*Research Evaluation*, 19(2), June 2010, pages 119–128
DOI: 10.3152/095820210X510115; http://www.ingentaconnect.com/content/beech/rev

# Inclining the columns to make the temple look straight: a first glance at monetary indicators on university–industry cooperation

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The analysis of university–industry cooperation (UIC) rarely considers the geographic implications of its promotion. We hypothesise that UIC may lead to a cumulative advantage of already good performers. The 6th EU R&D Framework Programme is a useful source to verify this hypothesis because of its *a priori* neutrality regarding UIC. Using original data on the funding allotted per participant, we build national indicators of the value of FP6-sponsored UIC across the EU27. The results confirm that richer countries involved in UIC get more funds than poorer countries. We discuss the role of policy in light of the apparent entry barriers in UIC.

THIS ARTICLE TRIES to shed further light on two research questions at the intersection of cumulative advantage and asymmetries in access to public R&D funding:

- Do richer countries involved in university–industry cooperation (UIC) get more funds from the European Union (EU) than poorer countries involved in UIC?
- Do EU-funded UIC agreements get more funds than other kinds of agreement?

To address these questions, we use data from the 6th EU R&D Framework Programme (FP). The FPs are a well-known source of data for inter-country comparisons of UIC (Geuna, 1998; Caloghirou *et al*, 2001) and the presence of geographical disparities and cumulative effects across EU member states (Luukkonen, 2001) — although sometimes with the opposite finding, that is, a higher involvement of smaller member states (Capron and Cincera, 2007). While information about funding flows is not public, our institute, the Institute for Prospective Technological Studies, has access to funding data which, compared to other studies using FP data, has the advantage of showing not only the number of participations and the project's overall budget but also the amount of money allotted to each participant. The relevance of money per participant is that it allows for the construction of indicators about the value of the participations.

There are good reasons to engage in this type of research. Improving links between universities and firms is among the key societal needs and policy targets, so the measurement of the phenomenon has raised considerable attention. Both actors have incentives to engage in cooperation.

For instance, firms may be interested in cooperation with universities because of the economic benefits of publicly funded research: increasing the stock of knowledge, training skilled graduates, creating

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For acknowledgements see page 127.

 0958-2029/10/02119-10 US$12.00  

new instrumentation and methodologies, forming networks and stimulating social interaction, creating new capacity for scientific and technological problem-solving, creating new firms and providing social knowledge (Martin and Tang, 2007).[1] Cooperation increases firms' organisational learning capability, and thus their innovation performance (Alegre and Chiva, 2008).

Universities may be interested in cooperation with firms, among other reasons, to get access to public funding. Actually, policy-making in OECD countries has considerable reliance on UIC as a motor of regional clustering and innovation (Harding, 2007).

Critiques have always accompanied the promotion and rise of UIC in the sense that:

> an excessive emphasis on the mission of the university to satisfy immediate societal needs may compromise other missions, notably the fundamental knowledge production function that underpins future innovation and economic development. (Romero, 2008)

However, case studies suggest that high-quality scientific production is reinforced by UIC (Van Looy *et al*, 2004; Lebeau *et al*, 2008), at least with high-quality UIC and up to a threshold — when the funds obtained through these activities do not exceed 15% of the researcher's total budget (Manjarrés-Henríquez *et al*, 2008). Symmetrically, low-level UIC may lead to unimportant scientific activities up to the point of deteriorating already poor research systems (Vega-Jurado *et al*, 2007). This allows postulating the existence of a Matthew effect in UIC (Van Looy *et al*, 2004), which makes sense because UIC is led by scientific prestige, even more than by monetary rewards (Azagra-Caro *et al*, 2008). This can be the case in Europe, where the tradition of academic entrepreneurs has been linked to career development, more than in USA, where the role of strengthening intellectual property rights and spin-off has been more relevant (Franzoni and Lissoni, 2007).

In addition to theses interdependencies between scientific prestige and UIC, there are various specific reasons to think that UIC is subject to cumulative advantage. First, there is a learning process that facilitates those faculty members who started UIC to repeat the experience and finally concentrate most of the collaborations (Hoye and Pries, 2009). Second, scientific productivity appears to go hand-in-hand with patented industrial applications by university researchers (Meyer, 2006; Wong and Singh, 2009). Third, excellent universities in regions with low absorptive capacity may cooperate with firms from other territories (Azagra-Caro *et al*, 2006) in the search for advanced technological standards (Azagra-Caro, 2007). In these other regions with higher absorptive capacity, proximity may be enough for cooperation among local actors (Castro *et al*, 2008), so firms will benefit from universities within and outside the region, reinforcing their previously winning position. This may be true even at national level, since UIC is an international activity, requiring resources that can compete at that level (Geoghegan and Pontikakis, 2008), which poorer countries may not have.

