International Business Travel: An Engine of Innovation?

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Introduction

- What is the role of international business travel for innovation?

It depends on whether **face-to-face communication** still matters for the transfer of technology in the world of the Internet and increasing openness to trade and FDI

The importance of face-to-face: initial evidence

- **Harvard Business Review Survey**
  - Key to sucess of long-term relationships-95%
  - Allow to build stronger business relationships-95%
  - Overcoming language and cultural barriers- 93%
  - Essential for "sealing the deal"- 89%
- **Forbes Insight Survey**
  - Build stronger, more meaningful business relationships- 85%
  - More social interaction, ability to bond with co-workers/clients- 75%
  - Allow for more complex strategic thinking- 49%

Harvard Business Review (2009), Forbes (2009)

Clearly, business executives **prefer face-to-face meetings** over other forms of communication

Face-to-face communication, technology transfer, and innovation

- Role of face-to-face communication for innovation is crucial especially because
  - Innovation is incremental
  - Technology is often tacit

- **If so, international business travel** can help facilitate exchange of information and transfer of ideas

Question: Do countries with more access to US technological knowledge and ideas through business travel innovate more?

Plan of paper

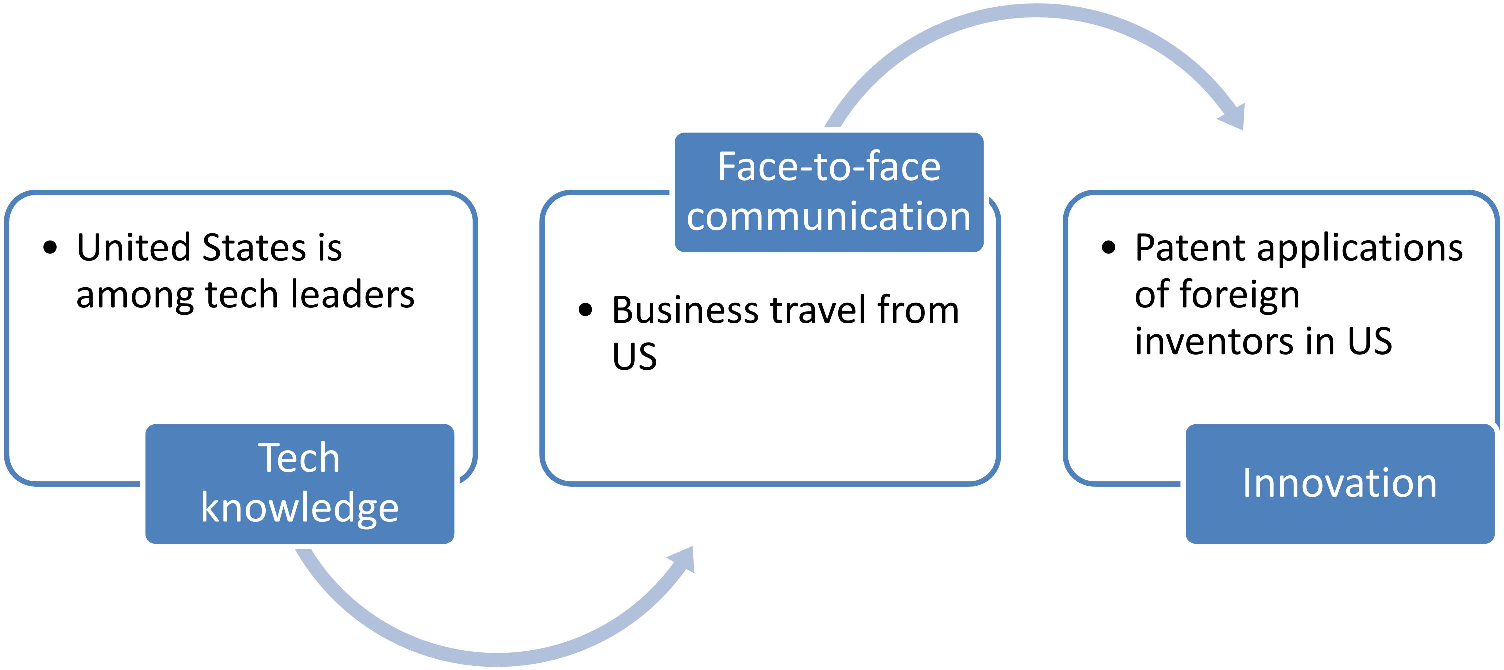
Analyze the impact of business travel from the United States on 36 countries' patenting in the period of 1993-2003

