Migration and Innovation Diffusion: A Thematic Survey

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CONTEXT & MOTIVATION

• WHY MIGRATION?
  - New Age of Mass Migration
  - Europe at the Forefront

• WHY INNOVATION?

• WHY ME?
WHY MIGRATION? /1

• THE NEW AGE OF MASS MIGRATION

* includes Mexico ; ** includes USSR until 1990a // NB Different sources for 1965-1990a and 1990b-2010
Source: adapted from table 2 in Ferrie and Hatton (2013) & table 10.1 in Hatton and Williamson (2005)
The period from 1820 to the First World War saw the **rise of mass migration**; over this hundred-year period 55 million Europeans emigrated to North America, South America and Australasia. (Ferrie and Hatton, 2013; p.4)
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• WHY INNOVATION?
  • Highly Skilled Migration, incl. Scientists & Engineers
  • Europe again!

• WHY ME?
WHY INNOVATION? /3

- HIGHLY SKILLED (EDUCATED) MIGRATION

Characteristics of migrants aged 15 years old and over in OECD countries, by region of origin (2000/01-2010/11)

Note: Highly educated migrants are defined as persons who have completed tertiary education. Recent migrants are those who have been in the destination country for five years or less.
Map 2. Emigration rates of the highly-skilled to the OECD, 2010/11 (percentages)

- EUROPE AND HIGHLY SKILLED MIGRATION

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  - Europe again!

• WHY ME?
• **MIGRATION & LOCATIONAL ADVANTAGE** (Niebuhr, 2010; Ozgen et al., 2013; Bellini et al., 2013; Tom Kemeny’s recent papers and presentation here)

• **MIGRATION & THE MARKET FOR SCIENTISTS & ENGINEERS**
  - Immigrants’ self-selection (Stephan and Levin, 2001; Hunt, 2009 & 2013; No and Walsh, 2010; Matthias Dorner’s presentation here)
  - Displacement of natives (Borjas 2004 & 2009)

• **BRAIN DRAIN VS BRAIN GAIN** (Mountford, 1997; Beine et al., 2008; Docquier and Rapoport, 2012)

• **MIGRATION AND DIFFUSION OF INNOVATION INPUTS** (TRADE SECRETS, PRIVATE INFORMATION, SKILLS….)
MIGRATION AND DIFFUSION: OVERVIEW

3 MAIN THEMES

1. MOBILITY vs MIGRATION
2. DIRECTION of diffusion flows
3. CONTENTS of diffusion flows

3 STRANDS OF LITERATURE

1. History: religious minorities and diffusion of innovation in modern Europe
2. Geography: spatial limits of knowledge diffusion
3. International trade: ethnic minorities and bilateral trade or FDIs
A CLASSIC TOPIC IN ECONOMIC HISTORY  (Cipolla, 1972; Hilaire-Pérez, 2008)

→ RELATIVE IMPORTANCE OF 2 DIFFUSION CHANNELS IN MODERN EUROPE:

1. The international mobility of individual craftsmen, in response to specific incentives for importing foreign trade secrets and best practices  (Belfanti, 2004)

2. The massive migration of protestant minorities, incl. 200k French Huguenots just before/after the revocation of the Edict of Nantes in 1685 (Hornung, 2014; Luu, 2005)
Highly skilled refugees, ultimately very successful

The great Prince-elector of Brandenburg-Prussia welcomes arriving Huguenots after the edict of Potsdam, 1685 (Johannes Boese, 1885 - Französischer Dom, Berlin)
1. Individual mobility and isolation:
   - Lack of skilled and/or receptive workforce at destination
   - No availability of high quality inputs (silk industry, glassmaking…)

2. The Protestant migrants’ advantage:
   - Joint migration of masters & workforce
   - International network for input provision (and distribution)
3 PERSPECTIVES ON MINORITIES’ MIGRATION IN MODERN EUROPE (Luu, 2005)

1. Transfer-centred: Migrants arrive along with home-grown skills → pass them on to local workers: homophily & cliquishness as obstacles to diffusion

2. Revisionist: Episode-debugging → “reverse causality”

3. Community-centred (diaspora-centred):
   3a. Learning at destination
   3b. Cross-destination learning
   → homophily & cliquishness as conducive to diffusion
Historical studies:
- Classic
- Cliometric: natural experiments & IV

- Sociology of minorities
- Geography: spatial limits of knowledge diffusion
- Social networks in S&T

**Direction of Diffusion Flows**

<table>
<thead>
<tr>
<th>Origin-to-destination</th>
<th>At destination</th>
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<tbody>
<tr>
<td>Cross-destination (international)</td>
<td>Destination-to-origin</td>
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</table>

International trade

International knowledge diffusion, Migrants and FDIs
Historical studies:
• Classic
• Cliometric: natural experiments & IV

« Shock » migration of scientists & inventors:
• Jewish chemists escaping Nazi Germany (Moser et al., 2014)
• Russian scientists leaving former USSR (Borjas and Doran, 2012 & 2015, Ganguli 2015)
Ganguli (2015): differential impact of migrant Russian scientists by city of destination, within the US.