Verifying the existence of cumulative advantage in the case of UIC at national level is an open question. There is of course a problem of measurement because of lack of data and standardised indicators. Existing studies on university–industry links tend to rely on non-monetary indicators, such as citations to public research found in firm research papers (Tijssen and Van Leeuwen, 2006) or university–industry co-authorship of papers (Tijssen *et al* 2009), and in *ad hoc* groups of countries.

The existing literature rarely offers many elements of comparison between the funding of UIC and other modalities of research, that is, not involving UIC. It is thus difficult to understand, for instance, whether UIC is more appealing in public calls for tenders for universities and firms than other modalities of research. Hence our second research question on whether publicly funded agreements that imply UIC may get more funds than other kind of agreements. It would be remarkable, given that the reality of companies is somewhat different, as the results derived from the 4th Community Innovation Survey show: in EU27, universities are not an important cooperation partner for innovative companies, except for a few member states such as Finland, Slovenia and Sweden (Eurostat, 2007).

## Context of the research

Apart from the financial data, the use of the 6th EU R&D FP (FP6, in short) has an additional advantage for our research: its neutrality regarding UIC by design.

First, the goal of the FP6, similarly to previous FPs, is to:

> further the objective set out in Article 163(1) of the Treaty, of strengthening the scientific and technological bases of Community industry and encouraging it to become more competitive at international level, while promoting all the research activities deemed necessary by virtue of other Chapters of this Treaty. (EC, 2002a)

In short, the aim is to strengthen the competitiveness of the European economy (EC, 2002b), which does not impose any national discrimination regarding funding destined to UIC projects.

Second, hundreds of independent experts evaluate FP proposals on the basis of its scientific and technological merit (EC, 2002c) and not to any particular geographical distribution of the research actors or specific institutional sectors involved.

Of course, many of the financial instruments are addressed to collaboration among partners, and UIC

**What seems true is that there are no targeted provisions to counterbalance any possible consequences of a process of cumulative advantage in university–industry cooperation**

in particular, because EU policy-making places high value on UIC, and concretely on joint research to foster two of the principles of a well-functioning European Research Area: strengthening research institutions and knowledge-sharing (EC, 2007). What seems true is that there are no targeted provisions to counterbalance any possible consequences of a process of cumulative advantage in UIC, due to the Matthew effect and the other aforementioned specific reasons. If national disparities in UIC arise, they are likely to be related to the self-reinforcing nature of UIC rather than the context of the research.[2]

## Methodology and data

We obtained in September 2007 a comprehensive database of research activities co-financed by FP6. While in principle FP6 caters for the planning period 2002 to 2006, in practice research financed by FP6 started slightly later and extended beyond this period.[3] The database contains 8,861 distinct projects, for a total value of €15.8 billion, and a total of 69,260 participations involving universities, private firms, public or private research centres and other organisations. This is a 'live' database constructed at the Directorate-General for Research, European Commission, for internal use.

Given our focus on UIC, we narrowed down the database to a subset of projects with at least one university and one firm. Additionally, in line with the primary focus of the FP, we confined our analysis to the EU's 27 members (including Romania and Bulgaria, that properly speaking were associated countries during the time span of FP6). A field in the database included the nationality of the participant. After gaps adjustments (surprisingly minor, given the sheer size of the database) and checking inconsistencies in this field (against reported participant addresses), we were able to build national aggregates.

EU member states were involved in 88% of the projects (7,829 projects) representing 91% of the total value (€14.5 billion). The rest were associated and third countries. As expected, 88 and 91 are high percentages, because EU member states are the main target population of FP6 participants. For descriptive purposes, Table 1 offers a country breakdown.

**Table 1. Breakdown of UIC projects in the 6th EU R&D FP**

| EU member state | % of number of UIC projects over total number of UIC projects | % of value of UIC projects over total value of UIC projects |
|---|---|---|
| Austria | 3% | 4% |
| Belgium | 5% | 5% |
| Bulgaria | 1% | 0% |
| Cyprus | 0% | 0% |
| Czech Republic | 2% | 2% |
| Denmark | 2% | 2% |
| Estonia | 0% | 0% |
| Finland | 3% | 3% |
| France | 6% | 7% |
| Germany | 14% | 15% |
| Greece | 5% | 5% |
| Hungary | 2% | 2% |
| Ireland | 3% | 2% |
| Italy | 9% | 10% |
| Latvia | 1% | 1% |
| Lithuania | 0% | 0% |
| Luxembourg | 0% | 0% |
| Malta | 0% | 0% |
| Netherlands | 5% | 5% |
| Poland | 5% | 4% |
| Portugal | 2% | 2% |
| Romania | 1% | 0% |
| Slovakia | 1% | 0% |
| Slovenia | 1% | 1% |
| Spain | 7% | 7% |
| Sweden | 7% | 8% |
| United Kingdom | 15% | 15% |
| Total | 100% | 100% |

Highest shares of participation in terms of number of UIC projects and budgets correspond logically and largely to largest countries.

