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# Identifying research labs of MNEs and analyzing Global Innovations based on patent data

Rainer Frietsch, Peter Neuhäusler and Oliver Rothengatter

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# Starting points: insights from the literature

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## Motives to internationalize R&D

- Access to markets
  - Home-base exploiting (Kuemmerle 1998)
  - Market-driven (Patel, Vega 1999; Belitz et al. 2006; Cantwell, Janne 1999; Dalton, Serapio 1999; UNCTAD 2005)
- Access to resources (resource-driven)
  - Knowledge: Home-base augmenting (Kuemmerle 1998; Florida 1997)
  - Infrastructure (incl. cheap labor) (Patel, Vega 1999; Belitz et al. 2006; UNCTAD 2005)
  - Attracting factors: market size/income and skills (qualifications and research), e.g. tax-incentives are less relevant (Dachs 2014; Belitz 2014; Thursby and Thursby 2006)
  - Substitution/offshoring (Kinkel, Maloca, Dachs 2010; Kinkel, Lay, Maloca 2007; Ernst 2008; Thursby and Thursby 2006)
- More recently: Speed of R&D processes and shorter technology cycles
  - 24/7 R&D processes
  - Global innovations

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# Starting points: insights from the literature

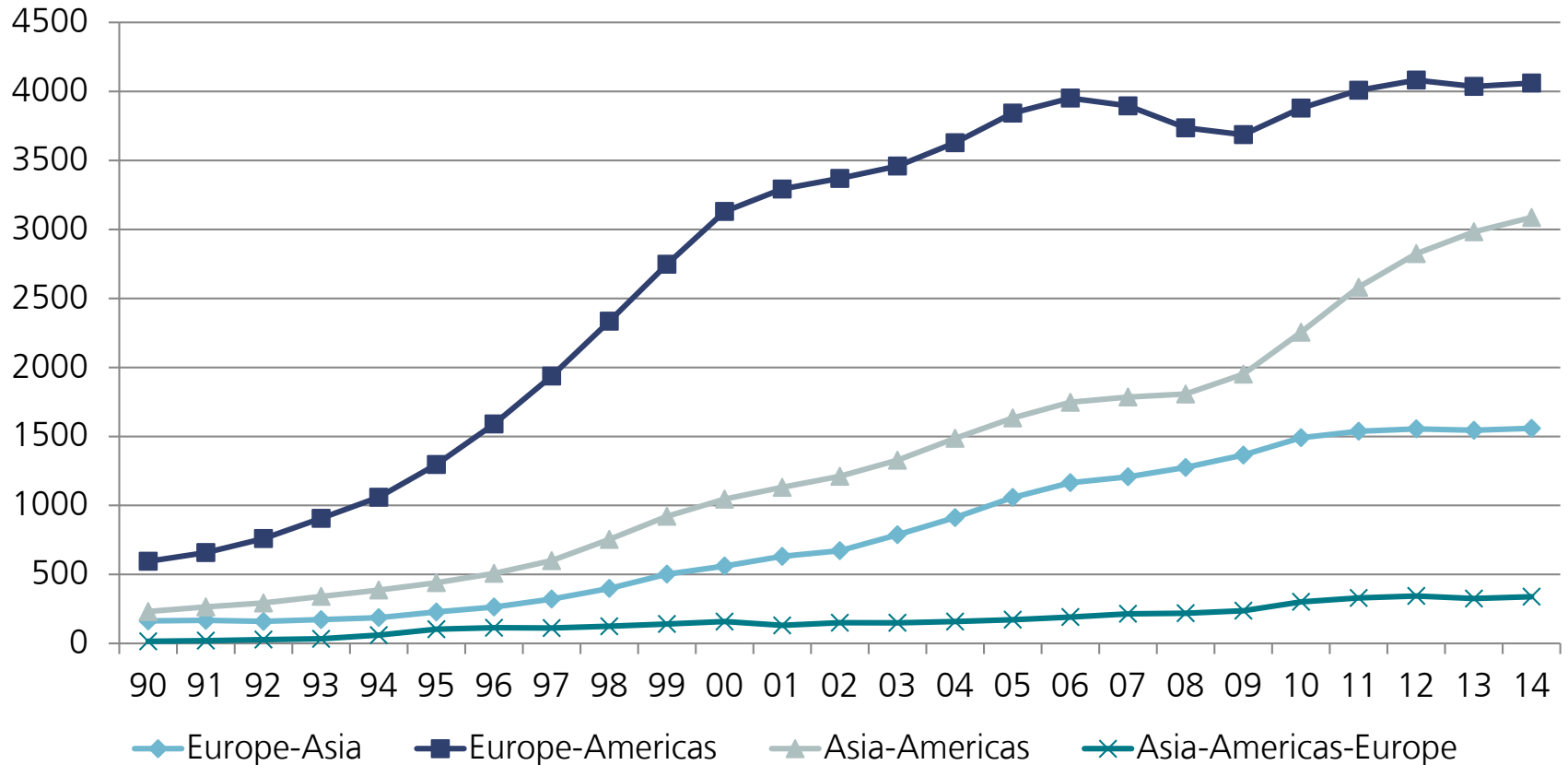
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## Empirical findings:

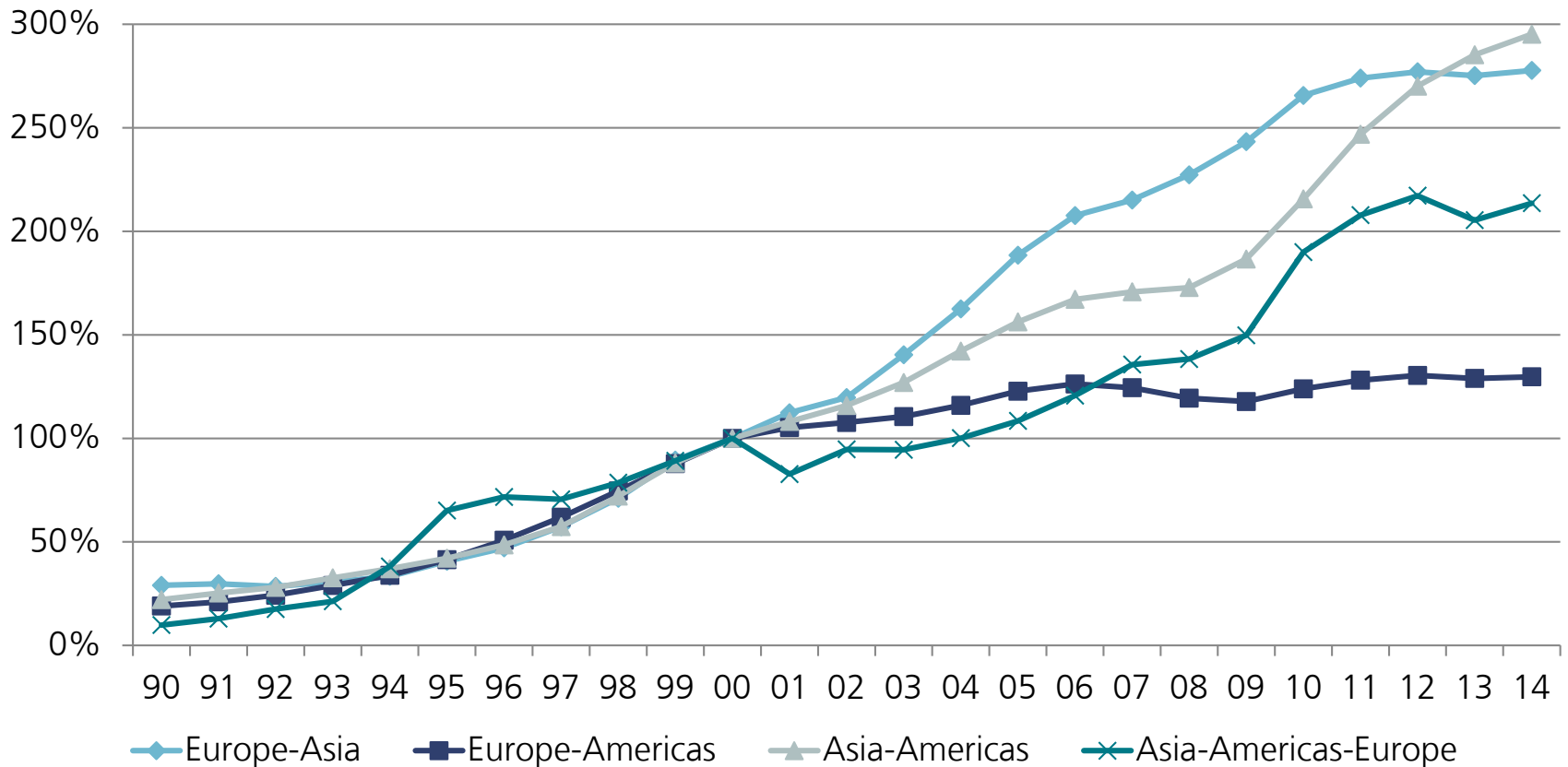
- R&D-related FDI increased; R&D follows production (Kuemmerle 1998; UNCTAD 2005; Dachs 2014)
- Internationalization of R&D is less dynamic in the 80s and 90s than many other business activities (Patel, Pavitt 1991; Edler 2003)
- Companies seek complementary knowledge in developed countries and more often conduct home-base exploiting activities in countries with growing markets (Kuemmerle 1998; Edler 2003; Belitz 2006; Thursby and Thursby 2006; Kafouros 2008; Dachs 2014)
- Knowledge-intensive areas internationalize with a higher probability (Edler 2003; Patel, Vega 1999; UNCTAD 2005)
- Quality of R&D and legal framework are important factors; knowledge-driven R&D is often located in developed countries (Thursby and Thursby 2006; Belitz 2017)
- Success / benefit from internationalization is dependent on the activity level (and also some other factors like sector, experience etc.) (Kafouros et al 2008)
- Global innovations gain importance (Neuhäusler et al. 2017; Kafouros 2015)

