# Multinationals and regional development: evidence from across the globe

Riccardo Crescenzi

London School of Economics

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# Multinationals hit the headlines …
## when they come …

**To 'central' cities: PARIS**

VIDEO. Chez Google, Sarkozy vante les mérites du Web

Le Parisien | 06 Déc. 2011, 11h31

Nicolas Sarkozy, ici au côté d'Eric Schmidt, ancien numéro un de Google, a inauguré les 10 000 mètres carrés du siège parisien de Google France (Paris 9e).
AFP/JACQUES BRINON

**Or 'peripheral' cities: NAPLES**

Technology

## Apple opens centre to train app coders

21 January 2016 | Technology

Tim Cook is searching for a new generation of creative developers

Apple is opening a training centre in Naples that aims to teach a "new generation" of computer coders how to develop new software for its app store.

# Multinationals hit the headlines …
## when they leave…



# Multinationals hit the headlines …
## when they just say they will leave …

## Increasing FDI flows

**Figure 1.  FDI inflows: global and by group of economies 1995-2015**
(Billions of US dollars)



*Global FDI flows jumped 36% in 2015 to an estimated US$1.7 trillion,* their highest level since the global economic and financial crisis of 2008-2009

Source: UNCTAD -  Global Investment Trend Monitor 2016

## FDI Projects in the city-regions of the world
### (inward, cumulative count)

2004-2014



FDIMarkets data – Own  elaboration

## FDI Projects in the city-regions of the world
### (inward, cumulative CAPEX)

2004-2014 (In million USD)

(150000,207000]
(100000,150000]
(75000,100000]
(30000,75000]
(15000,30000]
(10000,15000]
(5000,10000]
(3000,5000]
(1800,3000]
(1200,1800]
(800,1200]
(400,800]
(250,400]
(150,250]
(40,150]
[0,40]
No data

FDIMarkets data – Own elaboration

## Surprisingly little is known about Multinationals'…

### LOCATION

### IMPACTS

**Research Questions**

*Where do multinationals go? And Why?*

*What activities are (de)localised where and how?*

*How location drivers vary across MNEs? Are EMNEs different?*

*Where and how do they have an impact on local innovation and employment ?*

*How do they interact with domestic firms?*

*How can regions leverage Multinationals for innovation and recovery?*

**Disciplines**

International Business Studies

International Economics

Economic Geography

4

# Innovation agents and their networks

- The geography of innovation is shaped by the evolving location of innovation agents and their performance.
- Innovation agents are nodes of complex **social, cognitive, organisational or institutional** networks of varying spatial densities;
- The attention has moved **from 'regional (black) boxes' towards**:
  - **Integrated frameworks** for regional **analysis and diagnosis**:
    - Impact of local and non-local knowledge flows is assessed in relation to local institutional conditions and political economy factors
  - Micro-level analysis of the **spatial behaviour and impacts of key innovation actors**: mobility of individuals (e.g. inventors) and **(multinational) firms (and their combination).**

# Spatial behaviour and impacts of multinational firms (1)

The joint analysis of location and impacts makes it necessary to:

1. **Bridge firm-level characteristics**, **investment-level characteristics** and features of the **host economies** at the **national** and **city-region** level (spatial, economic and socio-institutional features of the host economies)
2. Conceptualise internationalisation in terms of:
   1. **Spatial extent**: extra-local, international and global
   2. **Nature**: capital, skills and knowledge are bundled in the intra- and inter-firm connections that form GPNs/GVCs. The actual combination of their constituent elements and their sophistication/complexity depend on the function (or value chain stage) pursued by the agents 'connected' by each flow
   3. **Direction**: regional economies simultaneously exposed to inflows and outflows (bi-directionality). 'Host' and 'home' country/regions overlap

## Spatial behaviour and impacts of multinational firms (2)

- Embed into **economic geography** and **urban and regional economics** concepts and insights from **international economics**, **strategy and management**, **Global Value Chain analysis** and **international business studies**
- Combine **rigorous quantitative methods** with complex data problems at a 'global' scale (external validity)
- Assess the **rationale** <u>and</u> **impact** of **existing policies for the attraction and retention of FDI**

## Long-run research agenda …

– **(Selected) published work:**

**LOCATION**

- How do multinationals organise their value chains in space? What is the role of national vs. regional factors? Do regional innovation factors matter for the location of FDI? [Crescenzi, Rabellotti and Pietrobelli, 2014]
- Do multinationals from Emerging Economies follow different spatial strategies vs. advanced economies multinationals? [Crescenzi, Rabellotti and Pietrobelli, 2016]
- How does the location behavior of MNEs is shaped by the economic institutions of the host countries? How do MNE preferences changes across sectors and functions? [Ascani, Crescenzi and Immarino, 2016]

