



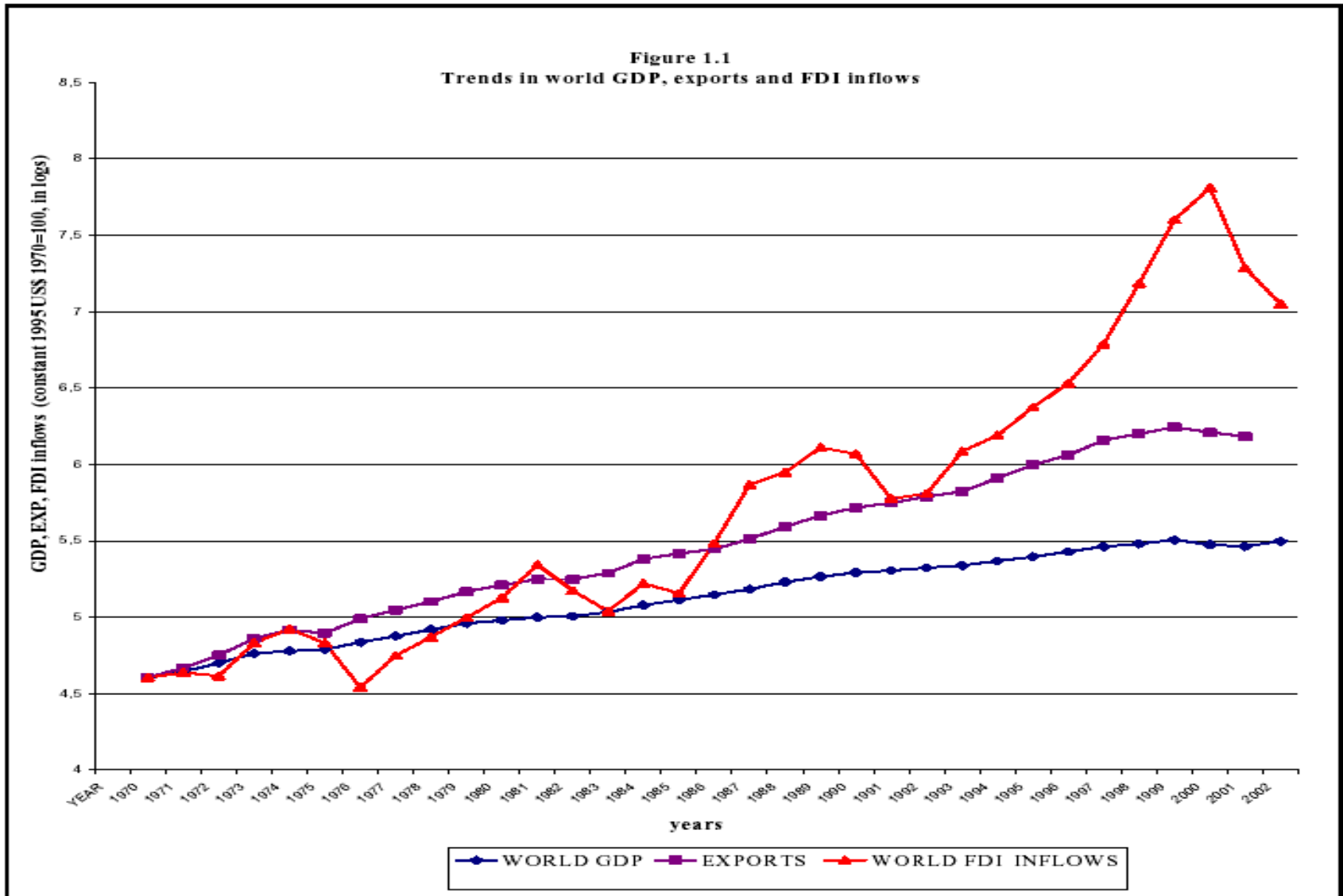
Global Political Economy

Technology Demand and FDI

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Our point of departure: Increasing FDI/Export ratio



Source: authors' calculations on World Bank WDI and UNCTAD data

Notes: the value of the index (100 in 1970) for the year 2002 (base year 1970=100) corresponds to 1319 for "World FDI Inflows" and to 244 for "World GDP", while for "Exports" the last available data refers to 2001 and the corresponding value of the index is 484.

