

# The Drivers of Patent Activity in China

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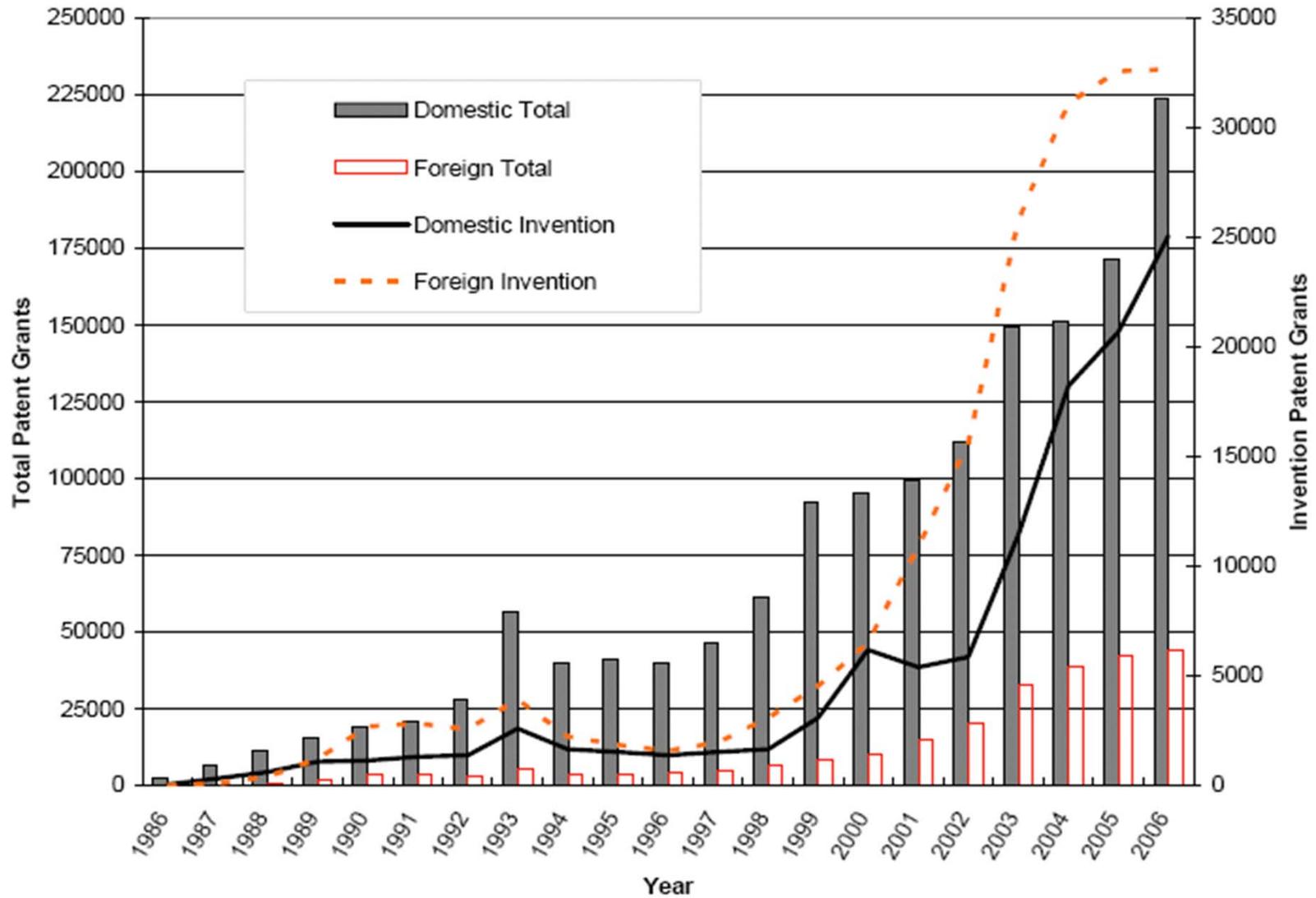
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draft

# Purpose/structure of the talk

- During the past decade, China has exhibited a surge in patent activity – what has driven that surge?
- Specifically we look at:
  - the drivers of China's rising R&D intensity,
  - the impacts that R&D and FDI have on patenting behavior,
  - firm-level motivations for patenting.
- We use both large-scale firm-level data sets and survey data to examine these links.

