TECHNOLOGICAL INNOVATION & TRIPS: INTERNATIONAL EMPIRICAL EXPLORATION, BY SECTOR*

(*TRIPS = WTO Agreement on Trade Related Aspects of Intellectual Property Rights, 1995)

Douglas Lippoldt (TAD/DD)

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Contact: douglas.lippoldt@oecd.org

OECD
BETTER POLICIES FOR BETTER LIVES

Outline of Presentation

1. Key concepts & analytical approach
2. Trade & FDI: merchandise & services, licensing
3. Innovation inputs and outputs; technological achievement
4. Next steps: assessing agriculture
5. Conclusions & caveats

1. KEY CONCEPTS & APPROACH

IPR Key Concepts

- **Property rights are an important institution**: "they help a man form those expectations which he can reasonably hold in his dealings with others" (Demsetz, 1967)
- **Intellectual property: unlike physical goods**, a single bit of intellectual property can be made available simultaneously, repeatedly, non-exclusively; non-rivalrous; linked to tech change & econ growth. (Romer 1990; Jones, 2004)
- **Incentive problem**: the intangible nature makes it possible to leverage an idea, but also difficult to appropriate economic benefits (Demsetz, 1967); therefore governments help protect intellectual property rights.
- IP **Sources**: domestic innovation, import or transfer from abroad
- **For output per capita, the total stock of available ideas** (domestic or imported) matters more than the amount per capita (Jones, 2004)
- **TRIPS: the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights** established a minimum standard for IPR protection and was associated with a broader wave of IPR reform during the 1990s.
- **A global framework assuring appropriate rights means potential access** to global stock of ideas via the market.

Analytical approach: OECD empirical studies on IPRs

- Co-authors: Walter Park (AU); Ricardo Cavazos (UC)
- **Hypothesis: strengthened IPRs associated with improved economic performance**

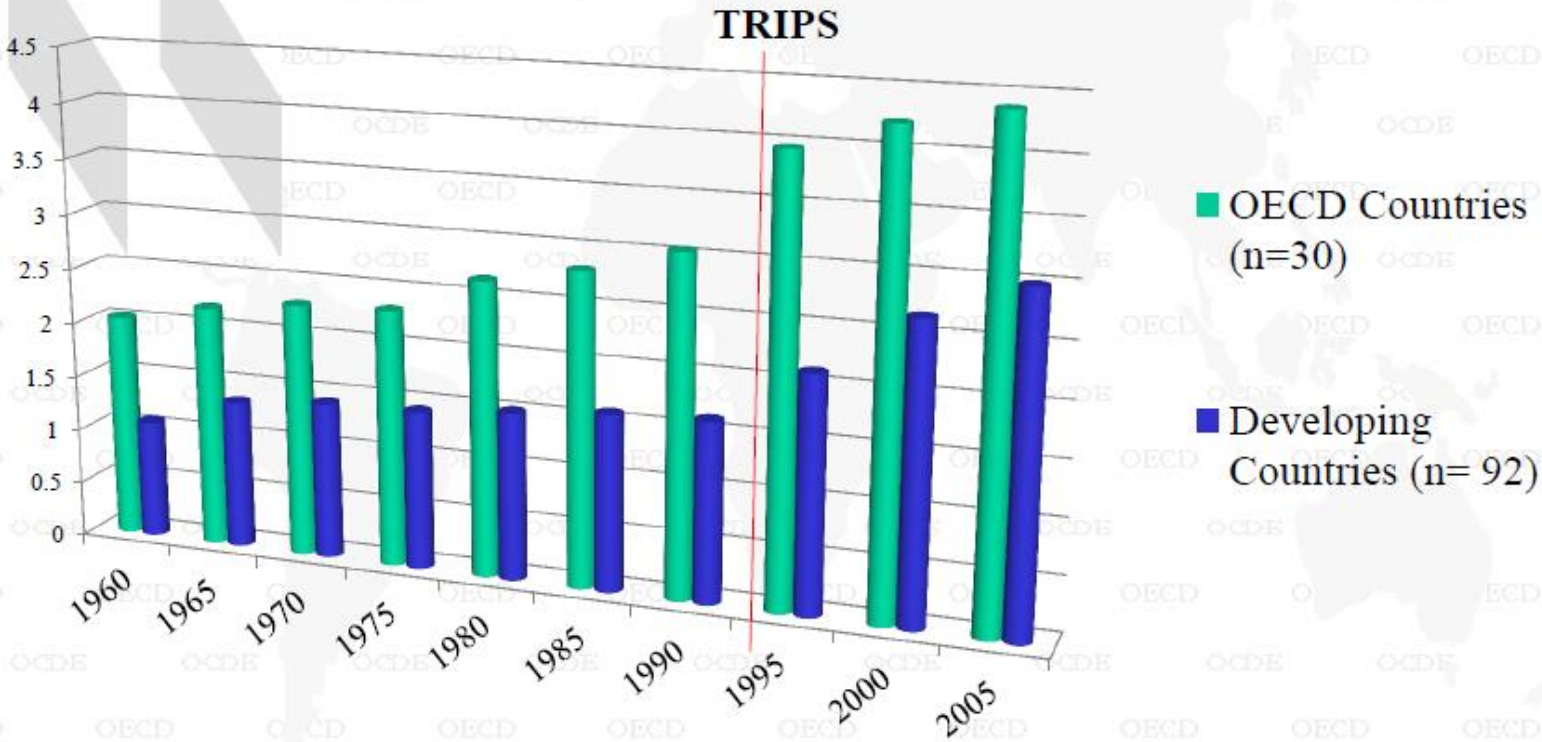
  ***ln* Econ performance indicators =**
  ***ln* f(IPR protection+controls)+error term**
- IPR indicators:
  - IPR laws on the books => indices for patent rights, ©,™
  - IPR enforcement effectiveness (business perceptions)
- Econ performance items: trade, FDI; innovation inputs & outputs (e.g., R&D)
- Controls: GDP p/c, freedom to trade, legal effectiveness, regulatory barriers, governance, among others

Patent Rights Index

1. **Membership in international treaties**: Paris Convention, PCT, UPOV, Budapest Treaty, TRIPS
2. **Coverage**: pharmaceuticals, chemicals, food, surgical products, microorganisms, utility models, software, plant & animal varieties
3. **Restrictions**: "working" requirements, licensing, revocation of patents
4. **Enforcement**: preliminary injunctions, contributory infringement, burden of proof reversal
5. **Duration of protection**

- Ginarte & Park (1997), Park (2008)

