

## Cross-border technology flows in a globalized world

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## Spillovers and technology transfer

- Spillovers are unintended
  - No payments are involved
- Technology transfer refers to trade of technology
  - It carries a price tag

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## Two notions of R&D spillovers

- Pecuniary spillovers
  - Transfer of rents
  - Reason: imperfect price discrimination and imperfect information
- Knowledge spillovers
  - Transfer of knowledge
  - Reason: knowledge is a non-rival and partly non-excludable good

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## Channels of transmission

- Trade
- Foreign direct investment
- Mobility of personnel
- Meetings, fares, conferences
- Publications, patent descriptions
- Collaborations
- Purchase of know-how (licenses)

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## Types of spillovers

- Intra-firm, inter-projects
- Intra-industry, inter-firms
- Interindustry
- International, intra-sectoral or inter-sectoral
- Intertemporal

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## Modeling of R&D spillovers

$$Q_{it} = f(X_{it}, R_{it}, S_{it}, T_{it}, \varepsilon_{it})$$

$$S_{it} = \sum_j a_{ji} R_{jt}$$

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## Choice of weights in spillover term

- Equal weights  $a_{ij}=1$
- Weights proportional to flows
  - j's purchase from i
  - i's sales to j
  - i's direct and indirect impact on j (Leontief's inverse)
  - FDI flows from i to j
  - Patent citations
  - Co-operation agreements
  - R&D personnel
  - innovation

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## Choice of weights in spillover term

- Proportional to proximity in
  - patent space
  - research areas
  - qualification of scientists and engineers
  - lines of business

Keller (2004): results are robust to different matrices

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## Stylized empirical findings

- Significant spillovers of innovative activity at all levels of aggregation both within & between countries
- Spillovers are generally found to be positive
- Social returns exceed private ones by 50% but they vary greatly across countries/industries/time
- Absorption hypothesis: complementarity of spillovers to own R&D

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## In search for explanations

- Signs of endogeneity of R&D spillovers dependence on
  - size
  - technological advancement
- Differences in spillover effects by type of research
  - low for defense R&D, high for academic R&D
- How does it occur?

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## Does proximity matter?

- Geographical spillovers
  - Jaffe (1989) using patents
  - Acs, Audretsch and Feldman (1992) using innovations
  - Jaffe, Henderson, Trajtenberg (1993) using patent citations
- Relational and networking effects
  - Audretsch and Stephan (1994)
  - Zucker, Darby and Armstrong (1994)
  - Breschi and Lissoni (2001)

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## Spillovers from labor mobility: matched employer-employee data

- Møen (2005) tries to trace knowledge flows from employees creating spin-offs from subsidized IT-research. Potential spillovers are internalized in wages of R&D workers
- Milaranta, Mohnen and Rouvinen (2006) find that hiring young educated R&D experienced workers increases productivity

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## Spillover from science

- R&D spillovers within science parks (Squicciarini, 2005)
- Importance of academics as sources of information leading to innovation (competitors, clients, suppliers, universities,...) using innovation survey data (Veugelers and Cassiman, 2003)

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## Spillovers and economic policy

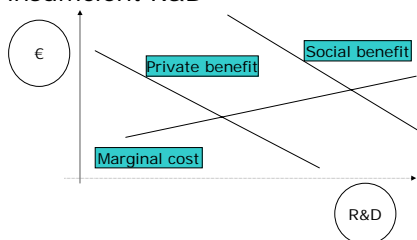
- Knowledge leakages create disincentives to do R&D
- To restore incentives:
  - Intellectual property rights
  - Tax incentives
  - Public labs
  - Permission of R&D joint ventures

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## Spillovers and economic policy

- Source of market failure: insufficient R&D



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## Conclusion

- There are various signs of the existence of spillovers
- We are progressing in our understanding of how spillovers occur
- Can we manage spillovers? Wishful thinking

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## Spillovers are not free of charge

- Need to build absorptive capacity
- Some knowledge is tacit
- Create markets for technologies

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## Negative R&D spillovers

- Duplicative R&D in patent races where the winner takes all
- R&D is used as a strategic weapon to block or discourage entry on a market

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