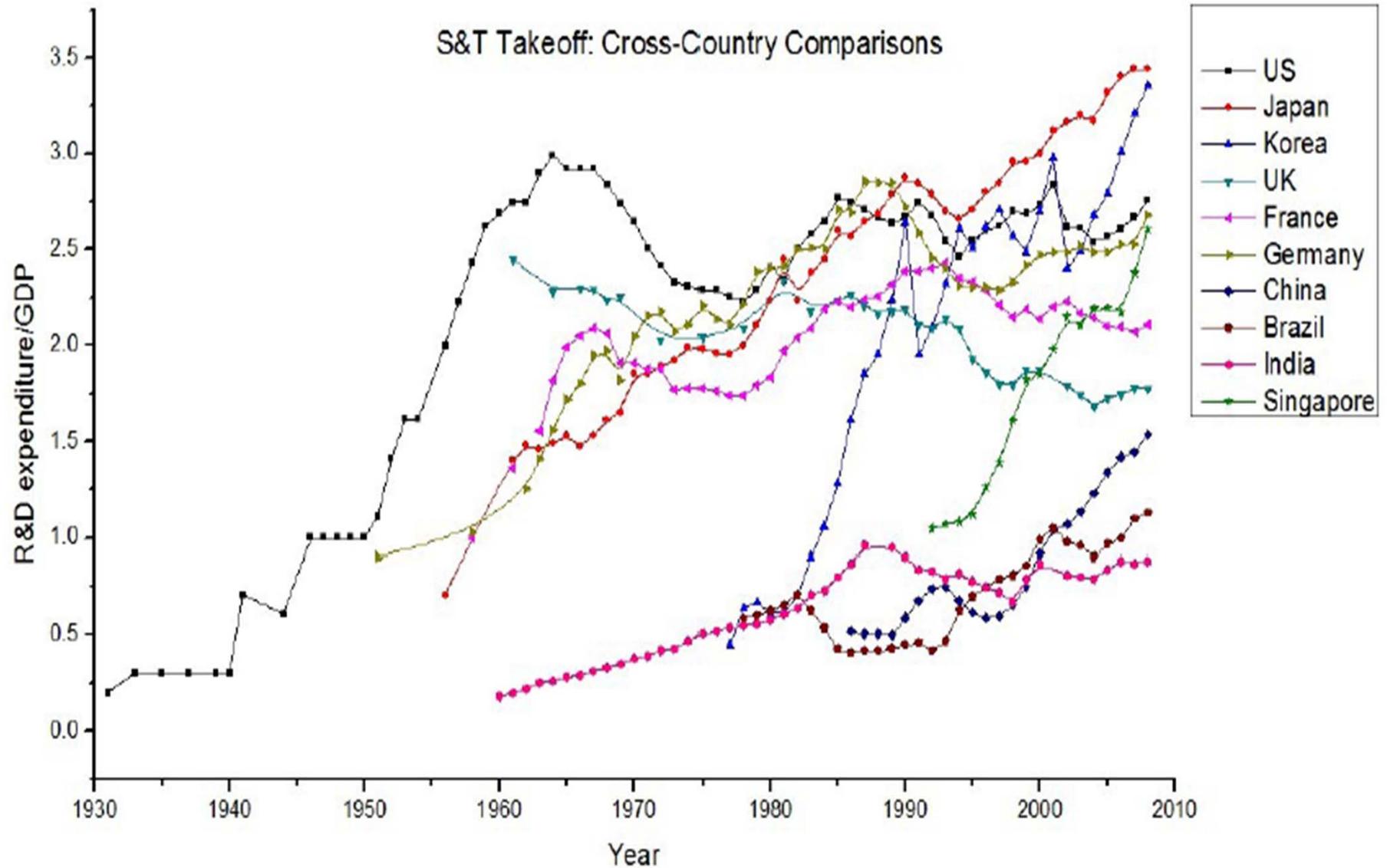
# The Surge: Hu and Jefferson, “Great Wall of Patents,” JDE (2009)



# Research on impact of foreign technology on patents

- Research is largely focused on the industrial sectors – not including the research institute, university sectors, and individual patent filers.
- In 2008:
  - 35% of the total patent applications were invention patents; 27% were utility patents; 38% were design.
  - about 2/3 of the invention patent applications are domestic (about 1/2 of the granted are domestic).
  - About 1/2 of these were filed by industrial enterprises
  - Nearly all of the utility and design patents are domestic.