Connecting to previous lectures

- The choice between Export and FDI is under monopoly is affected by sector and country specific characteristics, inter alia by trade costs
- However standard monopoly models with trade costs do not explain the paradox of increasing FDI/Export ratio
- Considering different types of FDI helps frame the paradox and explain why FDI may increase in the presence of diminishing trade costs
- Introducing Oligopoly assumptions and taking into account technological advantages and firm heterogeneity also helps explain the paradox

Today's focus

- Interactions between demand and technology factors in shaping exports and FDIs
- Technology accumulation approaches to internationalisation
- Ex ante and ex post technological advantages as drivers of FDIs
- Measuring asset exploiting and asset seeking FDIs
- Implications for:
 - the organization of innovative activities,
 - intra-industry heterogeneity
 - the geography of innovation
 - global value chains

Interactions between technology and demand factors



Vernon's Product Life Cycle (1966)

- Historical setting: US technological leadership and multinational growth after WWII
- Trade and FDI are innovation driven
- Innovation is demand led: US consumers and user firms are more advanced and induce early introduction of technology in the US market

Vernon (cont'ed)

- Phase 1: new product is produced for local market
 - Phase 2: new product is exported when local market is exhausted and foreign (EU) markets emerge for it
 - Phase 3: product gets standardised and its price elasticity increases → FDIs to react to competitive threats from firms in local markets via cost reduction and proximity to consumers
 - Phase 4: product reaches maturity, actual competition increases in the EU market → EU market is abandoned and less developed markets are exploited though FDIs → new product are introduced and a new cycle starts
-
- FDI substitutes for Trade when technology matures and competition emerges
 - This story illustrates globalisation processes in an era of economic and political integration in the Western world (Washington Consensus, IMF, GATT/WTO) → Innovation driven FDIs occur even in the presence of decreasing trade costs
 - Limitations:
 - demand-pull is only one of the sources of innovation
 - product cycles may not follow the same patterns
 - other leaders (different from the US) emerge over time

The Technological Accumulation Approach

- Innovation may not be demand driven
- Technological evolution follows firm specific and path dependent patterns (Rosenberg, 1982; Nelson e Winter, 1982)
- Firms strategically invest in R&D to innovate, expand their market shares and increase their market power (Cantwell&SannaRandaccio 1994)
→ *multiple technological leaderships* within and across countries according to R&D investment patterns
- Knowledge accumulated through R&D investment creates opportunities that can be exploited internationally (Cantwell 1989)

The Technological Accumulation Approach (cont'ed)

- As knowledge is at least partially *tacit* its international exploitation requires proximity to application markets through FDIs
- Technological development requires access to complementary bits of knowledge → FDIs to gain access to foreign sources of knowledge
- FDIs thus depend on firm specific technological accumulation and on technology sourcing strategies, *regardless of distance and of transportation costs*
- From the traditional view of FDIs as driven by «ex ante» advantages to a new emphasis on FDIs as determinants of «ex post» advantages

The traditional view: Ex ante advantages as drivers of FDI

Links between innovation and internationalisation in the literature on MNCs and on intern'l trade

Ex-ante advantages have been traditionally emphasised

- Needed to overcome “Liability of foreignness” (Hymer 1960)
 - MNCs endowed with “superior technology” and able to exert higher market power than uninational firms
 - MNCs associated with market imperfections and long term investment decisions
- Innovation as the dynamic engine of internationalisation (Vernon 1966)
- Ownership advantage as a pre-condition for intern'l investment (Dunning 1970, 1977)
- Internationalised firms outperform uninational firms: An old idea that has been recently formalised in international trade theory (Helpman, Melitz, Yeaple 2004)

