

# ECONOMICS OF INTELLECTUAL PROPERTY

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Walter G. Park,  
American University

*Presentation at the Inter-American Development Bank,  
Competitiveness and Innovation Division  
16<sup>th</sup> May, 2014.*

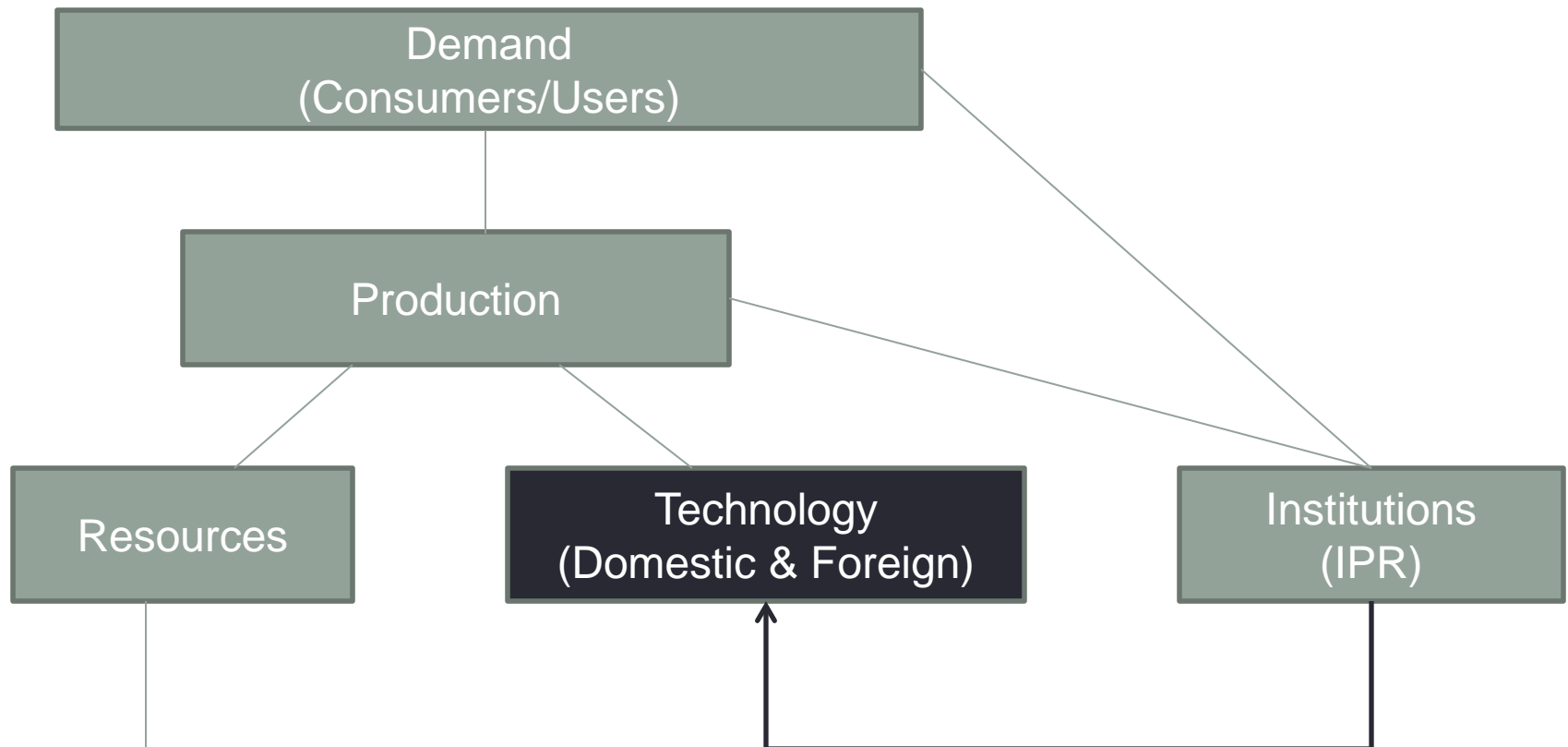
# Survey of Research

- Overview
- Background Trends
- Theories about Intellectual Property Rights (IPR)
  - Implications for Innovation, Technology Transfer, and Economic Development
- Empirical Evidence
  - Measurement Issues
  - Patents, Copyrights, and Trademarks
  - Lessons