# Surge in R&D intensity



# Recent measures...

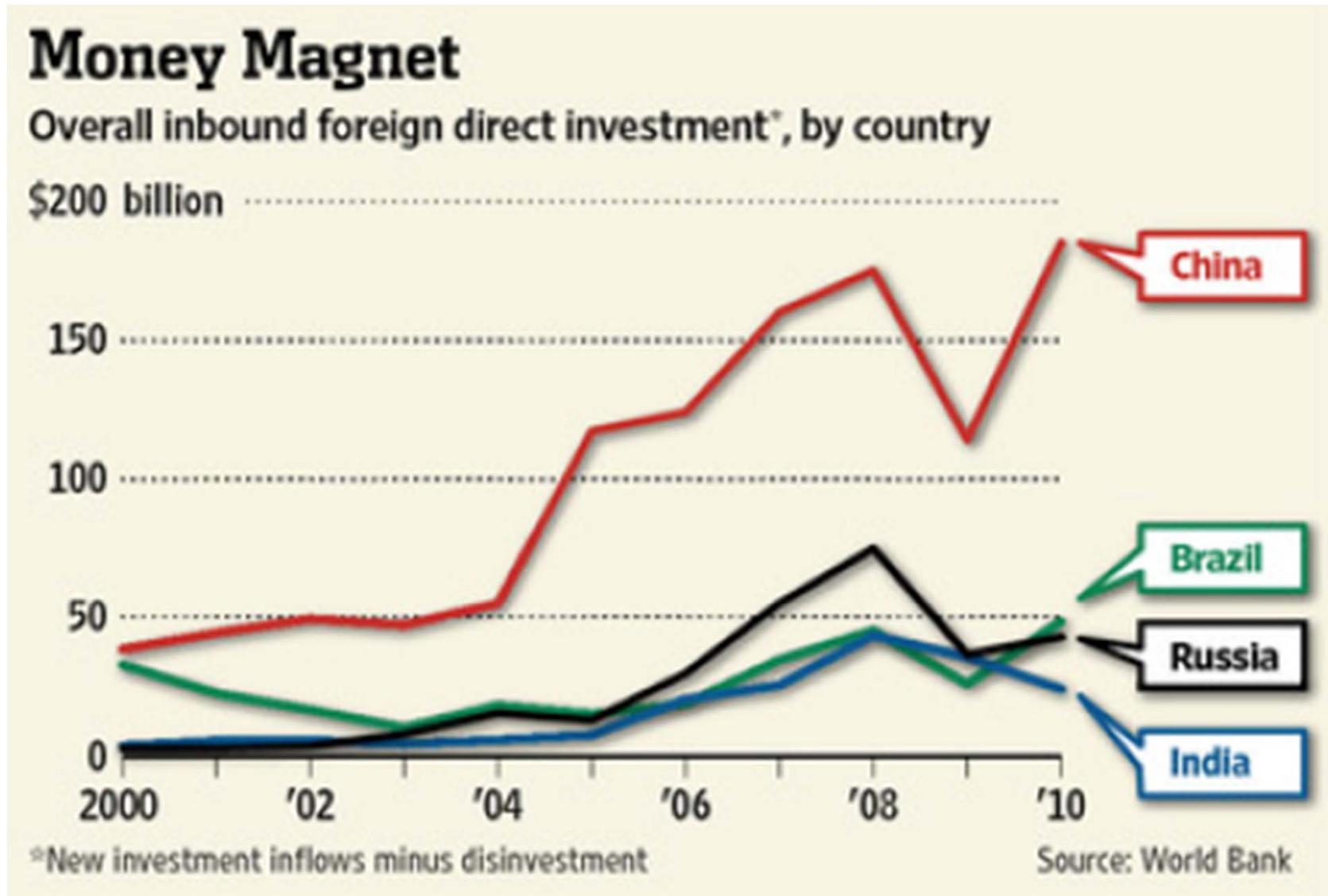
- R&D/GDP
  - 2009: 1.70%
  - 2005: 1.32%
- % basic to total R&D
  - 2009: 4.6%
  - 2005: 5.3%
- % government funds to total R&D
  - 2009: 23.0%
  - 2005: 26.3%