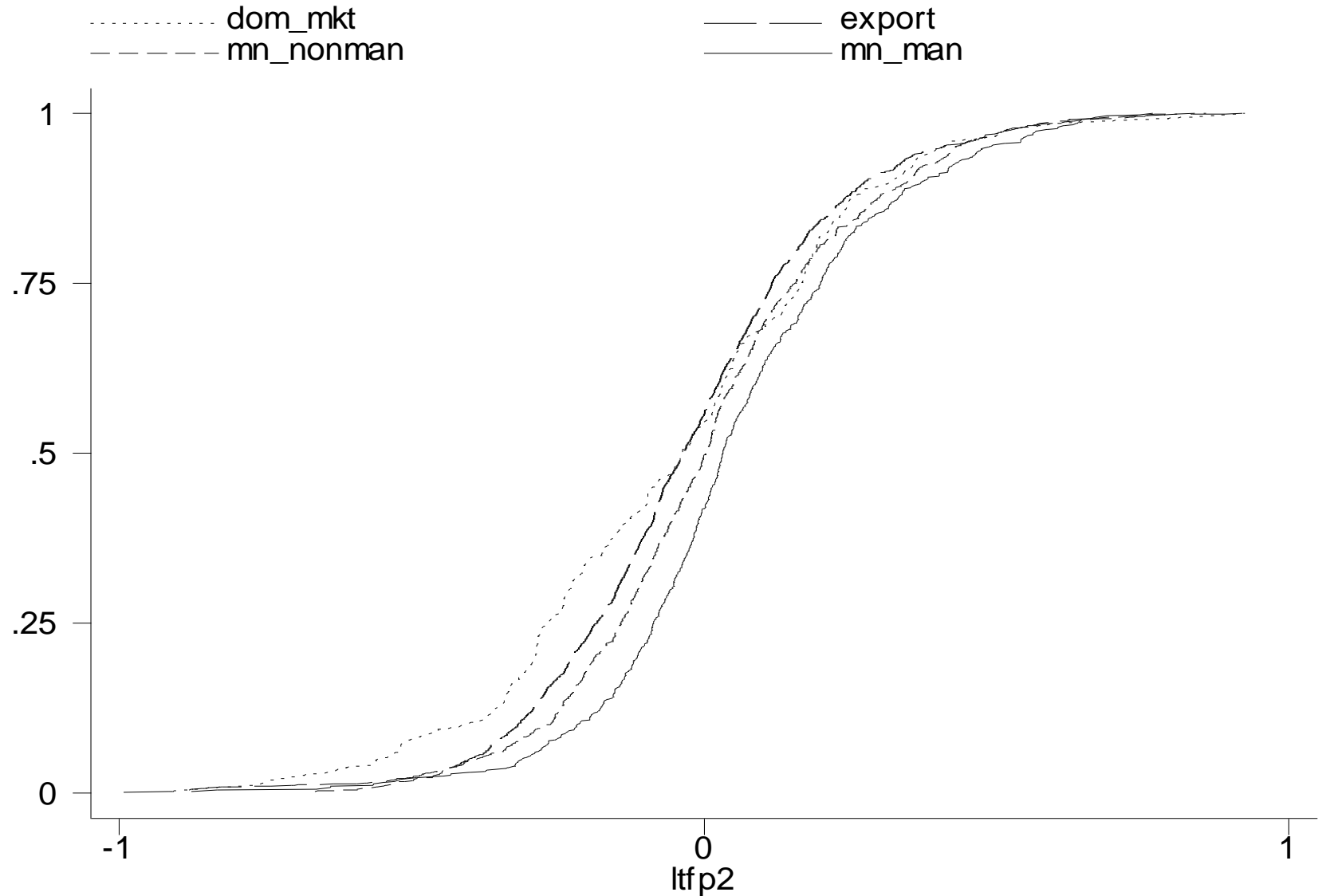
Evidence in support to ex-ante advantage hypothesis

- **High correlation between R&D FDI and local sales of affiliates:** consistent with ex ante advantage and adaptive research abroad (Safarian 1966, Mansfield et al. 1979, Lall 1979)
- **Differences in productivity across firms with different degrees of internationalisation** are often used in support to the ex-ante advantage hypothesis (Helpman, Melitz, Yeaple 2004, Beekes, Murakozy 2013)
- **Self-selection in exporting and FDI**
 - Lots of studies reporting that best performer self select as exporters (Bernard and Jensen, 1999; Clerides et. al., 1998, Wagner 2012)
 - Few studies combining exporters, importers and MNEs, and productivity and innovation. (*Ireland:* Girma, Gorg and Strobl, 2003; *UK:* Girma, Kneller and Pisu, 2003; *Japan:* Head and Ries, 2003; *Italy:* Castellani et al 2007, 2013)

Differences in productivity and internationalisation -USA vs. Italy

	Italia (Castellani,Zanfei 2006)	Usa (Helpman,Melitz, Yeaple 2004)
Multinazionali	0.165*** (0.027)	0.537*** (0.037)
Esportatori non multinazionali	0.038 (0.025)	0.388*** (0.041)
Differenze nei coefficienti	0,128 <i>p-value</i> [0,000]	0,150 [0,000]
numero di imprese	1106	3202

Cumulative distribution of the log of TFP, by firm type (ELIOS data for Italy)



Differences in productivity, innovation and internationalisation- Evidence on Italy

	N. firms		Empl.	Labour Prod.	“Approx.” TFP	TFP
	%					
DOM MKT	98	13%	435	73.0	0.97	1.00
EXP	395	51%	393	76.8	0.96	1.01
MN NON MAN	164	21%	1511	79.3	1.00	1.06
MN MAN	121	16%	1756	88.7	1.09	1.12
Total	778	100%	881	79.0	0.99	1.04
	Share of firms			R&D intensity		
	Innov. products	Innov. processes	Carrying out R&D	Total R&D	Internal R&D	External R&D
DOM MKT	28%	40%	34%	1.9%	0.2%	1.7%
EXP	59%	59%	65%	2.5%	0.7%	1.7%
MN NON MAN	69%	66%	73%	3.0%	0.9%	2.1%
MN MAN	80%	78%	89%	3.1%	1.2%	1.8%
Total	60%	61%	66%	2.6%	0.8%	1.8%