# Overview

- Rationale for IPR
  - Public Good (non-excludability, non-rivalry)
    - *Missing Markets problem*
- Globalization of IPR
  - Trade and Foreign Direct Investment (FDI) in IP goods/services
  - Strategic Trade
  - International Knowledge Spillovers
- Key Issues
  - How important are IPRs in technological progress?
    - *Complementary factors vs. Alternative factors*
  - Optimal IPR (i.e., balancing benefits & costs)?
  - Appropriate level for developing countries?

# Context



# Trends

- Measures of Innovation and Technology Transfer over Time

NORTH	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
1994-1996	1.00	1.00	1.00			1.00	1.00
2003-2005	1.46	2.12	1.31	1.00	1.00	3.01	2.85
2010-2012	2.02	2.02	1.51	1.88	1.92	4.88	4.95

SOUTH	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
1994-1996	1.00	1.00	1.00			1.00	1.00
2003-2005	3.31	5.45	1.77	1.00	1.00	2.93	3.84
2010-2012	21.82	12.71	3.56	3.27	2.91	8.42	14.90

LATIN AMERICA	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
1994-1996	1.00	1.00	1.20			1.00	1.00
2003-2005	1.59	3.37	1.50	1.00	1.00	3.04	2.73
2010-2012	2.44	4.28	2.31	2.48	2.34	8.24	7.13

# Trends

- Measures of Innovation and Technology Transfer Between Groups

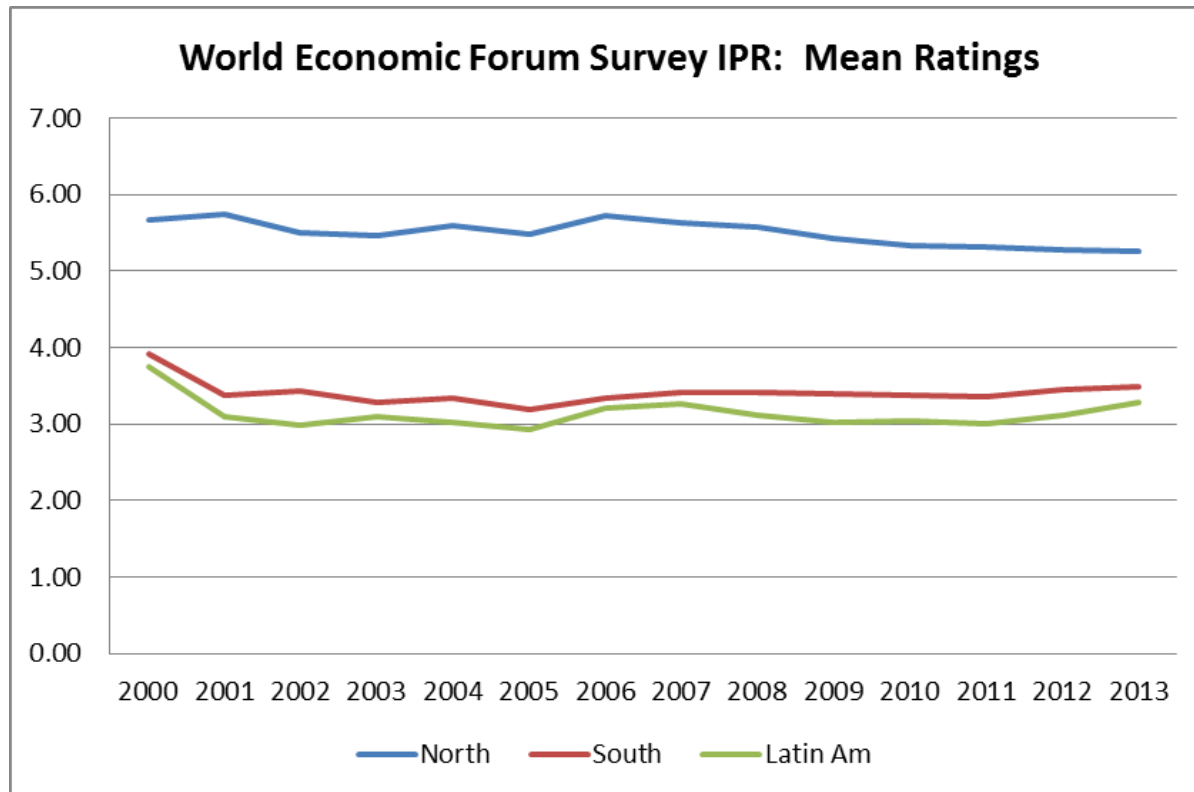
	Group	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
1994-1996	North	1.00	1.00	1.00	n/a	n/a	1.00	1.00
	South	0.01	0.01	0.02	n/a	n/a	0.05	0.01
	Latin Am	0.002	0.004	0.03	n/a	n/a	0.09	0.03