**IMPACT**

- What is the innovation impact of Multinationals on domestic firms active in their same sector? [Crescenzi, Gagliardi and Iammarino, 2015]
- How do openness and connectivity interact with regional economic development trajectories? How has the crisis changed this link? [Crescenzi and Iammarino, 2017]

# THE SPATIAL BEHAVIOUR OF MNES

with Vito Amendolagine (Univ. of Pavia) and Roberta Rabellotti (Univ. of Pavia)

## MNE ESTABLISHMENT MODE, FIRM HETEROGENEITY AND LOCAL INSTITUTIONAL CONDITIONS

# Establishment mode choice

- Multinational Enterprises (MNEs) can engage in foreign direct investment (FDI) via:
  - **Cross-border acquisitions** i.e. entering foreign markets by acquiring an existing local company;
  - **Greenfield FDI** i.e. entering foreign markets by establishing a new local firm.
- Different modes of establishment might foster different reactions in the host countries and regions but <u>there is no consensus in the literature on:</u>
  - Determinants of the establishment mode choice
  - Differential impacts on the performance of the (new establishment
  - Impacts on the host economy.
- Sub-national level evidence on all these aspects is missing.

# Research Questions

- Our paper aims to start filling these gaps by addressing the following research questions:
  - Are MNE characteristics influencing establishment mode choice? How?
    - Are more productive (or more innovative firms) systematically favouring one establishment mode over the other?
  - How are investing enterprises and 'host' economies matched via different establishment modes?
  - Do national AND regional characteristics of the host economy matter for this matching?
    - Do investments in more 'advanced' countries/regions favour one establishment mode over the other?
    - Does local institutional quality influence the matching process?

# What drives FDI entry mode ?

- Existing literature mostly focused on macro-drivers, such as market size and market competition intensity (Mattoo, et al. , 2004; Eicher and Kang, 2005; Muller, 2007);
- Nocke and Yeaple (2007, 2008) develop a theoretical model that explains how "*the two modes of FDI differ significantly in both the characteristics of the firm that engage in these modes as well as in the characteristics of the host countries in which firms invest*";
- We follow Nocke and Yeaple (2008) in looking at the entry mode choice as a positive assertive matching process between subsidiaries and headquarters;
- However in our framework not only macro-level wages and productivity differences drive investment decisions but also REGIONAL strategic assets and institutional conditions;
- Firm-level characteristics interact with national and regional characteristics and institutional conditions shaping establishment mode choices.
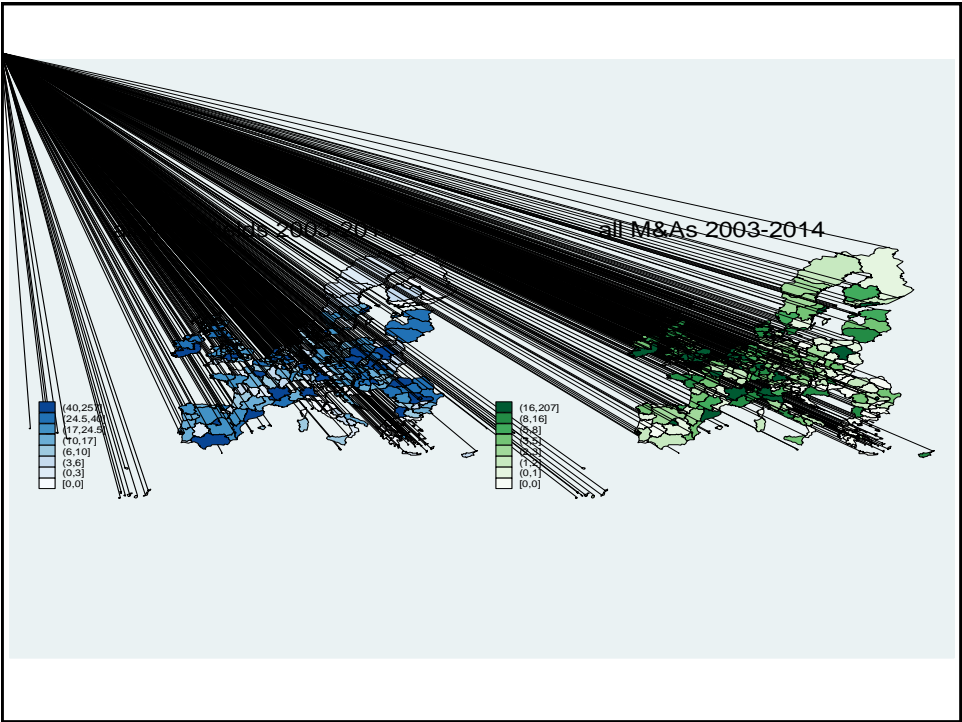
# **Empirical model**

- Following Nocke and Yeaple (2008), we estimate the following logit model:

- $\Pr(y_{ijkl}=1|x_{ijkl})=\frac{exp(x_{ijkl}\beta)}{1+exp(x_{ijkl}\beta)}$ ,

  - $y_{ijkl}$ is the dependent variable that takes value:
    - **1** if parent firm **i** in the industry **j** <u>**acquires**</u> a foreign company in industry **k** within country **l**,
    - **0** if the same company opts for a <u>**greenfield FDI**</u>.
  - $x_{ijkl}$ is a set of observable characteristics of firm i, sector j in which firm i is active, industry k of the foreign investment and the destination country/region l.
  - The time indicator t is omitted. Two periods before and after the crisis are defined

## The variables

| VARIABLES | DESCRIPTION |
|---|---|
| **Dependent Variable** | |
| ACQ | Indicator =1 for acquisitions, 0 otherwise |
| **Investing Company Firm-level Variables** | |
| EFFICIENCY (1) | Total Sales (log) |
| EFFICIENCY (2) | Sales/Employee (log) |
| SIZE | Employees (log) |
| DIVERSIFICATION ACROSS INDUSTRIS | Number of SIC sectors in which the firm is active |
| INNOVATION | R&S expenditure/Sales (log) |
| EXPERIENCE | Indicator for previous experience in the country of destination |
| INTERNATIONALISATION | N. of countries with affiliates of the company (log) |
| FOREIGN SALES RATIO | Foreign sales/Total Sales (log) |
| **Host Economy Variables** | |
| REAL GDP | Real GDP per capita (log) |
| POPULATION | Country population (log) |
| OPENESS | (Exports plus imports)/GDP |
| REGULATORY_Q | WB index for regulatory quality (log) |
| GOV_EFF | WB index for government effectiveness (log) |
| CONTROL_CORRUPTION | WB index for control of corruption (log) |

# Data

- The dataset innovatively combines firm-level information on MNEs and their foreign investments with country/regional level data.
- Investing companies are taken from the **Forbes Global 2000 list** (for the year 2015):
  - it selects the world major publicly listed companies through a composite index built over four metrics (i.e. sales, profits, assets, market value);
  - out of 2,000 companies, 1,116 have at least one investment in the EU-28 in the time-period 2003-2014 ;
  - overall, their investments represent around 42 % and 41 % of the total value of, respectively, greenfield and M&A deals directed to the EU-28 in 2014 (UNCTAD 2016).
- Firm-level data on investing companies are from **Worldscope Database**.
- For each investing company we identify all foreign investments in the EU-28 over the 2003-2014 period:
  - M&A from **Zephyr** (Bureau van Dijk);
  - Greenfield FDI from **FDI Market** (Financial Times Group)**;**
  - For each investment we identify entry mode, year, sector, country, region and financial value.
- Economic and institutional indicators are associated to each destination country/region (**Eurostat,** Summers' and Heston's **Penn World Table,** World bank's **Worldwide Governance Indicators**).
- Distinction between periods before and after the crisis (2008).

all M&As 2003-2014

## Preliminary Results

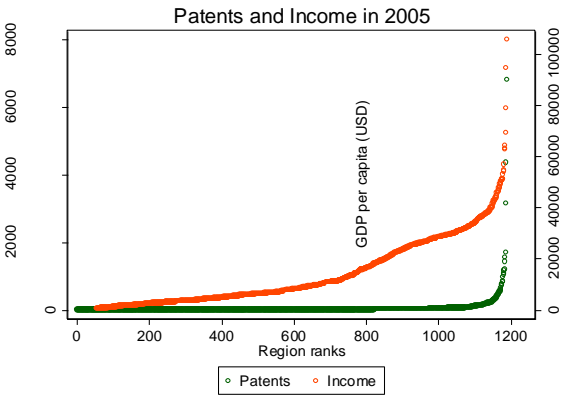| VARIABLES | Sign and Significance | |
|---|---|---|
| **Dependent Variable** | | |
| ACQ | Indicator =1 for acquisitions, 0 otherwise | |
| **Investing Company Firm-level Variables** | | |
| EFFICIENCY (1) | | |
| EFFICIENCY (2) | - *** | *Investing Company Characteristics* |
| SIZE | | |
| DIVERSIFICATION ACROSS INDUSTRIS | Not sig. | |
| INNOVATION | Not sig. | |
| EXPERIENCE | + *** | |
| INTERNATIONALISATION | Not sig. | |
| FOREIGN SALES RATIO | Not sig. | |
| **(Selected) REGIONAL Host Economy Variables** | | |
| REGIONAL GDP | + ** | *Host economy Characteristics* |
| REGIONAL POPULATION | +*** | |
| QUALITY OF GOVERNMENT | + *** | |
| REGIONAL QOG | + *** | |
| **INTERACTION TERMS** | | |
| QOG*EFFICIENCY | - *** | |
| QOG*INNOVATION | Not sig. | |