# Global Innovation – absolute numbers (3-years-average)



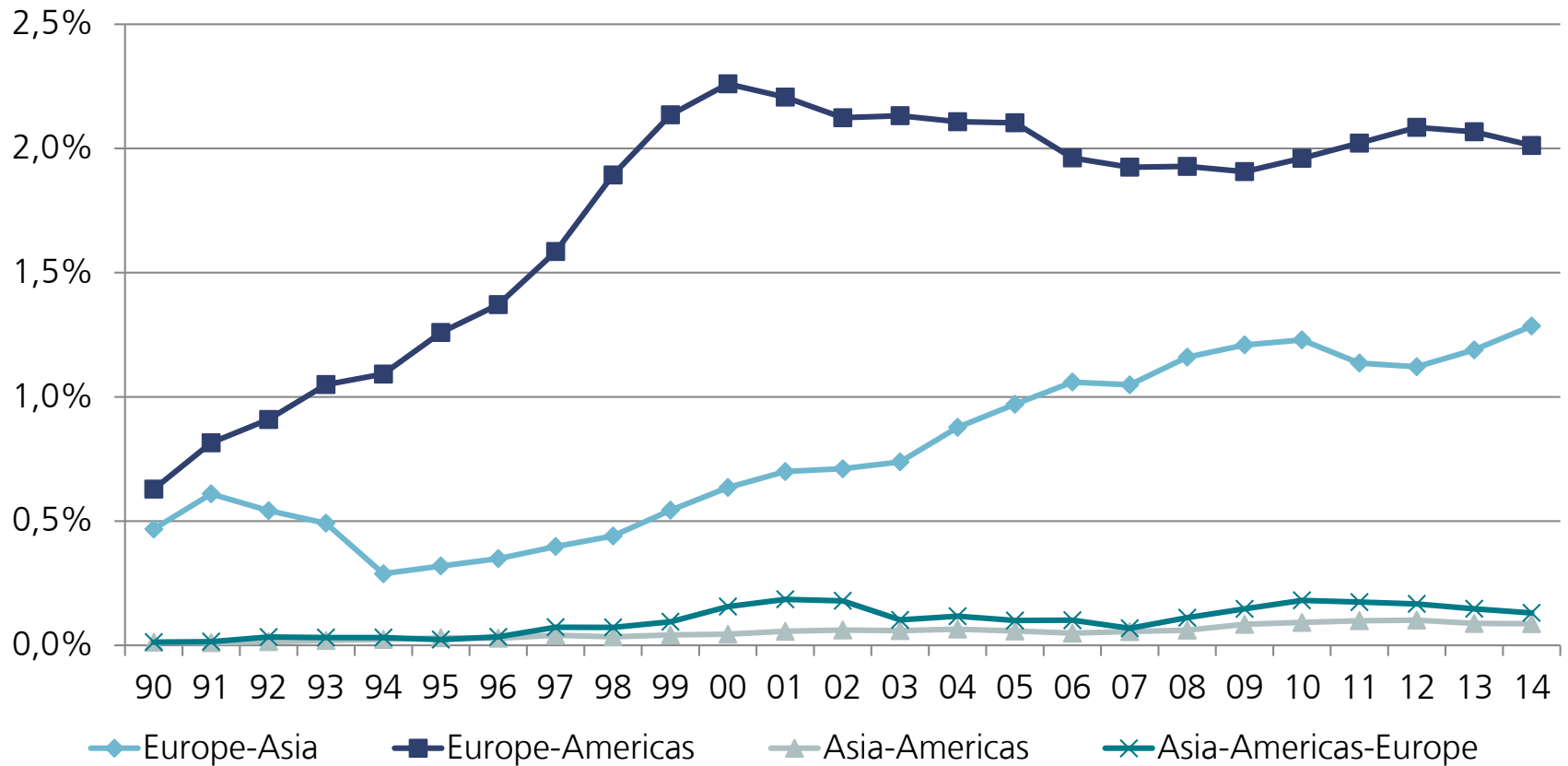
Source: EPO – PATSTAT; Fraunhofer ISI calculations.

