November 2024

Jack Liang

Address: Department of Economics
Yale University
New Haven, CT 06520-8268

Telephone: +1 (401) 252-6488

E-mail: liang.jack.a@gmail.com

Web page: https://sites.google.com/view/jackliang/

Citizenship: US

Fields of Concentration:
Primary Field(s): International Trade
Secondary Field(s): Spatial Economics, Macroeconomics

Comprehensive Examinations Completed:
2020 (Oral): International trade (*with distinction*), Macroeconomics (*with distinction*)
2020 (Written): Macroeconomics, Microeconomics

Dissertation Title: *Knowledge and Firm Growth in Space*

Committee:
Professor Costas Arkolakis (Co-Chair)
Professor Peter Schott (Co-Chair)
Professor Teresa Fort
Professor Michael Peters

Education:
Ph.D., Economics, Yale University, 2025 (expected)
M.Phil., Economics, Yale University, 2021
M.A., Economics, Yale University, 2020
B.S., Mathematics (*with honors*), University of Chicago, 2017

Fellowships, Honors and Awards:
Dissertation Fellowship, Yale University, 2024-2025
Arvid Anderson Prize Fellowship, Yale University Cowles Foundation, 2024
Ryoichi Sasakawa Young Leaders Fellowship (SYLFF), Yale University, 2023
Doctoral Fellowship, Yale University, 2019-2025

Teaching Experience:

Spring 2024, Teaching Assistant to Peter Schott, Decision Making with Data (MBA), Yale University School of Management

Fall 2023, Teaching Assistant to William Nordhaus, Intermediate Macroeconomics (undergraduate), Yale University

Fall 2018, Teaching Assistant to Costas Arkolakis, The Economics of Space (undergraduate), Yale University

Fall 2016, Winter 2017, Spring 2017, Course Assistant, Abstract Algebra (undergraduate), University of Chicago

Fall 2014, Winter 2015, Spring 2015, Course Assistant, Calculus I-III (undergraduate), University of Chicago

Research Experience:

Research Assistant to Peter Schott, Yale School of Management, 2021-2023
Research Assistant to Costas Arkolakis, Yale Department of Economics, 2017-2020
Research Assistant to Tarek Hassan, University of Chicago Booth School of Business, 2015

Work Experience:

AQR Capital Management, Research Intern, 2016

Working Papers:

"Knowledge and Firm Growth in Space", *Job Market Paper*, 2024

"Market Power and Tradability" with Wei Xiang, 2024

*"*Superstar ZIP Codes", with Camilo Acosta and Fabian Eckert, 2024

"Why are *Valuable* Patents Getting Harder to Find?", with Teresa Fort, Nathan Goldschlag, Peter Schott, and Nikolas Zolas, 2024

"A Method to Construct Geographical Crosswalks with an Application to US Counties since 1790", with Fabian Eckert, Andrews Gvirtz, and Michael Peters, 2020

Seminar and Conference Presentations:

2024: Dartmouth Trade Workshop, US Census Bureau

Languages:

English (Native), Mandarin Chinese (Fluent)

November 2024

References:

Prof. Costas Arkolakis
Yale University
Department of Economics
New Haven, CT 06520
Phone: 203-506-3990
costas.arkolakis@yale.edu

Prof. Teresa Fort
Dartmouth College
Tuck School of Business
Hanover, NH 03755
Phone: 603-646-8963
teresa.c.fort@tuck.darmouth.edu

Prof. Michael Peters
Yale University
Department of Economics
New Haven, CT 06520
Phone: 203-436-8475
m.peters@yale.edu

Prof. Peter Schott
Yale University
School of Management
New Haven, CT 06520
Phone: 203-436-4260
peter.schott@yale.edu

Dissertation Abstract

Knowledge and Firm Growth in Space [Job Market Paper]

The accumulation of knowledge is a critical driver of economic growth. In this paper, I study how firm investment in knowledge creation facilitates firm growth across space. Geographic frictions within the firm in the diffusion and replication of knowledge influence the firm's joint decision to generate knowledge and to produce output across locations. Firms' endogenous knowledge investment responses to geographic shocks can amplify and propagate the welfare effects of the shocks.