For member states, one third of the total number of projects (i.e. 2,400 projects) involved at least one university and one firm as participants. The value of projects involving UIC was €9.5 billion. The average value per UIC project was nearly €4 million in EU25, but with variations among countries ranging from €1.2 million for Romania to €4.76 million for Germany.

In order to build indicators of the value of UIC across the EU, we constructed two very simple measures:

$$\text{Share of number of projects with } UIC_i = \frac{\text{Number of projects with } UIC_i}{\text{Total number of projects}_i} \quad (1)$$

$$\text{Share of number of projects with } UIC_i = \frac{\text{Value of projects with } UIC_i}{\text{Total value of projects}_i} \quad (2)$$

where *i* represents a given EU member state. The time period is the sum of years 2003 to 2007. First, we will compare indicator 1 against indicator 2, which should be logically correlated. Then, since they express the involvement of EU member states in UIC through the FP but not the absolute value of the FP projects, we also calculated:

$$\text{Average value of projects with UIC}_i = \frac{\text{Value of projects with UIC}_i}{\text{Number of projects with UIC}_i} \quad (3)$$

This is the indicator used to capture the ability of fund-raising from FP in a given country. We examine the possible association between this indicator and national wealth (*per capita* GDP). GDP data were downloaded in July 2008 from Eurostat's online public database, expressed in purchasing power standards (PPS) at market prices, taking the average of years 2003 to 2007 as a reference.

We will correlate indicator 3 with *per capita* GDP. A positive correlation would suggest that richer countries get projects of higher average funding than poorer countries. Of course, a more fine-tuned analysis would also look for correlations with (gross, business and higher education) expenditures on R&D, but since R&D is positively associated with wealth too (Lederman and Maloney, 2003), the analysis of *per capita* GDP suffices to illustrate a first approach to the cumulative advantage of UIC. R&D variables, as discussed in the Conclusions, would be indispensable for a causal analysis beyond the scope of this research.

However, one reason for a positive correlation between indicator 3 with *per capita* GDP could be the different national cost levels (researcher wages, price of capital goods, etc.) Ideally, we should then control for these costs. Although we do not have such a cost variable, we can use something as good. First, we calculate the following indicator of the value of projects that do not involve UIC:

$$\text{Average value of projects without UIC}_i = \frac{\text{Value of projects without UIC}_i}{\text{Number of projects without UIC}_i} \quad (4)$$

Then, by dividing indicator 3 into indicator 4, we obtain a ratio that expresses the preference of projects with UIC over projects without UIC:

$$\text{Value of UIC projects relative to non-UIC projects}_i = \frac{\dfrac{\text{Value of projects with UIC}_i}{\text{Number of projects with UIC}_i}}{\dfrac{\text{Value of projects without UIC}_i}{\text{Number of projects without UIC}_i}} \quad (5)$$

A value equal to one for this ratio means that a country is raising the same funds for projects that involve UIC and other projects. If higher (lower) than one, the country will be getting more (less) funds out of UIC projects than of other projects.

Looking at this ratio, we reduce differences in national cost levels somewhat. Then, by correlating this ratio with *per capita* GDP, we exert a kind of control of the simpler relation that could be found with indicator 3.

We will call indicator 5 our *crown indicator*. In a second step, we will break the aggregate data for this indicator into the different components of the 6th EU R&D FP: specific programmes, thematic priorities and instruments. Thus we will identify more homogenous measures of the indicator and verify the robustness of the aggregate results.

