A large scale comparison of the position of countries in international collaboration and mobility according to their scientific capacities

Zaida Chinchilla-Rodríguez, Lili Miao, Dakota Murray, Nicolás Robinson-García, Rodrigo Costas and Cassidy R. Sugimoto

STI 2017, 6-8 September, Paris, France
Research Agenda

What is the Relationship between collaboration and mobility?

How does this relate to a nation’s scientific and economic capacity?
Dimensions of Connectivity

Mobility…serves to both strengthen the scientific capacity of the countries and benefit the scientific careers of individual researchers (OECD 2008)
Dimensions of Connectivity

**International collaboration** plays an important role in fostering high-quality knowledge production (Royal Society 2011)

Mobility…serves to both strengthen the scientific capacity of the countries and **benefit the scientific careers of individual researchers** (OECD 2008)
Dimensions of Connectivity

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Mobility...serves to both strengthen the scientific capacity of the countries and benefit the scientific careers of individual researchers (OECD 2008)

...mobility has been advocated as key to increasing the efficiency and effectiveness of research (Van Noorden, 2012: Scellato et al. 2015)
Many Institutions Believe

International partnerships are important

Such partnerships improve science
International Partnership

• Traditionally, large-scale analyses have examined only *collaboration or mobility*
Well-studied “elite” countries
Understudied Periphery
Moving away from the elite

- To understand the global system of science, we must move away from the “elite” and towards a new comprehensive analysis of international scientific partnership
Our Goal

Introduce new indicators and approaches
Our Goal

Introduce new indicators and approaches

Demonstrate how they can help to understand global system of science
ESTABLISH A TERMINOLOGY
International Partnerships

Collaboration

Co-Affiliation

Migration
Collaboration
Example: this paper!
Other forms of mobility
International co-affiliation

Holding more than one affiliation in two countries during a period of study
Linked by co-affiliation
International Migration

More permanent movements between affiliations in 2 or more countries
Linked by migration
Scientific Mobility

both co-affiliation and migration
For a more thorough treatment

- **Careers & Mobility (2)**

- **Thursday 7 Sept. 11:30 – 13:00 – Session 222 – Room 2**

- **Unveiling the multiple faces of mobility: Towards a taxonomy of scientific mobility types based on bibliometric data**

COUNTRY-LEVEL CLASSIFICATIONS
Scientific capacity of nations

- **Scientific Capacity** is the ability to use specialized knowledge and exploit it to conduct research, (Wagner et al 2001).

- Investment, infrastructure, and output
Income level

(World Bank, 2016)
Research Questions

• What is the relationship between the international mobility and collaboration of a country?

• What is the relationship between the number of collaborative and mobility links between countries?

• To what extent do these relationships vary by the scientific and economic capacity of the country?
DATA
Web of Science

2008 – 2015
Web of Science

2008 – 2015

First publication in 2008 – 2015
Web of Science

2008 – 2015

First publication in 2008 – 2015
Disambiguation

Caron and van Eck (2014)

John Smith
Disambiguation

Caron and van Eck (2014)

WoS includes emails during starting 2008
Final Dataset

3,251,797
Final Dataset

3,251,797  14,097,939

STI Conference 2017
Final Dataset

3,251,797

14,097,939

213 Countries
METHODS AND RESULTS

Lili Miao
Total number of publications
Number of international publications

+1  +3
Total number of active researchers
Number of mobile researchers

STI Conference 2017
Percentage of international collaboration

#international pubs
#all pubs
Percentage of mobile researchers linked to other counties
Number of countries linked in collaboration
Number of countries linked in mobility

STI Conference 2017
Results (I)

An overview of collaboration and mobility patterns
Size matters. Strong size-dependence relationship

Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, (c) more prolific countries and (d) less prolific countries
Size matters. Strong size-dependence relationship

Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, (c) more prolific countries and (d) less prolific countries.
Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, and (b) number of countries with which a country has established mobility links by the number of countries with which that country has collaboration co-authored publications.
Scientific relationships are highly resource-dependent

