The Contribution of Foreign Master's Students to US Start-Ups

Michel Beine (University of Luxembourg)
Giovanni Peri (UC Davis)
Morgan Raux (Aix-Marseille University)

Stanford University Workshop

January 19, 2026

Motivation: Entrepreneurship and Graduate students

- The US is one of the **most entrepreneurial and business-dynamic countries in the world.**
- US NEWS Number 1 in Entrepreneurship in the World

- People with graduate degrees create 54% of Start-ups
- The US is the **world leader in tertiary education, especially graduate education (Masters, PHD)**.
- 8 US institutions in top 10; 17 in top 20, and so on.

Examples of companies by foreign graduates

- Hamdi Ulukaya (Turkey), Master of Business Administration, SUNY Albany, Chobany (Yogurt and dairy products)
- Alberto(Beto) Perez and Alberto Perlman, BA Babson College, Colombia, Zumba, (Fitness franchise: dance/martial art)
- Piotr Szulczewski (Poland) and Danny Zhang (China), U. of Waterloo, then in San Francisco. Wish (e-commerce platform) connecting customers to low cost shops.

Question

- Does an **increase in Foreign-share in a Master program have a positive causal impact on start-up rates of that graduating cohort** in first 5 years?
- Do foreign Students **have spillover effects on the start-up rate of US-Born Master classmates?**
- If such spillover exists **what are the channels?**

Contributions of this paper

- We link a representative database on **US start-up founders 1999-2019 to administrative one on graduates from US Master Programs 1999-2014**.
- We use **university-cohort variation** driven by tuition to assess causal effects of foreign-born masters on start-up creation.
- We validate the IV with the more traditional **country-networks-based shift share** variation across universities.
- We estimate the spillover impact of foreign-born classmates on US-born start-up founders and its channels.

Preview of results

- An increase by 10 percentage points (=60) more foreign master graduates results in about **0.7-0.9** additional start-ups in the average Master cohort (600 people)
- Of those between **0.27 and 0.54** companies represent the spillover effect on US-origin start-ups.
- Spillover effects of foreign graduates are in large part explained by increased **start-up co-founding**. They also increase the **"differentiation"** in "idea space" of start-ups.

Related literature

- **Higher propensity of foreign-born to be entrepreneurs** (Fairlie, 2008; Fairlie and Lofstrom, 2015; Kerr, 2015, Kerr and Kerr (2020), Azulay et al 2020).
- **Positive spillover effects of immigrants on native entrepreneurship** Fairlie (2008); Anelli et al., (2023).
- **Positive impact of foreign skilled individuals on innovation in the US** (Kerr and Lincoln (2010) (role of visas); Bernstein et al.(2022); Suen et al. (2012); Chellaraj et al. (2008); Crown et al. (2020)).

Data

Postsecondary education data (IPEDS)

- **Comprehensive postsecondary education administrative data (IPEDS)** to measure the **number of graduates** by university, degree, international/native status and year between **1999 and 2014**

- And **in-state and out-of-state average tuition and fees per degree and university in US dollars** between 1997 and 2019.

Crunchbase Data and Match

- Crunchbase data on start-ups in the US $\rightarrow$ companies bringing innovation to market founded by master graduates from US universities between 1999 and 2015
- We focus on Master degree founders, aggregate this number by university and graduation cohort-year and match with founders from crunchbase.
- We cover about 4 million Master Graduates, over 18 years and about 80,000 start-up creators. About 40,000 matched to University-Graduation cohorts
- Matched sample representative of the total rep.

Pros and Cons

- **Source:** Crunchbase.com, the largest crowdsourcing platform on US start-ups. More than 400,000 in total. Used in few econ papers, e.g. Dimmok et al (2022)– but many in management science.
- **Period:** 1999-2019
- **Pro:** Oversamples successful start up (mostly survived at least 3 years);
  Exact identification of start-up founders first and last names (not top earners), highest degree and year of graduation;
  Representative of Start-ups.
- **Cons:** Info on foreign-born status of founders $\rightarrow$ needs to be inferred from names.