# Preliminary Results (Summary)

- Are different types of firms involved in different establishment modes?
  - More efficient companies are more likely to undertake greenfield investments;
  - Technological factors do not seem to influence directly entry mode choice.
- Do national AND regional characteristics of the host economy matter for this choice?
  - National factors matter (e.g. more 'open' economies are more likely to host greenfield investments)
  - But regional characteristics matter on top of national features
- Does local institutional quality influence entry mode choice?
  - Both national and regional QoG matter and increase the probability of foreign acquisitions;
  - However they also help the 'selection' of greenfield investments by the most efficient MNEs

# THE LOCAL IMPACTS OF MNES

with Arnaud Dyevre (LSE) and Frank Neffke (Harvard)

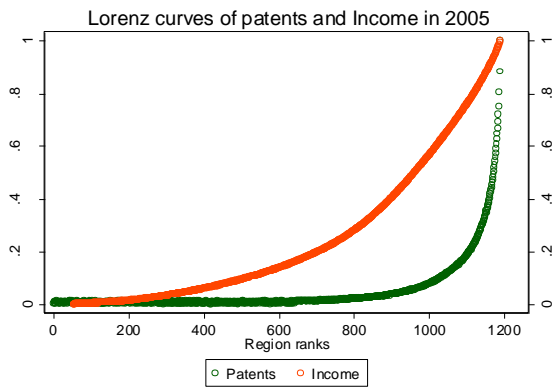# INTERNATIONALISATION AND THE SPREAD OF INNOVATION ACROSS CITIES: EVIDENCE FROM ACROSS THE GLOBE

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# Patenting around the world
## *More unequally distributed than income*



Note: US States are excluded
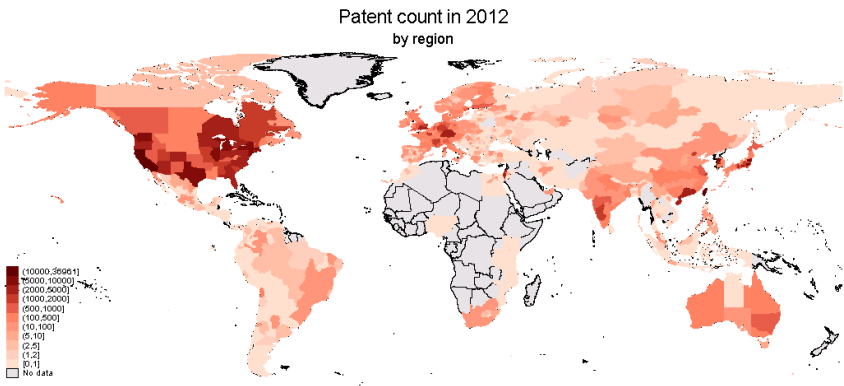
13

# Overview of patenting around the world
*Lorenz curves*

Lorenz curves of patents and Income in 2005
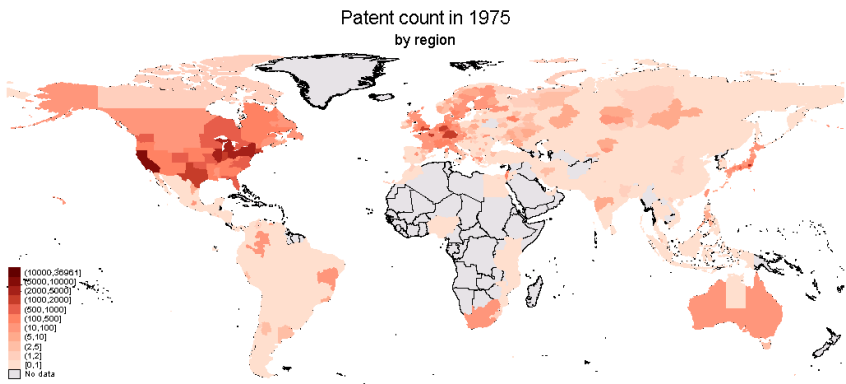


Note: US States are excluded

# Overview of patenting around the world
*Unequally distributed*

Patent count in 2012
by region

# Overview of patenting around the world
*Unequally distributed*

Patent count in 1975
by region



# Overview of patenting around the world
*Very stable over time*

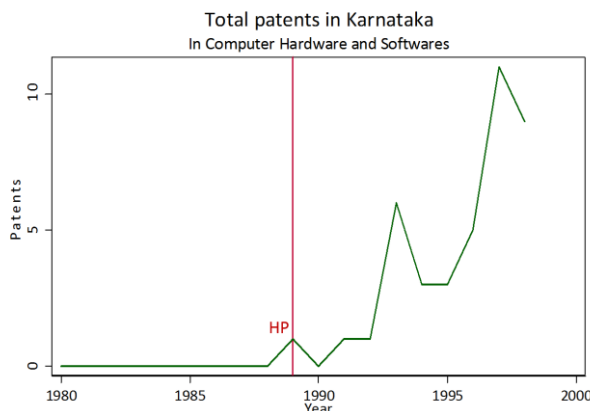|  |  | Quintiles of patent count 1991-2012 | | | | |
|---|---|---|---|---|---|---|
|  |  | **1** (0-3) | **2** (4-6) | **3** (7-23) | **4** (24-438) | **5** (439-440k) |
| **Quintiles of patent count 1975-1990** | **1** (0 patent) | 59.3% | 27.1% | 11.9% | 1.8% | 0.0% |
|  | **2** (1-3) | 19.5% | 45.8% | 27.0% | 7.5% | 0.2% |
|  | **3** (4-5) | 16.9% | 34.8% | 23.4% | 23.9% | 1.1% |
|  | **4** (6-73) | 1.3% | 4.9% | 19.0% | 58.2% | 16.7% |
|  | **5** (75-100k) | 0.0% | 0.3% | 1.0% | 15.7% | 83.0% |