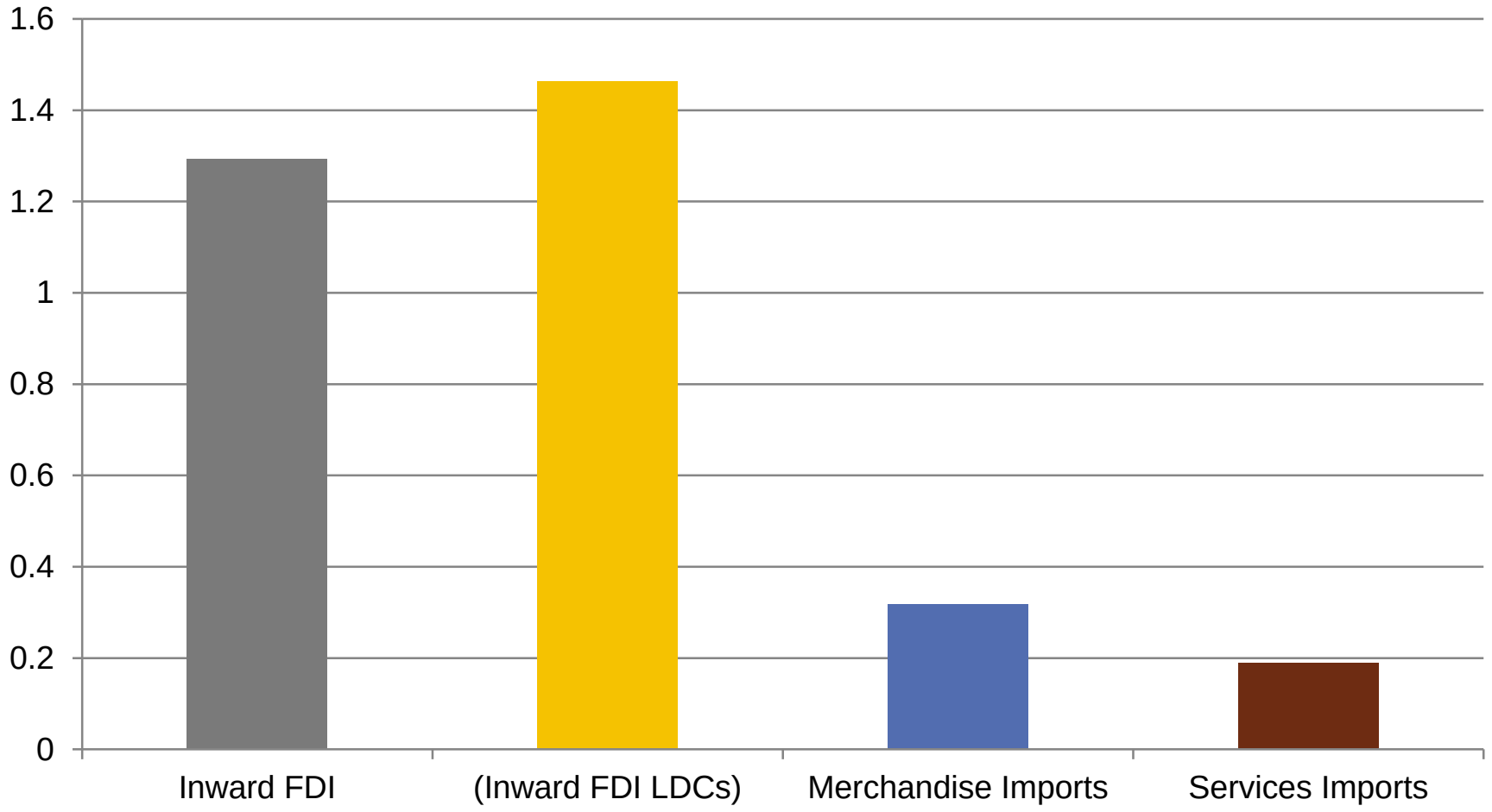
Index of Patent Rights
Based on laws on the Books (0 = weak, 5 = strong)



Source data: Park and Lippoldt (2008)

