Technology Capital Transfer

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This Paper

- **Transfer of technology capital** through FDI
  - China
- New in the theory
  - MP(09,10): M_i;
  - HMP(12): $M_{ij} = q_{ij} M_i$
  - technology transfer: $(1 - h(q_{ij}))M_i$, $h'(.) \geq 0$
- New in the calibration
  - match *bilateral* FDI inflows (as % of host country's GDP)
- Micro evidence on patents (for foreign, JV, and domestic firms) in the Chinese car industry
  - support the choice of technology transfer parameters

Calibration: Aggregate and Bilateral FDI inflows (2007)

FDI Inflows (% of GDP)

	Host			
Origin	USA	EU	JPN	CHT
Data				
USA+EU+JPN	0.97	1.08	0.34	0.55
CHT+BRI	0.01	0.01	0.01	0.00
ROW	0.59	0.37	0.10	1.00
Total	1.58	1.46	0.45	1.55
Model without Transfers				
USA+EU+JPN	0.78	0.77	0.25	1.22
CHT+BRI	0.68	0.59	0.17	0.23
ROW	0.11	0.10	0.03	0.11
Total	1.58	1.46	0.45	1.55
Model with Transfers				
USA+EU+JPN	1.07	1.02	0.32	0.58
CHT+BRI	0.00	0.00	0.00	0.00
ROW	0.51	0.44	0.13	0.97
Total	1.58	1.46	0.45	1.55

The Mechanics of the Calibration

- Model w/o technology transfer (MP, 09; MP, 10)
  - FDI frictions calibrated to FDI inflows (over GDP)
- Model w/ technology transfer (HMP, 12)
  - $h_i(q) = \min\{\overline{h}_i q e^{-\eta(1-q)}, 1\}$
  - $FDI(ROW, CHT)$ to match $\overline{h}_{CHT} = \overline{h}_{BRI} > 0$
  - impose $h_{USA} = h_{EU} = h_{JPN} = 0$
  - calibrated FDI frictions are lower
  - model fits with zero indigenous (Chinese) technology capital

Counterfactuals: Have Chinese Policies been Successful?

- Yes! Welfare and growth would decrease under stronger IPR policies, *in a world with technology transfers*
- No... Technology capital in China increased due to MNEs, but not due to indigenous innovation
  - imitation versus innovation

HMP(12) Story: Sleeping with the Enemy

- Joint Ventures in China (early 90s)
  - market access for technology transfer
  - weak intellectual property rights
  - goal conflicts (e.g. profitability vs growth), and lack of cooperation among partners
  - ownership restrictions did not promote technology transfer (like in counterfactuals)

- Evidence on technology transfers
  - ownership restrictions for final car assembly (83% of MNEs are JV)

	Patent Counts in Car Industry	
	China (00-10)	WIPO (78-11)
Multinational Firms	13,721	55,258
JV Chinese Firms	1,076	17
Independent Chinese firms	3,602	577

My Comments

- Reinterpreting the theory
  - why is a JV formed?
- The empirical evidence in perspective
  - JV, foreign firms, and R&D in China
- The role of spill-overs

Reinterpreting the Theory

- MNEs entry choice: JV versus wholly-owned affiliate
- JV formed to exploit complementarities
  - better foreign technology capital coupled with knowledge of local networks/business-work practices/consumer base
- Re-interpret $1 - h(q_{ij})$
  - the cost of forming the JV
  - the bargaining share of the MNEs (constrained by the strength of IPR and Gov policies)
- Wholly-owned affiliate
  - $q_{ij} = 1$, higher σ_i—cannot access that easily the domestic market

Chinese Joint-Ventures (JV): Lessons from the Past

- Most ownerships restrictions have been lifted and we still observe the formation of JV
- McKinsey Quarterly Report (Dec. 10): renew interest in forming JV with Chinese firms
  - bring only older technology to China
  - leave blueprints at home
  - limit JV to steps in the value chain that involve limited IP (e.g. assembly, packaging, tailoring)
  - sell IP to the JV (e.g., up-front cash payments, license fees)

FDI Trends in China

	FDI Stocks, as % of GDP				
	1990	1995	2000	2007	2011
inward	5.1	13.4	16.2	9.4	10.1
outward	1.1	2.3	2.3	2.7	5.2

- Slow shift from developing to developed countries as main FDI source
  - in 2000, around 50% of foreign firms were owned by investors from Hong Kong, Macao, or Taiwan
  - "round-tripping"
- Changes in regulations (specially, since 2001)
  - shift from export-oriented activities to domestic market activities

What do Foreign-Invested Enterprises (FIEs) Do in China?

- Defever-Riano (12): comprehensive firm-level data, 2000-06
  - more than 50% of FIEs are JV (more than 30% of foreign PTEs)
  - more than 30% of FIEs export more than 90% of output
  - **84% of all FIEs are located in a FTZ** (87% if FIEs exporters only)
  - FIEs also include foreign Processing Trade Enterprises (PTEs)
- Export-oriented foreign firms
  - isolated from the domestic market
  - enormous tax benefits and other preferential treatments
  - very little R&D, labor-intensive activities ("processing trade")
- Regulation: Till 2001, FIEs *had to* be exporters

R&D Trends in China

- R&D spending in China triplicated between 96 and 02
  - Preferential treatment to either technology-intensive or pure-exporter foreign firms

    e.g., 2002 Provisions on Guiding FDI
  - Off-shoring of R&D activities by MNEs (00s)

    vertical chains in R&D activities

- Main industries: ICT, automotive, chemicals
  - JV like Lenovo and Intel
  - wholly-owned affiliates like Motorola

Multinational Activity and R&D in China (UNCTAD WIR, 05)

- Share of foreign affiliates in (business) R&D (03)
  - China 24%; Ireland 72%; UK 45%; Avg 16%; USA 14%
- UNCTAD Survey of 700 largest R&D MNEs spenders (04)
  - USA 59%, China 35%, France 35%, India 25%, Taiwan 6%
  - 2/3 named China as the most attractive location for R&D-based affiliates (05-09)
- Japanese MNEs
  - from 13 to 67 R&D bases in China (20% of total) in 00-04
- US majority-owned affiliates
  - R&D expenditures in China raised from 0.1% to 3.1% in 94-02
  - adaptive innovations for the Chinese market
  - low costs, large supply of talent, good universities, research centers, high-tech parks, change in Gov policies
- New trend: China seeks technology capital abroad
  - M&A's in developed countries
  - Chinese MNEs operate R&D centers abroad (2/3 in USA+EU) for product design

Spill-overs?

- Suggestion: Leave them out!
  - very similar to "appropriation "in the theory
    technology transfers, imitation, worker training, ...
  - no empirical evidence (Hale and Long, 11)
  - not clear how they can be disciplined in the data
  - they do not improve the fit of the model