# How do places become innovative? Case-studies

*The New Argonauts: Regional Advantage in a Global Economy* (2006)

- Foreign interventions fosters innovation and economic growth
- **Bangalore, India:** Infosys founded in 1981, quickly followed by leading US tech companies including HP (1989) and Texas Instruments (1985). From a virtually absent IT in base, the region now accounts for a third of India's IT exports.
- **Hyderabad, India:** In 1999 National Semiconductor rejects plan for MP3. Indian inventors establish firm in India→ In late 2000s, firm employs engineers coding the operating system of the Apple iPod
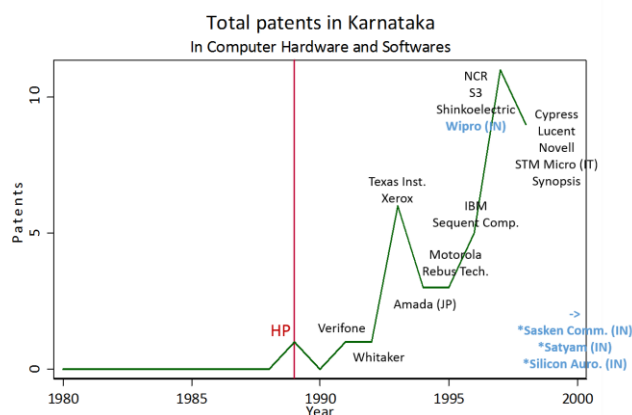
# Example from patent data
*Hewlett-Packard in Bangalore*



Total patents in Karnataka
In Computer Hardware and Softwares

# Example from patent data
*Hewlett-Packard in Bangalore*



Total patents in Karnataka
In Computer Hardware and Softwares

# What is the role of FDI in propelling local innovation?

The importance of foreign activities in triggering a local virtuous circle of innovation remains an open question:

- Evidence on pre-selected case studies
  – E.g. Saxenian (2006)
- Quantitative Empirical evidence is non-causal and remains inconclusive
  – E.g. Breschi, Lissoni & Tarasconi (2014)
- Key aspect of globalisation: steady increase in global flows of foreign investment, scientists and engineers and global collaboration networks
  – Freeman (2010), Docquier & Rapoport (2012), Crescenzi & al. (2016)

# Research Questions & Approach

By looking at patenting across the globe between 1975 and 2012 we address the following questions:

- What is the impact of FDI on the innovative performance of the host regions/technology fields?

- How does this impact (if any) vary across contexts?

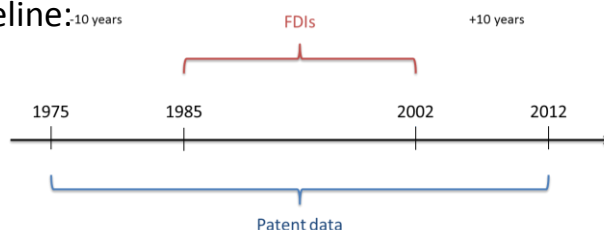- How investing firms characteristics shape impacts?

# Data
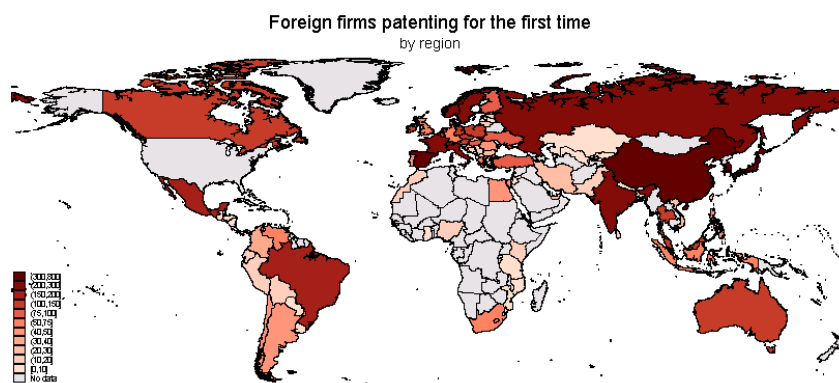## *Patents and region-level observables*

- **US Patent and Trademark Office:** 3.6 million distinct inventors, 6.0 million patents
  - From 1975 to 2012
  - Inventor names and owners of the patents are disambiguated via Discriminative Hierarchical Coreference (Wick, Kobren & McCallum, 2013)
  - Geo-coordinates of inventors' cities of residence
  - Patents in 6 technological categories (Chemicals, Computers &Communications, Drugs & Medical, Electrical & Electronic,Mechanical, and Others) (Hall et al., 2001)
- **Regional observables:**
  - 1528 regions, from 83 countries
  - from 1960 to 2010 (discontinuous and varying with regions)
  - GDP, population, average years of education, geology, reliance on oil and gas (country and region