Top 10 universities by number of start-ups

University	Number of start-ups	Start-ups by 10,000 graduates	Average share of international graduates
Public universities			
University of California-Berkeley	106	33.94	22.77
University of California-Los Angeles	96	24.18	16.64
The University of Texas at Austin	75	16.59	22.24
University of Michigan-Ann Arbor	66	11.85	25.09
University of Washington-Tacoma Campus	36	148.7	1.47
University of Virginia-Main Campus	35	13.66	13.56
University of Central Florida	31	10.61	9.87
University of Colorado Boulder	29	16.47	14.79
University of North Carolina at Chapel Hill	23	7.83	10.19
Georgia Institute of Technology-Main Campus	21	8.84	39.77
Private universities			
Stanford University	483	144.71	33.55
Harvard University	350	62.99	29.03
Massachusetts Institute of Technology	278	111.13	36.25
Columbia University in the City of New York	208	24.85	32.9
University of Pennsylvania	199	42.72	27.38
Northwestern University	135	30.65	22.87
New York University	135	14.35	21.42
University of Chicago	128	32.58	25.53
University of Southern California	102	14.77	32.47
Carnegie Mellon University	94	34.63	44.43

Measuring US-origin of start-up founders, to identify spillovers

- From IPEDS : the share of foreign students (F and J visas) in the university-Cohort is an exact measure of foreign-born intensity
- From Crunchbase $\rightarrow$ we infer US-non US born probability from first and last names.
- We rely on the '*forebears.io*' website that provides for each first and last name the probability of being from each country. If most likely country is US, we also assign 1 as weight, as alternative.
  - "Giovanni Peri" Prob. US=0.04 Prob. Foreign=0.96
  - "John Peri" Prob. US=0.25 Prob. Foreign=0.75

Validation Exercise

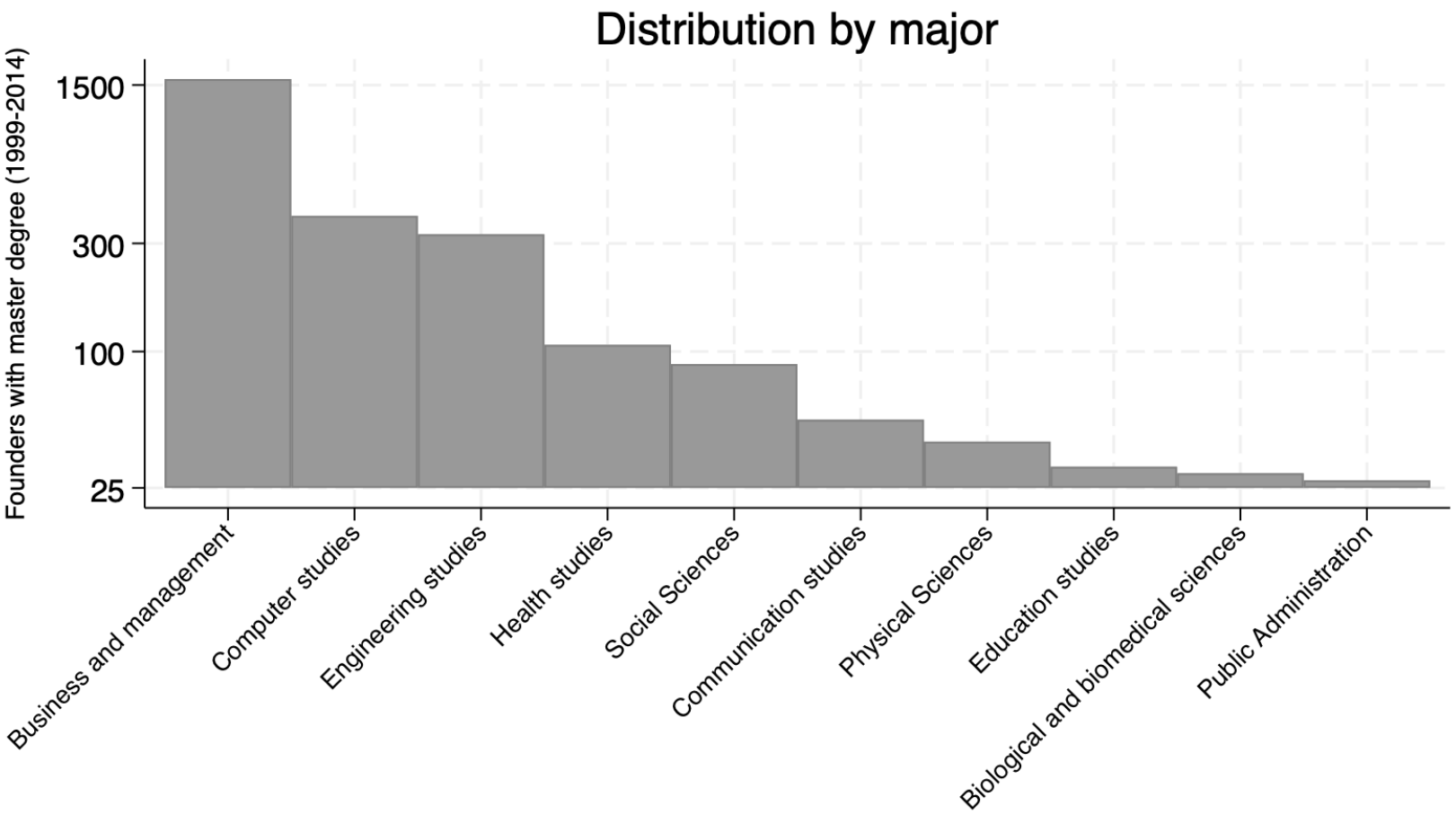
On a subsample of 1,500 entrepreneurs we do extensive online search (webpages, videos, facebook, social media accounts) to establish place of birth with very high confidence.

