Re-Innovation Nation:
Explaining Technology Transfer Policy in Rising China

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Motivation

Importance of Technology Transfer Policies in China:

1. Helped fuel China’s rise

2. Central to U.S.-China trade war and technology competition
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Tech Transfer Policies in China, 1995-2015

Sources: PKU Laws and Regulations Database
Puzzle: The Dogs That Did Not Bark

Aircraft Engines  Renewable Energy  High-Speed Rail
Puzzle: The Dogs That Did Not Bark

Aircraft Engines  Renewable Energy  High-Speed Rail

Batteries  Navigation Equip.  Semiconductors
Puzzle: The Dogs That Did Not Bark

What explains variation in China’s use of tech transfer policies?
Contributions

Theory: Security interests x Bargaining power → Technology transfer policy in China
Contributions

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2. Data: Construct original industry-level measure of “technology extractors” from 1995-2015
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2. **Data**: Construct original industry-level measure of “technology extractors” from 1995-2015

   - Joint venture (JV) requirements, local content requirements, preferential government procurement
Contributions

1. **Theory**: Security interests × Bargaining power → Technology transfer policy in China

2. **Data**: Construct original industry-level measure of “technology extractors” from 1995-2015
   - Joint venture (JV) requirements, local content requirements, preferential government procurement

3. **Findings:**
Contributions

1. **Theory**: Security interests x Bargaining power → Technology transfer policy in China

2. **Data**: Construct original industry-level measure of “technology extractors” from 1995-2015
   - Joint venture (JV) requirements, local content requirements, preferential government procurement

3. **Findings**:
   - Strategic industries account for >85% of the 6.6x growth in use of technology extractors after WTO entry
   - China is 2.4x less likely to use these policies when it sits in the middle of global value chains in an industry
Top-down national power and regime security considerations lead China to pursue technology extraction in strategic industries.
Theory: Argument in Brief

Top-down national power and regime security considerations lead China to pursue technology extraction in *strategic industries*.

But China’s *bargaining power* over foreign firms constrains the use of technology extractors, even in highly strategic industries.
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But China’s bargaining power over foreign firms constrains the use of technology extractors, even in highly strategic industries.

China’s bargaining power rests on central state enforcement capacity and China’s position in global value chains (GVCs) in an industry.
Theory: Breaking Down Bargaining Power

Enforcement Capacity:

1. Restructuring, 1998-2003
3. Medium- and Long-Term Program, 2006
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Prediction: ↑ Enforcement capacity,
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China’s Position in GVCs:

1. Downstream: Firm leverage ↓
2. Intermediate: Firm leverage ↑
Theory: Breaking Down Bargaining Power

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China’s Position in GVCs:
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Prediction: China intermediate in GVCs, ↓ tech extraction
Observable Implications

Hypotheses:

1. China primarily introduces tech extractors in strategic industries.
2. The use of tech extractors increases with the growth of central enforcement capacity, particularly after launch of the Medium- and Long-Term Program (MLP).
3. China seldom introduces tech extractors in strategic industries in which it occupies an intermediate position in GVCs.
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Research Design

Quantitative Analysis:

- **DV**: Technology extractors by industry-year, 1995-2015
- **IV**: Interaction of industry strategic status and bargaining power
- **Controls**: Concentration, SOE share, year FE, industry FE (2-digit)
- **Strategy**: Poisson regression with cluster-robust standard errors
- **Robustness**: OLS, negative binomial, zero-inflated poisson, lagged DVs, alternative measures of DV and IV

Qualitative Case Studies:

1. Wind turbine technology
2. Semiconductor design and fabrication
Problem: Off-the-shelf datasets omit technology extractors or are insufficiently granular
Data: Develop Novel Measure of Tech Extractors

**Problem:** Off-the-shelf datasets omit technology extractors or are insufficiently granular

**Goal:** Create first systematic map of technology extractors in China
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**Strategy:** Manually analyze 500+ pages of Chinese-language central state laws and regulations on three policies:
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Strategy: Manually analyze 500+ pages of Chinese-language central state laws and regulations on three policies:

1. FDI Ownership Restrictions: FDI Guidance Catalogue
2. Local Content Requirements: PKU Laws and Regulations Database
Data: Strategic Industries, Bargaining Power, Controls

Strategic Industries

1. High Barriers to Entry: "Global Innovation 1,000" index (PwC)
2. Basic Infrastructure: Hand coded
3. Critical Inputs: U.S. Department of Defense Strategic Materials list

Bargaining Power
1. Enforcement: Launch of Medium- and Long-Term Program in 2006
2. GVC Position: Processing trade dependence

Controls
1. Geographic Concentration: Herfindahl–Hirschman Index
2. Vested Interests: State-owned enterprise share of industrial output
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**Results: Tech Extraction Before and After MLP Launched**

**Total Technology Extractors in Place, 1995-2015**

- **Strategic**
- **Not Strategic**

**Key:** Tech extractors concentrated in strategic industries in which most Chinese imports are consumed in China
Results: Impact of Strategic Status Declines in GVC Position

Marginal Effect of Strategic Status on Tech Extraction
Poisson w/ Cluster Robust SEs

Key: Marginal effect of strategic status on the use of tech extractors conditional on processing trade dependence
Results: Impact of Strategic Status Declines in GVC Position

**Expected No. of Tech Extractors by Strategic Status and Median Processing Share**

**Key:** China 2.4x more likely to introduce tech extractors in strategic industries in which it is downstream of GVCs
Conclusion

Implications:

- The mechanics of rising powers’ rise
Conclusion

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1. The mechanics of rising powers’ rise

2. “Bring the state back in” to trade politics
Conclusion

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1. The mechanics of rising powers’ rise
2. “Bring the state back in” to trade politics
3. Global value chains and state-firm bargaining
Conclusion