## Identifying innovation-enhancing FDI

- **First foreign patent:** When first firm from OECD (1985) files the first patent application in a foreign region with a local resident:
  - E.g. German firm patenting in Tyrol with an Austrian resident
- **Home country of firm:** given address of the company at which most of its patents are filed (cross-checked using ORBIS)
- Timeline:



# Treatment:  Where to?



Foreign firms patenting for the first time
by region

# Identification strategy
## *Propensity score matching*

- **Propensity score matching: on region×technology cells:**
  - Using GDP/cap in country, GDP of region, average years of education in region (all in logs) and 3-year average growth rate in the country at the time of intervention
  - Keeping 3 nearest neighbours
- **Matching restrictions:**
  - Exact match on year
  - Exact match on technology
  - Exact match on World Bank macro regions (East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, South Asia, Sub-Saharan Africa)
  - Control cells cannot have received foreign firms before
  - Two regions from the same country cannot be matched (avoid geo spillovers)
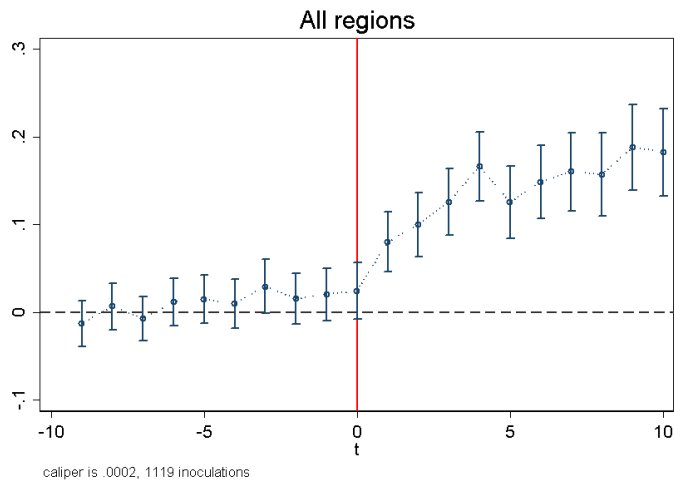
# Balance

- Good balance on observables

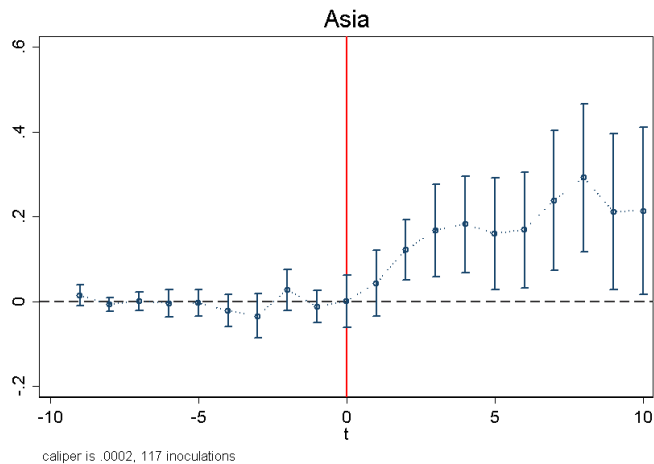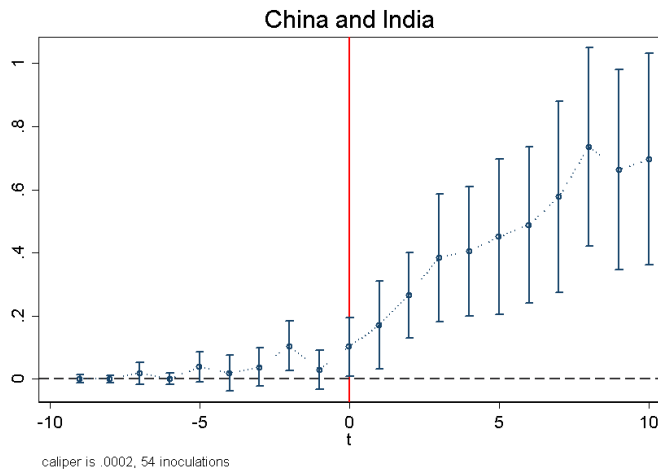| Variable | Treatment | Control | Example in 1985 |
|---|---|---|---|
| Population | 1.07 million | 0.93 million | Sevilla (Spain) |
| GDP (region) | 15.8 bn $ | 13.3 bn $ | Auvergne (France) |
| GDP per capita (country) | 15,500 $ | 15,200 $ | Israel |
| Years of education | 8.2 | 8.1 | Pest (Hungary) |
| Average growth rate (country) | 2.57% | 2.59% | Italy |