## Results

### *A two-speed UIC pattern in the EU*

As can be seen in Figure 1, countries getting the lion's share of UIC projects in terms of numbers and value are member states with higher *per capita*

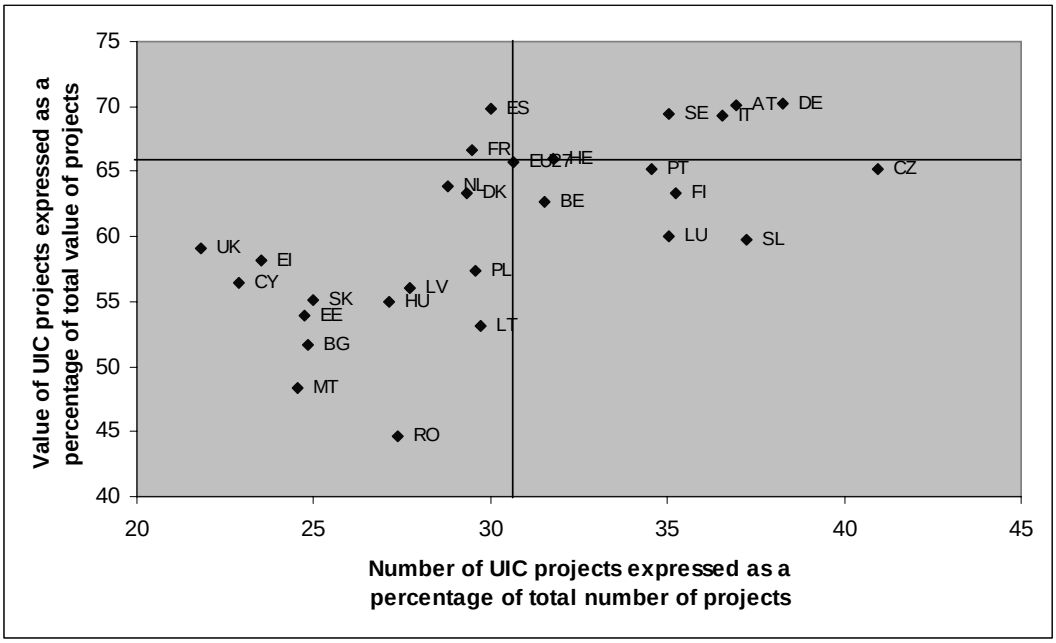


**Figure 1. Involvement of EU member states in UIC in the 6th EU R&D FP**

GDP: Germany, Austria, Italy and Sweden present high percentages for both number and value of UIC; Finland, Luxembourg, Belgium, Spain and France stand out in at least one out of the two indicators. *Per capita* GDP may well be reflecting higher R&D expenditures that make the difference.

Countries with lower *per capita* GDP (Lithuania, Poland, Latvia, Romania, Hungary, Slovakia, Bulgaria, Estonia, Malta and Cyprus) tend to rank low in both the proportion of number and value of university–industry FP projects. Again, lower levels of R&D expenditure may be at stake, with the additional observation that the majority of these countries are new member states, with little experience in participating in FP projects, apart from other structural problems pertaining to the transition.[4]

Therefore, to some extent, richer countries tend to engage into higher levels of UIC. However, the pattern shows several exceptions: Richer countries such as Denmark, Netherlands, Ireland and United Kingdom do not engage in UIC as often as their EU15 counterparts, while poorer countries such as the Czech Republic, Slovenia or Portugal have a higher average number of UIC contracts than the other new member states. The average value of FP6 projects offers a partial explanation of the exceptions.

By dividing the value of FP6 projects by the number of FP6 projects, it is possible to build an indicator of the average value of FP6 projects, that is, indicator 3. It appears in the Y-axis of Figure 2. Despite being involved in low levels of UIC, projects in Denmark, Netherlands, United Kingdom and (to a lesser extent) Ireland have high average value. By contrast, despite being involved in high levels of UIC, projects in the Czech Republic, Slovenia or Portugal have low average value.

The X-axis of Figure 2 shows national *per capita* GDP. The correlation with the average value of FP6 projects is very high. This supports the idea that richer countries involved in UIC get more funds than poorer countries.

Going back to Figure 1, it is possible to notice that the percentage of UIC project value over the total value is much higher: two thirds of the FP6 funds in EU27 correspond to projects with UIC, even if UIC projects represent less than one third of the total number of projects. We will further explore this in the next section.

### *The UIC preference before other forms of research co-operation*

If we now move to a comparison between indicators 3 and 4, Figure 3 shows that, for the EU average, a UIC contract involves a funding four times bigger than other forms of collaboration.

The higher average value of projects with UIC over projects without UIC is present for every member state. It is possible to wonder whether the relation of one to another is always the same. To verify it, a good indicator is the ratio of the average value of projects with UIC over the average value of projects without UIC, that is, indicator 5. It expresses the degree of preference for the average value of projects with UIC over the average value of projects without UIC. Figure 4 shows the values for the EU and the member states and puts them in relation with *per capita* GDP.