## Drivers of R&D intensification –

Gao and Jefferson, Asia Pacific Business Review, 2007

- The factor income share of technology-intensive intermediate inputs rises in relation to that of production labor,
- The productivity of R&D labor rises (holding constant the supply of technological opportunity),
- The scale effects of available knowledge grows, i.e., an enlarged base of technological opportunity enables the efficiency of R&D activity to rise, and
- Subsidies to R&D labor increase, including, possibly, a rise in the productivity of R&D labor in relation to its wage.

# The role of FDI: China in relation to the other BRICs (WSJ, 1/2/12)



# Key drivers of patenting

- R&D/GDP: Specific drivers of R&D intensification:
  - FDI
  - Foreign tech. expenditure
  - Domestic tech. expenditure
- Direct impact of FDI

# The impact of patenting: R&D vs. FDI

Hu, Jefferson, and Qian: Great Wall of Patents (JDE, 2009)

- Research objective: to explain the determinants of China's patent surge, 1995-2001.
- Key findings:
  - Domestic firms: R&D significantly affects patenting, but relative to the OECD countries, the impact is weak;
  - Foreign firms – R&D has no impact on patenting.
  - Concentrations of FDI have a strong impact of patenting in domestic firms, foreign FDI motivates domestic R&D spending and patenting, particularly in FDI intensive industries such as electric machinery, transportation equipment and chemical industries.

