Moving people with ideas
Does mobility of skilled individuals foster innovation?

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Disclaimer

Stylized Facts: EU

- "In order to become a truly modern and competitive economy, and building on the work carried out on the future of science and technology and on the modernisation of universities, Member States and the EU must remove barriers to the free movement of knowledge by creating a "**fifth freedom**" based on:
  - enhancing the cross-border mobility of researchers, as well as students, scientists, and university teaching staff,
  - making the labour market for European researchers more open and competitive,
  - providing better career structures, transparency and family-friendliness,
  - Etc."

Presidency Conclusions of the Brussels European Council (13/14 March 2008)

Background literature (1): mobility

Policy emphasis on labour mobility as a means to promote innovation is supported by the **existing academic literature on the geography of innovation**:

- Mobility is a primary channel of knowledge diffusion: "knowledge tends to travel along with people who master it" (Breschi and Lissoni, 2001);
- "Agglomeration centres for knowledge flows" are the 'winners' in technological and economic competition (Miguelez et al, 2010);
- Local firms, as key actors of the innovation process, take advantage of the availability of skilled labour and of the existence of a "contextually – enabling environment" for innovativeness (Glaeser et al, 2010).

Logic

- Inflows of highly skilled/creative individuals boost innovation by enhancing the local knowledge base through injections of valuable, individual-embodied knowledge;
- The effect of mobility on innovation is ether mediated by the labour market ("learning by hiring") or associated to pure externality mechanisms ("knowledge is in the air")

Background literature (2): Mobility

The seminal work by Zucker, Darby & colleagues (1998a, 1998b, 2002, 2006, 2007) looked at the geographical mobility of star scientists (in the US) and suggested a positive relationship between local innovation and migration inflows.

This evidence has been recently confirmed by looking at:

- Canada (*Partridge and Furtan, 2008*);
- Europe (*Miguelez and Moreno, 2010; Miguelez et al, 2010*);

Alternative studies focusing on different typologies of movers supported similar conclusions:

- Graduates (*Faggian and McCann, 2006, 2009*);
- Highly skilled individuals (*Gagliardi, 2011*);

Background literature (3): Firm dynamics

The literature focusing on **firm-level dynamics** suggests that different knowledge acquisition strategies are possible;

- Firms combine internal and external knowledge sources in different ways (Allen and Cohen 1969; Cohen and Levinthal, 1990);

- The productive use of external knowledge crucially depends on firm-level characteristics and absorptive capacity (Arora and Gambardella, 1994) in particular;

→Limited investigation of the actual role of external conditions and 'local' processes including geographical mobility (e.g. of inventors) in existing firm-level analyses;

→Conversely, the 'regional' / 'spatial' literature overlooks relevant firm-level dynamics and heterogeneity.

Research Questions

Does inventors' mobility improve the innovative performance of firms located in recipient regions?

In other words:

Does it make sense to target the mobility of high-skilled workers in order to promote the innovative performance of local firms?

Key Results:

- **Inventors' mobility per se is NOT a significant determinant of firms' innovation;**
- **Highly heterogeneous impacts at the firm level overlooked by regional-level aggregated analyses;**
- **Geographical mobility becomes relevant if and only if firm-level absorptive capabilities are fully accounted for.**

Innovative Contribution of the Paper

1. Focus on firms' innovative performance rather than on 'aggregate' measures of innovative output;
2. Matching of patent data (to capture inventors' mobility) with firm-level data (to measure innovative performance) at a detailed geographical scale:
   a) No mechanical correlation generated by the use of the same data source (i.e. patents data) to compute both dependent and independent variables;
   b) Focus on the innovative performance of a balanced sample of firms in terms of size and sector of activities
3. Innovative identification strategy based on Instrumental Variable approach;

Outline

- Stylised Facts and Relevant literature
- Research Question and Innovative contribution
- Data
- Empirical strategy:
  - Measuring Mobility;
  - Geography;
  - Estimation procedure.
- Key Results
- Preliminary conclusions.