	Group	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
2003-2005	North	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	South	0.01	0.02	0.03	0.07	0.01	0.05	0.02
	Latin Am	0.002	0.01	0.03	0.04	0.01	0.10	0.03

	Group	US Patent Grants	EPO Patent Filings	R&D	Licensing Inward	Licensing Outward	FDI Inward	FDI Outward
2010-2012	North	1.00	1.00	1.00	1.00	1.00	1.00	1.00
	South	0.06	0.05	0.05	0.11	0.02	0.09	0.04
	Latin Am	0.003	0.01	0.03	0.05	0.01	0.16	0.04

# Trends

- Perceptions of Intellectual Property Enforcement
  - Global Competitiveness Report, various issues



# Theories about IPRs

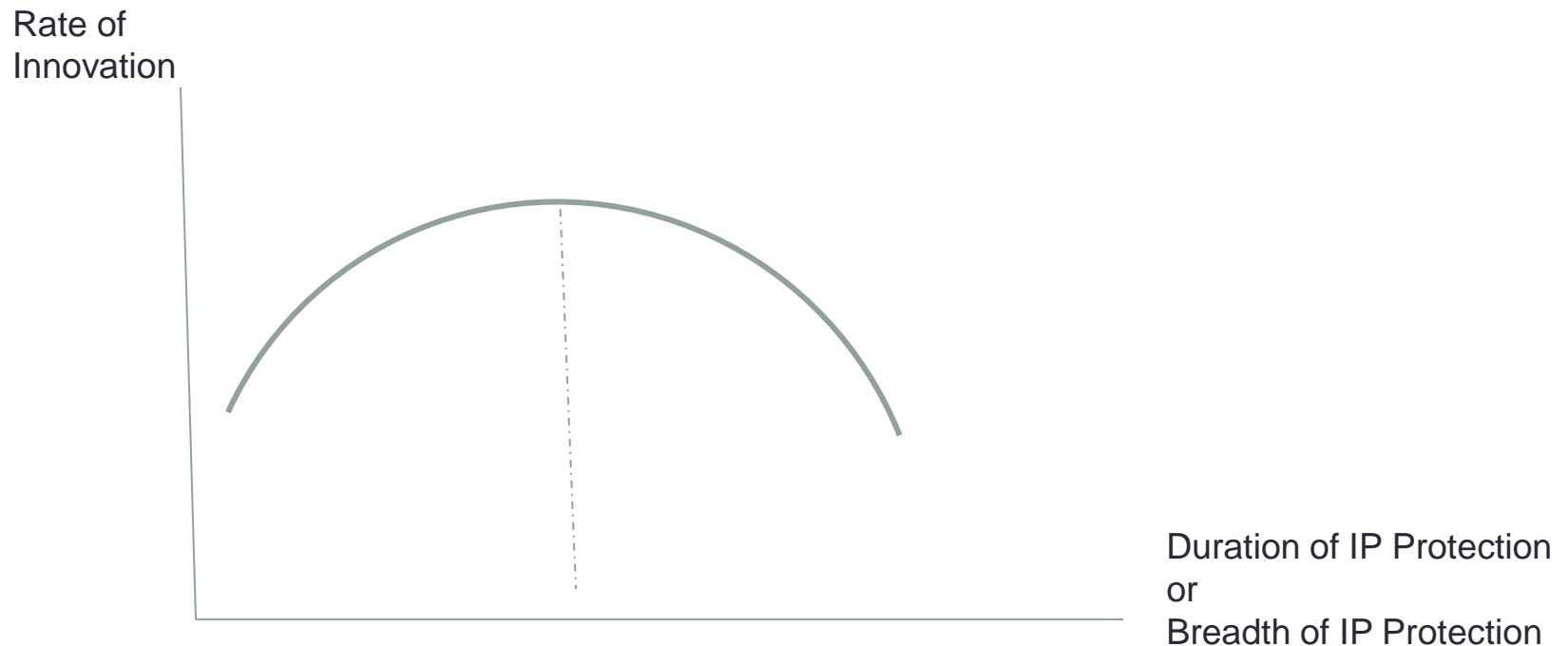
- North – South Models



- Resources in N allocated between R&D and manufacturing
- Effects of tighter Southern IPR on Northern innovation & tech transfer are conditional on (i) whether N engages in FDI & licensing in S; (ii) costs of imitation.

# Theories about IPRs

- Nonlinearities



- Role of Competition/Rivalry; impact on follow-on innovation

# Theories about IPRs

- Stages of Economic Development
  - Optimal IPR should vary with
