Co-location of Manufacturing and Technology Creation: The Impact of Offshoring on Innovation

Teresa Fort
Dartmouth
Wolfgang Keller
U Colorado
Stephen Yeaple
Penn State
Nikolas Zolas
US Census Bureau

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Motivation

- US manufacturing employment on the decline
  - Big focus on import competition from China
- More recent work relates Chinese imports to decreased innovation
- Broader concern that US losing its manufacturing capabilities
  - Why would that be important?
  - One explanation is that innovation depends on production
Geography: does it still matter?
Key Potential Mechanisms and Channels

- Potential importance of proximity between production and research due to

1. Face-to-face interactions between R&D scientists (engineers) and production workers (mechanics)

2. Feedback from manufacturing on feasibility of design for production
Main Questions

- Do manufacturing and R&D need to be co-located?
  - Is R&D more productive when manufacturing is nearby?
  - Does colocation need to be within the firm?
  - How has co-location changed over time?

- How does knowledge flow from firm to firm?
  - Do firms concentrate innovation in geographic areas?
  - How important are within vs. across firm patent citations?
  - Does knowledge flow farther within the firm?
Main Contributions w/ 1987 to 2012 Census data

- New evidence on the co-location of US R&D and manufacturing
  - Within-firm measures of distance between manuf and R&D
  - Characteristics of co-located establishments
- Measures of knowledge flows from firm to firm
  - Concentration of patenting and design activities within zip codes
  - Within versus outside the firm citation distances
- Estimates of innovation elasticities to co-location
  - Supplement production function of innovation with proximity
- Extension from US analysis to more recent offshoring
Measuring the Co-location of R&D and Manufacturing

- Longitudinal Business Database
  - Every private, non-farm employer establishment
  - Establishments classified based on their main activity
- Focus on NAICS 5413-5417 and 551114 as R&D establishments
  - Headquarter establishments (firm can have more than one)
  - R&D labs (NAICS 5417)
  - Other design, engineering services establishments
- Associate with relevant manufacturing based on firm’s plants
  - 4 digit manuf industries
  - Firms often span multiple industries
- Focus on firms with both manuf and professional estabs
Manufacturing and R&D Co-location Patterns over Time

Industry Measures of Agglomeration
Commuting Zones in 1982

Industry Measures of Agglomeration
Commuting Zones in 2012
Estimating Firm Size Using the Commodity Flows

Jacob Howard and Wolfgang Keller

University of Colorado at Boulder

Rocky Mountain RDC

October 24th, 2018
Firms are Increasingly Interconnected

- Understanding how firm-level shocks are transmitted across the economy can inform policy
- Need firm-level transaction data to study these questions
- Commodity Flows Survey has data on domestic shipments by firms
  - CFS has value of shipment and destination-location, but can’t identify destination-establishment
Project Goal

- We will use a firm-level transaction dataset for Compustat firms to calibrate a firm-level economic geography model.

- We will use this calibration to estimate the destination parent firm size for the CFS.

- These estimates can be used to generate a firm level transaction dataset.
  - Then use these estimates to study how China’s ascension to the WTO affected workers across different firm sizes.
Through SEC filings we observe a production network for publicly-traded firms.

Estimate parameters of a model where firms must endogenously form a production network as in Lim (2017):

- Firms only sell to another firm if profitable.
- Size of the order, costs, and distance all matter in determining profit.
- Model predicts positive assortative matching.

Use these parameters to predict destination parent firm size in CFS.
Getting to a Production Network

- Merge our new estimates with LFTTD and LEHD
- Collapse merged data down to the firm-size level
  - We now have a firm production network dataset that includes international and domestic transactions
  - Also controls for workforce composition
- Using this production network, we can analyze how the structure of firms changed in response to China joining the WTO
Input output methods might be overestimating the negative effects of exposure to trade with China.