
The Supply Side of Innovation: H-1B Visas and US Ethnic Invention

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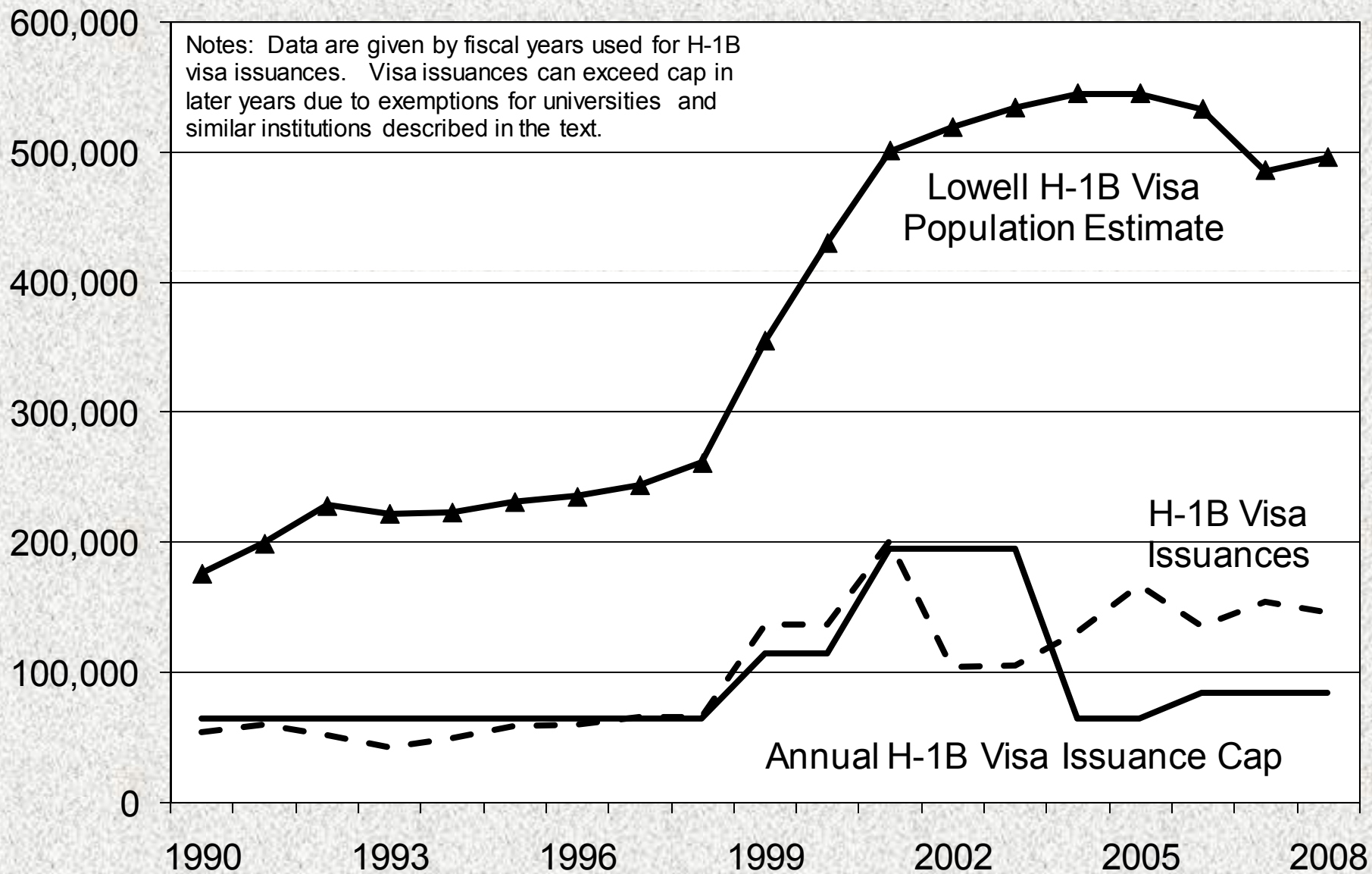
Introduction