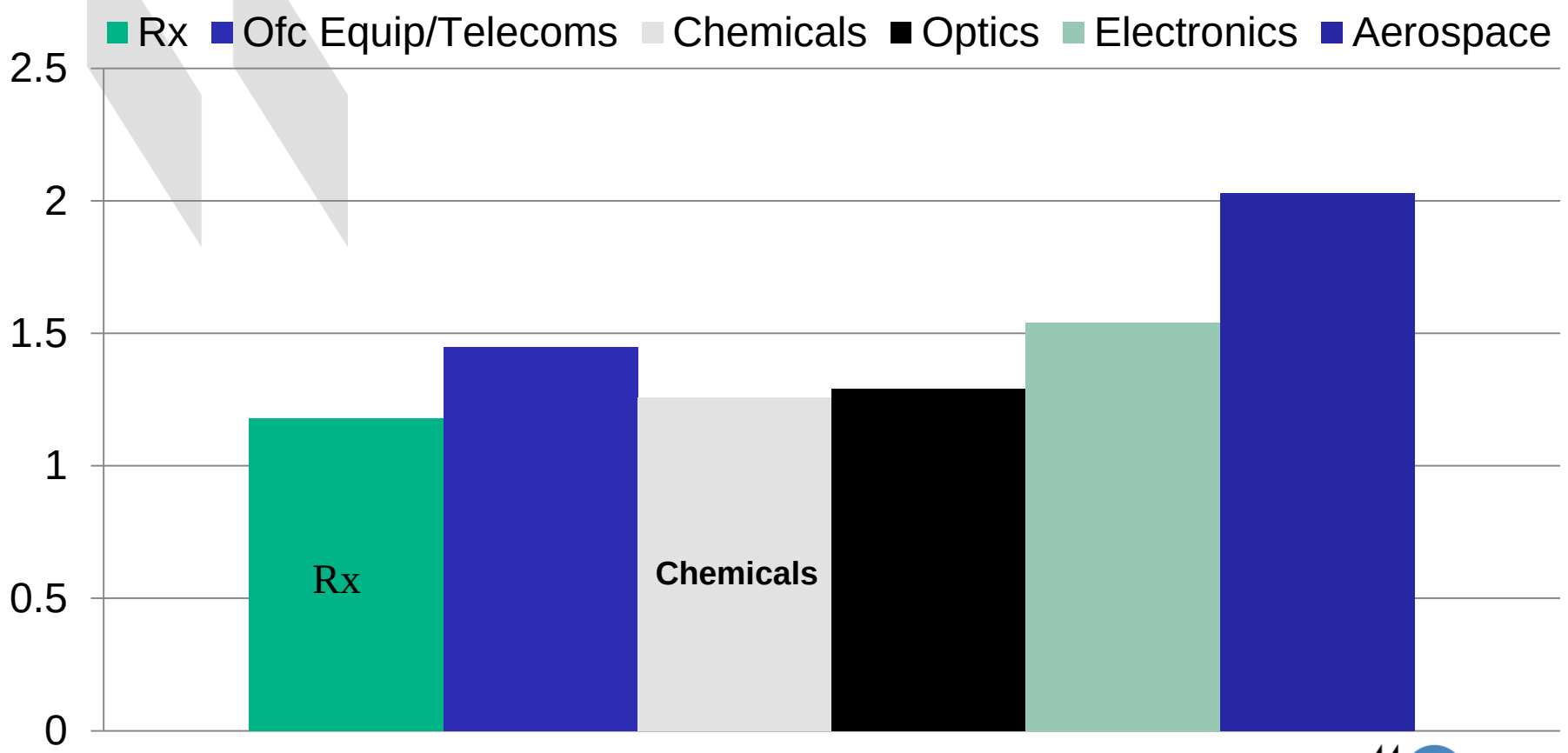
2. TRADE AND FDI

Developing countries: relationship of a 1% increase in the Patent Rights Index to changes in FDI and trade, 1990-2005



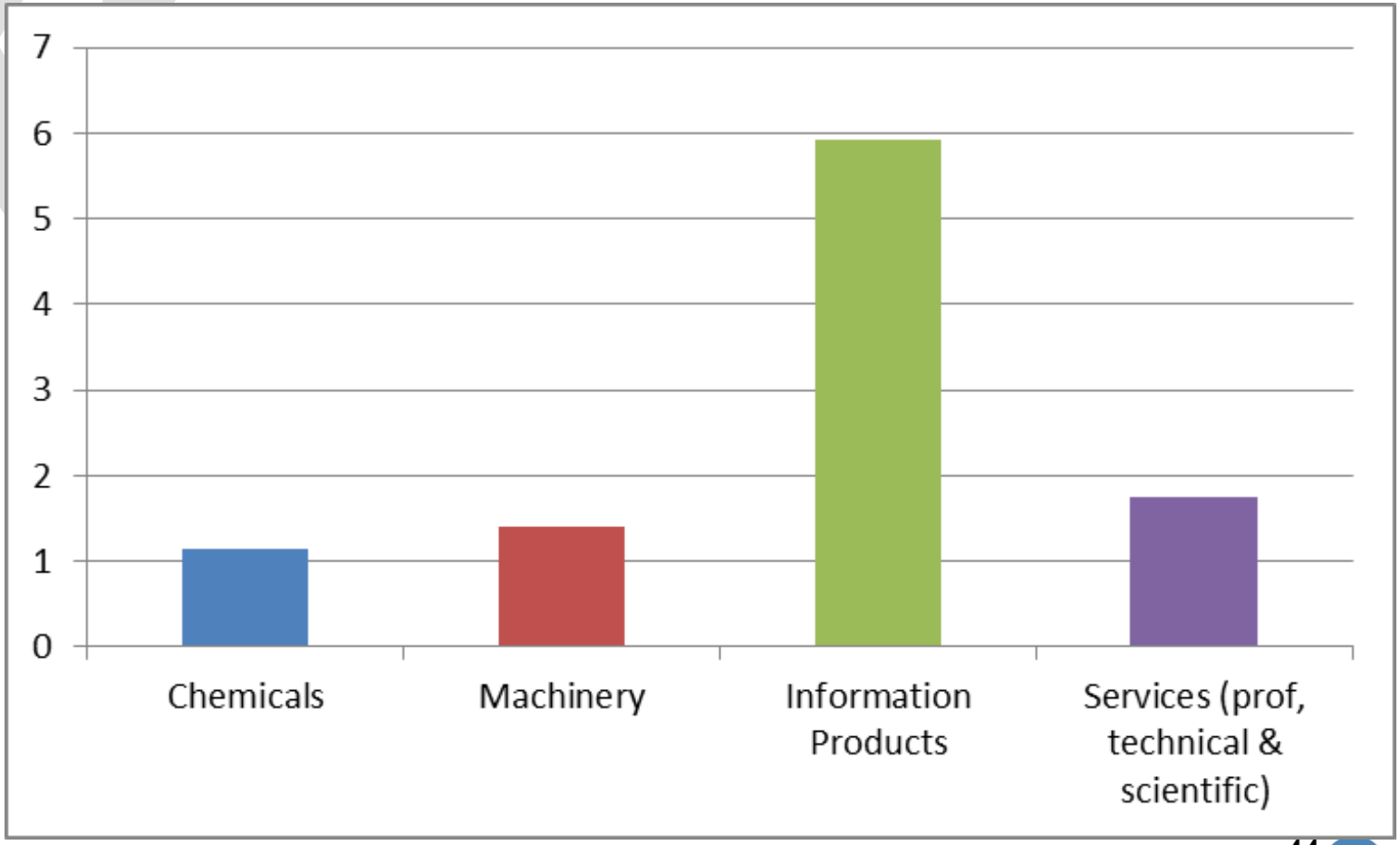
Source: Lippoldt (2011); Park & Lippoldt (2008)

Developing country goods imports: % change associated with 1% change in Patent Rights Index, 1990-2005



