ANALYSIS OF ‘KNOWLEDGE TRIANGLE’ USING NATIONAL-LEVEL UNIVERSITY DATA

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Rationale

Develop new **country-level indicators** of role of higher education institutions in research, innovation and education => core theme of the Knowledge Triangle project

Forerunner to further granular econometric analysis => What associations hold at a national level and warrant further investigation at the micro-level?
Project Overview and Steps

Empirical evidence supporting the TIP/CSTP Knowledge Triangle project, specifically supporting the case studies

Steps foreseen for this activity until December

1. Characterise the distribution of education, research and innovation performance across institutions (December TIP document)
2. Obtain country indicators and associate them with education, industry and innovation performance (today’s presentation)
3. Econometric analysis of HEI characteristics and impacts (for December TIP)
Develop national-level data source for European countries from ETER database

<table>
<thead>
<tr>
<th>University</th>
<th>Country</th>
<th>v1</th>
<th>v2</th>
<th>v3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universität Linz</td>
<td>Austria</td>
<td>97</td>
<td>51</td>
<td>56</td>
</tr>
<tr>
<td>Universität Wien</td>
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<td>74</td>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>Fachhochschule Kärnten</td>
<td>Austria</td>
<td>35</td>
<td>85</td>
<td>94</td>
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<tr>
<td>Vrije Universiteit Brussel</td>
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<td>72</td>
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<td>Universiteit Gent</td>
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<td>32</td>
<td>85</td>
<td>72</td>
</tr>
<tr>
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<td>79</td>
<td>85</td>
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<tr>
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<td>Denmark</td>
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<tr>
<td>Aarhus Universitet</td>
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<td>36</td>
<td>93</td>
<td>46</td>
</tr>
</tbody>
</table>

Number of universities

<table>
<thead>
<tr>
<th>Country</th>
<th>v1</th>
<th>mean(v2)</th>
<th>mean(v3)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1</td>
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<tr>
<td>Belgium</td>
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<td>Czech Republic</td>
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<td>56</td>
<td>75</td>
</tr>
<tr>
<td>Denmark</td>
<td>0</td>
<td>59</td>
<td>75</td>
</tr>
</tbody>
</table>

...
Indicators (examples)

**ETER-derived**
- Total number of students
- Number/proportion students in STEM
- Leiden-ranked universities
- Average students per university
- Share of enrolment among largest HEIs
- Fraction of HEIs that are universities vs. universities of applied sciences, public v. private etc.

**OECD STI and EDU indicators**
- % HERD financed by industry
- Total and top-cited SCOPUS publications
- Average problem-solving skills of tertiary graduates (PIAAC)
- Earnings premium of tertiary graduates

**Other contextual**
- GDP
- Population
- % national value-added from manufacturing

Additional combined indicators
3 Questions for Exploration

1. How are national HEI characteristics associated with HERD financed by industry?
2. How is the HEI structure related to education, research and innovation performance?
3. Are education outcomes related to research and innovation activities?
1. HOW ARE NATIONAL HEI CHARACTERISTICS ASSOCIATED WITH HERD FINANCED BY INDUSTRY?
Average size and industry-financed HERD? (1)
Average size and industry-financed HERD? (2)
STEM education and HERD

Proportion of students studying STEM subjects vs. % of HERD financed by business enterprise.
2. HOW IS THE HEI STRUCTURE RELATED TO EDUCATION, RESEARCH AND INNOVATION PERFORMANCE?
Potential negative association between fraction of privately-educated students and top-cited publications

Percentage of top-cited publications 2003-2012

Proportion of total students enrolled in private institutions
Potential positive association between fraction of private institutions and graduate premium

![Graph showing the relationship between the fraction of private institutions and graduate premium. The x-axis represents the fraction of institutions that are private, ranging from 0 to 0.8. The y-axis represents the ratio of earnings for tertiary (type A) over secondary (ages 25-34, M+F), ranging from 1 to 1.8. Points are scattered across the graph for different countries, such as AT, CZ, EE, FR, DE, IT, NL, NO, PL, PT, SK, ES, CH, and UK.]}
Role of universities of applied sciences?

![Graph showing the fraction of institutions that are universities of applied sciences from 2003 to 2012 for various countries.](image)

Percentage of top-cited publications 2003-2012

- CH
- AT
- BE
- DK
- EE
- FI
- DE
- GR
- HU
- IE
- NL
- NO
- PL
- PT
- SK
- CH

5 10 15 20
3. ARE EDUCATION OUTCOMES RELATED TO RESEARCH AND INNOVATION ACTIVITIES?
Not a strong association between business funding of HERD and education outcomes
Research quality & research universities are not related to education outcomes either.
The conclusions are only suggestive at this point but raise interesting question regarding diverse university systems’ impacts on innovation.

Further work will follow up with more thorough econometric analysis to isolate how distinct characteristics affect outcomes in different regional contexts.