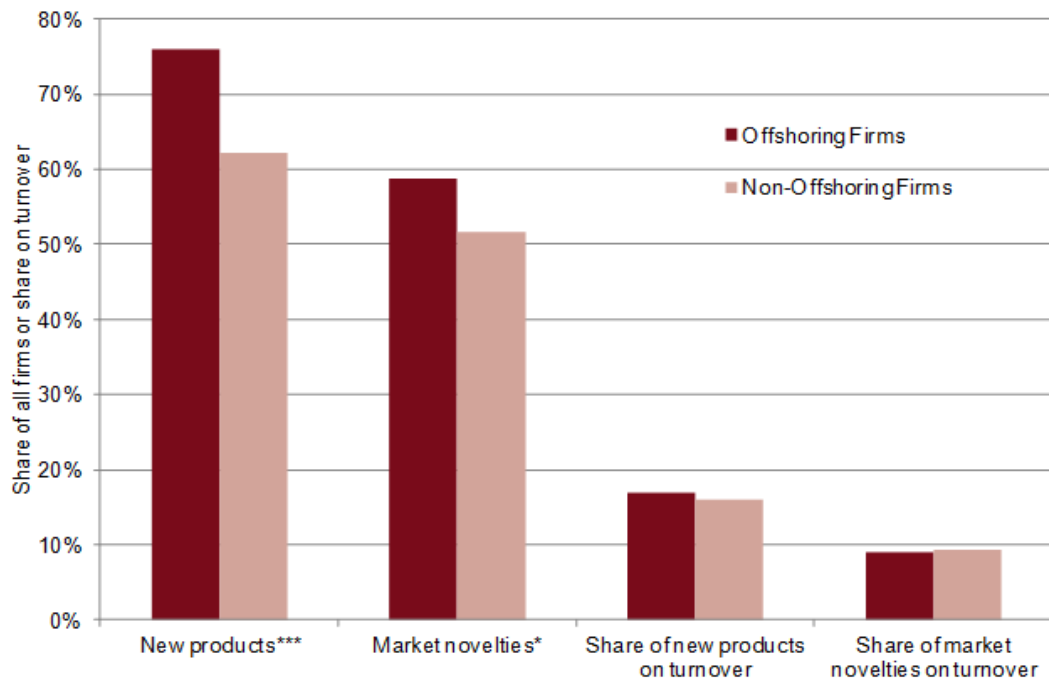
Source: Castellani D., Zanfei A., *Multinational firms innovation and productivity*, E.Elgar, 2007

Differences in “best managerial practices” and internationalisation

Figure 2b: Management practices, firms by country of ownership

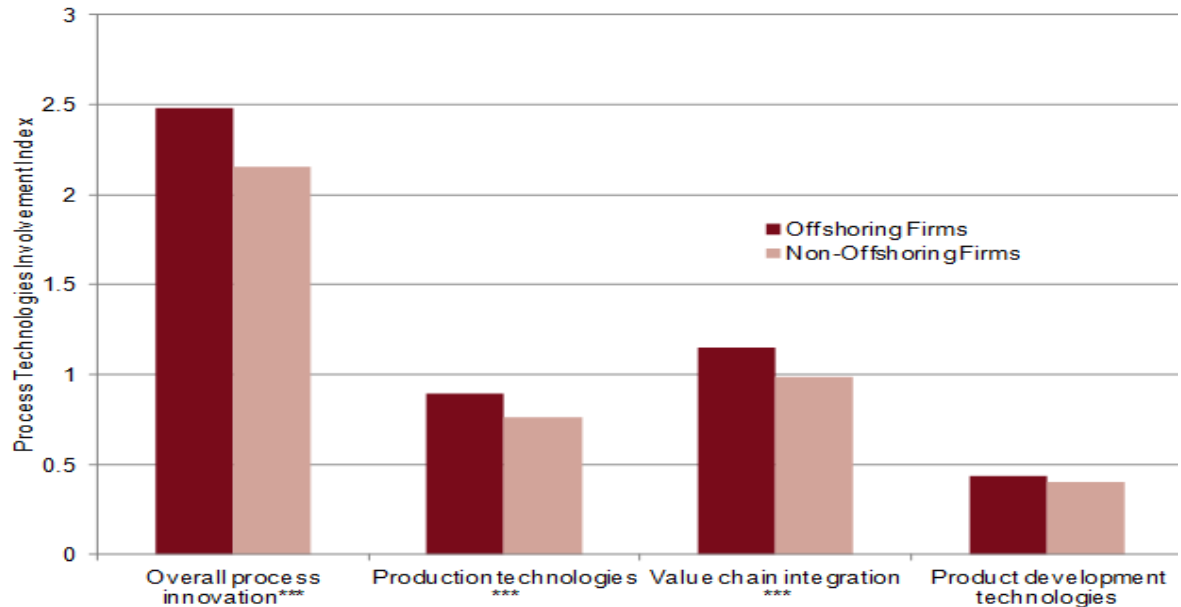


Product Innovation



Dachs et al (2013) based on European Manufacturing Survey, 7 countries

Process Innovation



Ex post advantages and FDI

Correlations between ex ante advantages and FDIs are often based on cross-sectional data: *direction of causality?*