- Immigrant SEs are very prominent in US technology development and commercialization
- Policy Q: Appropriate quotas for permanent immigration? temporary workers?
- We investigate the impact of recent H-1B visa admissions on US invention patterns
- Characterize the supply side to innovation

H-1B Visa Program

- H-1B is a non-immigrant visa category
 - Temporary help for "specialty occupations"
 - Employer is responsible for visa application
 - Three-year visa, renewable once, allows "dual intent"
 - Restrictions on wages and working conditions
 - Cap on visa issuances since 1990
- Most accepted H-1B visa applications are for
 - Computer-related and SE occupations (~60%)
 - ... coming from India (~40%) or China (~10%)
 - ... with a bachelors degree and above

Fig. 4: H-1B Visas and Population Estimates



H-1B Visa Program

- Detractors argue H-1B workers
 - Displace American workers
 - Lower wages
 - Discourage on-the-job training
- Proponents argue H-1B workers
 - Keep US businesses competitive
 - Strengthen the overall economy
 - Keep companies from moving abroad
- Often wrapped-up in the outsourcing debate
- Role of Indian firms

H-1B Visa Program

How important can the H-1B program be?

- CPS estimates discussed in paper ...
- Immigrants account for $\sim 2/3$ of net US S&E growth since 1995 ... non-citizen immigrants are at least $1/2$ of this gain
- Average annual changes in the H-1B program have the power to:
 - Increase the growth of non-citizen immigrants by 150%, levels shift of 12%
 - Increase the growth of S&E by 50%, levels shift of 1%

US Ethnic Invention

- NBER Patent database plus HBS extensions
 - Individual patent records for 1975-2008
 - Invention details: technology classification, citations
 - Inventor(s) information: name, city
- Ethnic-name database for inventor records
 - High match rate to patent records (>90%)
 - Nine ethnicities identified