Contributions

- Estimate the contribution of business travel relative to trade and FDI
- Incorporate differences in knowledge held by business travelers
- Distinguish innovation with and without US co-inventors

Main Result: Business travel raises a country's rate of innovation, with a 10% increase in business travel increasing patenting by about 0.6%

Model



United States is among tech leaders
Tech knowledge
Face-to-face communication
Business travel from US
Patent applications of foreign inventors in US
Innovation

Empirical model

$$P_c = \varphi(B_c, Z_c, \theta)$$

P_c **-** patenting in a particular country c

B_c **-** inward business travelers from US

Z_c **-** other observed and unobserved determinants

θ **–** vector of unknown parameters

- Count data: Negative Binomial Regression
- Endogeneity: Control Function Approach

Data

International Travel Data: Survey of International Air Travelers, US Department of Commerce

- Quarterly survey (1993-2003) of U.S. resident outbound travel, by US city
- Purpose of the trip (business versus non-business related)
- Destination cities

US patent data: US Patent and Trademark Office

- US patents to foreign country inventors
- US patents that have joint US/ foreign country inventors

Controls: Population, GDP per capita, R&D expenditures, US exports, US FDI, resident and non-resident patent applications

Estimation Equation

$$E\left[P_{cqt}\middle|B_{cqt},X_{cqt},Z_{cqt}\right] = \exp[\alpha lnB_{cqt} + \beta lnX_{cqt} + \mu_c + \mu_q + \mu_t + \varepsilon_{cqt}]$$

where

- Indexes are c for country, q for quarter, and t for year
- P_{cqt}: expected patent counts
- B_{cqt}: weighted number of business travelers
- X_{cqt}: other determinants of country's patenting

$$\mathrm{B_{cqt}} = \sum_{\mathrm{s \in S}} \frac{\mathrm{P_{sqt}}}{\mathrm{GSP_{sqt}}} * \widetilde{\mathrm{B}}_{\mathrm{scqt}}$$

- $\mathrm{P_{sqt}}$: patent stock of US state s in quarter q of year t
- $\mathrm{GSP_{sqt}}$: US state's gross product
- $\tilde{B}_{scqt}$: (unweighted) number of business travelers from US state s in quarter q of year t

Fixed Effects Results

	US patents	Joint US patents
Business travel	**0.086**	**0.138**
Population	**2.376**	**1.442**
Real GDP per capita	**0.440**	**0.627**
US exports	0.034	**0.578**
US FDI	0.068	**-0.157**
R&D Expenditures	**0.698**	**0.277**
Patent applications, non-residents	-0.012	-0.017
Patent applications, residents	**0.139**	**0.212**
Observations	1,164	1,164
Log-likelihood	-4,973	-2,457

Negative binomial regressions, include year, quarter and country fixed effects.

All RHS variables in logs. Statistically significant coefficients in bold.

Concern: Endogeneity

Control Function Approach

$$E\left[P_{cqt}\middle|B_{cqt},X_{cqt},Z_{cqt}\right]=\exp[\alpha lnB_{cqt}+\beta lnX_{cqt}+\mu_c+\mu_q+\mu_t+\varepsilon_{cqt}]$$