    - *Market Size*
    - *Innovative Capacity*
  - South's optimal IPR < North's optimal IPR
  - Role of Utility Models (Petty Patents)
    - *Reward adaptive, imitative innovations*
    - *Minor inventive activity as a stepping stone for major (future) innovations*
    - *China, S. Korea, Taiwan*

# Theories about IPRs

- Technology Transfer
  - Effect of IPR on TT depends on
    - *Market Expansion Effect*
    - *Market Power Effect*
  - Effect of IPR on Composition of TT
    - *Depends on Wages and Imitation Risks abroad*
    - *Possible sequence: Export → FDI → License*
- Relevance of Composition of TT
  - *Empirical Work (volume vs. switching effects)*
  - *Implications for employment, costs, and knowledge diffusion*
  - *Quality/Type of technologies transferred and purpose of FDI*

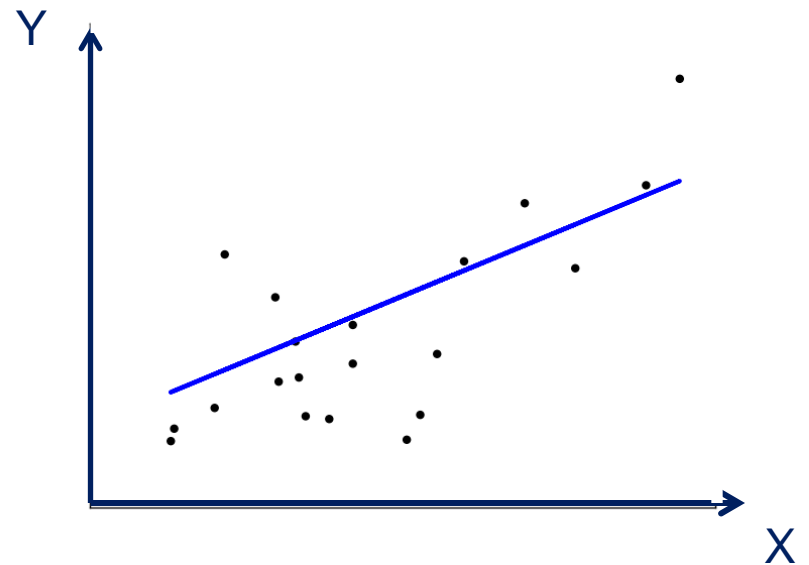
# Empirical Evidence

## Framework:

- Regression Analysis

$$Y = \alpha + \beta X + \gamma Z + \text{error}$$

- $Y$  = *variable (outcome) of interest*
- $X$  = *measure of IPR*
- $Z$  = *vector of control variables*