Chinese English European Indian Hispanic
Japanese Korean Russian Vietnamese

Fig. 1: Ethnic Share of US Domestic Patents

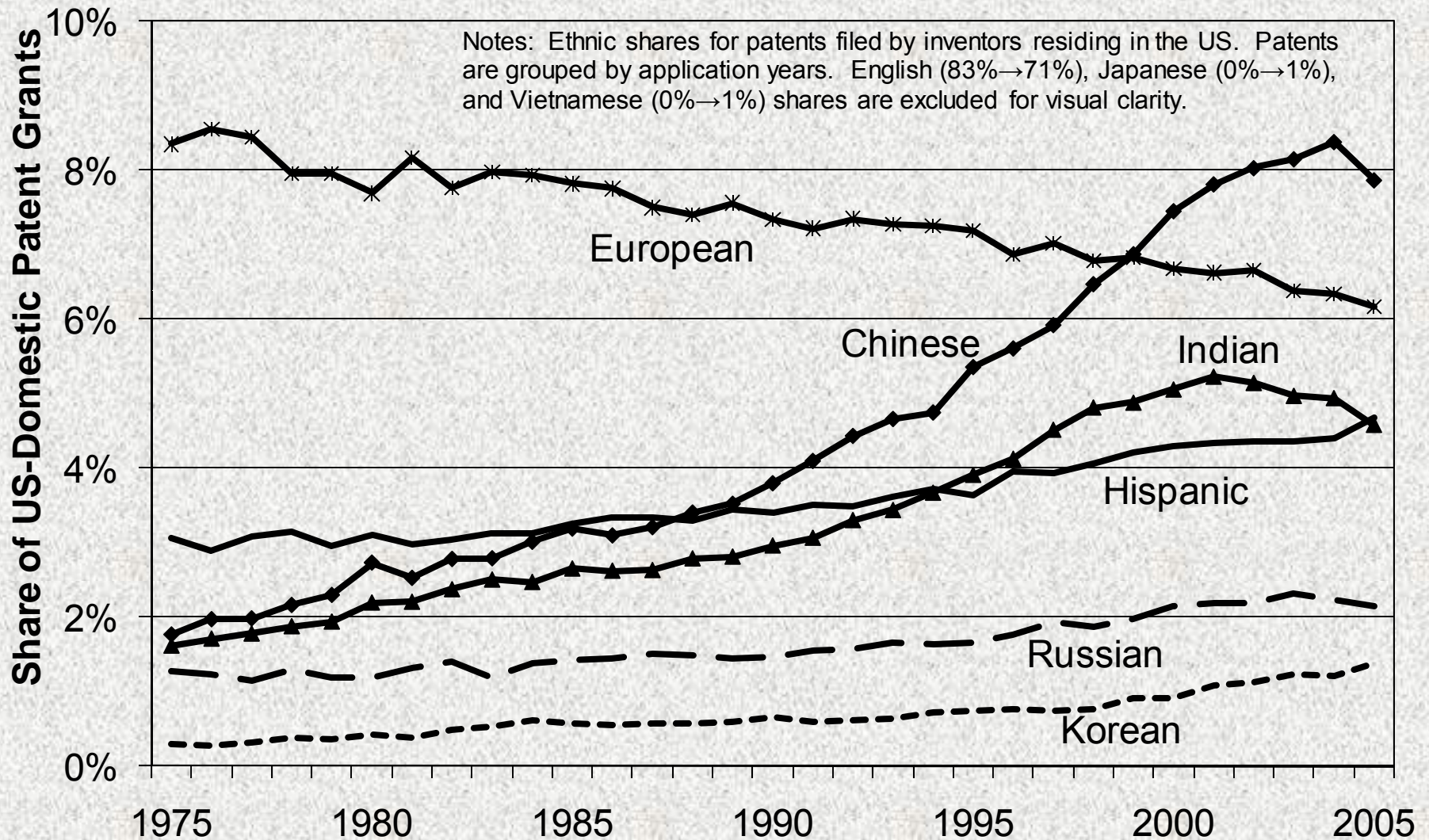
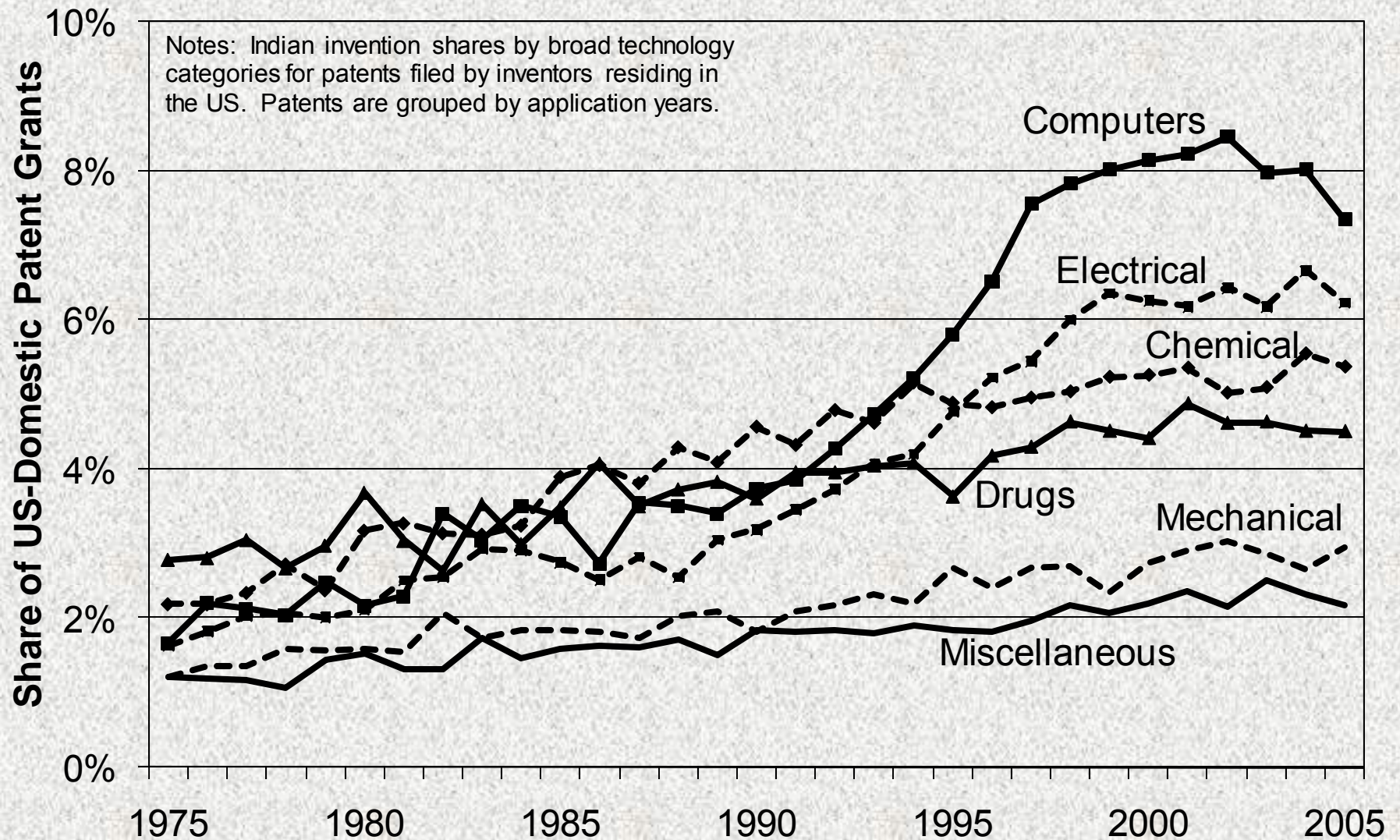