# The impact of foreign entry on R&D

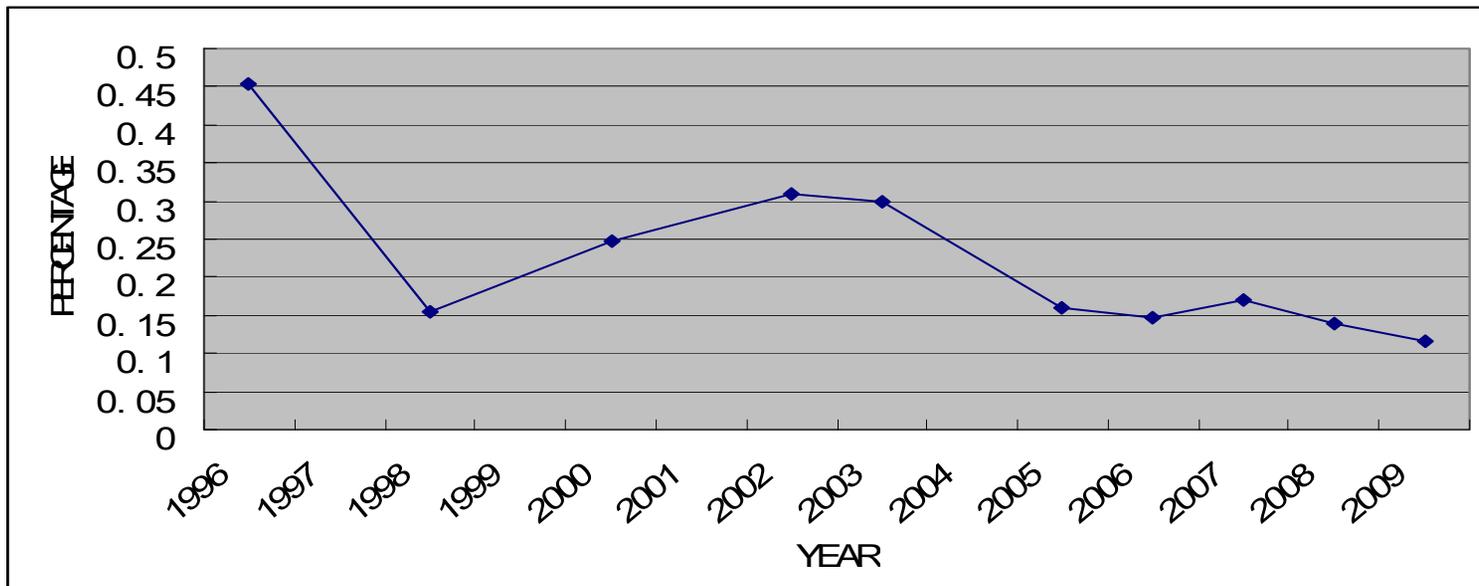
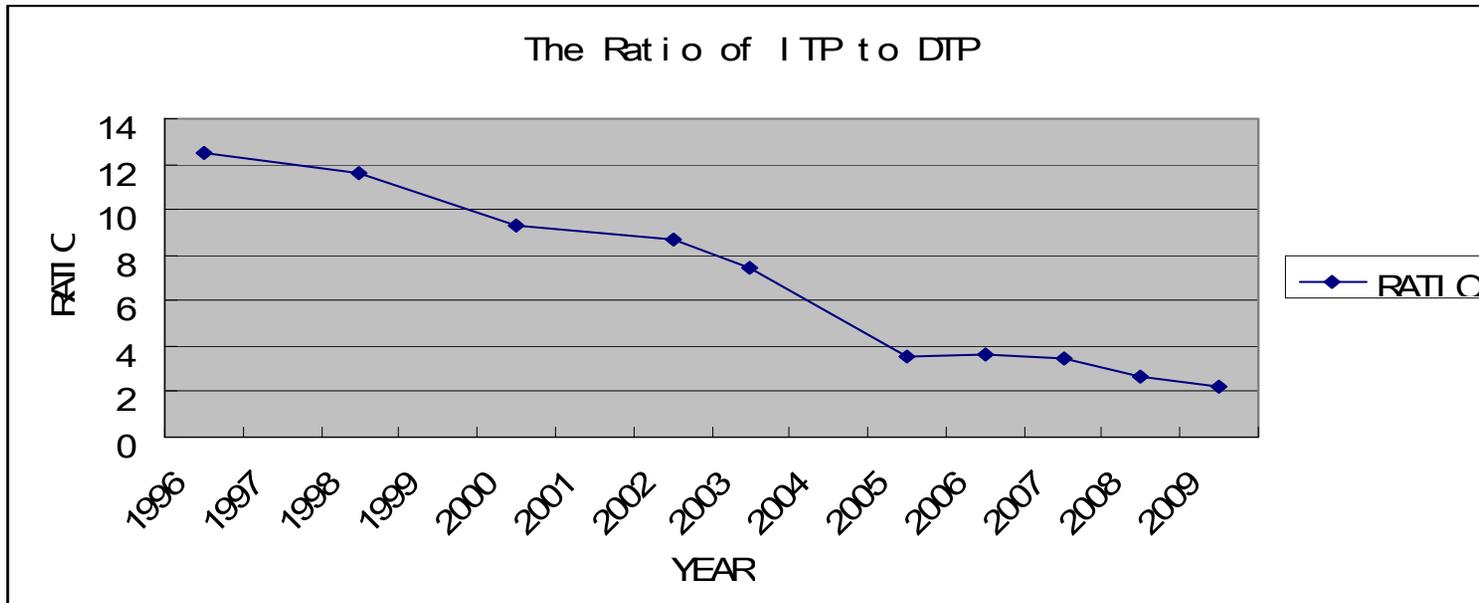
- Deng and Jefferson (2011) – Foreign entry (FE) motivates domestic firms to spend more on R&D.
- A separation effect, i.e. separate the LMEs into high productivity-low productivity groups, as measured by their distance from the FE technology frontier.
- As a result of FE, both groups:
  - spend more on R&D;
  - however, the high-productivity firms increase their R&D spending by considerably more than the low-productivity firms.
- Also, as a result of FE:
  - The high-productivity firms patent more;
  - The low-productivity firms patent less.

# The Impact of technology purchases on R&D

Hu, Jefferson and Qian (REStat, 2005)

- Use the LME data set covering 1995-1999.
- Key findings:
  - Firms that purchase foreign technology (FTP) also tend to maintain internal R&D;
  - For domestic firms, R&D and FTP are strongly complementary;
  - They are not complementary for foreign-invested firms;
  - An increase in FTP alone has no impact on firm productivity;
  - a 1% increase in both R&D spending and FTP is predicted to lead to a 1% increase in firm productivity with most of the increase coming from the interaction of R&D with FTP.