Implications:

1. The mechanics of rising powers’ rise
2. “Bring the state back in” to trade politics
3. Global value chains and state-firm bargaining

Summary: Top-down strategic interests shape technology transfer policy in China, but their impact is conditional on institutional capacity and where China sits in global value chains.
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## Appendix: Theory – Strategic Interests

### Existing Approaches

- **Vested economic interests**
  - **Problem:** Aggressive tech extraction in infant industries

- **Bureaucratic fragmentation**
  - **Problem:** Rise of tech extractors follows institutional consolidation

### My Argument

- **Rising great power, late modernizer, performance legitimacy**
- **Leninist political structure**
- **Public and private speech evidence from senior Chinese leaders**

**Key:** China pursues technology extraction in strategic industries
Appendix: Theory – Enforcement Capacity

Three-Step Process:

1. Administrative restructuring and consolidation, 1998-2003
   - Eliminates 3/4 of industrial line ministries

   - NDRC gains approval authority over large-scale FDI in China

3. Launch of the Medium- and Long-Term Program, 2006
   - Improves inter-agency coordination, facilitating expansion of tech extraction beyond core NDRC policy domains

Key: Improved enforcement capacity enables more aggressive tech extraction in strategic industries
### Appendix: Theory – GVC Position and Credible Threats

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<th>Interest</th>
<th>China</th>
<th>Foreign Firms</th>
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<td><strong>Short-Term</strong></td>
<td>Present Security</td>
<td>Present Sales</td>
</tr>
<tr>
<td></td>
<td>(Exports)</td>
<td>(Market Access)</td>
</tr>
<tr>
<td><strong>Long-Term</strong></td>
<td>Future Security</td>
<td>Future Sales</td>
</tr>
<tr>
<td></td>
<td>(Get Technology)</td>
<td>(Protect Technology)</td>
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**China Intermediate to GVCs:** Firms can more credibly threaten China’s short-term interest in exports and employment than China can threaten theirs in present sales.

**China Downstream of GVCs:** China can more credibly threaten firms’ short-term interest in present sales than firms can threaten China’s in exports and employment.

**Key:** China will refrain from imposing tech extractors in strategic industries in which it is intermediate to value chains.
Appendix: Case Selection

Detailed Industry Case Studies:

- Wind turbine technology: “less likely”
- Semiconductor design and fabrication: “most likely”

Case Selection Criteria:

1. Variation on DV
2. Variation on GVC position
3. Substantive Importance and diversity

Method:

- Within-case: “Before & after” gains in enforcement capacity
- Cross-case: Variation in GVC position

Evidence: Interviews (n = 22), primary documents, secondary sources
Before Admin. Restructuring

- Bureaucratic competition
- Policy redundancy
- Soft Inducements: Tech transfer “encouraged”
- Limited efficacy: Installed capacity low; Goldwind opened first facility in 2002

**Key:** Enforcement cap. limited tech extraction before ~2003

**Installed Wind Power Capacity in China (MW), 1995-2015**

Source: Global Wind Energy Council
Appendix: Case Study #1 – Wind Turbine Technology (Part 2)

After Admin. Restructuring

- NDRC takes control
  1. 2004: Wind Concessions
  2. 2005: Expands 70% req.
  3. 2007: Imposes JV req.
  4. 2009: Govt. procurement

- Hard localization mandates

- Improved efficacy: Installed capacity rises 100x, domestic share from <25% to >90%

Key: Increased enforcement cap. spurs tech extraction after ~2003

“[T]he Chinese government bet correctly that...Rather than fight, Gamesa and the other leading multinational wind turbine makers [would opt] to open factories in China and train local suppliers to meet the 70 percent threshold.”

“Within weeks...Gamesa sent dozens of Spanish engineers to Tianjin. The engineers...fanned out to Chinese local Chinese companies and began teaching them how to make a multitude of steel forgings and castings, and a range of complex electronic controls.”

Appendix: Case Study #2 – Semiconductors

Import Processing Share
ICs vs. Wind Turbines, 1997-2011

“Other industries – rail, wind, aircraft – are closed loop, which gives [China] incredible leverage...In semiconductors, for much of the 2000s...the vast majority of consumption by companies in China was for manufacture and export to international customers.”
– Interview with SIA executive (2021)

“Much of the market was for re-export processing...so not strong leverage to impose JVs...[Instead] China had to offer sweetheart deals to lure investment.”
– Correspondence with China-based industry expert (2022)

Source: China Customs Data
Appendix: Alternative Explanations

Motives:

1. Economic interest groups
2. Bureaucratic fragmentation

Absence in Strategic Industries:

1. Technological complexity
2. Rates of innovation
3. International concentration
Appendix: The Stakes of Processing Trade for China

Exports as a Share of China’s GDP, 1992-2008

Processing Trade as a Share of China’s Exports, 1992-2008

- Exports from processing trade account for 19.8% of China’s GDP in 2006
- Foreign firms account for >80% of process. trade in China from 1995-2009
- Export-related employment heavily concentrated in coastal cities

Source: World Bank
Source: National Bureau of Statistics
Appendix: Data – Coding Technology Extractors

FDI Catalogue
“Oil, natural gas” → CSIC Industry Code
“Oil and n.g. extraction” → From CSIC to ISIC
“Natural gas extraction”
Key: Varying measures of strategic industry does not affect the results
Appendix: Technology Extractors by Type

Technology Extractors by Type, 1995–2015

Key: Results hold with each type set as outcome
Key: Including a lagged outcome variable does not affect results
Appendix: Negative Binomial Regression

Marginal Effect of Strategic Status on Tech Absorption
Binning Estimator (Negative Binomial Link)

Key: Alternating modeling strategies does not affect results