Data

- CIS (Community Innovation Survey):
  - Two waves: CIS4 (2002-2004) & CIS5 (2005- 2007);
  - Dependent variable:
    "Product or Process Innovation": Dummy variable taking value 1 if the firm performed any product or process innovation.
  - Orientation towards external knowledge sources.
  - Firm level controls:
    Intramural Investments in R&D
    Share of employment with a science degree
    Firm size
    Sector of activity
    Export orientation
- KITES:
  - Regressor of Interest:
    "Inventors' inflows" based on the share of inventors' changing their residential address

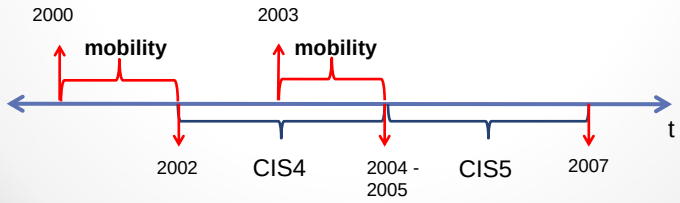
Empirical Strategy (1)

1. Tracing inventors' mobility using patents data

Key advantages:	Key problems:
•Use of individual-level information; •Possibility to trace mobility at a detailed geographical scale.	•'Who's who' problem due to misspelling and misreporting; •Identification of movers limited to multi-patenting inventors

Our main measures of mobility:
Inventors' inflows (shock) = Dummy variable taking value 1 if the areas experienced inflows of inventors

(!) Focus on recent movers (people that moved between 2000/02 and 2003/05)



Empirical Strategy (2)

2. Linking inventors' mobility and firm innovation

Spatial Correlation approach (*Borjas, 1999*): Effect of mobility identified on the basis of the spatial correlation between inflows and changes in the outcome variable (i.e. firm innovative performance);

Rationale: Potential raise in the creativity and productivity of local interactions (*Mare' et al, 2011*).

KEY: Choice of the geographical unit of analysis

Travel to Work Areas (TTWAs): Functional units including both urban and non-urban areas and generated in order to be 'self-contained' labour markets

(!) Possibility to account for both market mediated and non-market mediated interactions resulting from geographical mobility BUT impossible at this stage to separate them out

Empirical Strategy (3)

3. Heterogeneity in firm-level knowledge acquisition strategies

•Need to identify firms that are relying on external sources of knowledge to complement internal information (Arora and Gambardella);

• We refer to the 'customary' CIS variable capturing "external market sources" of information (*Klomp, Van Leeuwen, 2001, Crespi et al, 2008, UK Data Archive Service, 2008*).

KEY: We control for heterogeneous effects in our IV strategy

Empirical Strategy (3)

3. Estimation procedure

Knowledge Production Function (KPF) approach (*Griliches, 1979, 1986; Jaffe,1986; Crescenzi et al. 2007 and 2012*)

$$P\left(Innovative\ performance^{i}_{c,t-T}\right) = \beta_0 + \beta_1 K^{i}_{c,t-T} + \beta_2 L^{i}_{c,t-T} + \beta_3 Inventors' Inflows^{i}_{c,t-T} + \beta X_{c,t-T} + \delta_c + \delta_{t-T} + \varepsilon^{i}_{c,t-T}$$

Linear Probability Model (LPM) estimation with TTWA and time dummies

➢Insufficient 'within' variation to include firm-level fixed effect: Repeated cross sections with clustered standard errors (*Cameron & Trivedi, 2005*);

➢Endogeneity due to omitted variables and reverse causality: 2SLS Estimation.

Key results: OLS

	(1)	(2)	(3)
Dep. Var.: Process or Product Innovation	OLS	OLS	OLS
R&D	0.391***	0.398***	0.392***
	(0.0166)	(0.0165)	(0.0167)
Employment with degree	0.0015	0.0018	0.0015
	-0.0041	-0.0044	-0.0043
Sme	-0.0414**	-0.0409**	-0.0382**
	(0.0171)	(0.0171)	(0.0174)
Inventors' inflows	0.0456***	0.0297*	0.0415*
	(0.0163)	(0.0163)	(0.0215)
National mkt	0.0317*	0.0340*	0.0373**
	(0.0184)	(0.0184)	(0.0185)
European mkt	0.0463**	0.0510**	0.0482**
	(0.0220)	(0.0220)	(0.0221)
International mkt	0.0496**	0.0468**	0.0392*
	(0.0222)	(0.0222)	(0.0223)
Constant	0.0809	0.127	-0.0401
	(0.160)	(0.160)	(0.150)
Sectoral Dummy	YES	YES	YES
Time Dummy	NO	YES	YES
TTWA Dummy	NO	NO	YES
Observations	4,424	4,424	4,424
R-squared	0.260	0.268	0.299