# Quantifying IP Regimes

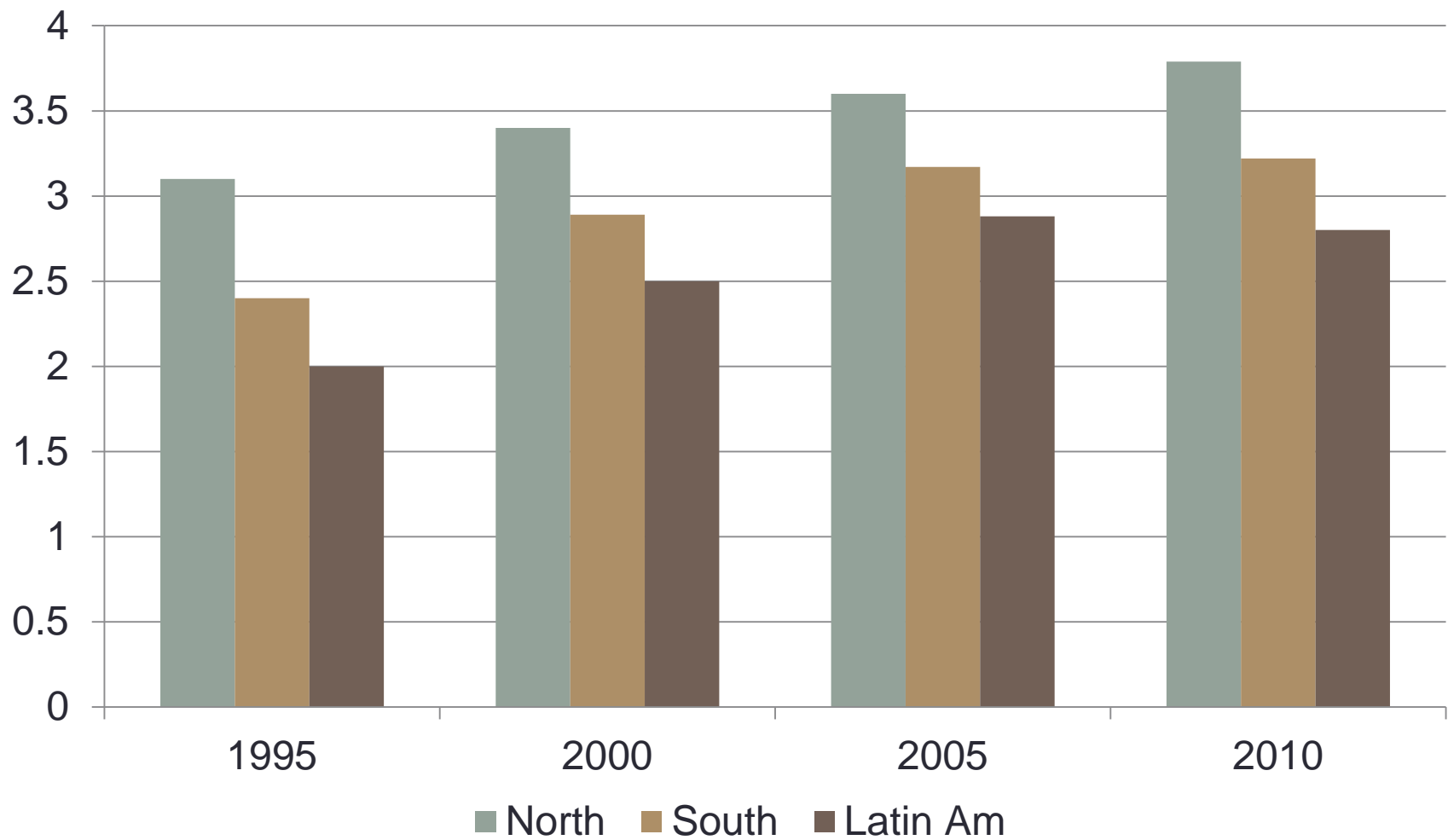
Index of Patent Rights		
<u>Components</u>	<u>Description</u>	<u>Point Value</u>
Duration of Protection	<i>Fraction of 20 years</i>	1
Coverage	<i>Fraction of subject matter protected</i>	1
Enforcement Mechanisms	<i>Fraction of available provisions</i>	1
Membership in International Agreements	<i>Fraction of relevant treaties, agreements, ...</i>	1
Restrictions	<i>Fraction of restrictions not imposed</i>	1
Total Score		0 - 5