- “*Asset seeking*” (AS) investment and “*competence creating subsidiaries*” as sources of “*ex-post advantages*” (Dunning&Narula 1995, Cantwell& Mudambi 2005, Santagelo 2013)
- The *nature of ownership advantages changes*: They are needed to compete with other MNCs and to filter/absorb external knowledge (Cantwell&Narula 2001)
- *AS co-exist with Asset Exploiting (AE)* (Criscuolo et al 2005):
 - One reinforces the other
 - Firms need to use a variety of assets and their portfolio is diversified in terms of strength and weaknesses

Sparse evidence on ex post advantages

- **MNCs are more attracted into areas that are technologically advanced** (Cantwell&Iammarino 2003, Unctad 2005, Le Bas and Sierra 2002, Cantwell and Molero 2004, OECD 2011)
- **MNCs cite local innovations** when they are active in advanced areas (Cantwell and Noonan 2002, Singh 2004)
- **MNEs involved in different segments of the global value chain wherein both AE and AS strategies are pursued** (Unctad 2005, Saliola and Zanfei 2009)
- **Productivity improvements *follow* increases in foreign activities**
 - *Learning by investing*: Kraay, 1999; Barba Navaretti and Castellani, 2004, Germany: Schworer 2013)
 - *Two way trade* : performance improvements may occur via imports even when no learning by exporting occur (Kasahara and Lapham 2008, Serti et al 2010, Aristei et al 2013)
- **Increases in innovation are associated with *FDI intensity* (not only with changes in internationalisation status)**
 - Criscuolo, Haskel and Slaughter, 2004; Ietto-Gillies and Frenz 2005, Castellani and Zanfei 2006, Dachs et al 2014

On asset seeking in the USA (1)

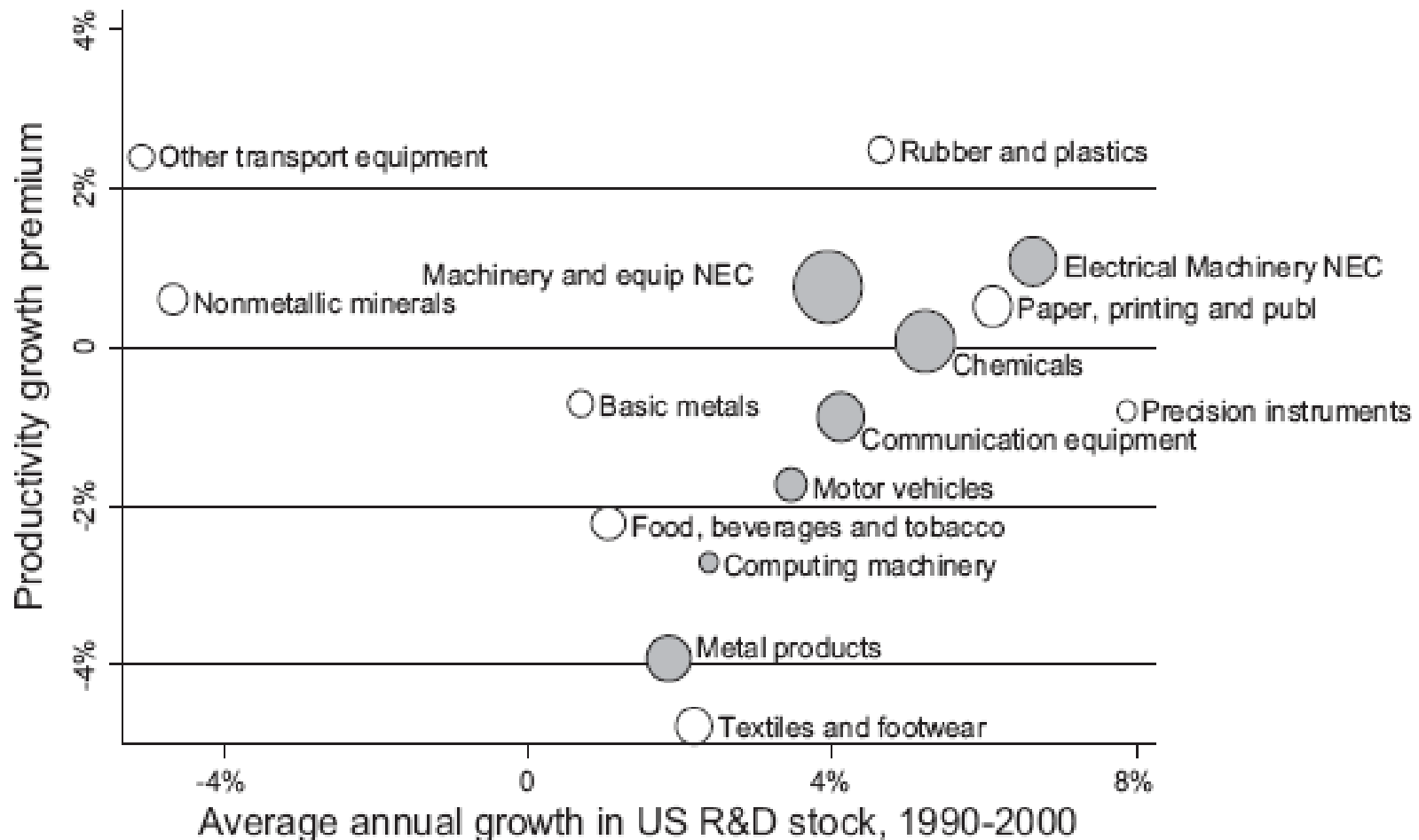


FIGURE 1. US R&D GROWTH AND “PRODUCTIVITY GROWTH PREMIUM” FOR UK FIRMS WITH A HIGH PROPORTION OF US INVENTORS

source: R.Griffith, R.Harrison, J.Van reenen, AER, 2006, p.1860

On Asset seeking in the USA(2)