# Difference-in-Differences
*Patents by all firms*



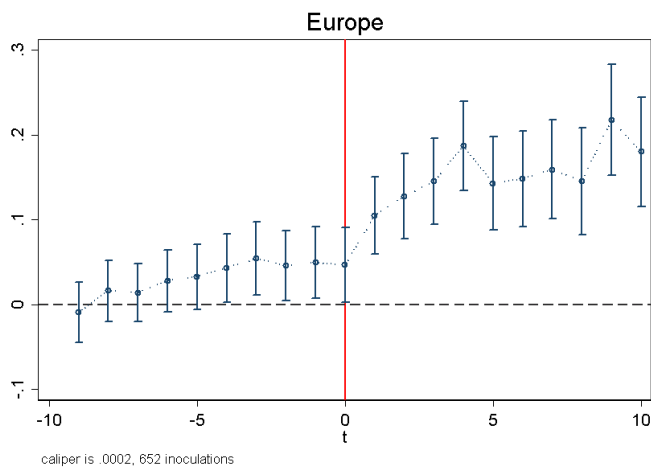# Difference-in-Differences
*Patents by all firms*

# Difference-in-Differences
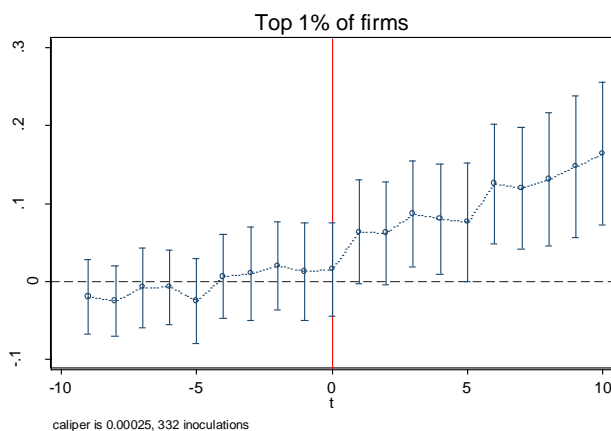*Patents by all firms*



China and India

caliper is .0002, 54 inoculations

# Difference-in-Differences
*Patents by all firms*



Europe

caliper is .0002, 652 inoculations

# What makes foreign firms more impactful?
*Some smoking guns*

- Continent-specific factors?
- Technology-specific factors?
- Level of development of the host region?
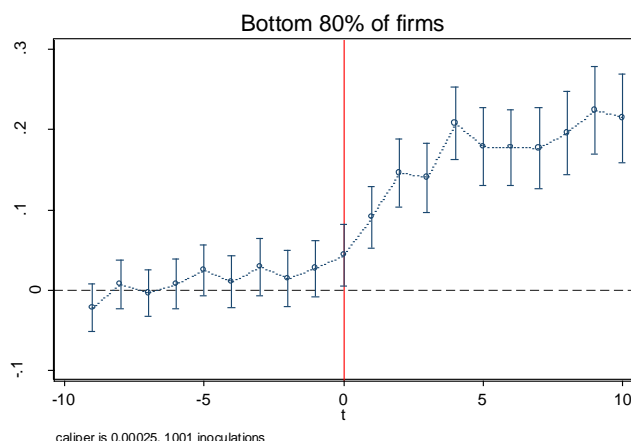- **Most innovative foreign investors?**

# What can explain the impact?
*Most innovative firms vs. medium sized firms*



Top 1% of firms

caliper is 0.00025, 332 inoculations

# What can explain the increase?
*Most innovative firms vs. medium sized firms*

Bottom 80% of firms



caliper is 0.00025, 1001 inoculations

# What makes foreign firms more impactful?
*Regression for heterogeneous effects*

**Regression framework:** Inspired by labour economics (Jacobson, Lalonde & Sullivan, 1993)

Taking difference between average of patent count before t-2 and after t+2, regress difference on treatment ($T_{rct}$) interacted with a variable of interest ($D_{rct}$), and on vectors of region-specificvariables ($X_{rc}$), country dummies ($X_c$) and dummies for years oftreatment ($y_{rct}$):

$$(PatAveragepost\ treatment - PatAveragepre\ treatment)rct = \alpha0 + \beta1Trct \times Drct + \beta2Trct + \beta3Drct + \beta4Xrc + \beta5Xc + yrct + \varepsilon rct$$