# Quantifying IP Regimes

Index of Copyrights		
<u>Components</u>	<u>Description</u>	<u>Point Value</u>
Coverage	<i>Percentage of Duration per type of copyrightable work</i>	1
Usage	<i>Degree of private use (e.g., fair use) not permitted</i>	1
Enforcement Mechanisms	<i>Fraction of available provisions</i>	1
Membership in International Agreements	<i>Fraction of relevant treaties, agreements, ...</i>	1
Total Score		0 - 4

Index of Trademark Rights		
<u>Components</u>	<u>Description</u>	<u>Point Value</u>
Coverage	<i>Fraction of permitted marks, or types thereof</i>	1
Procedures	<i>Fraction of available provisions</i>	1
Membership in International Agreements	<i>Fraction of relevant treaties, agreements, ...</i>	1
Total Score		0 - 3

# Index of Patent Rights



## Correlations with IP Survey by World Economic Forum

Correlation between WEF and:	All Countries	North	South	Latin America
Index of Patent Rights	0.75	0.79	0.73	0.89
Index of Copyright Protection	0.31	0.34	0.31	0.58
Index of Trademark Rights	0.32	0.37	0.30	0.82

# Evidence: Patent Protection & Innovation

- Measures of Innovation:
  - R&D (input) and Patent Filings (output)
- Samples: Multi-country panels
- Findings vary by income group:
  - Patent protection has a significant effect on R&D and patenting in the North, *controlling for other factors*.
  - Weak (insignificant) effects on Southern R&D and negative (in some cases) on Southern patenting, *controlling for other factors*.
- Possible Explanations:
  - lagged effect
  - threshold effect (if sufficient indigenous technological capacity exists)
  - imitative, adaptive R&D constrained

# Evidence: Patent Protection & Technology Transfer

- Modes of TT: Exports, FDI, and Licensing
- Findings:
  - mixed but mostly positive  $\beta$  estimates
  - varies by industry, type of intangible asset, and income group
  - effects are conditional on presence of other factors (human capital, wages, market size, governance, taxes)
- Limitations of Existing Work:
  - single mode
  - lack of non-U.S. data
  - inadequate information about 'quality' of TT or prices and access (quantity supplied).

## Impact of Patents on Technology Transfer (holding other factors constant): Range of Findings

	Single Mode			Joint Modes
Country Group	Exports	FDI	Licensing	Exports, FDI, and Licensing
Pooled	+, 0	+, 0	+	Ratio of Licensing to FDI, + Ratio of FDI to Exports, +
Developed Countries	?	?	n/a	Ratio of Licensing to FDI, + Ratio of FDI to Exports, ?
Developing Countries	+	+, 0	n/a	Ratio of Licensing to FDI, n/a Ratio of FDI to Exports, +

Symbol Key: + positive effect, - negative effect, 0 insignificant, ? indeterminate, n/a not avail.

Source: Park (2008)