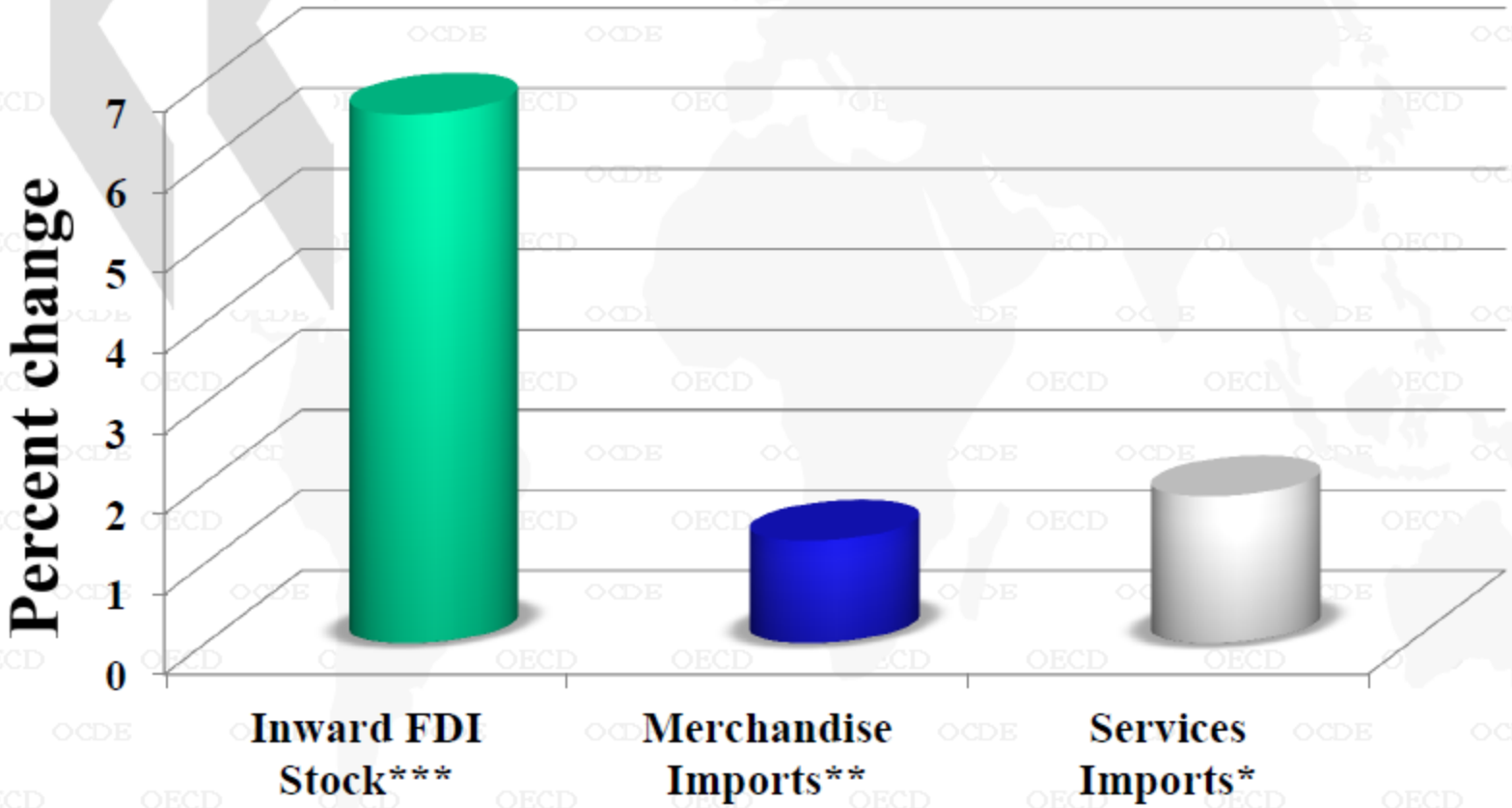
Source: Park and Lippoldt (2008, p 52)

US majority-owned affiliates abroad: % asset change associated with 1% change in Patent Rights Index, 1990-2005 (outward FDI)



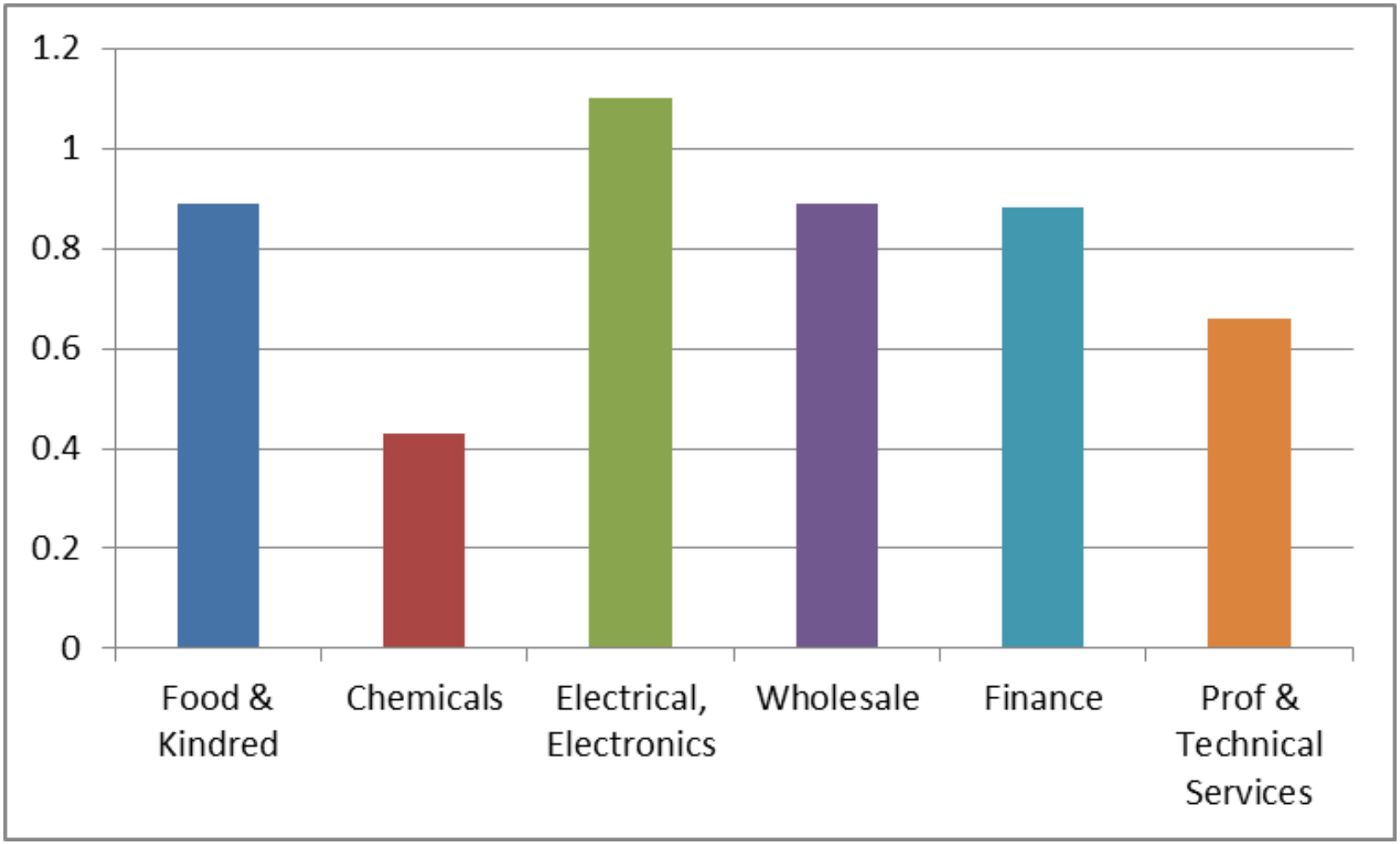
Source: Park and Lippoldt (2008, p 51)

High-Income Countries: Change in int'l econ flows associated with 1% change in strength of patent rights, 1990-2005



Source data: Park and Lippoldt (2008), calculations Ricardo Cavazos (2009).