	Observed US-born	Observed foreign-born	Total
Predicted US-born	616 (68.29 %)	79 (12.42 %) False negatives	695
Predicted foreign-born	286 (31.71 %) False positives	557 (87.58 %)	843
Total	902 (100%)	636 (100%)	1538

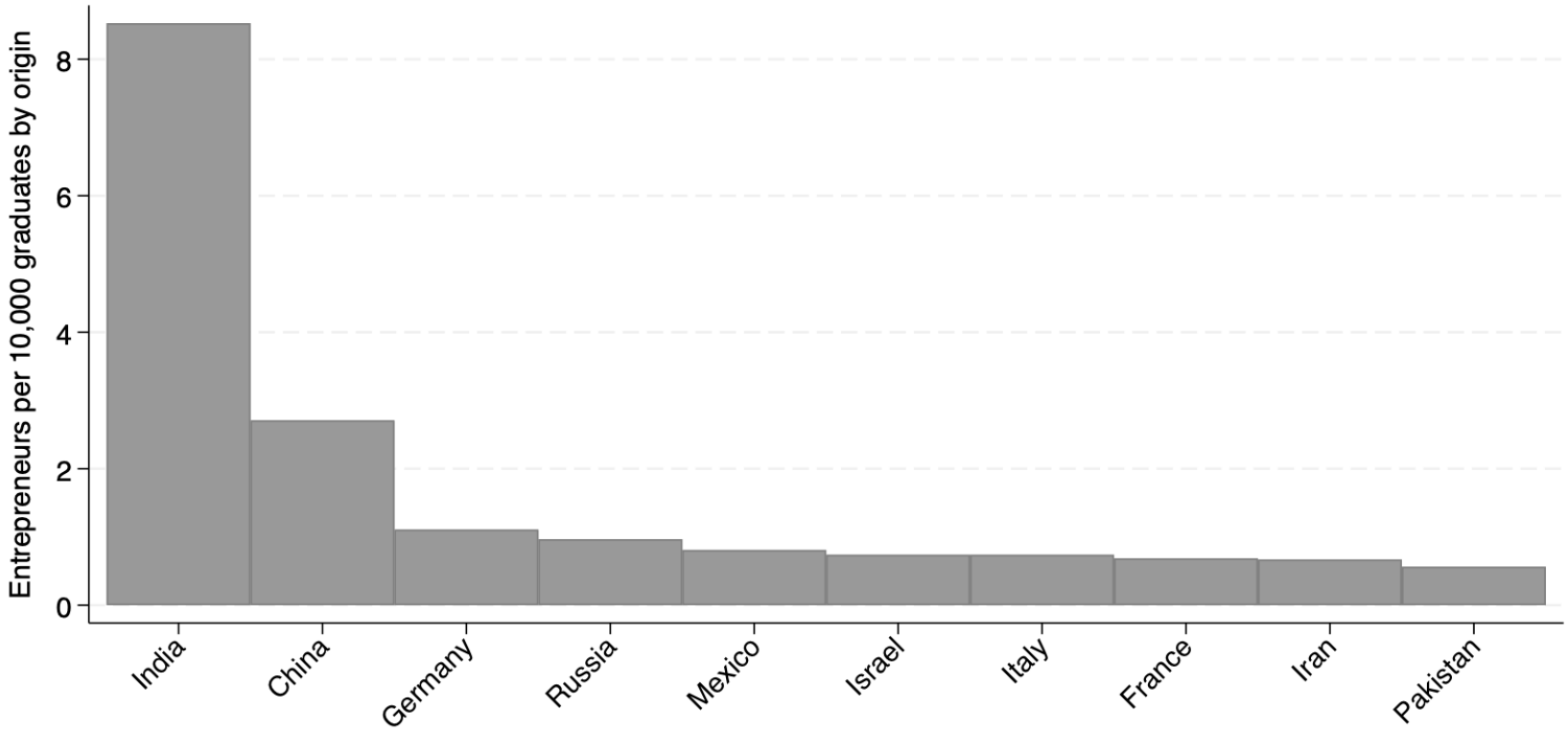
When attributing US-born status, we use the probability of false positive to generate a distribution of spillover estimates.