Fig. 2: Indian Contribution by Technology



City-Level Analysis

$$\begin{aligned}\ln(PAT_{c,t}^{Dep}) &= \phi_c + \eta_t \\ &+ \beta_1 \cdot [I_c(\text{Top Quintile}) \cdot \ln(H-1B_t)] \\ &+ \beta_2 \cdot [I_c(\text{2nd Quintile}) \cdot \ln(H-1B_t)] \\ &+ \beta_3 \cdot [I_c(\text{3rd Quintile}) \cdot \ln(H-1B_t)] + \epsilon_{c,t},\end{aligned}$$

- Pat_{ct} models ethnic-specific invention rates in city
- $H-1B_t$ models aggregate US H-1B dynamics
- Will add controls for expected city-ethnicity patenting
- Regressions have 3372 observations from 281 cities over the 1995-2006 period
- Regressions are unweighted and cluster se by city

City-Level Analysis

LCA-Based Dependency

City's 2001-2002 LCA Filings for
H-1B Visas Per Capita (x1000)

Census-Based Dependency

City's 1990 Non-Citizen Immigrant SE
Workforce per Capita (x1000)

	(1)	(2)
#1	San Francisco, CA 8.323	Lafayette-W. Lafayette, IN 7.810
#2	Miami, FL 5.502	Bryan-College Station, TX 5.571
#3	Washington, DC 5.430	San Francisco, CA 5.096
#4	Raleigh-Durham, NC 5.220	Columbia, MO 4.462
#5	Boston, MA 5.149	Gainesville, FL 4.146
#6	Austin, TX 4.897	Champaign-Urbana-Rantoul, IL 4.023
#7	New York, NY 4.777	Washington, DC 3.168
#8	Burlington, VT 4.491	Boston, MA 3.129
#9	Atlanta, GA 4.116	Raleigh-Durham, NC 2.723
#10	Dallas-Fort Worth, TX 3.943	Los Angeles, CA 2.288
#11	Champaign-Urbana-Rantoul, IL 3.819	Rochester, MN 2.247
#12	Iowa City, IA 3.804	New York, NY 2.185
#13	Houston, TX 3.712	Houston, TX 2.156
#14	Bryan-College Station, TX 3.577	Spokane, WA 2.078
#15	Seattle, WA 3.393	State College, PA 2.058