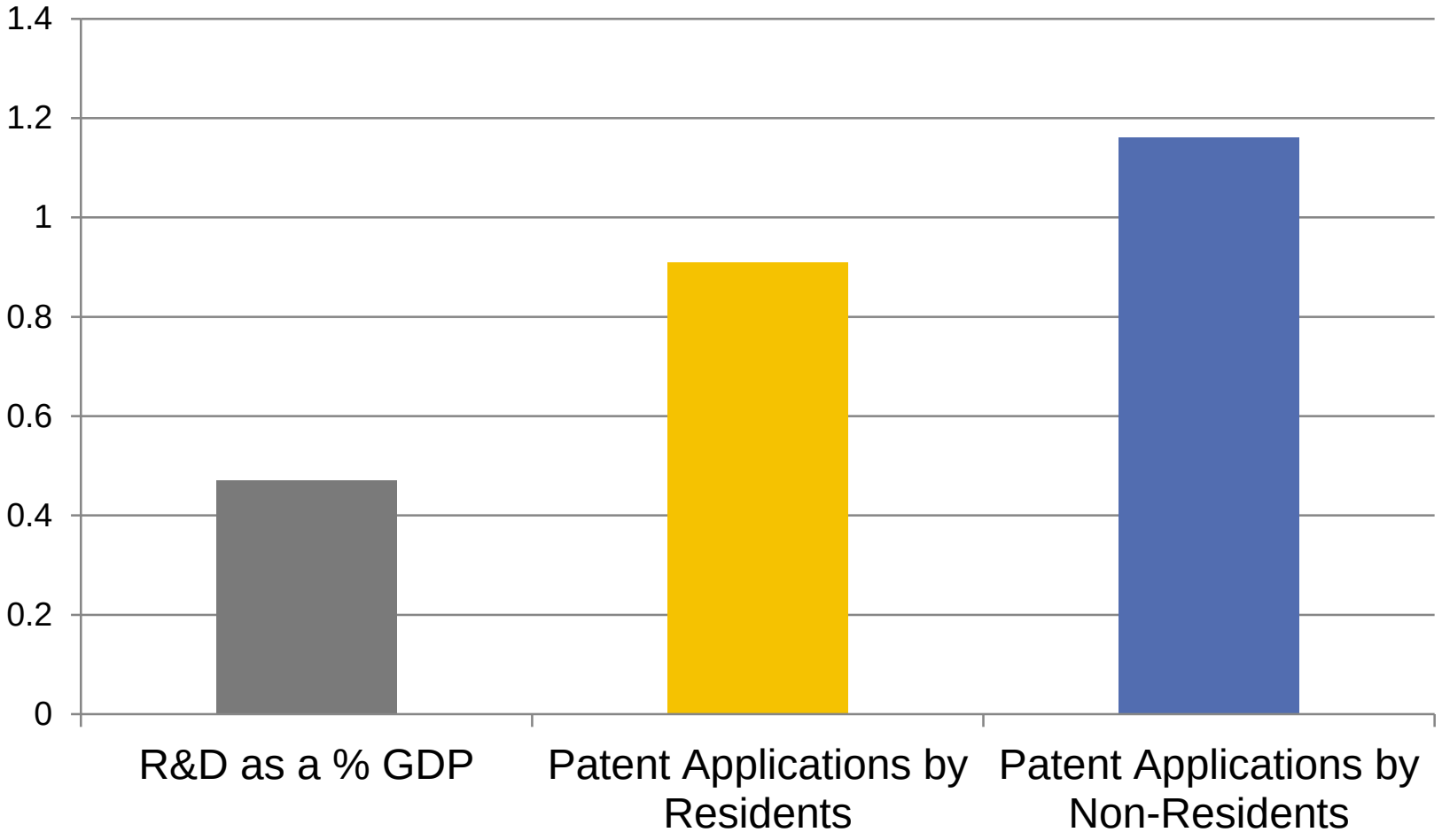
US royalty & licensing fees from abroad: % change associated with 1% change in IPR enforcement effectiveness (perceived), 1992-99



Source: Park and Lippoldt (2005, p 28)