Once again, there is a clear relationship. Although FP6 budget allocation gives unambiguous preference to UIC projects, another gap between old and new member states appears with clarity. In countries with

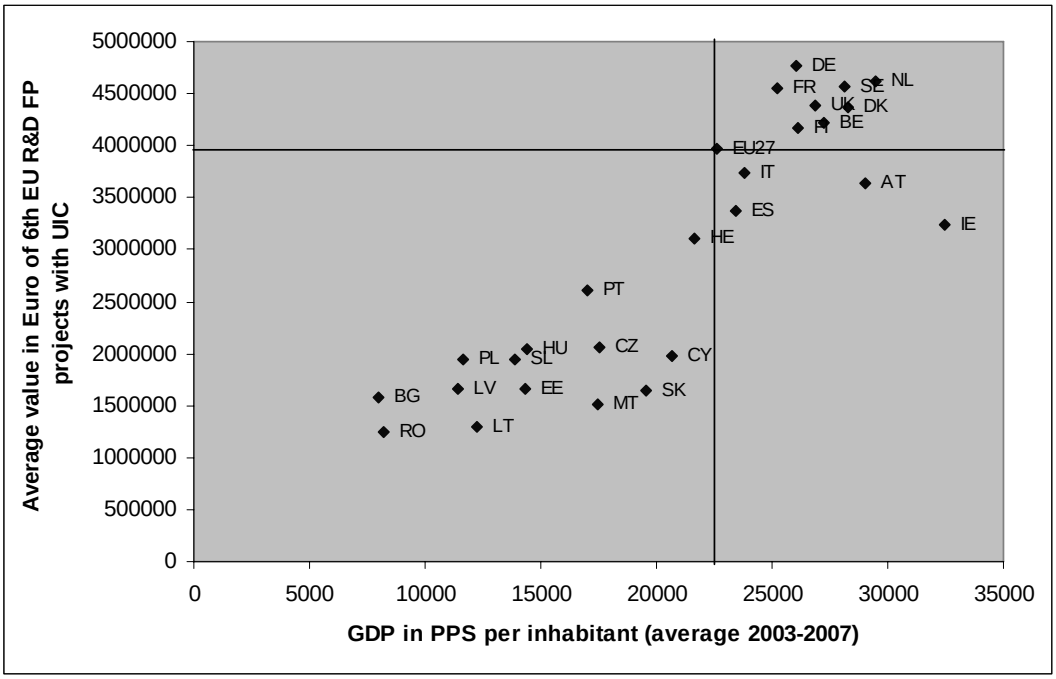


**Figure 2. The relation between average value of EU R&D FP6 projects with UIC and *per capita* GDP in the EU**

*Note*: Luxembourg excluded for being an outlier

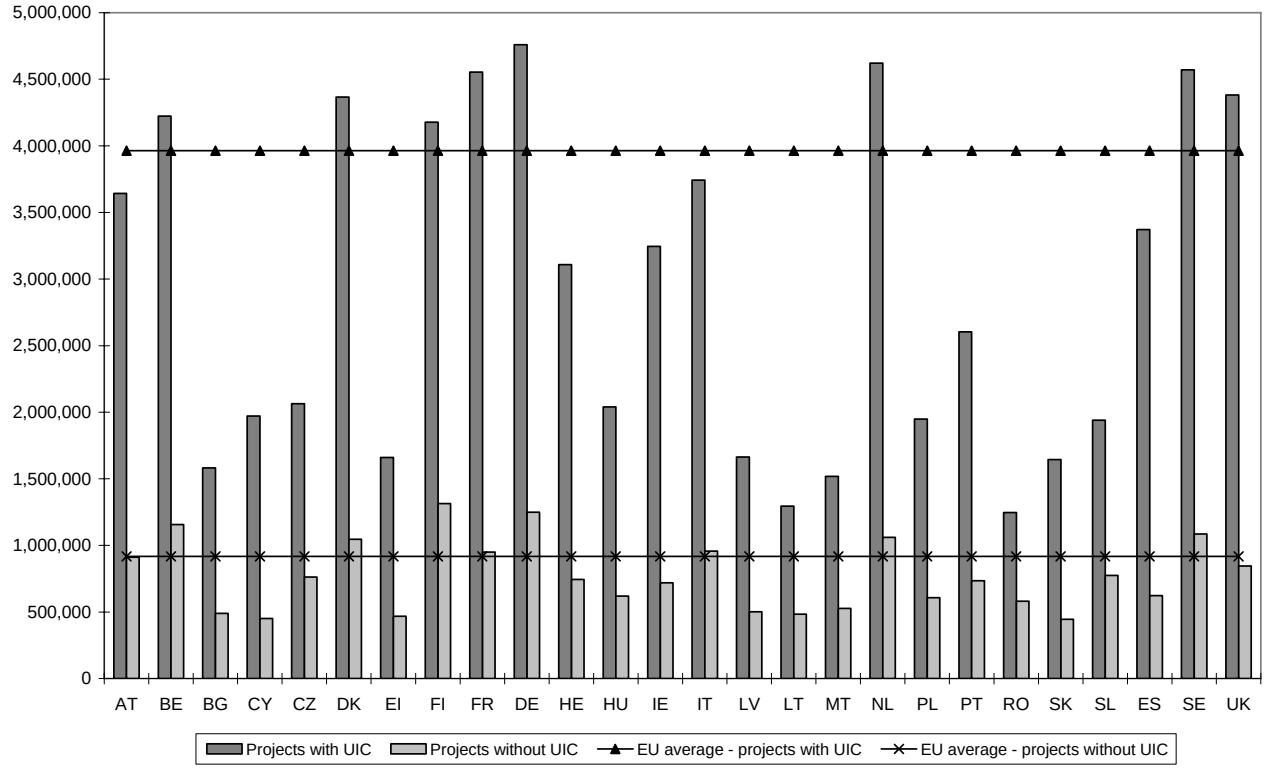


**Figure 3. Average value of projects with UIC and non-UIC in the 6th EU R&D FP by EU member state**

higher *per capita* GPD, the value of UIC relative to non-UIC projects is higher than in countries with lower *per capita* GDP. This