The smaller the country, the more dependence on connectivity

<table>
<thead>
<tr>
<th>S&amp;T capacity index groups</th>
<th>% international collaboration</th>
<th>% authors in mobility</th>
</tr>
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<tr>
<td>Advanced</td>
<td>51.40</td>
<td>16.65</td>
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<tr>
<td>Proficient</td>
<td>49.94</td>
<td>13.68</td>
</tr>
<tr>
<td>Developing</td>
<td>61.89</td>
<td>19.81</td>
</tr>
<tr>
<td>Lagging</td>
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<td>69.18</td>
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Mean average of mobile authors and international publications by group.
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Mean average of mobile authors and international publications by group.
The number of countries with mobility is fewer than collaborative partners.

Mobile researchers in advanced countries reach 68% of collaborative partners, whereas in lagging countries, they hardly reach 29%.

Mean average of countries with mobile authors and international publications by group.
Partnerships, preferences, or possibilities?

Distributions of mobility and international collaboration by group.
Results (II)

Group-specific analysis according to their scientific and technological capacities
Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically advanced countries

**Legend:** The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)
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Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically developing countries

Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)
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Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically lagging countries

Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)
Dakota Murray

SUMMARY
Introduced indicators
Collaboration related to mobility

213 countries

$y = 1.3221 x^{0.554}$

$R^2 = 0.1339$
But not the same
Partnership preferences

### MOBILITY

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<th>Total</th>
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<tr>
<td>Advanced</td>
<td>65.32</td>
<td>75.19</td>
<td>64.33</td>
<td>63.04</td>
<td>59.86</td>
<td>67.00</td>
</tr>
<tr>
<td>Proficient</td>
<td>22.01</td>
<td>14.58</td>
<td>17.74</td>
<td>12.86</td>
<td>13.21</td>
<td>19.61</td>
</tr>
<tr>
<td>Developing</td>
<td>5.54</td>
<td>5.22</td>
<td>6.36</td>
<td>9.13</td>
<td>6.13</td>
<td>5.77</td>
</tr>
<tr>
<td>Lagging</td>
<td>6.29</td>
<td>4.38</td>
<td>10.57</td>
<td>13.32</td>
<td>11.75</td>
<td>6.68</td>
</tr>
<tr>
<td>Others</td>
<td>0.84</td>
<td>0.63</td>
<td>0.99</td>
<td>1.66</td>
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### COLLABORATION

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<td>4.39</td>
<td>4.85</td>
<td>9.71</td>
<td>16.73</td>
<td>9.33</td>
<td>5.59</td>
</tr>
<tr>
<td>Others</td>
<td>0.96</td>
<td>1.72</td>
<td>2.31</td>
<td>2.22</td>
<td>3.94</td>
<td>1.33</td>
</tr>
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Heterogeneity of the “global brain”
IMPLICATIONS
Not all partnerships are equal
Deviance from assumptions
Heterogeneity
Many perspectives needed
Revisiting classifications
LIMITATIONS AND FUTURE WORK
Heterogeneity

• Preliminary, large-scale analysis

• No consideration of disciplinary context

• Size-dependent indicators
Causality

- Mobility ≠ Collaboration, but they are related
- Does mobility cause collaboration, or vice versa?
- Are the people who are mobile the same people who are collaborating?
Future Approaches
Future Approaches

Network analysis
Future Approaches

Network analysis

Time dimension
Future Approaches

Network analysis

Time dimension

Diverse Indicators
Future Approaches

Network analysis

Time dimension

Diverse Indicators

Mobility Flows
Future Approaches

Network analysis

Time dimension

Diverse Indicators

Mobility Flows

Size-independent indicators
  • Affinity Indices
Acknowledgements

• Zaida Chinchilla-Rodríguez, Nicolás Robinson-García, Rodrigo Costas and Cassidy R. Sugimoto

• CWTS for insights and data

• STI 2017 Paris
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*Thanks for your attention!*  
*Questions?*

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