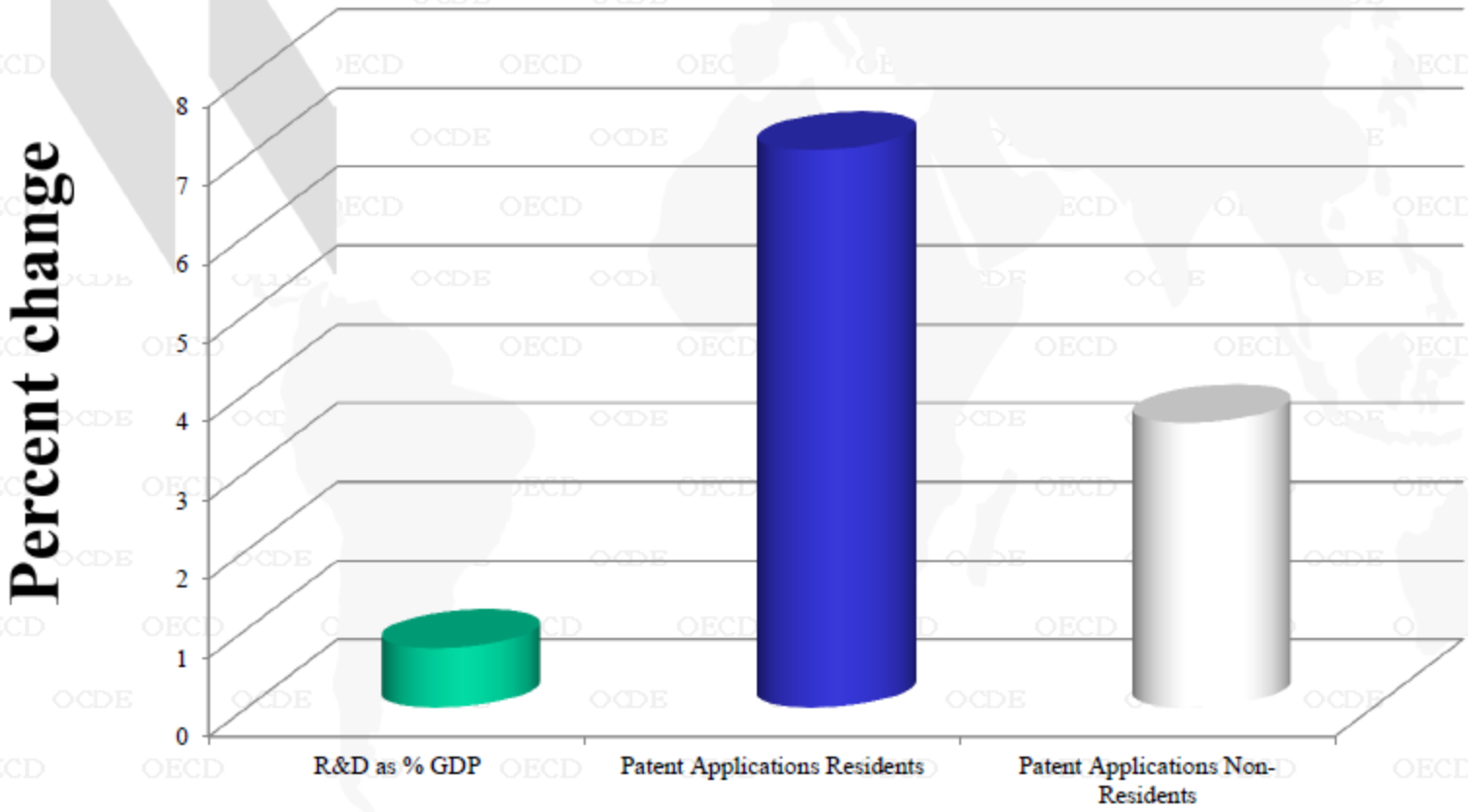
3. INNOVATION INPUTS & OUTPUTS

Developing countries: relationship of a 1% increase in the Patent Rights Index to innovation indicators, 1990-2005



Source: Lippoldt (2011); Park & Lippoldt (2008)

High-Income Countries: Change in innovation associated with 1% change in strength of patent rights, 1990-2005



Source data: Park and Lippoldt (2008), calculations Ricardo Cavazos (2009).

WB Technology Achievement Index, 1990-2000

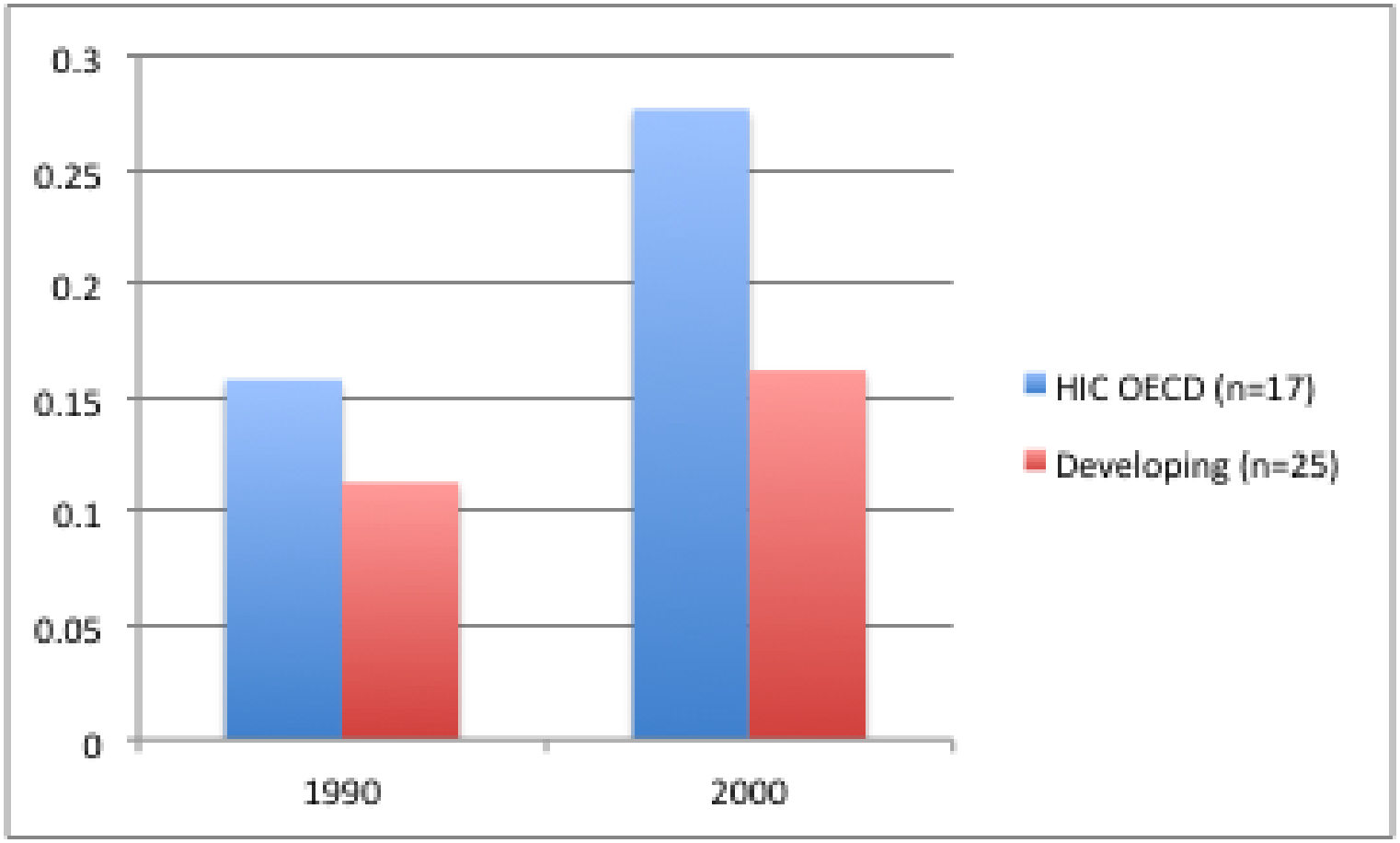
Components:

- Innovation (e.g., patents, journal articles)
- Technological adaptive capacity (e.g., human capital)
- Channels of technology diffusion (e.g., scale of licensing)
- Diffusion of recent technologies (e.g., Internet users)
- Diffusion of old technologies (e.g., electric consumption, tractors per 100 hectares)

- WB *Global Economic Prospects* (2008).

Technological Achievement Index (TAI)

(Regressing *ln* Patent Rights Index on *ln* TAI = coef 0.3643**, adj r2= 0.66)



Source: Authors' Calculation; TAI from WB Global Economic Prospects (2008), see also Cavazos & Lippoldt (2011).