After controlling for time and TTWA dummies the regressor of interest is statistically significant at 10% level

Key Results: Robustness check

	(1)
Dep. Var.: Process or Product Innovation	OLS
R&D	0.343***
	(0.0360)
Employment with degree	0.0109
	(0.0119)
Sme	-0.0664*
	(0.0353)
Inventors' inflows (weighted productivity)	-0.0239
	(0.0679)
National mkt	0.0150
	(0.0401)
European mkt	0.0772
	(0.0492)
International mkt	0.0734
	(0.0462)
Constant	-0.591*
	(0.319)
Sectoral Dummy	YES
Time Dummy	YES
TTWA Dummy	YES
Observations	888
R-squared	0.329

There is no additional effect associated to the composition of the flows.

The effect of mobility on innovation is likely to be not systematically dependent on self-selection mechanisms

Key results: 2SLS

	(1)
Dep. Var.: Process or Product Innovation	2SLS
Inventors' inflows	0.0795
	(0.0541)
R&D	0.392***
	(0.0164)
Employment with degree	0.0015
	-0.0042
Sme	-0.0384**
	(0.0171)
National mkt	0.0370**
	(0.0181)
European mkt	0.0482**
	(0.0217)
International mkt	0.0388*
	(0.0219)
Constant	-0.0612
	(0.149)
Sectoral Dummy	YES
Time Dummy	YES
TTWA Dummy	YES
Observations	4,424
R-squared	0.299

After controlling for the potential endogeneity bias through reverse causality our regressor of interest become statistically insignificant

The first stage regression confirms the validity of our instrument (significant at 1%). First stage statistics further exclude any risk of weak instrument based on both the Staiger and Stock 'rule of thumb' and the Stock and Yogo threshold values.

Note: The result remains consistent when the relation of interest is re-estimated with nonlinear techniques (CF approach–Rivers & Vuong, 1988)

Key Results: Heterogeneous Effects

Strong evidence in favour of the lack of significance of Inventors' mobility

HOWEVER

The availability of new knowledge is translated in economically viable innovation if local firms have the capability to exploit new sources of knowledge available locally.

	(1)
Dep.Var.: Product or Process Innovation	2SLS
Inventors' Inflows	0.117**
	(0.0578)
R&D	0.304***
	(0.0195)
Employment with degree	0.0004
	(0.0058)
Sme	-0.0334*
	(0.0202)
National mkt	0.0484**
	(0.0246)
European mkt	0.0319
	(0.0243)
International mkt	0.0409*
	(0.0239)
Constant	0.0157
	(0.233)
Sectoral Dummy	YES
Time Dummy	YES
TTWA Dummy	YES
Observations	3,293
R-squared	0.226

Need to test for potential heterogeneous effects due to differences in firms' attitude towards external sources of knowledge

Once the sample is restricted to firms that "make relevant use of external sources of information" the regressor of interest is significant at 5% level.

(Very) Preliminary conclusions

When looking at the full sample of British firms, inventors' mobility is NOT a significant determinant of firm' innovative performance

HOWEVER

a relevant impact emerges when taking into account firms' knowledge acquisition strategies by restricting the sample to firms oriented towards the exploitation of external sources of knowledge

1. The availability of new knowledge/skills at the local level is not valuable per se **but** only when firms' internal capabilities are fully accounted for;
2. The effect on 'outward' oriented firms is strong: significance levels suffer from **attenuation bias** (lower bound estimate) due to the features of patent data;

Preliminary conclusions (2)

1. Innovation policies targeting mobility of high-skilled individuals should be embedded into **balanced strategies targeting** firms at the same time;
2. The key message is that when looking at mobility we need to move away from a simple spatial approach (mobility is good per se) and develop fully place-based policies able to take into account people and firms at the same time;
3. A diagnostic approach to the identification of the knowledge-search strategies of local firms is crucial for the maximisation of the impact of mobility-focused policies

Acknowledgment

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http://www.gredeg.cnrs.fr/projets/pick-me/index.html

Work in progress: comments warmly welcome!

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