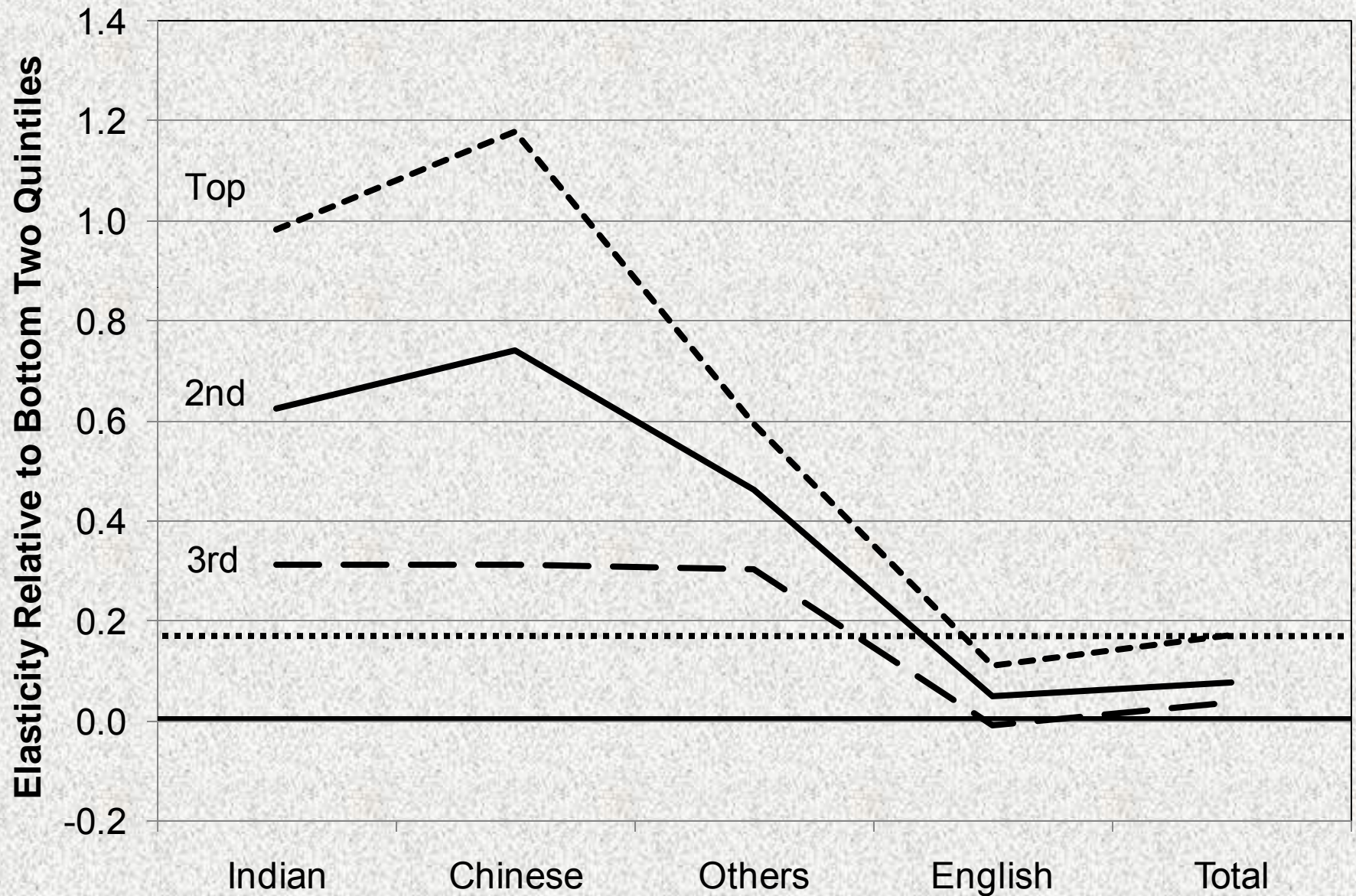
City-Level Analysis

City-Year Patenting

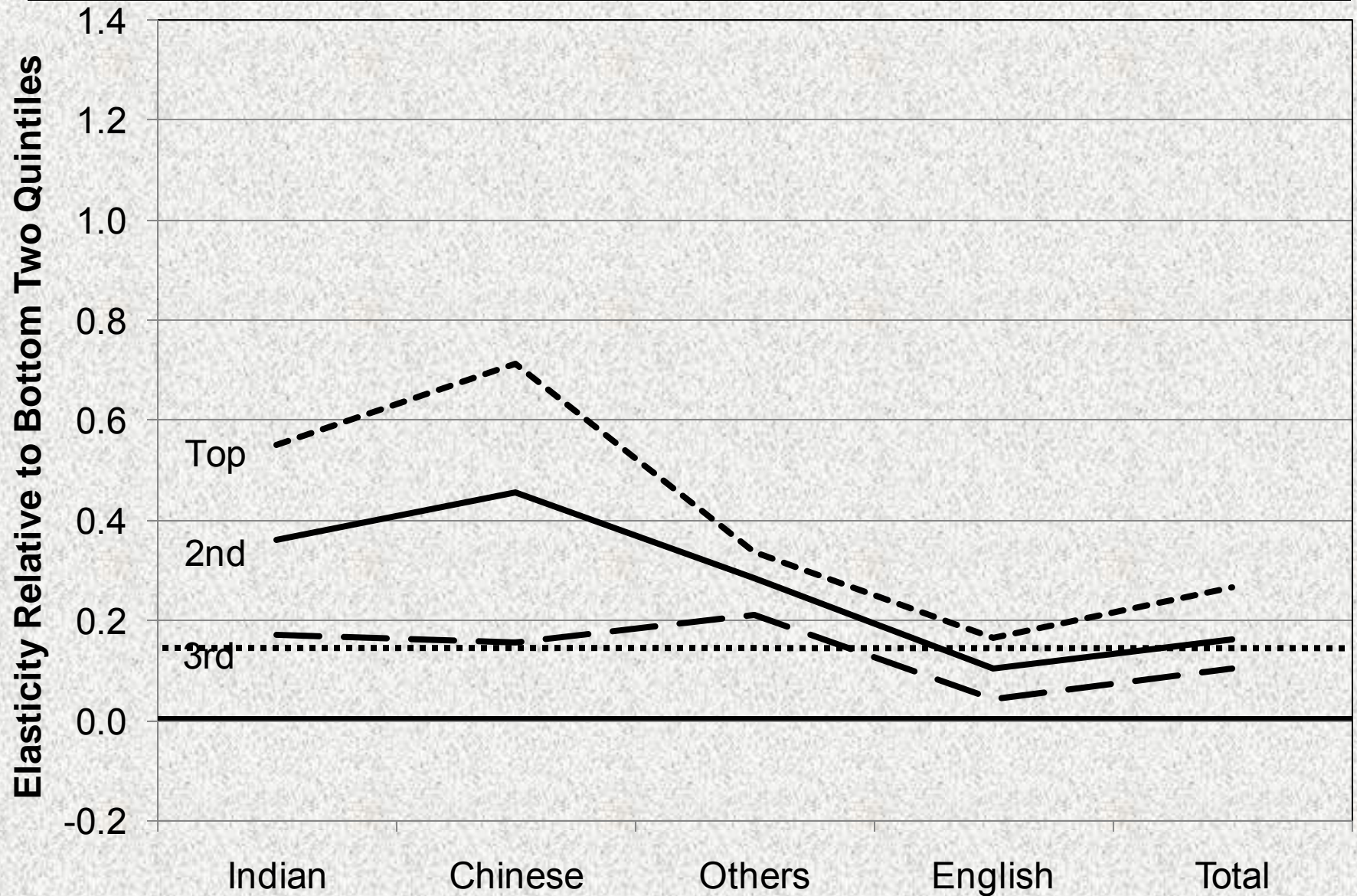
	Indian Patenting	Chinese Patenting	Other Non-Engl. Patenting	English Patenting	Total Patenting
	(1)	(2)	(3)	(4)	(5)
<u>Log National H-1B Population x</u>					
Third Dependency Quintile [LCA]	0.313 (0.087)	0.311 (0.095)	0.305 (0.106)	-0.010 (0.101)	0.037 (0.107)
Second Dependency Quintile [LCA]	0.623 (0.090)	0.741 (0.108)	0.461 (0.096)	0.050 (0.087)	0.078 (0.083)
Most Dependent Quintile [LCA]	0.982 (0.078)	1.179 (0.091)	0.593 (0.092)	0.109 (0.086)	0.172 (0.086)