Descriptive Statistics and Stylized Facts

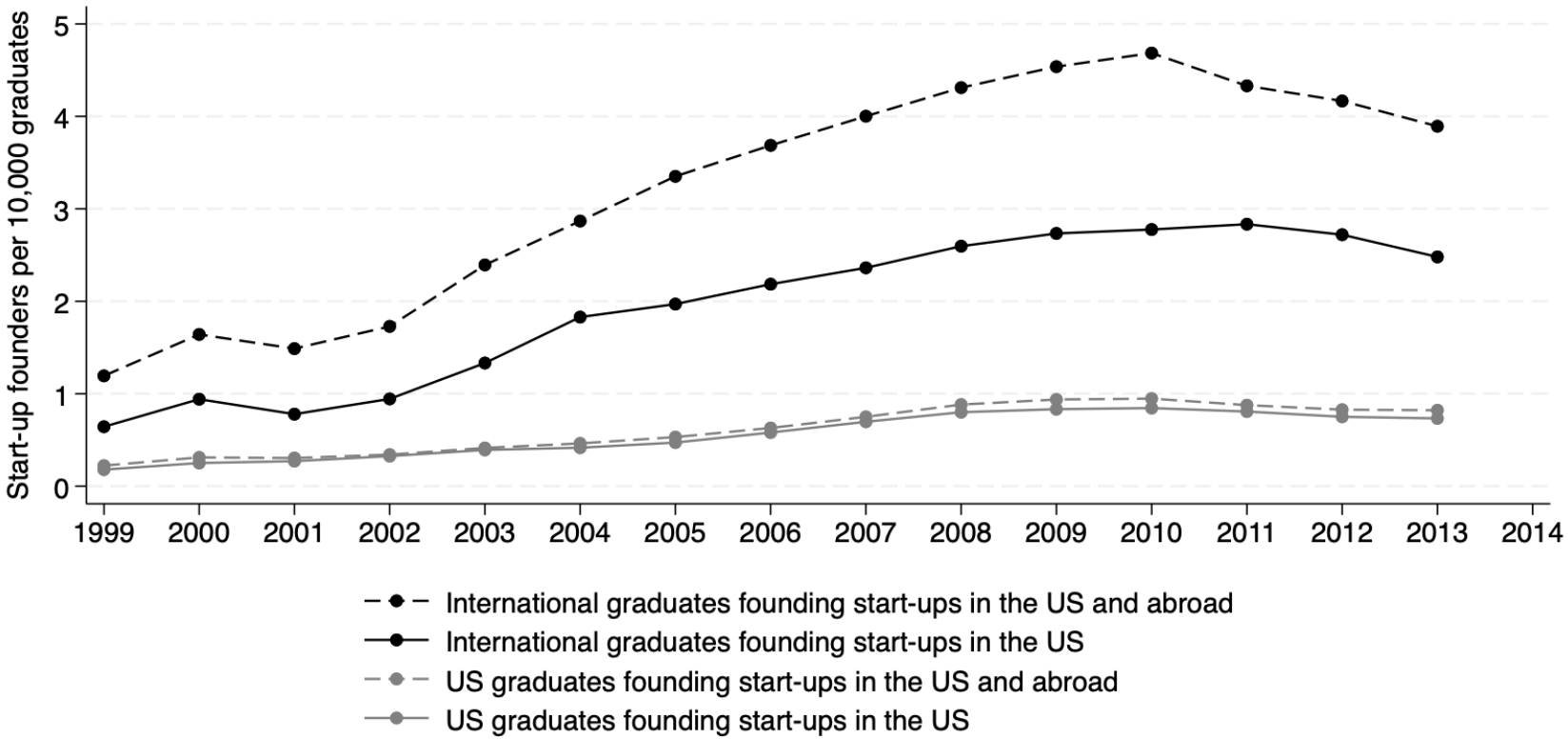
Distribution of start-ups founders by Master Type