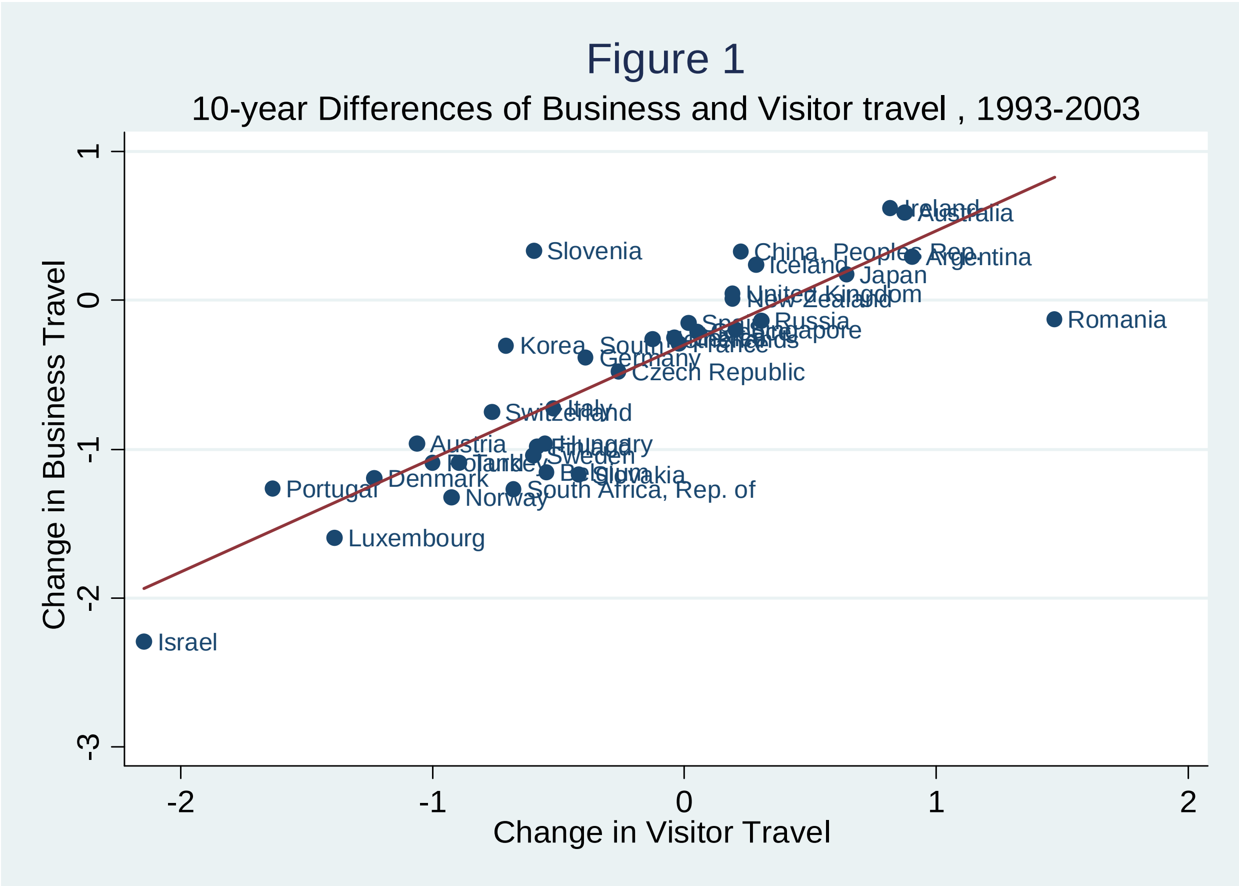
Now suppose $\varepsilon_{cqt}=\omega_{cqt}+u_{cqt}$

- Idea is to simply model the term ω_{cqt} ("shock to innovation climate") to which business travel from the US may be reacting

With a good estimate of ω_{cqt} included in the regression as control function, endogeneity is dealt with

What makes for a good control function?

- A measure of <u>*'unusually high'*</u> business travel, b/o these are times of positive shocks to the country's innovation environment



- Use the residual from business on non-business travel as control function

Creating the control function: Results

Table 3: Control Function Regressions				
Dependent variable	Business travel			
	(1)	(2)	(3)	(4)
Visitor travel	0.581** (0.034)	0.565** (0.039)	0.560** (0.038)	0.520** (0.043)
Retired travel		0.018 (0.019)	0.017 (0.019)	0.008 (0.018)
Religious travel			0.046** (0.017)	0.040* (0.017)
Homemaker travel				0.065* (0.027)
Population	-0.584 (0.681)	-0.543 (0.670)	-0.505 (0.676)	-0.558 (0.674)
Real GDP per capita	0.406 (0.291)	0.416 (0.289)	0.399 (0.282)	0.371 (0.280)
US exports	-0.044 (0.084)	-0.046 (0.085)	-0.037 (0.087)	-0.050 (0.088)
US FDI	0.073 (0.060)	0.071 (0.059)	0.076 (0.058)	0.070 (0.060)
R&D Expenditures	-0.030 (0.118)	-0.026 (0.115)	-0.010 (0.114)	0.001 (0.112)
Patent applications, non-residents	0.010 (0.027)	0.010 (0.027)	0.006 (0.025)	0.008 (0.026)
Patent applications, residents	0.049** (0.017)	0.050** (0.017)	0.051** (0.017)	0.050** (0.017)
Number of observations	1164	1164	1164	1164
R-squared	0.625	0.626	0.628	0.632