I leverage confidential US Census microdata to identify establishments within the firm that produce knowledge, and use payroll towards these establishments to construct a firm-level measure of knowledge capital. Firms grow by expanding in the geographic vicinity of their knowledge-producing establishments, and do so because establishments distant from the firm's sources of knowledge tend to be less productive. This is consistent with geographic frictions within the firm that cause the effectiveness of knowledge to decay with distance.

I provide direct evidence that knowledge-creating establishments help firms replicate their knowledge across its production units: in particular, firm knowledge production is associated with learning about and adopting improved management practices at the firm's production sites.

To understand the firm's complex decision of establishment location and knowledge production, I construct a dynamic spatial general equilibrium model of firm growth. The model features a forward-looking decision to accumulate a stock of knowledge capital in each location, as well as frictions in the effectiveness of knowledge replication that increase in the distance between establishments.

The firm solves a dynamic combinatorial problem with high-dimensional, continuous state variables. I develop a novel computational algorithm that exploits the fact that the firm's stocks of knowledge produced in each location are complements. This algorithm can be applied to a broad class of supermodular firm investment problems. In essence, the algorithm reduces the firm's problem from solving one high-dimensional combinatorial problem to solving many low-dimensional problems, which are significantly easier to solve and can be efficiently parallelized.

I estimate the model to assess the impact of regional shocks in the US. I find that negative shocks are both amplified and propagated to nearby regions due to firms' knowledge investment decisions. Specifically, as the returns to investment in knowledge creation are lowered in affected regions, firms respond by cutting back knowledge production. This not only decreases firm productivity in the directly shocked regions but also in adjacent areas, subsequently weakening firms' incentives to invest in knowledge creation in these indirectly affected regions. This negative feedback loop results in heightened welfare losses, which intensify with geographic proximity to the negatively shocked region. Ultimately, firms' knowledge creation decisions amplify the welfare effects of a -10% shock to the productivity of producing output in California by 21%.

Market Power and Tradability, with Wei Xiang

Do firms with significant labor market power also possess similar product market power? Given the close link between firm productivity and market power, many models predict that labor and product market power, and thus labor and product market concentration, are tightly linked. Using US Census Bureau microdata, we indeed find that labor and product market concentration are nearly perfectly correlated when product market concentration is measured where production occurs. However, the welfare relevant notion of market concentration is measured where output is sold. We show using a dataset on establishment shipments that measuring product market concentration in this way breaks the link between the two types of market power, especially in sectors where firms produce tradable output. Intuitively, firms producing easily tradable output face competition not only from local producers but from producers in other markets. We develop a stylized multi-region general equilibrium model and use it to show that labor and product market power jointly shape the passthrough of productivity to the real wage following changes in trade costs.

Superstar ZIP Codes, with Camilo Acosta and Fabian Eckert

Whether poor locations catch up to richer ones as a country grows is a key question in economics. We show using a newly constructed dataset on ZIP code wages and industry structure from 1994 to 2020 that wage growth in the US has exhibited a clear U-shape, with the initially lowest and highest wage ZIP codes growing fastest. Catch-up growth occurs in low wage ZIP codes across all commuting zones, but growth starting from high initial levels is limited to high wage ZIP codes in high wage commuting zones. We focus on "superstar" ZIP codes, namely those that in spite of their high initial wages have maintained rapid wage growth, and show that they account for the

majority of aggregate wage growth. However, we find mixed evidence on the extent to which superstar ZIP codes share their prosperity with their neighbors, suggesting that they may contribute to worsening regional inequality.

Are *Valuable* Patents Getting Harder to Find?, with Teresa Fort, Nathan Goldschlag, Peter Schott, and Nikolas Zolas

We examine the efficiency at which US firms produce patents from 1977 to 2021 by constructing a new bridge matching patents to the universe of US firms. We use administrative data on firms' payroll and R&D expenditures to construct a range of patent input stocks. In contrast to a literature suggesting that ideas are getting harder to find, we find that firms are producing patents with increasing efficiency per unit input. Our results are robust to using proxies for patent quality such as citations and patent novelty, however, the efficiency at which *valuable* patents are produced has been declining, suggestive of a divergence in the scientific and economic return to firm-level investment in producing patents.