Distribution of start-ups founders by origin



Start-up per 10,000 Master's graduates



- Foreign-origin 2.5-3 times as likely to be founders

Empirical Strategy and Identification

Empirical specification

We Estimate the following Basic specification:

$$\text{Start-Up}_{ut} = \alpha_u + \alpha_t + \beta FG_{ut} + \gamma X_{ut} + \varepsilon_{ut}$$

Where:

- Start-Up$_{ut}$= Number of start-up by Graduates within 5 years of Graduation.
- FG_{ut}= Measure of Foreign Grads (share or Ln number)
- $\alpha_u, \alpha_t, \gamma X_{ut}$ = fixed effects and controls

'u' is the university and 't" is the graduation cohort for Master students.

Endogeneity issues

- Enrollment of foreign students in a given university might depend on (unobserved) factors affecting the propensity of start-up creation.
- Examples: local policies; sector specialization in area, living costs.
- $\rightarrow$ We use 2 IV strategies.

Tuition IV Strategy

The idiosyncratic part of the per term out-of-state minus in-state tuition netted out from quality and other factors :
It affects costs of education for foreign-born but less with factors of entrepreneurship

$$\text{(Out-of-state tuition - In-state tuition)}_{ut} = \delta_t + \gamma_1' \text{Quality proxies}_{u,t} + \gamma_2 \text{State appropriations}_{ut} + \gamma_3 \text{Int Graduates}_{u,t-1} + \nu_{ut},$$

We use $\widehat{\nu_{u,t-2}}$ as IV for Share of foreign students graduating in t.
Only Public Universities, 1999-2014

Shift-Share: origin countries and networks

- F1-student visa data: $N^{F1}_{u,o,t}$: students from country o enrolled in University u in year t. we use $t_0 = 2001$:

$$(Share)^{F1}_{u,o,t_0} = \frac{N^{F1}_{u,o,t_0}}{N^{F1}_{o,t_0}}$$

- Imputed number of students, in university u, year t:

$$(\hat{N})_{o,u,t} = (Share)^{F1}_{u,o,t_0} * (N)^{F1}_{o,t}$$

$$(\hat{N})_{u,t} = \sum_{o \in O} (\hat{N})_{o,u,t}$$

- Imputed share of foreign students in year t.

$$(\hat{Share})_{u,t} = \frac{(\hat{N})_{u,t}}{(\hat{N})_{u,t} + (NUS)_{u,t_0}}$$

Strength and Validity of IV

Instrument: Strength and Validity: overview

- Both IVs have strong predictive power of foreign enrollment and graduation.
- No pre-trend correlation of both IVs with past foreign graduates and enrollees.
- No correlation between IV and quality (graduation rates) of US-students.
- No correlation between tuition IV and native graduation (less convincing for Shift share).

First Stage IV: Coefficients and Power

Dependent variable:	Share of international graduates			
	(1)	(2)	(3)	(4)
Sample:	Public universities		Not-for-profit universities	
Standardized predicted residuals from equation (1)	-0.8805***	-0.8839***	-	-
	(0.1121)	(0.1119)		
Shift-share IV	-	-	0.0782***	0.0791***
			(0.0167)	(0.0171)
Log number of master graduates	-	-0.1964	-	0.0355
	-	(0.4731)	-	(0.2482)
Observations	6,019	6,019	5,767	5,736
University fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
First-stage F-statistic	61.67	62.37	21.97	21.46

Validity Test for Tuition and Shift-Share IV: Pre-trends correlation

Table: Test IV pre-trends.