1. The city-field inflow of Russian scientists affects positively the nr of post-1990 citations to pre-1990 publications by USSR authors (IV: % of city residents of Russian origin).

2. Diff-in-diff on matched sample of pre-1990 publications by migrant vs non-migrant USSR authors → citations to migrants’ publications increase after migration (self-citations are excluded)

Limitation: What benefits for recipient cities? And the overall US scientific system?
Borjas and Doran (2012, 2015) on Russian mathematicians: sceptical view (displacement of natives)

1. increased competition for scarce resources and attention

2. positive externalities (knowledge spillovers).

Test on “cognitive mobility”: probability for papers at t=1 and t>1 (by same native author) to occur in different fields

- higher in fields affected by Russian immigrants, after the migration shock
- BUT NOT for most productive natives: do top scientists stand to benefit from migration, at the expenses of the others? [Associated loss of publications by young natives]
Borjas and Doran (2012, 2015) (cont.)

Limitation: study does not capture entirely the diffusion effects of immigration

1) industry (techn transfer)

2) human capital formation (teaching)

3) do displaced native scientists improve total welfare by moving into fields in which they hold a comparative advantage?
Ethnic networks of scientists & engineers in the US

- Patent (citation)-based analysis of knowledge flows (Agrawal et al., 2008; Breschi et al., 2015)
- Homophily and co-authorship (Almeida et al., 2015; Freeman & Huang, 2015)

At destination

- Sociology of minorities
- Geography: spatial limits of knowledge diffusion
- Social networks in S&T
Breschi et al. (2015): JTH-adapted test on the “diaspora effect” (or “citation homophily”)

\[ \text{Prob}(y = 1) = f(\text{co} - \text{ethnicity, spatial distance, social distance}) \]

- **Ethnic inventors’ cited patents**
- **Citing patents from within the US (“local” sample)**
- **Control patents** (same year & IPC group)

Inventors in the patent pair from the same CoO

Co-location at city and state level + linear distance

Min geodesic distance between patents in the pair, as measured on the inventor network

**NB:** company self – citation dropped
DIRECTION OF DIFFUSION FLOWS

Citation probability: marginal effect of social distance & co-ethnicity

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<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>&gt;3</th>
<th>no connect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-ethnic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non co-ethnic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph showing the citation probability across different social distance categories for Co-ethnic and Non co-ethnic groups.
% increase of citation probability if inventors both reside in the US and are from...

- China
- France
- Germany
- India
- Italy
- Japan
- R. of Korea
- Russia
Is homophily a “cognitive trap”?

Freeman and Huang (2015): 2.5M 1985-2007 WoS publications by US-residents → homophily score (based upon Melissa 9 ethnic groups)

✓ significantly different from benchmark value (random distribution of ethnicities, conditional on numerosity)

✓ inverse correlation with academic prestige of 1st-2nd authors and with citation impact

→ ethnic bias in collaboration is a sign of weakness

→ is it a peculiarity of migrant/foreign-origin inventors? (limitations of Melissa)

→ causality link?
Reverse knowledge flows

- Patent (citation)-based analysis of knowledge flows (Kerr, 2008; Agrawal, 2011; Breschi et al., 2015)

- Collaboration (inventors and authors) (Baruffaldi and Landoni, 2012; Scellato et al., 2015; Miguelez, 2014; Branstetter et al., 2015; Kerr & Kerr, 2016)


- Migrants as FDI brokers (Kugler and Rapoport, 2007; Foley and Kerr, 2013; Hernandez, 2014; Useche et al., 2016)
Citation-based analysis of knowledge flows (Breschi et al., 2015)

\[
\text{Prob}(y = 1) = f(\text{home country}|co - \text{ethnicity}, \text{same company}, \text{social dist.})
\]

- Inventors in citing (control) patent reside in the cited inventor’s CoO
- Inventors in the patent pair from the same CoO
- The patents in the pair belong to the same company or business group
- Min geodesic distance ...

Citing patents from outside the US ("international" sample)

Control patents (same year & IPC group)

Ethnic inventors’ cited patents
% increase of citation probability if one inventor resides in the US and the other in..