“we find that UK firms that had more of their inventive activity located in the US *prior* to 1990 benefited disproportionately from the growth in US R&D in the 1990s. According to our estimates, US R&D during the 1990s was associated with 5-percent-higher TFP for UK manufacturing firms in 2000 (about \$13 billion), with the majority of the benefits accruing to firms with an innovative presence in the US.”

**Source: R.Griffith, R.Harrison, J.Van reenen,
AER, 2006, p.1860**

Types of FDI and their importance

Corporate technological activities in the home country	Technological activities in the host country	
	Weak	Strong
Weak	<p>Type 1: market-seeking HomeRTA < 1 HostRTA < 1 (Technology is not a driver of FDI) (10%)</p>	<p>Type 2: technology-seeking HomeRTA < 1 HostRTA > 1 (13%)</p>
Strong	<p>Type 3: asset-exploiting HomeRTA > 1 HostRTA < 1 (Efficiency-oriented FDI in R&D) (30%)</p>	<p>Type 4: asset-augmenting HomeRTA > 1 HostRTA > 1 (Learning-oriented FDI in R&D) (47%)</p>

Source: adapted from Patel and Vega (1999, p. 152) and from Le Bas and Sierra (2002 p.606).

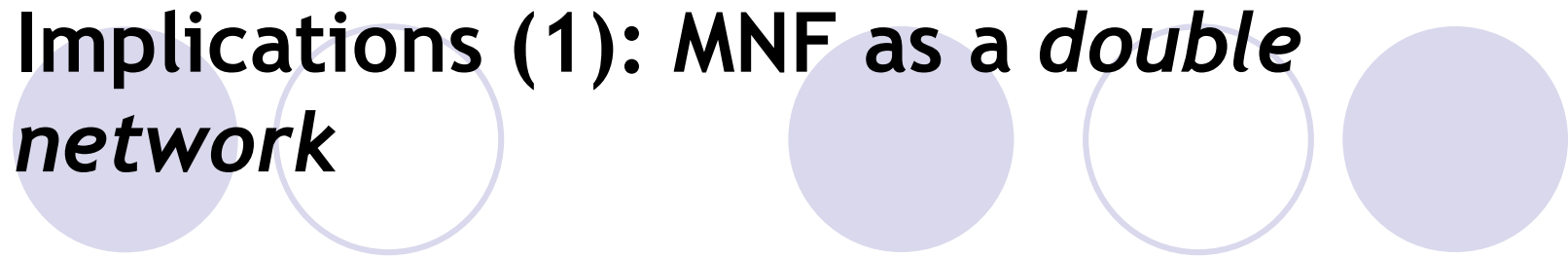
Assessing the likelihood of Asset exploiting, asset seeking, and asset augmenting FDIs

Suppose that German, US and OECD firms exhibit the following patterns of patenting activity in the field of biotechnology

	<u>Patents in Germany</u>	<u>Patents in USA</u>	<u>Patents in OECD countries</u>
<u>Biotechnology</u>	2.000	3.500	50.000
<u>All other technological fields</u>	20.000	35.000	600.000

What kind of FDIs are German firms likely to undertake in the US in the field of biotechnology?

Implications (1): MNF as a *double network*



- The combination of Asset Seeking and Asset Exploiting entails a transition of MNFs towards a *double network*:
 - *Internal network* of subsidiaries increasingly involved in innovative activities to adapt home technology and to absorb local knowledge
 - Development of *external networks* in order to increase *exploration* capacity
- Are internal and external networks complements or substitutes?