Panel A: Residual tuition IV

Controls :	Share of international graduates (4 years lag) (1)	Share of international graduates (5 years lag) (2)	Share of international enrollees (4 years lag) (3)	Share of international enrollees (5 years lag) (4)	Entrepreneurs per 10,000 graduates (4 years lag) (5)	Entrepreneurs per 10,000 graduates (5 years lag) (6)
Dependent variable:						
Predicted residuals from equation (1)	-6.0862	-3.1070	2.9505	10.1554	-4.7347	-5.5349
	(6.3079)	(6.4109)	(13.8105)	(14.9880)	(6.2046)	(6.6461)
Observations	6,789	6,765	6,819	6,798	6,779	6,754
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
University fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Shift-share IV

Controls :	Change in number between 1995 and 2003					
	Graduates (1)	Foreign graduates (2)	US graduates (3)	Entrepreneurs (4)	Foreign entrepreneurs (5)	US entrepreneurs (6)
Dependent variable:						
Change in predicted share of international graduates from SSIV b/w 2004 and 2014	0.1233	1.9070***	-0.0687	-93.0237	-210.2281	-80.3994
	(0.1517)	(0.4835)	(0.1632)	(69.5576)	(165.8605)	(77.8220)
Observations	548	548	548	548	548	548

Validity Test: Correlation with US-Born graduates

Table: Impact of instruments on native and foreign graduates

Dependent variable:	asinh(Number of graduates)		asinh(Number of foreign graduates)		asinh(Number of US graduates)	
	(1)	(2)	(3)	(4)	(5)	(6)
Standardized predicted residuals from equation (1)	-0.0171***		-0.1138***		-0.0063	
	(0.0061)		(0.0200)		(0.0062)	
Shift-share IV		-0.0003		0.0065***		-0.0015
		(0.0011)		(0.0020)		(0.0012)
Observations	6,019	5,736	6,019	5,736	6,019	5,736
University fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Main Results

Effect of Foreign Share on total number of start-ups

Tuition IV

Dependent variable:	Number of entrepreneurs		Number of companies	Number of local companies	Number of surviving companies	Number of companies funded above the avg	Number of patenting companies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Share of international master graduates	0.0005	0.0698***	0.0721***	0.0715***	0.0686***	0.0475**	0.0121***
	(0.0011)	(0.0258)	(0.0277)	(0.0276)	(0.0191)	(0.0201)	(0.0042)
Observations	6,019	6,019	6,019	6,019	6,019	6,019	6,019
University fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	.	61.67	61.67	61.67	61.67	61.67	61.67

Shift-share IV

Dependent variable:	Number of entrepreneurs		Number of companies	Number of local companies	Number of surviving companies	Number of companies funded above the avg	Number of patenting companies
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Share of international master graduates	0.0012	0.0923***	0.0913***	0.0911***	0.0710***	0.0514***	0.0059*
	(0.0018)	(0.0270)	(0.0280)	(0.0279)	(0.0210)	(0.0174)	(0.0032)
Observations	5,767	5,767	5,767	5,767	5,767	5,767	5,767
University fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-Statistic	.	21.97	21.97	21.97	21.97	21.97	21.97

OLS Bias: strong negative correlation rent increase-local enrollment and positive correlation price-increase start-up rate ◂ OLS Bias

Quantification

- Increase in foreign-born by 10 pp (doubling) in a graduating cohort (60 more students) increases start-up by **0.7-0.9** . Increase in start-up, about 1.2 to 1.5 per 100 foreign students.

- Of These: 0.4 raise more than the average funding ; **0.1** will have a patent in first 3 years.

Spillover effects

Separating the spillover effect

- Assign each start-up by to the inputed US-origin persons -or the probability-.

$$\text{Start-Up}_{ut}^{US-founder} = \alpha_u + \alpha_t + \beta FG_{ut} + \gamma X_{ut} + \varepsilon_{ut}$$

- Using Tuition and Shift-Share IV

Spillover effects, using 0-1 assessment of US-born

Dependent variable:	Number of entrepreneurs	Number of companies	Number of surviving companies	Number of companies funded above median	Number of patenting companies
	(1)	(2)	(3)	(4)	(5)
Panel A: Residual tuition IV					
Share of international master graduates	0.0524**	0.0547**	0.0552**	0.0570***	0.0095**
	(0.0205)	(0.0223)	(0.0223)	(0.0159)	(0.0038)
Observations	6,019	6,019	6,019	6,019	6,019
University fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	61.67	61.67	61.67	61.67	61.67
Panel B: Shift-share IV					
Share of international master graduates	0.0411**	0.0420**	0.0428**	0.0415***	0.0025
	(0.0161)	(0.0171)	(0.0170)	(0.0145)	(0.0021)
Observations	5,767	5,767	5,767	5,767	5,767
University fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	21.97	21.97	21.97	21.97	21.97