Estimations explain 4%-5% of Indian and Chinese residual variance, 0.5% of English variance, and 1% of total variance

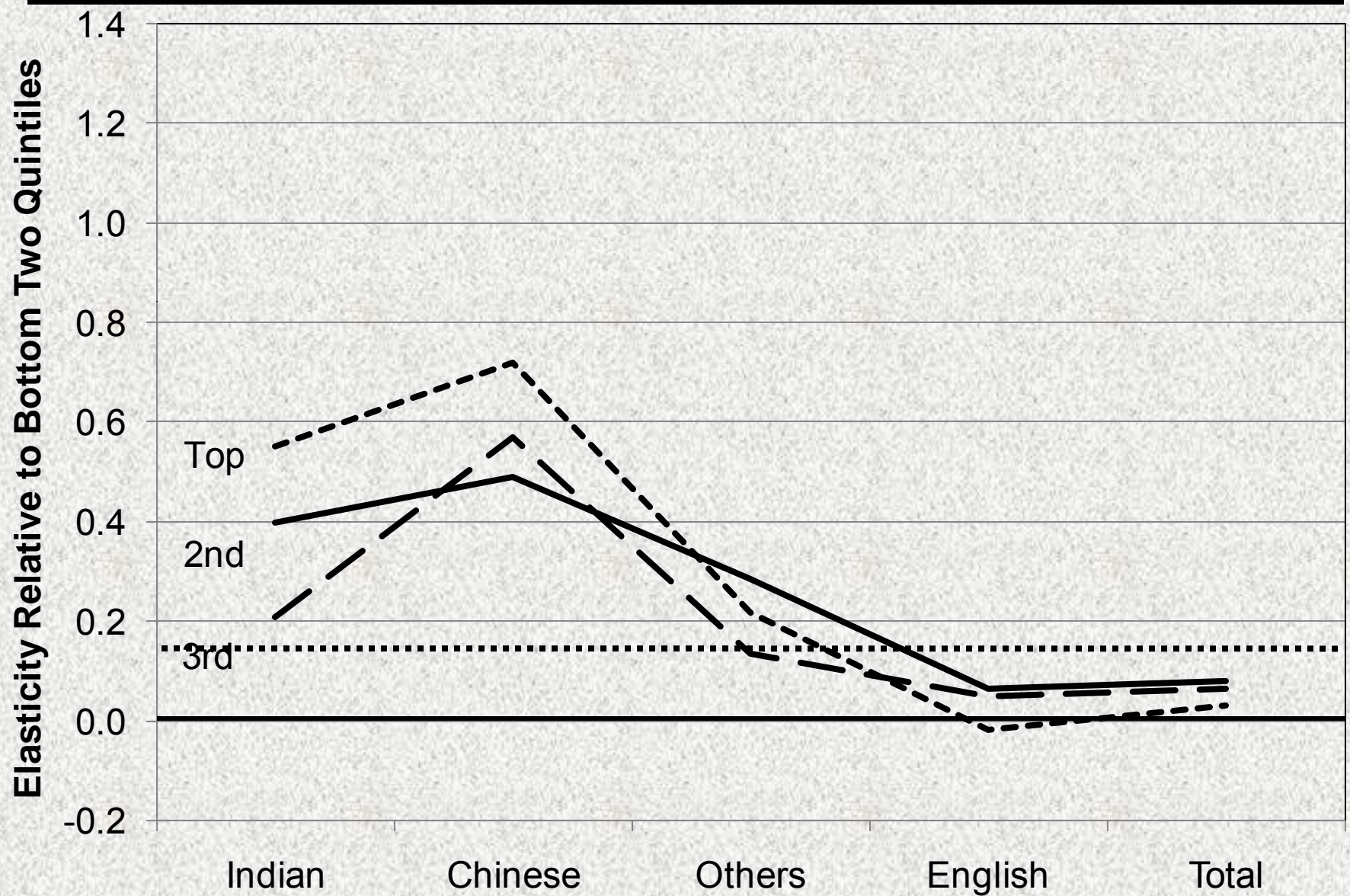
LCA-Based Specification



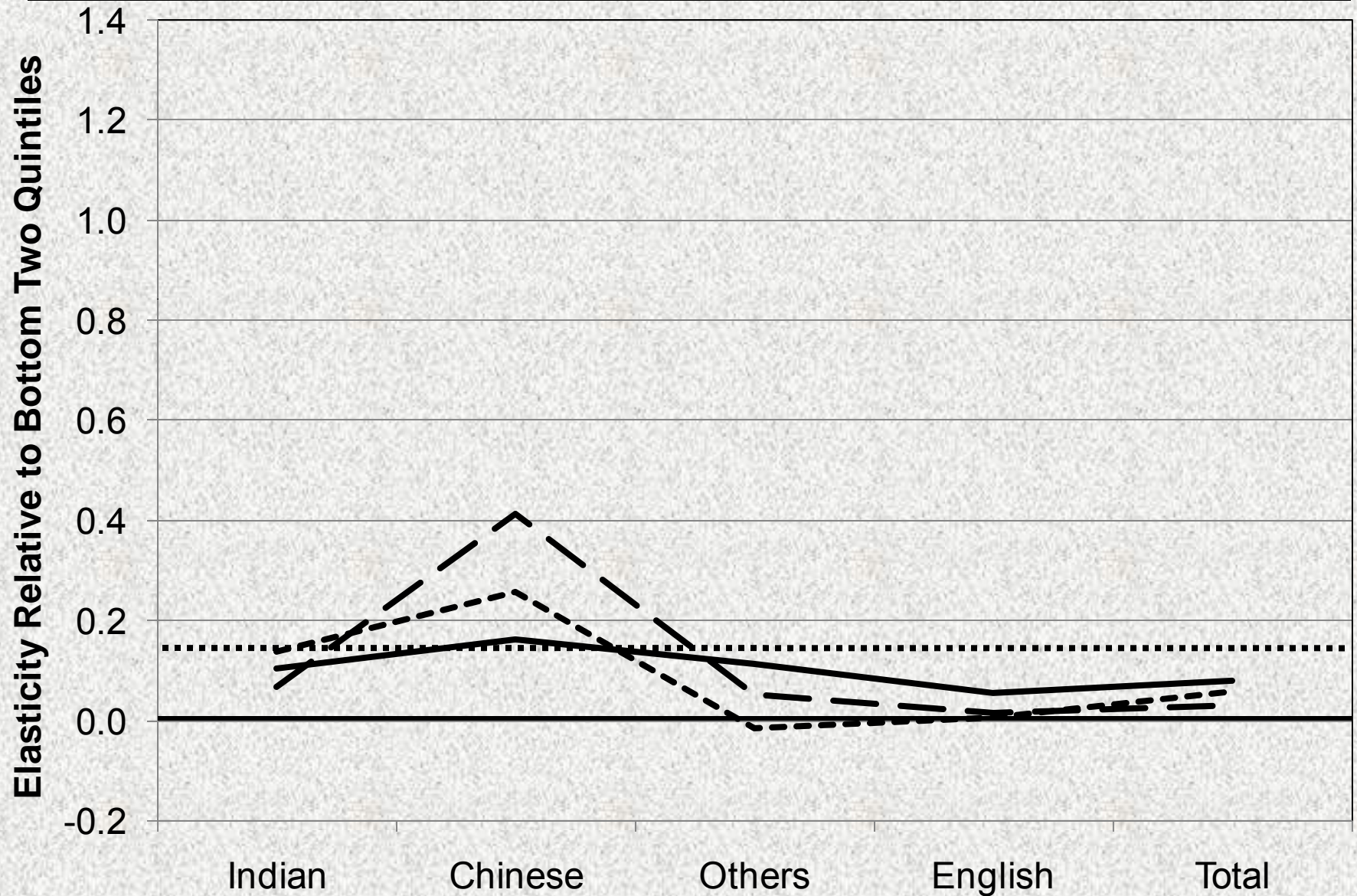
Including Technology Trends



Census-Based Specification



Including Technology Trends



Remainder of Paper

- Robustness checks
- Lag structure analysis
- CPS analysis
- Canadian analysis
- Firm-level analysis