# The ratio of FTP:DTP and the ratio of FTP/GDP\* \*FTP=ITP



## More on the impact of FDI on patenting

H, J,Q: “Great Wall of Patents...”

- Although channel of effect is ambiguous:
  - More fish in the technology pond, i.e., new innovation opportunities, or
  - Strategic patenting of already developed technologies or lower quality innovations, i.e., higher propensity to patent?
- Do not distinguish whether the impacts are on higher quality invention patents or lower quality utility patents.
- Hence, the net effect of FDI on Chinese patenting may be ambiguous.

# What motivates firms to patent – or not patent?

Jefferson, Liu, Ren IPR survey

- 2009 - ~150 domestic and foreign firms in Beijing;
- 2010 - ~ 150 domestic and foreign firms in Shenzhen;
- Industries:, electronics, mechanical, automobile, chemical information technology, software, communications
- Pooled the Beijing and Shenzhen samples

# Preferred methods for securing IPR

- China: secrecy, lead time, domestic patenting (both product and process innovation), foreign patenting is last for both product and process innovation.
- US: secrecy, lead time, patenting (tied with complementary sales/service and manufacturing) – for both product and process innovation.
- Conclusion: For both China and the U.S. – patenting is NOT the method of securing IPR that is used most frequently or viewed as most effective...

# Main reason for applying for a patent

- Survey possibilities:
  - limit entry and sales by competitors (blocking)
  - Evaluate personnel achievement
  - Licensing revenue
  - Negotiations
  - Prevent lawsuits
  - Prevent copying
  - Reputation
  - Other

# Motives for patenting

- China: Enhance *reputation*, followed by *prevent copying* and *prevent lawsuits* about equal, followed by *limit entry and sales (blocking)*;
- U.S. (CNW and Yale surveys): Both product and process innovation - prevent copying, blocking (limit entry and sales), and prevent lawsuits
- Differences may reflect:
  - Reputation: priority and extensive incentives provided by Chinese government;
  - Prevent lawsuits seemingly receiving less priority in the U.S. survey: somewhat earlier U.S. surveys – 1994 (CNW) and (1984) Yale.

# Reasons for not patenting

- Choices:
  - headquarter's rules
  - Importance of the overseas market
  - Ineffectiveness of legal enforcement
  - Insufficient duration of the patent
  - Application and renewal cost too high
  - Legal defense costs
  - Easy for competitors to invent around the patent
  - Application procedure takes too long
- Chinese survey: ineffectiveness of legal enforcement, ease of inventing around, application procedure takes too long.

# U.S. comparison

- CNW: Ease of inventing around, difficulty demonstrating novelty, disclosure requirement.
- Interpretation: Chinese reasons for not applying for patents are more focused on weaknesses in the patent system – enforcement, duration...

# Satisfaction with the IPR system

- Firms in Shenzhen tend to be less satisfied with China's IPR system than those in Beijing; SOEs in Beijing are the most satisfied.
- Firms that are most satisfied with the IPR system are more likely to license their IP to other companies, while those that are less satisfied retain the IP within their firm boundaries – self-use, transfer to parent company, or establish a joint venture.

Strategic patenting – discourage litigation;  
facilitate litigation/settlements; block entry

- Strategic patenting seems to be one arena in which is taking place.
- Company survey: The R&D manager reported that one of the firm's motives for its prolific patenting was to “protect” itself against the aggressive strategic patenting of foreign firms.

# Conclusions I

- Drivers of patenting in China differ from the U.S. and other OECD countries:
  - In China, R&D plays a more limited role; FDI and foreign entry play a much larger role (both directly and by motivating R&D)
- Foreign factors play a critical role in motivating China's R&D intensification – and patenting:
  - FDI has robust impacts on R&D spending but firm heterogeneity matters.
  - Foreign (and domestic) technology purchase also enhance the returns to R&D, also motivating its intensification.

# Conclusions II

- The incentive structure for seeking IP protection and patents in China and the U.S. are largely similar:
  - Relative importance/frequency of means for securing IPR similar;
  - Motives for patenting similar.
  - Motives for not patenting differ. Differences reflecting the quality of the patent systems and ownership structures.