother with a graduate degree. Turning to field choices, STEM PhDs are clearly a major draw for foreign students – almost 70 percent in that area – with 30 percent in Engineering alone. And two countries, China (with 35 percent) and India (16 percent) are the source for more than half of all foreign PhD students in our sample. Developing countries (as defined above) comprise about one-third of the sample. And, as for debt (we do not know whether this is owed to US vs. home-country institutions), on average these new PhDs owe $6,342 (in 2001 dollars, that would be over $9,000 in 2021 dollars), of which almost three-quarters is graduate student debt.

In Table 2 we break down some of these variables by STEM PhDs, level of development of the source countries, and quality of PhD institution. STEM PhDs are far more likely to remain in the US (at least initially) after receiving their degrees than are those in other fields (only 10 percent returning home, compared to over 25 percent of non-STEM graduates). The importance of students from China and India is even stronger – about 60 percent of all STEM PhDs from abroad. They are less likely to be female, Black, receiving fellowships, or at a Top-10 school. In terms of indebtedness on receipt of their PhD, STEM graduates have far less graduate student debt on average (and somewhat lower undergraduate debt).

Differences between developing and developed economy students are also quite clear (although some of these differences are sensitive to how China is categorized). Students from developing economies are more likely to return home, less likely to attend a top-10 school, more likely to have parents with graduate degrees, but the most striking difference is the much greater amounts of student debt – 30% more from undergraduate studies and four times as much graduate student debt. Comparing PhD students attending the most prestigious US institutions to others, we see that the students from these elite schools are less likely to return home immediately, have less grad student debt and are more likely to have received fellowship support.

Table 2. Mean Values, by STEM/other, Level of Development, Quality of PhD Institution

	STEM	**Other**	**Developing**	**Other**	**Top10**	**Other**
Return Home	0.134	0.151	0.102	0.255	0.180	0.134
Grad student debt	3.729	6.589	5.223	1.335	3.187	4.802
Undergrad student debt	1.576	2.106	1.292	1.000	1.711	1.742
On Fellowship	0.461	0.643	0.503	0.523	0.765	0.482
Carnegie-1	0.839	0.865	0.815	0.862	1.000	0.825
Top 10 School	0.114	0.142	0.087	0.140	1.000	0
Female	0.275	0.491	0.305	0.358	0.313	0.345
Black	0.003	0.008	0.008	0.003	0.005	0.005
Married	0.588	0.608	0.510	0.634	0.539	0.602

Table 3. Return home and debt, Mean values by source country

	Observations	**Return home**	**Graduate Debt**	**Undergrad Debt**
		(%)	(2001$)	(2001$)
China	36,118	6.1	3,306	1,312
India	16,274	4.2	1,977	893
S. Korea	11,066	24.7	7,154	2,834
Canada	5,122	25.3	5,506	4,519
Taiwan	4,975	25.2	5,476	1,229
Turkey	4,384	25.4	9,400	1,378
Thailand	2,626	77.6	13,435	2,829
German	2,414	14.7	2,865	1,621
Japan	2,337	34.1	6,435	4,211
Iran	2,306	1.1	2,073	554
Mexico	2,026	37.2	11,970	2,017
Russia	1,693	4.3	2,284	949
Italy	1,578	10.6	2,943	1,027
Brazil	1,497	38.1	6,605	2,243
UK	1,452	9.6	4,397	5,144
Colombia	1,388	30.9	10,361	1,933
Romania	1,358	2.1	3,090	1,618
France	1,305	12.0	3,460	1,153
Spain	1,047	11.5	2,296	841
Egypt	1,034	26.8	5,449	860

For a country-specific breakdown, we turn to Table 3. The two largest sources of international PhD students, those from China and India, are especially unlikely to immediately return home – only 6 percent of Chinese PhDs, 4 percent of Indian PhDs, but what is interesting to see is the wide range of "return-home" percentages – ranging from 77.6 percent of Thai students (a clear outlier, with the second highest percentage being 38 percent of Brazilian students) to just 2 percent of Romanian and 1 percent of Iranian PhD students returning home. This points to the importance of country-source fixed effects in the regression analysis below. Also striking are the dramatic cross-country differences in mean student debt, both graduate and undergraduate. Mean graduate student debt ranges from under two thousand dollars for Indian students to over thirteen thousand dollars for Thai students. And undergraduate debt ranges from $554 for those from Iran to $4519 for Canadian students.

It must be acknowledged that student debt cannot be regarded as fully exogenous and is to a large extent a choice variable. In addition, the decision to return home has both supply and demand-side influences – both a choice for the new PhD and a possible residual from the lack of demand by potential US employers. The latter suggests controlling for factors predictive of a less successful job search. Debt taken on during one's education is determined by parental resources (proxied by their level of education) and minority status (also likely correlated with family wealth), as well as the quality of the doctoral institution.[5] However, for doctoral candidates whose post-degree plans have been left undecided until near the end of their program, debt would seem to be largely pre-determined with respect to the decision to return home or not, and simultaneity concerns may be limited. Nevertheless, we acknowledge that our results should be viewed as empirical regularities rather than with a causal interpretation.