# Global Innovation – growth index (2000=100%; 3-years-average)



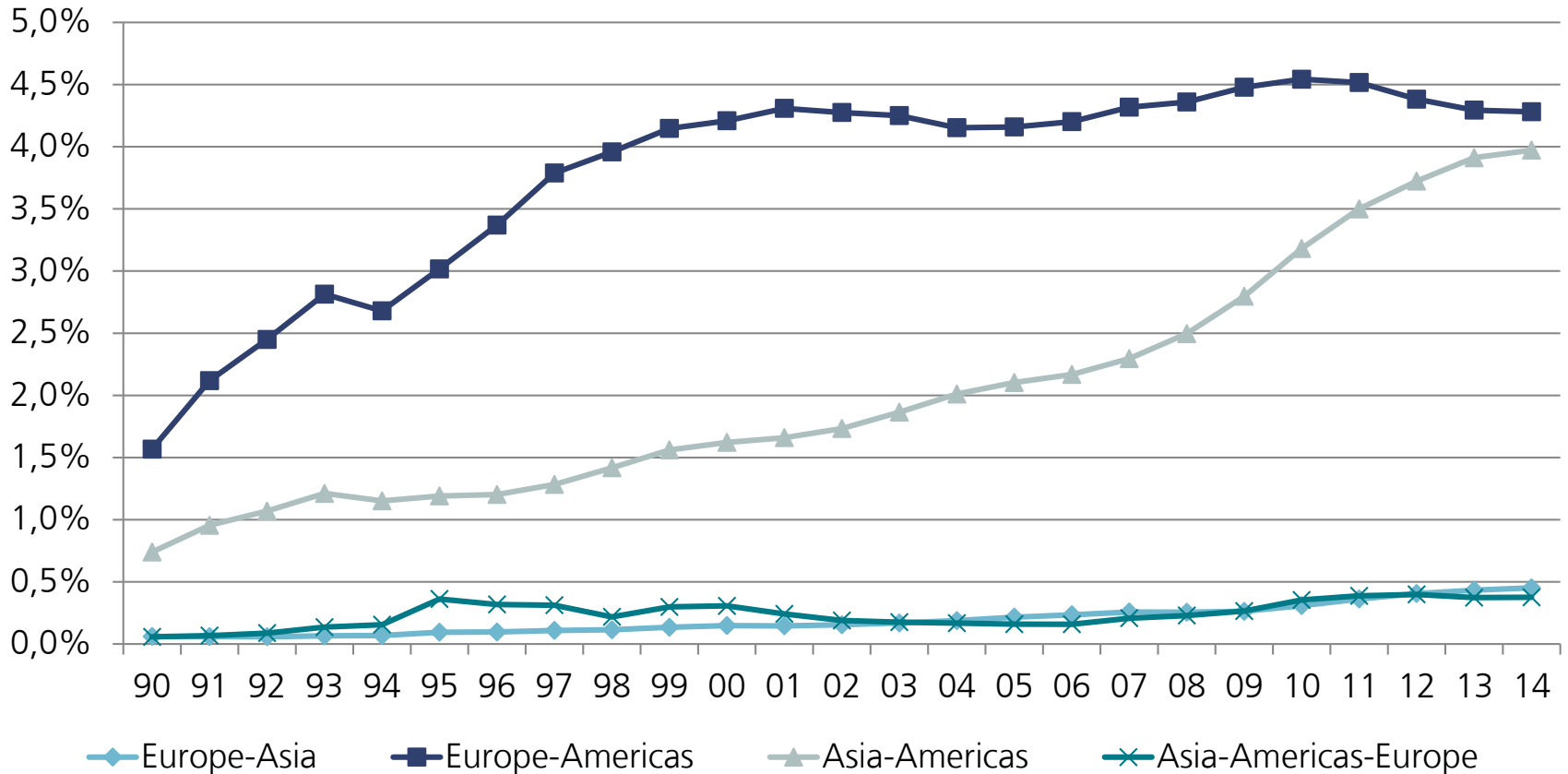
Source: EPO – PATSTAT; Fraunhofer ISI calculations.