Assessment of Significant Policy Complements

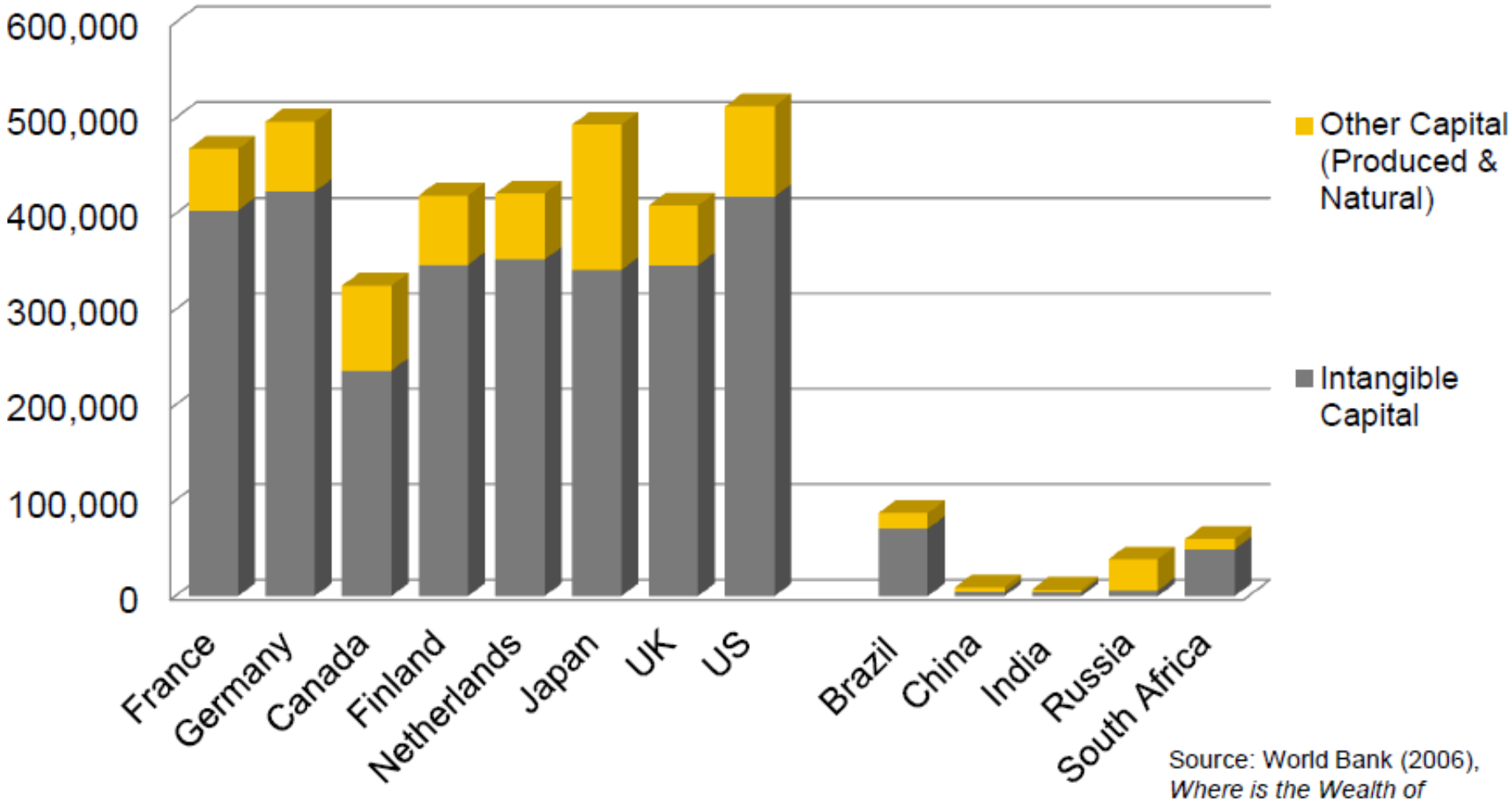
- IPR protection: patents, copyright, trademarks
- Physical property rights
- Legal effectiveness; enforceability of contracts
- Tax levels (lower)
- Government effectiveness
- Freedom to trade
- R&D expenditure
- University-Industry research collaboration

Promoting FDI: Positive Policy Interactions, 1990-2005

Policy Variable	Countries with Low Income per capita	Countries with Medium Income per capita	Countries with High Income per capita
FREE TRADE & PATENT PROTECTION		√*	
DOING BUSINESS & PATENT PROTECTION	√**		√*
PHYSICAL PROPERTY RIGHTS & PATENT PROTECTION	√*		
GOVERNMENT EFFECTIVENESS & PATENT PROTECTION	√*		

Standard Errors: *p<0.1 **p<0.05 *** p<0.01
Source: Cavazos, Lippoldt, and Senft (2010)

Wealth Estimates By Country: Total Stock Per Capita (2000, in USD)



Source: World Bank (2006), *Where is the Wealth of Nations?*.

4. NEXT STEP IN ANALYSIS: AGRICULTURE

Current Work on IPRs & Ag

- G20 origins – Follow up to paper on smallholder productivity (see refs below)
- Examine empirically agriculture technology developments in relation to IPR strengthening, specifically patents & PVP
- Hypothesis: Strengthening of IPR protection since 1990 – esp patent rights & PVP – increased incentives for innovation, tech transfer and diffusion; was associated with improved econ & innovation performance in ag