Results

In Table 4, we present results from a linear probability model (Probit results were quite similar) explaining the likelihood of returning home for the full sample of international PhDs by the explanatory variables discussed above, plus field, country of origin, and year fixed effects. Female, black, and married international students are less likely to return to their home countries. Those with more educated parents are also more likely to remain in the US. Students attending more-highly-rated PhD programs similarly remain in the US more often.

As suggested by the descriptive statistics of Table 2, students in the STEM fields are much more likely to remain in the US post-degree, perhaps indicative of strong US demand for new PhDs in these fields. But a striking result is the clear impact of graduate student debt in pushing students to return home, with every thousand dollars of additional debt (in 2001 dollars) increasing the probability of doing so by 0.2 percent points (or 1.3 *percent* on a base of the mean return probability of 15 percent). This, combined with an interpretation of parental education as an indicator of family wealth – and a significant negative impact of this in the return-home decision, suggests that students in more severe post-degree financial straits are more likely to return home.

When we estimated separately for developed and developing country students, we see a stronger effect for developing country PhDs of graduate student debt – the coefficient of

[5] Quality of institution has two possibly competing effects – one might avoid debt by attending a lower-ranked institution offering a "full-ride" vs. a higher-ranked one with no support or simply a tuition waiver, but many top-ranked institutions only admit students with full fellowships, so their students would have less debt on graduation.

0.0032 corresponds to each thousand dollars of graduate student debt raising the probability of returning home by almost 2 percent (from the mean of 18 percent). Splitting out STEM and non-STEM students we find comparable grad debt impacts for each, though lesser effects of parental education (consistent with stronger demand in the US for STEM graduates reducing the financial burden necessity to return home). Not reported here, but when we estimate separately for those attending top-10 schools and others, we continue to find graduate student debt to significantly increase the likelihood of returning home for both groups, though a much smaller impact for those attending leading US PhD programs; we also see a smaller role of parental education in the return-home decision for those attending leading institutions. These latter results suggest that, unless a foreign student graduates from a top US institution, job prospects at home (combined perhaps with a lower cost of living) will better allow the repayment of graduate student debt (or defaulting on this debt). This seems especially likely for students from developing countries. One puzzle is a finding that Chinese students – who are among the least-likely to immediately return home – do not seem to have the return-home decision impacted at all by levels of student debt.

Table 4. Regression results, explaining return home – year, field, source-country fixed effects

	Full sample	**Developed**	**Developing**	**STEM**	**non-STEM**
Real grad debt	0.0021**	0.0012**	0.0032**	0.0019**	0.0021**
	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Real undergrad debt	0.0001	0.0006**	-0.0008*	-0.0001	-0.0001
	(0.0002)	(0.0002)	(0.0004)	(0.0002)	(0.0003)
Fellowship	0.0006	-0.0073**	0.0141**	0.0017	0.0006
	(0.0021)	(0.0025)	(0.0035)	(0.0021)	(0.0049)
Top 10 School	-0.0208**	-0.0120**	-0.0480**	-0.0143**	-0.0290**
	(0.0032)	(0.0038)	(0.0063)	(0.0034)	(0.0069)
Carnegie-1	-0.0200**	-0.0290**	-0.0062	-0.0121**	-0.0380**
	(0.0028)	(0.0037)	(0.0044)	(0.0029)	(0.0069)
Female	-0.0251**	-0.0267**	-0.0227**	-0.0100**	0.0508**
	(0.0022)	(0.0027)	(0.0041)	(0.0023)	(0.0046)
Black	-0.0521**	-0.0945**	-0.0050	-0.0058	0.0910**
	(0.0181)	(0.0219)	(0.0276)	(0.0254)	(0.0254)
Married	-0.0045*	-0.0112**	0.0101**	-0.0106**	0.0122**
	(0.0021)	(0.0027)	(0.0034)	(0.0022)	(0.0047)
Grad degree father	-0.0128**	-0.0053	0.0238**	0.0075*	-0.0213**
	(0.0028)	(0.0040)	(0.0038)	(0.0030)	(0.0060)
Grad degree mother	-0.0086**	-0.0026	-0.0109**	0.0084*	-0.0109
	(0.0033)	(0.0052)	(0.0042)	(0.0035)	(0.0071)
N	102,000	69,107	32,893	70,808	31,192
R^2	0.203	0.109	0.365	0.178	0.185

** Significant at 1% *Significant at 5%

Robust standard errors in parentheses below estimated coefficients.

Conclusion

We examine in this study the role of financial constraints in driving foreign PhD students in the US to return home post-graduation. Data limitations prevent us from going beyond the first location decision of these students, but – based on a large sample, more than 100,000 students over the first part of the 21st century – there is clear support for the view that new PhDs with large amounts of graduate student debt and limited family resources are more likely to return home. This seems especially true for students from developing countries not graduating from the most elite US institutions.

Interpretation of this result is difficult given the limitations of the data, but (other than for Chinese students) the graduate debt/return-home finding holds after controlling for country of origin, demographics, and various demand-side characteristics (quality of PhD institution, field of study, fellowship awards). The results generally hold as well when we break down the sample by STEM vs. other, and highest-quality institutions vs. others.

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