MNF as a *double network* (cont.ed)

Complementarity between internal and external networks

- *Transaction cost perspective*: Internal networks, uncertainty and control
 - Internal network *reduces uncertainty concerning demand and cost conditions, thus favoring further hierarchy* (Gomes-Casseres 1989)
→ increasing intensity of internal networks
 - Internal network *reduces the risk of opportunism* (by reducing *behavioural* uncertainty, generating trust and allowing outside options), *thus favoring cooperation* (Robertson and Gatignon 1998)
→ internal networks facilitate external networks
 - *Dynamic efficiency perspective*: Internal networks, technological opportunities and cooperation
 - External networks are a means to explore technological opportunities.
→ *internal network increases exploration potential via external networks* (Cantwell 1995, Narula 2003, Castellani and Zanfei 2007)
- Evidence of complementarities between internal and external networks from some industries (including Electronics, Biotechnology, and Chemicals) (Castellani and Zanfei 2004)

Implications (2): MNEs as bridging institutions and heterogeneity

- *double network structure* → MNEs increasingly act as *bridging institutions* connecting a number of geographically dispersed economic and innovation systems
 - MNEs are affected by constraints and opportunities from a growing number of home and host systems (Carlsson 2003, Narula and Zanfei 2005)
 - MNEs drawing knowledge from different geographical sources have a higher potential impact on both home and host economies (Castellani and Zanfei 2007)
 - MNEs bridging a higher number of economic and innovation systems have a higher bargaining power vis a vis host economies (Ietto-Gillies 2001)
 - MNEs differ according to the extent and variety of their internal and external networks

MNEs as bridging institutions and heterogeneity (cont.ed)

- FDI selection policies need to be designed according to the variety of MNEs
 - As MNEs increasingly differ in terms of networking, MNEs are not equally attractive for host economies
 - Inward FDI must be selected according to MNEs' ability to connect economic and innovation systems that are worth being in touch with

Implications (3): The localisation of production and R&D



How extensive are bridges across national systems?

- *Production follows markets;*
- *R&D is more bound to where knowledge is available*
- *Gravity models need be revisited to account for the nature of FDI*
- *The availability of longitudinal activity based data allow this distinction*
- *Distance factors play different roles in the location of production and in the location of R&D (Castellaini, Jimenez-Palmero & Zanfei 2013, Castellani, Giangaspero and Zanfei 2014)*

the localisation of production and R&D (cont.ed)



“R&D bridges” may be longer than
“manufacturing bridges” (Castellani, Jimenez-Palmero, Zanfei 2013)

- Low (and decreasing) costs of transmitting information facilitates decisions to carry out R&D in remote locations
- Valuable knowledge is concentrated in space, hence MNFs may need to locate far away labs to be able to source cut edge technology
- Social, cultural and institutional connectors may explain bilateral R&D investments more than geographic separation

Higher geographical concentration of R&D FDIs relative to manufacturing

Table 1 - Distribution of the total number of investment projects in manufacturing and R&D, by geographical areas of destination, 2003-2008

Main business activity Area of destination	Manufacturing		R&D	
	N.	%	N.	%
EU15	1,276	10.7%	313	23.4%
New Members EU	2,006	16.8%	55	4.1%
Other Europe	862	7.2%	37	2.8%
North America	937	7.8%	130	9.7%
Japan	49	0.4%	27	2.0%
China	2,671	22.3%	276	20.6%
India	857	7.2%	181	13.5%
South-East Asia	1,796	15.0%	218	16.3%
Latin America	854	7.1%	29	2.2%
Oceania	87	0.7%	21	1.6%
Africa and Middle East	581	4.9%	52	3.9%
Total	11,976	100.0%	1,339	100.0%
Top 5 <u>Countries</u>	46.2%		52.3%	
HHI	0.136		0.156	

Source: Elaborations on fDi Markets

Measuring FDIs and distance factors

Table A.2 – Variable source and description

Variable	Description	% non-zero obs.	mean	std. dev.	Min.	Max.
<u>FDI_Man</u>	FDI project in Manufacturing	2.23%	.034	.278	0	34
<u>FDI_R&D</u>	FDI project in Research & Development	.28%	.004	.074	0	10
<i>Geographical distance</i>	Log of distance between the n major cities of s and d (weighted) (CEPII)		8.498	.970	5.081	9.880
Frontier	=1 if s and d share a border		.050	.219	0	1
<i>Time differences</i>	Time difference between s and d (n. of hours)		4.961	3.597	0	12
Colony	=1 if colonial ties existed between s and d (CEPII)		.048	.214	0	1
Legal origin	=1 if s and d share the same legal origin (CEPII)		.203	.402	0	1
<i>RTA</i>	=1 if s and d have a Regional Trade Agreement (CEPII)		.283	.451	0	1
BIT	=1 if between s and d a Bilateral Investment Treaty has initiated before 2000 (UNCTAD)		.322	.467	0	1
Language	Difference in language factor (Dow-Karunaratna)		-.014	.940	-4.346	.526
Religion	Difference in religion factor (Dow-Karunaratna)		-.060	1.014	-1.551	1.528
Firm R&D inv.	Total number of investment of each firm in R&D		.217	.974	0	24
Firm manuf. inv.	Total number of investment of each firm in Manufacturing		1.925	3.962	0	115
<u>Sectoral concentration</u>	Index of sectoral concentration of each firms' investments (Herfindal index based on the number of investments in each sector by of each firm)		.914	.192	.092	1

source: Castellani, Palmero, Zanfei 2013

Table 7 – Determinants of firms' international investments in R&D and manufacturing, 2003-2008, probit regressions