Patents and agriculture

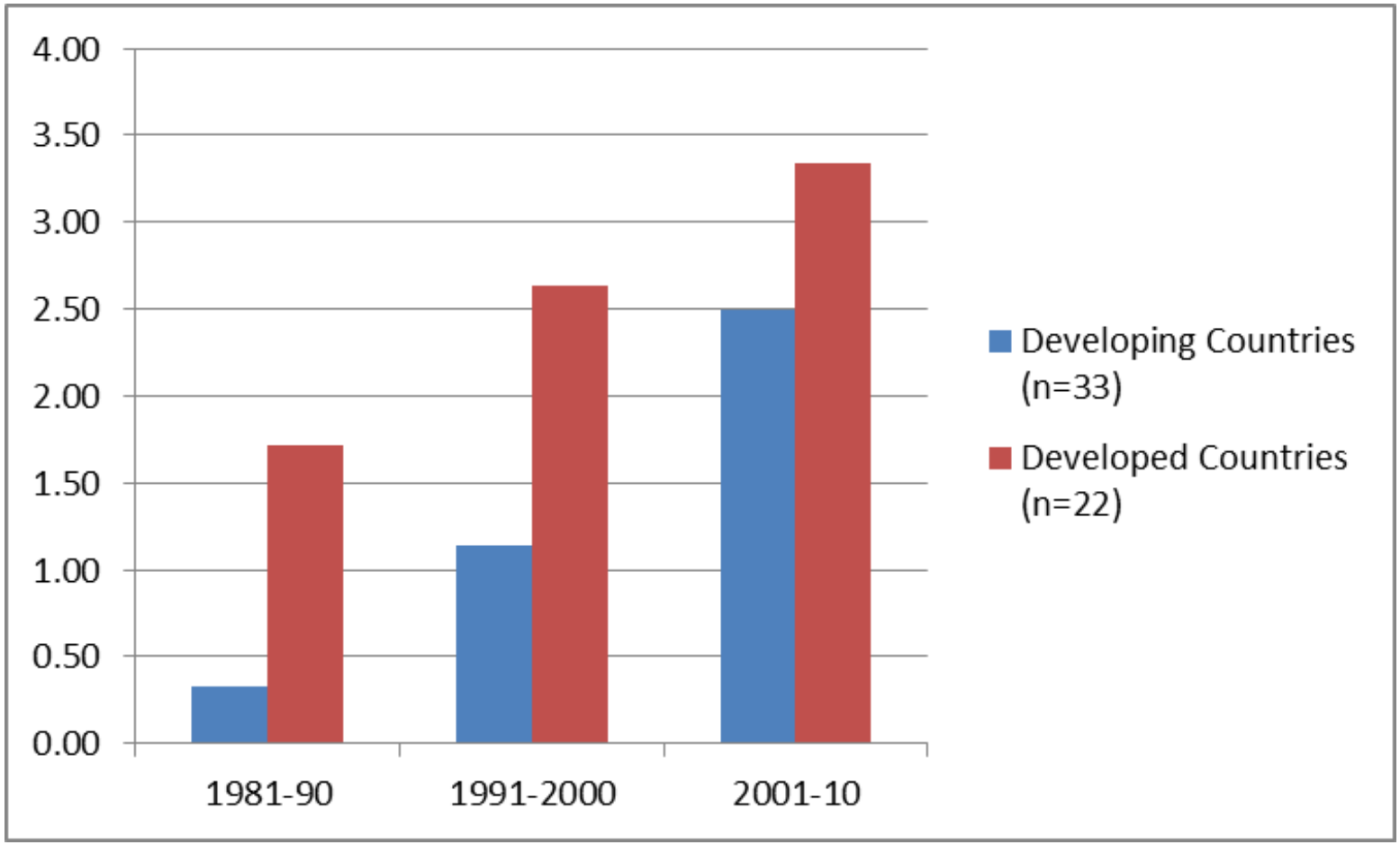
- Analysing change in patent rights vs ag innovation
- WIPO's Int'l Patent Classification – 36 three & four digit categories refer to "agriculture".
- Ag found in the following sections:
  - Section A - Human Necessities
  - Section B – Performing Operations; Transporting
  - Section C – Chemistry; Metallurgy
  - Section E – Fixed Construction
  - Section G – Physics
- International patent application data available via OECD patent statistics database

Index of Intellectual Property Protection in Plant Varieties: Composition

1. Ratification of UPOV conventions (1961, 1978, 1991)
2. Length of membership (years)
3. Exceptions: compulsory license, farmer's exception, essentially derived variety
4. Duration of protection (years)
5. Patentability: pharmaceuticals, microorganisms, food, plants & animals

- Campi & Nuvolari (2013)

Index of Intellectual Property Protection in Plant Varieties: Evolution



Source: data = Campi and Nuvolari (2013); calculations & presentation = Lippoldt.
Note: Developed country defined based on status as of 1990.

5. CONCLUSIONS & CAVEATS

Conclusions

- Presented above: the case of patents. Similar results for © & ™
- Across manufacturing and services overall, and in many key component industries, **strengthened patent rights during 1990s associated with innovative response and with diffusion** of these innovations via trade & investment.
- With some variation by sector, the level of IP protection appears to influence firms' market access strategies.
- IPRs are one factor – among others – that influence innovation; **require complementary conditions** to be effective: e.g., awareness, institutional capacity, rule of law, enforcement, human capital, appropriate business regulation.
- **Caveats apply**: the relationships shown represent association, not necessarily causality; refer to a specific timeframe and sets of countries, specific conditions; a positive relationship in this range does not mean increased protections will always yield similar additional results.
- Next steps in our research agenda:
  - Closer look at IPRs & ag innovation; delivery by 1Q2014.
  - Closer look at legal framework for protection of trade secrets; delivery by 1H2014.

References

- Campi, M., and A. Nuvolari (2013), "Intellectual Property Protection in Plant Varieties. A New Worldwide Index (1961-2011)," *LEM Working Paper Series*, No. 9, Laboratory of Economics and Management, Scuola Superiore Sant'Anna, April.
- Cavazos Cepeda, R., D. Lippoldt and J. Senft (2010), "Policy Complements to the Strengthening of IPRS in Developing Countries", *OECD Trade Policy Papers*, No. 104, OECD Publishing, http://dx.doi.org/10.1787/5km7fmwz85d4-en.
- Cavazos Cepeda, R., and D. Lippoldt (2011), Intellectual Property Rights Reform and Technological Achievement, in *Globalisation, Comparative Advantage and the Changing Dynamics of Trade*, Kowalski, P., Stone, S. (eds), OECD.
- Demsetz, Harold (1967,) "Toward a Theory of Property Rights", *The American Economic Review*, vol. 57, no. 2, Papers and Proceedings of the Seventy-ninth Annual Meeting of the American Economic Association, May, pp. 347-359.
- Jones, Charles I. (2004) ,Growth and Ideas, Working Paper 10767, NBER, September.
- Ginarte, J. C. and W. G. Park (1997), "Determinants of Patent Rights: A Cross-National Study," *Research Policy*, Vol. 26, 283-301.
- G20 Interagency Group (2012), *Sustainable Agricultural Productivity Growth and Bridging the Gap for Small-Family Farms*, Interagency Report to the Mexican G20 Presidency, June, available as of 22 November, here: http://www.oecd.org/tad/agriculturalpoliciesandsupport/sustainableagriculturalproductivitygrowthandbridgingthegapforsmall-familyfarms.htm.
- Lippoldt, D. (2011), *Patent Rights, Developing Countries and the Economic Influence of the Multilateral Trading System*, honors dissertation, Sciences Po, Paris, http://spire.sciences-po.fr/hdl:/2441/f4rshpf3v1umfa09lass9h1s2/resources/these-douglas-lippoldt-economie-2011.pdf .
- Park, W. G. (2008), "International Patent Protection: 1960-2005", *Research Policy*, No. 37, 761-766.
- Park, W.G., and D. Lippoldt (2008), "Technology Transfer and the Economic Implications of the Strengthening of Intellectual Property Rights in Developing Countries", *Trade Policy Working Paper,* No. 62, OECD, Paris, available here: http://www.sourceoecd.org/10.1787/244764462745.
- Romer, P.M. (1990), "Endogenous Technological Change," *The Journal of Political Economy,* Vol. 98, No. 5, October.