is to say, in relative terms, FP6 leads richer countries to reinforce the reliance of their research systems on UIC and poorer countries to reinforce the reliance of their research systems on other modalities of research.

### *Robustness of the results (and increasing complexity): Breakdown by specific programmes, thematic priorities and instruments*

The measures of the FP data presented so far are the heterogeneous aggregation of different specific programmes and blocks of activities, so it can be

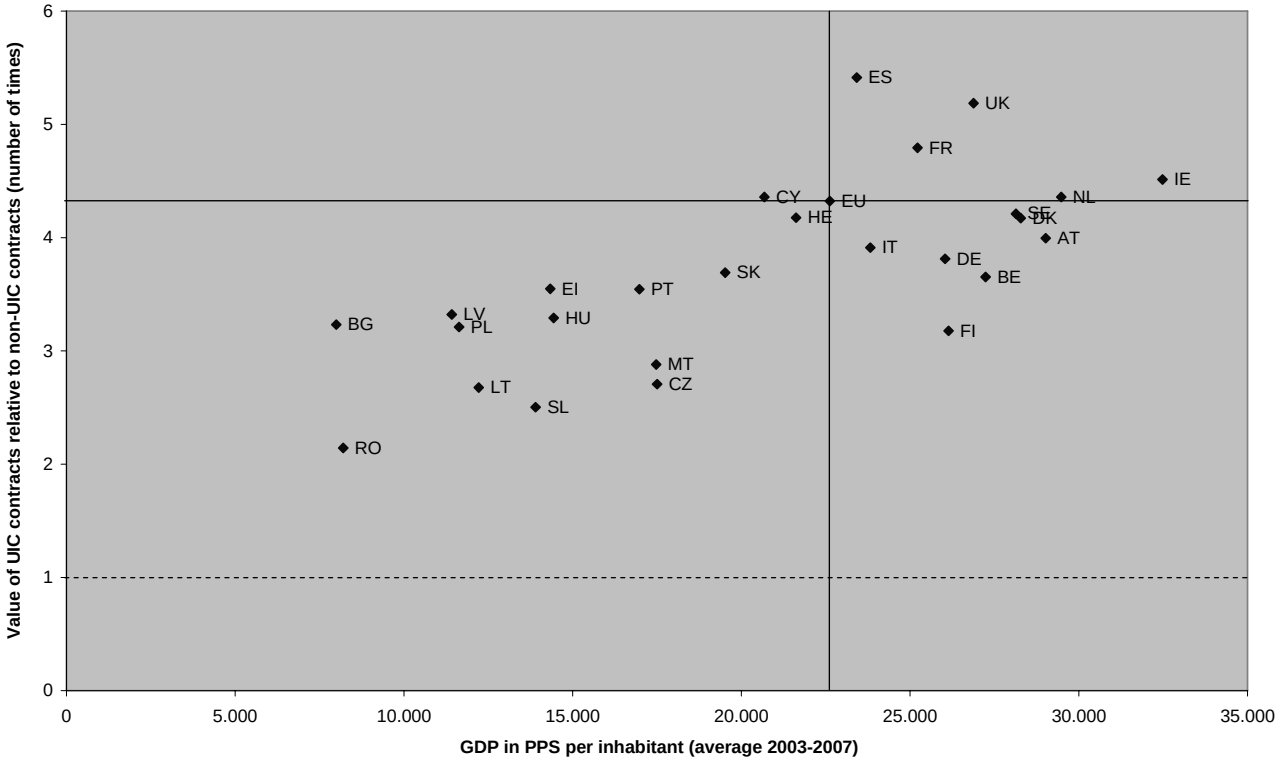


**Figure 4. Preference for UIC vs. non-UIC projects in the 6th EU R&D FP in relation to GDP**
*Note*: Luxembourg excluded for being an outlier