Decomposition based on 0-1 assessment, subject to false positive for foreigners

Channels: Co-founding and Increased Differentiation

- Studying with international people increases willingness to complement each other's skills and co-found a start-up. 15% of start-ups are co-founded
- Studying with foreign people increases the variety of ideas a US native master is exposed to, so will be more likely to create more differentiated start-ups

Channel: effect on co-founding

Dependent variable:	Number of cofounded companies				
	All	from same univ.	from same univ-cohort	b/w US/foreign born founders	b/w US/foreign born founders from same univ.
	(1)	(2)	(3)	(4)	(5)
Panel A. Residual tuition IV					
Share of international master graduates	0.0702***	0.0248**	0.0114*	0.0151*	0.0095*
	(0.0194)	(0.0102)	(0.0059)	(0.0088)	(0.0057)
Observations	6,019	6,019	6,019	6,019	6,019
University fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	61.67	61.67	61.67	61.67	61.67
Panel B. Shift-share IV					
Share of international master graduates	0.0793***	0.0394***	0.0183***	0.0319***	0.0143**
	(0.0214)	(0.0113)	(0.0058)	(0.0110)	(0.0058)
Observations	5,767	5,767	5,767	5,767	5,767
University fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
First-stage F-statistic	21.97	21.97	21.97	21.97	21.97

Channel: Differentiation of Start-Ups

- In Crunchbase data, each start-up is described using a set of keywords from 717 options
- We map start-ups onto a 717-dimensional vector of 0's and $\frac{1}{n}$ when n key words used.
- a start-up is "differentiated" if the distance to the year average vector of US Crunchbase start-up is above the median
- A start-up is "international content" if the distance to the year average vector of Crunchbase start-ups abroad is below the median.

Creation of differentiated start-ups

Dependent variable:	Number of companies above median median distance with US start-ups (1)	Number of companies above median median distance with US start-ups from same category (2)	Number of companies below median median distance with start-ups abroad (3)	Number of companies below median median distance with start-ups abroad from same category (4)
Panel A. Residual tuition IV				
Share of international master graduates	0.0309**	0.0415**	0.0401**	0.0429**
	(0.0142)	(0.0171)	(0.0167)	(0.0167)
Observations	6,019	6,019	6,019	6,019
University fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
First-stage F-statistic	61.67	61.67	61.67	61.67
Panel B. Shift-share IV				
Share of international master graduates	0.0427***	0.0464***	0.0419**	0.0264*
	(0.0129)	(0.0162)	(0.0169)	(0.0136)
Observations	5,767	5,767	5,767	5,767
University fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
First-stage F-statistic	21.97	21.97	21.97	21.97

Conclusion

- New data and new identification strategy to estimate direct and indirect effects of foreign master graduates on US start-ups.
- An increase by 10 percentage point foreign students in a university-cohort (60), increases start-up by **0.7 to 0.9**. Losing all foreign Master students will cost thousands of crunchbase start-ups per year.
- Of those between **33** and **66%** founded by people of US-origin.
- Of the additionally created firms a significant portion is likely to be co-founded and more "differentiated" from the other US start-ups and more similar to international start-ups.

Differences in Total and Education-matched sample

Back

Table: Summary statistics on missing values

	Start-ups with info on founders' name	Start-ups with info on founders' education	Difference in averages b/w samples
	(1)	(2)	(3)
Number of observations	80329	37596	
Average firm's age	7.47	6.99	-.48
	(5.02)	(4.77)	(.03)
Average number of cofounders	1.44	1.74	.31
	(.72)	(.98)	(.01)
Average capital raised within 3 first years (in millions of US dollars)	12.19	22.58	10.39
	(369.95)	(261.03)	(1.88)
Average firm's imputed number of employees	108.06	117.04	8.98
	(651.86)	(654.26)	(4.17)
Percentage of firm's patenting	1.7	6.16	4.46
	(12.94)	(24.05)	(.13)
Percentage of foreign-born founders	61.29	62.1	.81
	(25.08)	(25.25)	(.18)
Percentage of male founders	85.73	84.82	-.92
	(34.97)	(35.89)	(.22)