# National trends: applicant/assignee (owner) is a German enterprise (3-years-average)



Source: EPO – PATSTAT; Fraunhofer ISI calculations.

# National trends: applicant/assignee (owner) is a US-American enterprise (3-years-average)



Source: EPO – PATSTAT; Fraunhofer ISI calculations.

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# Research questions

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- Has internationalization gained importance over time?
  - Are there any home-base augmenting, exploiting or substituting effects?
- Has globalization gained importance over time?
  - Is it really a globalization or is it just a “China-fication”?
- Are internationalized/globalized enterprises technologically and/or economically more successful?
- What are the factors that drive the decisions to internationalize/globalize R&D?

Questions here:

- What are the technological profiles of the local units?
- How are the local units linked to other R&D units within the enterprise?
- How are the local units linked to R&D organizations in the host country (companies, public research)?

**=> How to identify local units and assess their activities/contributions?**

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# Patents as a mean to identify local R&D units: methods

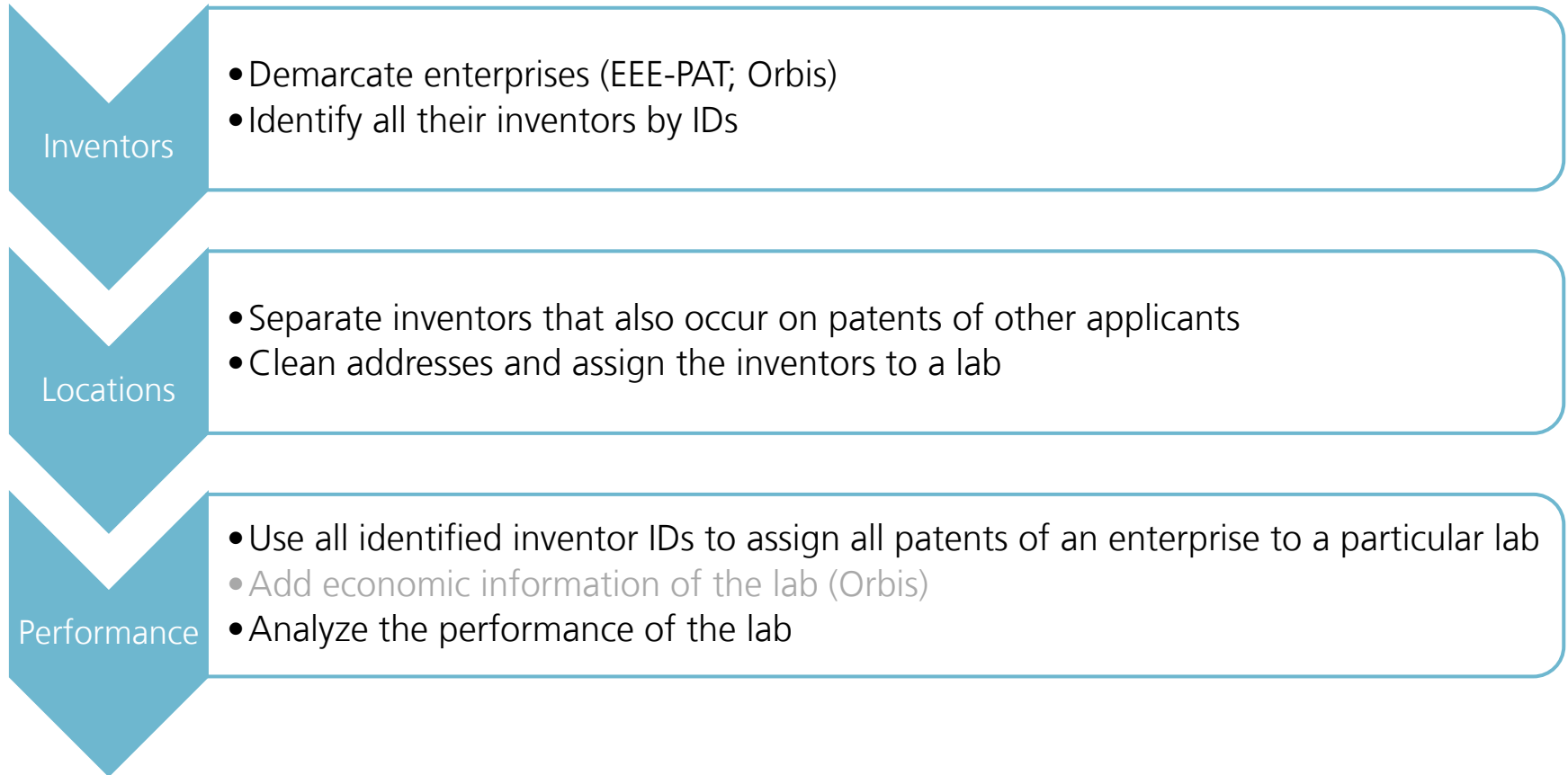
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- We use data from USPTO, EPO, GPTO, SIPO, JPO (offices with addresses in PATSTAT)
- We look into patent applications filed in the years 2012-2014
- Here just feasibility: focus on BASF, SIEMENS (and a couple of other like Bosch and Bayer)
  
- EEE-PAT Harmonized level 2 name and ID – manual adjustments made
- Only German MNEs (German applicants)
- Identify all inventors from abroad (person\_ID in PATSTAT)
- Exclusion: inventors with patents filed by another applicant (than the particular MNE)
  - No inventors from partner institutions
- Use the “agglomeration” of inventor locations to identify labs
- Check with real locations of these MNEs in Google
- Finally: Analyze all patents of a particular lab (incl. those with external inventors)

# Summary of method: a three-stage process

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# Patents as a mean to identify local R&D units: potentials and challenges

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## Challenges:

- Separation of R&D facilities from sales post, production sites etc.
- Addresses look different at different offices
- Inventors do not “live” in their labs and therefore scatter around the location of the lab
- Separate external partners and occasionally R&D-conducting units/persons
- Apply the method to a large scale of enterprises

## Potentials:

- Link with Orbis to take the whole enterprise into account (ultimate owner)
- Geo-coding of addresses to get a more detailed location of labs
  - Taking distances between labs and between labs and collaboration partners into account
- Collaboration patterns – a) internal versus external; b) with public research
- Technological profiles of labs

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# Patents as a mean to identify local R&D units: the problem of varying address info