considered noisy. In order to test the robustness of the results, we broke down the data in the quest for more homogeneous and meaningful indicators.

The clear positive slope of the regression line we could draw in Figure 4 finds its counterpart in the positive coefficient of correlation that we calculate for the FP6 overall, equal to 0.71, as Table 2 shows. The label of the second column is 'all specific programmes' because the FP6 consists of three specific programmes and the following columns present their breakdown: 'Focusing and integrating Community research', 'Structuring the ERA' and 'Euratom'. One can notice that the positive correlation persists in the three categories, which is a first sign of consistency of our results. The coefficients are smaller, though, which can be interpreted as if the overall higher correlation were due to somewhat independent minor effects in the same direction.

The bulk of the projects belong to the first specific programme, 'Focusing and integrating Community research', so it is worth breaking it down for a further consistency check. It combines two types of activities: 'Thematic priorities' (close to a separation by scientific disciplines) and 'Specific activities covering a wider field of research' (which are of a more horizontal nature). UIC is concentrated in the 'Thematic priorities', so this is where we perform our check. Table 3 reports the results.

There are seven thematic priorities. We calculated correlation coefficients for each one of them. For a more condensed presentation of results, we grouped them into two categories: those with a positive sign and those with a negative sign.

The first category actually involves almost exclusively the largest thematic priority, 'Information society technologies' (IST), with a small number of projects from the priority 'Citizens and governance in a knowledge-based society' and it is the main cause of the high correlation coefficient. In the rest of thematic priorities (other five, see footnotes of Table 3), the crown indicator has a negative correlation with *per capita* GDP, suggesting a counterbalancing effect, that is, a reduction of disparities in UIC across countries, although it is often not significant if taken one by one.

Thematic priorities can in turn be broken down into five financial instruments (see EC, 2002a for explanations, or EC, 2002b for an overview). We also grouped them into those with a positive and those with a negative correlation with *per capita* GDP. Only UIC projects implemented through one of these instruments — integrated projects (IP) — have the usual positive correlation. If crossed with thematic priorities, it changes the sign of the correlation of thematic priorities other than IST with *per capita* GDP, from negative to positive, with a value of 13%.

For the rest of the instruments (other four, see footnotes of Table 3), the negative correlation persists, equal to –51%. Therefore, even if the overall effect is of increasing national disparities on UIC,

**Table 2. Crown indicator of average value of the 6th EU R&D FP UIC projects by specific programme**

| Country | All specific programmes | Focusing and integrating Community research | Structuring the ERA | Euratom |
|---|---|---|---|---|
| Austria | 4.00 | 2.51 | 6.64 | 0.43 |
| Belgium | 3.65 | 2.22 | 4.99 | 3.47 |
| Bulgaria | 3.23 | 2.54 | 5.31 | 2.41 |
| Cyprus | 4.36 | 2.15 | 6.23 | 1.39 |
| Czech Republic | 2.71 | 2.03 | 3.87 | 1.68 |
| Denmark | 4.17 | 2.49 | 3.26 | 3.28 |
| Estonia | 3.55 | 2.65 | 3.76 | 1.05 |
| Finland | 3.18 | 2.26 | 3.49 | 1.35 |
| France | 4.79 | 2.55 | 5.79 | 2.05 |
| Germany | 3.81 | 2.43 | 4.02 | 3.09 |
| Greece | 4.18 | 2.21 | 3.87 | 0.87 |
| Hungary | 3.29 | 1.90 | 4.59 | 1.04 |
| Ireland | 4.51 | 2.69 | 2.89 | 1.93 |
| Italy | 3.91 | 2.22 | 4.92 | 2.28 |
| Latvia | 3.32 | 3.21 | 2.19 | |
| Lithuania | 2.68 | 1.80 | 3.47 | 2.95 |
| Malta | 2.88 | 2.91 | 1.17 | |
| Netherlands | 4.36 | 2.36 | 5.11 | 2.37 |
| Poland | 3.21 | 2.25 | 3.77 | 1.13 |
| Portugal | 3.54 | 2.32 | 4.57 | 0.58 |
| Romania | 2.14 | 1.54 | 3.04 | 1.49 |
| Slovakia | 3.69 | 2.70 | 6.02 | 2.56 |
| Slovenia | 2.50 | 1.72 | 3.54 | 0.99 |
| Spain | 5.41 | 2.30 | 7.85 | 2.59 |
| Sweden | 4.21 | 2.51 | 3.40 | 1.48 |
| United Kingdom | 5.19 | 2.42 | 4.44 | 1.29 |
| Number of projects | 2,400 | 2,184 | 184 | 32 |
| % projects | 100% | 91% | 8% | 1% |
| Correlation with GDP | 71% | 26% | 24% | 22% |