# Licensing: Affiliated vs. Unaffiliated

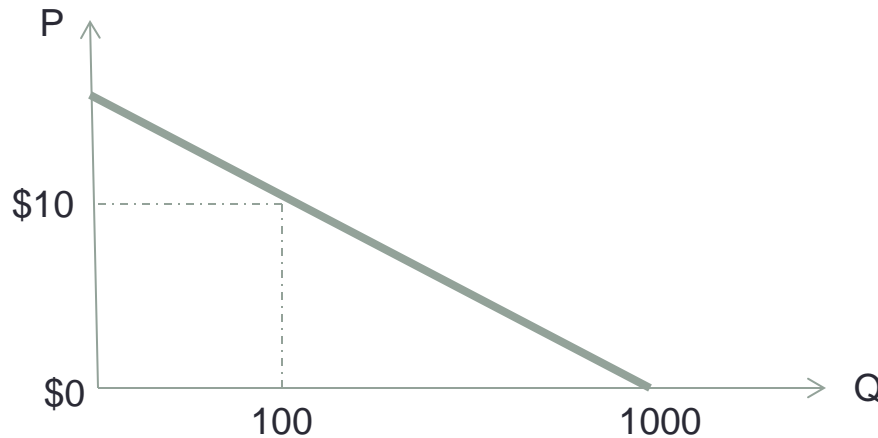
- Ivus, Park, and Saggi (2014) [in progress]
    - U.S. multinational activity in 44 developing countries, 1993 – 2009
  - Two types of industries:
    - discrete (pharmaceuticals)
    - complex (machinery, electronics)
- Imitation risk higher in discrete.*
- Unaffiliated licensing lower in discrete industries.
  - Sequence: typically affiliated licensing before arms-length
  - Patent reforms raise both kinds of licensing, but favors unaffiliated licensing relative to affiliated, and more so in sectors facing greater imitation risks.
  - Are there 'substantive' technology transfers?
    - Impact on local R&D, value added, and innovation is asymmetric:
      - parent's affiliated licensing affects R&D of subsidiaries
      - but unaffiliated licensing affects patenting by indigenous firms. Therefore, more knowledge spillovers associated with unaffiliated licensing.

# Evidence: Copyrights & Creativity

- Challenges:
  - Contribution of Copyright Industries to National Economies – lack causal structure
  - Limited metrics of innovation: equivalent of “R&D” spending; copyrighted works are not all registered (or need to be to obtain protection); sales data flawed (product of price and quantity).
  - How do copyrighted works affect technological progress?
    - Copyrighted works relate to arts, entertainment, culture
    - Some deal directly with inventive activity: software, internet technologies (broadband, cloud computing), infrastructure
    - Education, Libraries, Museums/Archives, Databases affect human capital accumulation, scientific & other scholarly work.
  - Role of Copyright Flexibilities and User Rights
    - Fair use, fair dealing, transformative use
    - Compare impacts on employment, business creation, research, and social welfare

# Economic Effects of Piracy

- Estimates of Revenue Loss are inexact



- Piracy crowds out legitimate sales less than 1:1
  - Sampling effects, network externalities
- Determinants of piracy
  - copyright strength and enforcement, social norms, incomes

# Trademarks

- Indicator of Innovation?
  - New product launches, or improvements upon existing goods
  - Positive correlation between patenting and trademarking
- Digression: Monopoly vs. Monopolistic Competition




Competition among varieties,  
each of which is 'exclusive'

- Correlation between PAT and TM high
  - in pharmaceuticals (i.e., helps maintain brand loyalty)
  - among product innovations more than process innovations
  - imperfect correlation since TM activity is intense in retail & advertising

# Trademarks

- Tradeoffs

- Benefits: creates incentive for firms to invest in product quality and promotion; reduces search costs for consumers (branding and reputation-building)
- Costs: creates market power (cf. consumer preference)

- Empirical Research on effect of trademarks on Firm (Stock Market) Value and Productivity

- Is 'trademarking' worth doing?
- Findings: some supporting evidence that TM raises firm value, especially in services, and TM more valuable for relatively *lower-tech firms* (high tech firms dependent more on patents and R&D)
- See Schautschick and Greenhalgh (2013) "Empirical Studies of Trade Marks – the Existing Literature" Working Paper.

# LESSONS

- IPR reforms have occurred worldwide. South has been catching up but *gaps* remain in levels of innovation and technology diffusion
- IPR create costs & benefits, and are *among* the factors that affect technological progress
- IPR have *varied* economic effects by industry, level of economic development
- Innovative *capacity* important for exploiting IPRs
- Technology transfer *modes* are affected as IPRs strengthen: from exporting to FDI to affiliated licensing to unaffiliated licensing
- IPR levels and enforcement in turn a function of *economic development*

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