Dep. Var.	(1) R&D	(2) Manuf.	(3) R&D	(4) Manuf.
<u>Geographic distance</u>	-0.768*** (0.256)	-1.135*** (0.092)	-0.019 (0.244)	-0.860*** (0.101)
<u>Frontier</u>	-0.264 (0.270)	0.191 (0.137)	-0.615** (0.271)	0.065 (0.131)
<u>Time difference</u>	0.065 (0.062)	0.034* (0.020)	0.067 (0.046)	0.034* (0.018)
<u>Colonial ties</u>			0.085 (0.255)	0.280** (0.123)
Common origin of legal sys.			0.205 (0.220)	0.209** (0.083)
<u>Regional trade agreement</u>			1.748*** (0.416)	0.187 (0.146)
<u>Bilateral Investment Treaty</u>			0.247 (0.176)	0.178** (0.073)
<u>Linguistic distance</u>			-0.360*** (0.100)	-0.224*** (0.046)
<u>Religious distance</u>			-0.339* (0.209)	-0.338*** (0.089)
Firm inv. in R&D	0.455*** (0.021)		0.465*** (0.022)	
<u>Firm inv in manuf.</u>		0.100*** (0.004)		0.096*** (0.004)
<u>Sectoral concentration</u>	-3.070*** (0.249)	-1.916*** (0.103)	-3.060*** (0.251)	-1.849*** (0.099)
Home fixed effect	Yes	Yes	Yes	Yes
Host fixed effect	Yes	Yes	Yes	Yes
Sector fixed effect	Yes	Yes	Yes	Yes
Log likelihood	-4890	-32458	-4828	-31570
N. observations	316538	403332	310677	354768

source: Castellani, Palmero, Zanfei 2013

Implications (4): Global value chains and development

- The coexistence of Asset Exploiting, Asset Seeking, Asset Augmenting implies that MNEs will play different roles in global value chains
 - According to their presence in markets where global suppliers are located
 - According to the variety of connections with global suppliers

Implications (4): Global value chains and development

The Global Value Chains story:

- *Global buyers* (including MNCs) involve *LDC suppliers* in their global value chains
- Different *typologies of suppliers* and *modes of involvement* imply different development potential (Gereffi 1999, Antràs and Helpman 2004, Pietrobelli and Rabellotti 2011)
- Local firms and institutions can *bargain* their position in the GVC and their *upgrading opportunities according to the specific assets they are endowed with* (Sturgeon and Gereffi 2008, Navas-Aleman 2011)



Implications on GVCs and development (Cont.ed)

Complementarity of GVC story with double network framework (Saliola and Zanfei 2009):

- International production approaches focus on MNCs and largely disregard the variety of local firms and of MNC-supplier linkages
- GVC literature focuses on value chain governance and largely disregards the variety of buyers
- Double network approach can help explain the variety of buyers (MNEs) and of their linkages with local firms

Integrating international production literature and GVC approach

A possible roadmap:

- *identify a wider range of value chain links (in terms of knowledge intensity, collaborative content, role/upgrading of suppliers) than in international Production literature;*
- *allow for a higher heterogeneity of global buyers (e.g. in terms of the nature and intensity of their presence in the host market) than in GVC literature;*
- *emphasise the competencies and bargaining power of indigenous firms and institutions.*

Heterogeneity of governance links

WB data on Thailand (Saliola and Zanfei 2009)

Types of Value Chain Governance	% of sales made according to buyers' unique specification	Design/qual ity and product quality standards	Technology dissemination and process and product R&D
GOV0 Low requirements	Less than 30%	No	No
GOV1 Higher requirements & DQ	More than 30%	Yes	No
GOV2 Higher requirements & DQ & Tech_RD	More than 30%	Yes	Yes

Some results from econometric analyses

$$\text{GOV}_{ij} = f(\text{SUB}_{j}, \text{AGE}_{j}, \text{LSUP}_{j}, \text{ADAPT}_{j}, \text{DOMTECH}_{ij}, \text{DOMPAT}_{ij}, \text{Z}_{ij})$$

i = firm, J = sector

GOV = 0, 1, 2 with increasing knowledge intensity of relationships

- The technological intensity of vertical relations is positively affected by *technical competencies of local suppliers*, and by the *efforts of MNCs to localise their activities close to foreign suppliers*
- *The quality of MNCs' presence matters*: efforts of MNC subsidiaries to *adapt* their technology to host country markets are associated with knowledge intensive relationships (GOV2)

Conclusion

- Implications of two way links between innovation and international production are worth exploring
- More attention should be given to both internal and external networks when looking at the role of MNFs in innovation
- Double network developments imply that MNFs increasingly act as bridging institutions and as sources of intra-industry heterogeneity
- R&D networks are more extensive than production networks
- Distance is not dying but has completely different meanings when dealing with R&D
- The extension and quality of internal and external networks changes the nature of MNCs, and their role in GVC