Notes: All specifications include country as well as year and quarter fixed effects. Number of countries included: 36. Robust standard errors in parentheses, + p< 0.10, *p<0.05, ** p<0.01

Patenting Results with Control Function

	US patent counts			US joint patents		
Business travel	**0.086**	**0.059**	**0.068**	**0.138**	**0.123**	**0.127**
Population	**2.376**	**2.379**	**1.969**	**1.442**	**1.441**	1.054
Real GDP per capita	**0.440**	**0.473**	0.366	**0.627**	**0.644**	**0.649**
US exports	0.034	0.018	0.151	**0.578**	**0.566**	**0.597**
US FDI	0.068	0.073	0.033	**-0.157**	**-0.153**	**-0.198**
R&D Expenditures	**0.698**	**0.691**	**0.789**	**0.277**	**0.274**	**0.335**
Patent app., non-residents	-0.012	-0.011	**0.054**	-0.017	-0.017	-0.002
Patent app., residents	**0.139**	**0.142**	**0.152**	**0.212**	**0.212**	**0.239**
Residual from first-stage		**0.055**	**0.067**		0.033	0.050
Countries, 99% US total patenting			X			X
Observations	1,164	1,164	804	1,164	1,164	804
Log-Likelihood	-4,973	-4,972	-4110	-2,457	-2,457	-2,133

Negative binomial regressions, include year, quarter and country fixed effects. Control function in all columns in visitor, retired, religious and homemaker travel. Statistically significant coefficients in bold.

The Significance of the Traveler's Technological Knowledge

Recall: Weighting travelers by US state patent stock

$$B_{cqt} = \sum_{s \in S} \frac{P_{sqt}}{GSP_{sqt}} * \widetilde{B}_{scqt}$$

	US patents		US joint patents	
	Weighted	*Unweighted*	*Weighted*	*Unweighted*
Business travel	**0.059**	0.003	**0.123**	0.004
Population	**2.379**	**2.356**	**1.441**	1.168
Real GDP per capita	**0.473**	**0.561**	**0.644**	**0.793**
US exports	0.018	-0.012	**0.566**	**0.482**
US FDI	0.073	0.081	**-0.153**	-0.121
R&D Expenditures	**0.691**	**0.67**	**0.274**	**0.222**
Patent app., non-residents	-0.011	-0.007	-0.017	-0.006
Patent app., residents	**0.142**	**0.147**	**0.212**	**0.25**
Residual from first-stage	**0.055**	**0.067**	0.033	0.055
Observations	1,164	1,164	1,164	1,164
Log-Likelihood	-4,972	-4,985	-2,457	-2,468

Negative binomial regressions with control function. Statistically significant coefficients in bold.

Summary: Inward business travel has a significant positive effect on innovation

- A 10% increase in business travel is associated w/ patent increase of about 1%, and 1.4% if the patent has a US co-inventor
    - Consistent with the idea that there are US co-inventors among the travelers

- Controlling for endogeneity lowers estimates to 0.6% for all patents, and 1.2% for patents with US co-inventors

- Incorporating info on the tech knowledge of the traveler is crucial

Conclusions

- Business travel has a significant effect in raising a country's rate of innovation up and beyond technology transfer through international trade and FDI

- The importance of face-to-face meetings for the transfer of technology is confirmed

- Impact of innovation depends on the quality of technological knowledge carried by each person

Policy Implications

- Policy measures that reduce cross-border movements of labor might not only lower innovation if they are affecting **long-term immigration** (Peri 2007, Hunt and Gautier-Loiselle 2010, Stuen, Mobarak and Maskus 2010)

- Our research shows that also restricting **short-term cross-border flows** – international business travel--will affect innovation rates

Policy Implications II

- Air freight transport liberalization is increasingly important for international trade, given vertical specialization, increasing importance of air freight, etc.
    - Static welfare effects

- Our research highlights additional benefits of the **liberalization of air passenger travel** in terms of innovation
    - Dynamic welfare effects: Innovation is crucial for rising living standards

Ideas for Future Work

- Expand the analysis to European sample w/ focus on introduction of low-cost airlines
- Include additional industry and geographic detail
- Analyze country's **outward** business travel and its impact on innovation (technology sourcing)
- Examine complementarities between cross-border travel, trade and FDI