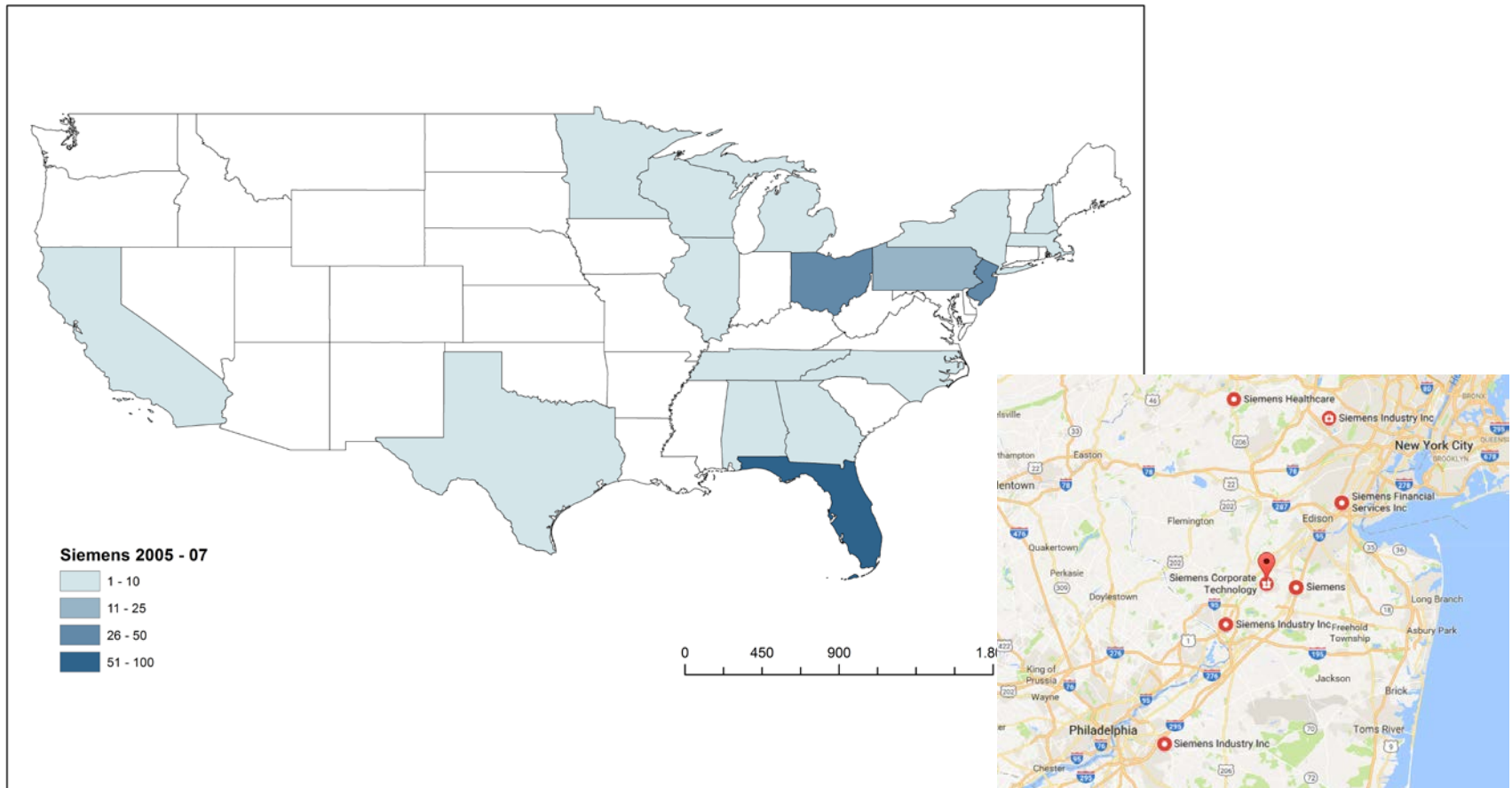
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- EPO: full address information
  - e.g. Schlettstadterstrasse 27,CH-4055 Basel
- GPTO: reduced address information
  - e.g. CH-4055 Basel
- USPTO: city only (and federal state for the US addresses)
  - e.g. Basel; or Hopatcong, NJ
- JPO: incomplete addresses before 2013; automated translation