Signif. >0 for companies’ self-citations (MNE?)
Collaboration / Miguelez (2014)

- Observations are South-North “corridors”, 1990-2010
- Quasi-likelihood “log-gravity model”:
  \[
  \text{Co-inventorship}_{\text{South-North}} = f(\text{Stock of migrant inventors}_{\text{South} \to \text{North}}; \text{Controls})
  \]
- \(\Delta 10\% \text{ migration} \rightarrow \Delta 2.0\% \text{ co-inventorship}\)
Collaboration / FDIs

- Foley and Kerr (2013): $\Delta^+ \%$ of a US MNE's inventions performed by “ethnic” inventors (name analysis)
  - $\Delta^+ \%$ of same MNE's inventions performed in inventors’ origin countries.
  - $\Delta^+ \%$ of FDIs without the support of local joint venture partners

- Hernandez (2014): first subsidiaries in US states, as a f. of migration from FDI’s origin country [300 firms X 49 states]
  Migrants’ concentration in a US State →
  1. Higher presence of subsidiaries of companies from the migrants’ origin country [stronger effect in hi-tech vs low-tech]
  2. Higher probability of subsidiaries’ survival [mediated by mother company’ experience in the host country]
International trade & FDIs

- Diasporas and trade flows (Rauch, 2001; Rauch and Trindade, 2002; Parsons and Vezina, 2014)
Diasporas and trade flows:

- **Bilateral (source-destination):** Parsons’ and Vézina’s (2014) « boat people » experiment → US-Vietnam

- **Multilateral (international diaspora):** Rauch’s and Trindade’s (2002) classic on Chinese minorities in country i and j → i-j trade flows (gravity model)

Diasporas and knowledge flows? More from Breschi et al. (2015)

- **Home-based/Total home**
- **Home-based/Home+abroad**

![Bar chart showing the distribution of patent pairs by country and type of home.](chart.png)
Probability of citation from outside the US, as a function of inventors’ country of Residence (Home country) and Origin (Co-ethnicity) -- OLS

<table>
<thead>
<tr>
<th>HOME COUNTRY</th>
<th>CO-ETHNICITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>0.0398***</td>
</tr>
<tr>
<td></td>
<td>0.0396***</td>
</tr>
<tr>
<td>Germany</td>
<td>-0.00108</td>
</tr>
<tr>
<td></td>
<td>0.000900</td>
</tr>
<tr>
<td>France</td>
<td>0.00761</td>
</tr>
<tr>
<td></td>
<td>0.0276***</td>
</tr>
<tr>
<td>India</td>
<td>0.00798</td>
</tr>
<tr>
<td></td>
<td>0.0284***</td>
</tr>
<tr>
<td>Italy</td>
<td>-0.0162</td>
</tr>
<tr>
<td></td>
<td>-0.00741</td>
</tr>
<tr>
<td>Japan</td>
<td>0.00118</td>
</tr>
<tr>
<td></td>
<td>0.00470</td>
</tr>
<tr>
<td>Korea</td>
<td>0.0992***</td>
</tr>
<tr>
<td></td>
<td>0.0976***</td>
</tr>
<tr>
<td>Russia</td>
<td>0.135***</td>
</tr>
<tr>
<td></td>
<td>0.119***</td>
</tr>
</tbody>
</table>
1. A classic topic & a clear distinction in geography of innovation (Sorenson, Klepper)

2. Limited evidence on knowledge flows
   - Unclear evidence on patent citations
   - Some association between homophily and low quality of patents and papers

3. More convincing evidence on managerial role of returnees (Choudhury, 2015)

4. Strong evidence on homophily and success in low-tech industries (Kerr and Mandorff, 2015)
✓ Susana:
  • lack of context → **Migration is the context** of mobility
  • interaction globalization-local as key issue → Migration is an unescapable **result of globalisation**

✓ Pierre-Alexandre: innovation is very unequally distributed →
  • Migration is the most important consequence of **inequality**
  • … and a **remedy** to it (?!)

✓ Mobility or migration?
  • A substantive issue
  • A political issue (Whatever word we use, we take sides)
Topics
1. Contents of diffusion flows: we need to know more about it
2. Homophily and research/invention quality
3. Diaspora effect at the international level
4. Do only superstars matter?

Data
1. Open access to name analysis information (on the model of the WIPO-PCT database) PLUS disambiguation
2. Name analysis of scientists, inventors and other innovation-relevant professional categories
3. Survey of foreign-named scientists and inventors
"... divers aliens come from beyond the seas and work in London, few or none having served for the trade of weaving, neither have they any certificate of what religion they are or of their learning the said trade or of their good behaviour, or of their honest departure out of their country..."  (Complaint by 1400 members of the Weavers Company against Dutchmen, London, 1635)

“... one third of Syrian refugees are fake...”  (T.de Maizière; it turned out that they are no more than 8%)
REFERENCES


Freeman, R.B., Huang, W., 2015. Collaborating With People Like Me: Ethnic co-authorship within the US. Journal of Labor Economics, 33(S1 (Special Issue: US High-Skilled Immigration in the Global Economy)), S289-S318.


REFERENCES (cont.)


→ Back-up slides
WHY MIGRATION? /3

• EUROPE AS A REGION OF ORIGIN

Number of migrants aged 15 and over in OECD countries, by region of origin (2000/01-2010/11)

Chart 9: Immigrant and emigrant populations aged 15 and over with tertiary education in OECD countries, 2005/06 and 2000

Note: Excluding persons with unknown education.
Source: DIOC 2005/06
Share of Immigrant Inventors, 1990-2010

Source: Miguelez & Fink, 2013
WHY MIGRATION?