## What makes foreign firms more impactful?

| | (1) Matching variables only | (2) + Continent interactions | (3) + Technology interactions |
|---|---|---|---|
| treatment | 0.170*** | 0.005 | -0.004 |
| | (0.01) | (0.04) | (0.05) |
| TxTop1 | -0.064** | -0.059* | -0.068** |
| | (0.03) | (0.03) | (0.03) |
| Top1 | 0.046** | 0.054*** | 0.033 |
| | (0.02) | (0.02) | (0.02) |
| GDP Region (ln) | 0.144*** | 0.152*** | 0.154*** |
| | (0.03) | (0.03) | (0.03) |
| GDP per capita country (ln) | 0.074 | 0.051 | 0.057 |
| | (0.12) | (0.12) | (0.12) |
| Years of education (ln) | 0.011 | 0.003 | -0.001 |
| | (0.07) | (0.07) | (0.07) |
| Population (ln) | -0.068** | -0.077** | -0.081*** |
| | (0.03) | (0.03) | (0.03) |
| Growth rate (country) | 0.663 | 0.725 | 1.001* |
| | (0.61) | (0.60) | (0.58) |
| TxcontAfrica | | 0 | 0 |
| | | (.) | (.) |
| TxcontAsia | | 0.433*** | 0.427*** |
| | | (0.09) | (0.08) |
| TxcontEurope | | 0.153*** | 0.142*** |
| | | (0.04) | (0.04) |
| TxcontLatAm | | 0.121** | 0.121** |
| | | (0.06) | (0.06) |
| TxcatChem | | | -0.030 |
| | | | (0.03) |
| TxcatComp | | | 0.128*** |
| | | | (0.04) |
| TxcatMed | | | 0.113** |
| | | | (0.04) |
| TxcatElec | | | 0.070* |
| | | | (0.04) |
| TxcatMech | | | 0.035 |
| | | | (0.04) |
| Year fixed effects | (YES) | (YES) | (YES) |
| Continent dummies | (NO) | (YES) | (YES) |
| Technology dummies | (NO) | (NO) | (YES) |
| Constant | -3.044*** | -2.858** | -2.973*** |
| | (1.16) | (1.16) | (1.13) |
| R-squared | 0.166 | 0.177 | 0.214 |
| N | 3608 | 3578 | 3578 |

## Differences in key transmission channels

- Differences in labour mobility:
  - 3.34% of repeat inventors move from foreign firms to local firms in regions 'treated' by the bottom 80% investors, against 2.40% in the regions treated by the top 1% (significant at the 1% level).
  - 2.13% of repeat inventors in bottom 80% moving from local firms to any foreign firm and 1.81% in the top 1% (significant 1%) moving from local to foreign.
  - If we consider only the inventors filing a patent in the region before and after the treatment, the figures are 7.95% for the bottom and 4.45% for the top (significant at the 1% level).
  - Descriptive evidence confirmed by formal regressions on probability of mobility
- Differences in citations from local firms towards the investing company and vice-versa
  - Ongoing analysis …

# Summary of Results

1. Foreign firms investing abroad increase the innovation capacity of their host regions
2. Heterogeneous impacts:
   - Local benefits possible under specific macro-continental conditions (Asia and Europe)
   - Drugs, Electronics and Computers most likely to benefit from foreign intervention
3. Medium-sized firms have a greater impact than top innovators
   - Ongoing exploration of differences in micro-level transmission channels
     - Labour mobility and circulation of inventors;
     - Localised knowledge spillovers (patent citations).
4. Relevant implications for FDI policies.

# Further on-going work on impacts

- Further empirical work on both low-impact and high-impact areas with detailed territorial AND investment data:
  - "Innovation in Russia: The territorial dimension" - with Alexander Jaax (LSE)
  - MNEs and the Geography of Innovation in Latin America: evidence from Brazil. Mexico and Colombia – with Alexander Jaax (LSE)
    - Impact differentiated by establishment mode
  - Inward FDI and Regional Performance in Europe – with Roberto Ganau (LSE & Univ of Padova)
- Additional work looks at transmission channels with reference to mobilty - with Arnaud Dyevre (LSE) and Frank Neffke (Harvard)

**SOME GENERAL CONCLUSIONS**

## Conclusions

- Exciting (often inter-disciplinary) field of research;
- Constantly improving data availability at the sub-national and firm level for both advanced and emerging economies makes new insights easier to achieve;
- MNE preferences and strategies are highly differentiated in terms of sectors, GVC stages, innovation intensity, establishment choices that result in complex sub-national geographies of internationalisation;
- Internationalisation and global connectivity are key to regional innovation and development but not necessarily in the forms and via the channels presented by the existing literature
- Towards more cautious regional development policies?

Credits

This research to be further developed in new large project at the LSE

# MASSIVE

MultinAtionals, inStitutionS and InnoVation in Europe

Funded by the **European Research Council** for the next five years
For more info: r.crescenzi@lse.ac.uk

erc

European Research Council
Established by the European Commission

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