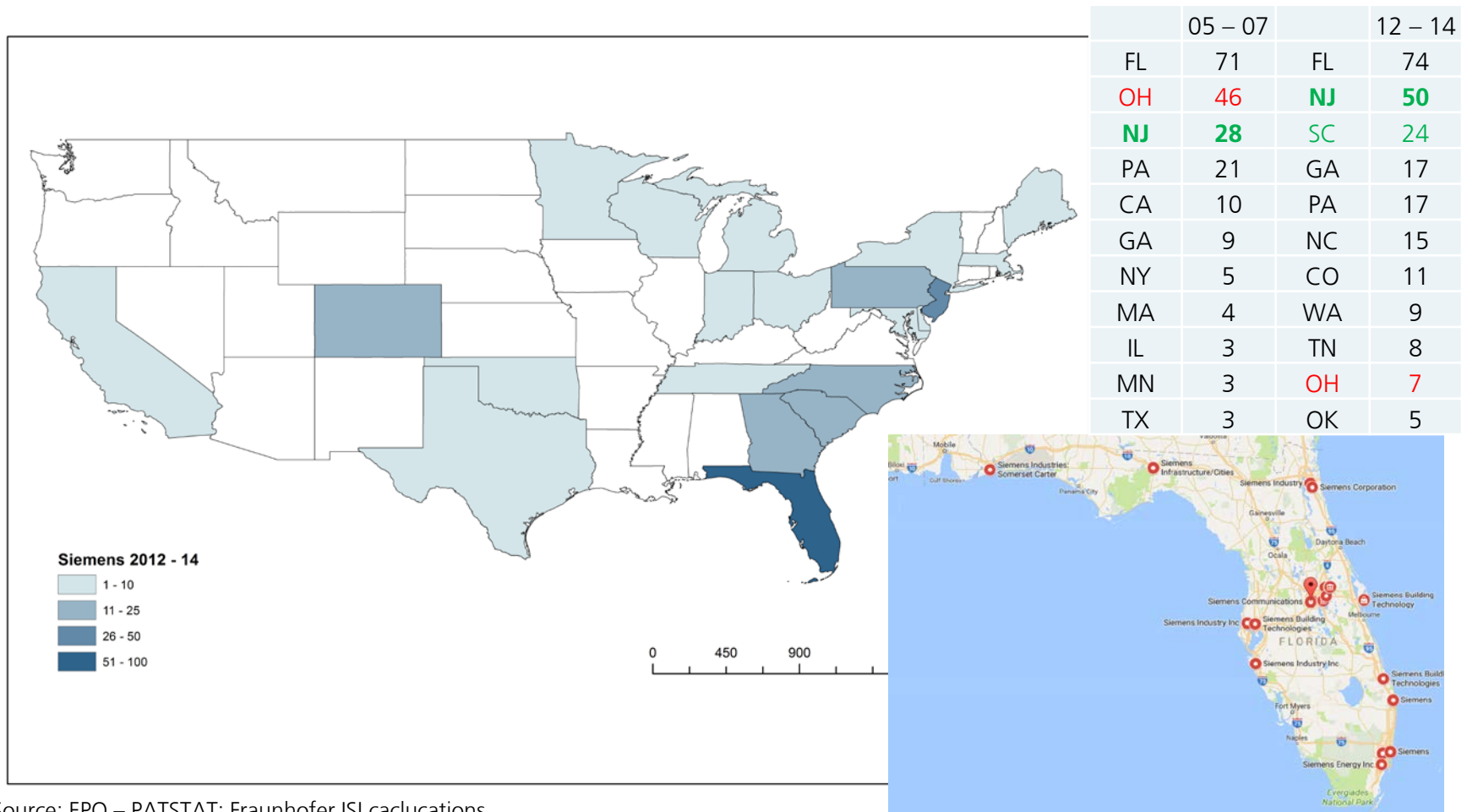


# Siemens in the USA: transnational patents by lab locations 2005-2007



Source: EPO – PATSTAT; Fraunhofer ISI calculations.

# Siemens in the USA: transnational patents by lab locations 2012-2014



Source: EPO – PATSTAT; Fraunhofer ISI calculations.



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# Summarizing Outlook

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- The trend of internationalization of R&D continues
- A trend of globalization of R&D seems to be a “China-fication” of R&D
- A shift from the globalization of markets to the globalization of knowledge seems to continue as well
- The questions of home-base augmenting vs. exploiting and of particular motives can only be answered on the level of labs / research locations (and technology fields)
- Patents can be used to identify labs / research locations of MNEs
- Together with additional (economic) data it is possible to analyze their performance and possibly identify the motive for conducting R&D abroad
- By up-scaling the method (number of different enterprises) this approach goes beyond what is currently done in the existing literature/analyses