**Table 3. Crown indicator of average value of the 6th EU R&D FP UIC projects – specific programme 'Focusing and integrating Community research' by thematic priority and instrument**

| Country | Information society technologies * | Rest of thematic priorities ** Integrated projects | Rest of thematic priorities ** Other instruments *** |
|---|---|---|---|
| Austria | 2.75 | 1.88 | 1.28 |
| Belgium | 2.71 | 1.09 | 2.04 |
| Bulgaria | 2.00 | 0.81 | 2.33 |
| Cyprus | 1.90 | 3.92 | 2.11 |
| Czech Republic | 1.62 | 1.63 | 1.32 |
| Denmark | 1.98 | 1.79 | 1.26 |
| Estonia | 1.67 | 1.18 | 3.45 |
| Finland | 2.76 | 0.74 | 1.37 |
| France | 2.66 | 1.39 | 1.32 |
| Germany | 2.37 | 1.13 | 1.40 |
| Greece | 1.84 | 1.05 | 1.56 |
| Hungary | 1.83 | 1.36 | 1.56 |
| Ireland | 2.81 | 1.77 | 1.60 |
| Italy | 2.05 | 0.99 | 1.35 |
| Latvia | 1.51 | 1.39 | 5.48 |
| Lithuania | 1.37 | 1.07 | 3.16 |
| Malta | 2.10 | 1.48 | 2.55 |
| Netherlands | 2.45 | 1.13 | 1.30 |
| Poland | 2.03 | 1.22 | 1.77 |
| Portugal | 1.96 | 2.91 | 1.88 |
| Romania | 1.46 | 0.78 | 1.31 |
| Slovakia | 1.94 | 0.95 | 2.41 |
| Slovenia | 1.24 | 0.81 | 1.86 |
| Spain | 2.23 | 1.27 | 1.23 |
| Sweden | 1.85 | 1.25 | 1.34 |
| United Kingdom | 2.21 | 1.06 | 1.45 |
| Number of projects | 708 | 329 | 807 |
| % projects | 29% | 14% | 34% |
| Correlation with GDP | 75% | 13% | –51% |

*Notes*: * It also includes two projects of 'Citizens and governance in a knowledge-based society'
** Life sciences, genomics and biotechnology for health; Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices; Aeronautics and space; Food quality and safety; Sustainable development, global change and ecosystems
*** Networks of excellence; Specific targeted research projects; Coordination actions; Specific support actions

some thematic priorities and instruments of the FP run in the opposite direction.[4] By contrast, if we cross the four progressive instruments with the thematic priority of IST, positive correlations persist, suggesting a quite robust effect of IST on increasing disparities on UIC. More specific studies on the IST sector in the FP6 go in line with this evidence when they suggest that 'the presence of hubs in a region raises disproportionately the connectivity of the region with others' (Cassi *et al*, 2008: 292).[5]

**Ancient Greek architects considered the optical effect according to which the columns in the peristyle of temples had to be inclined in order to seem straight when viewers looked at them from a distance**

## Conclusions and suggestions for future research

Ancient Greek architects considered the optical effect according to which the columns in the peristyle of temples had to be inclined in order to seem straight when viewers looked at them from a distance. Building completely vertical columns would have paradoxically produced the opposite effect — they would have looked inclined. The Matthew effect and other reasons for cumulative advantage in UIC produce a somewhat similar result: when the promotion of UIC tries to be neutral, it generates disparities; in order to be really neutral, complementary interventions would be needed to support the conditions for UIC in countries where they depart from a lower basis.[7]

Neutrality, though, is a matter of political choice, with supporters and detractors. The latter would argue that accumulation is not necessarily bad. A less polemic concern is that entry barriers should be minimal. If some countries face too high entry costs in UIC, we could be in the presence of a system failure, potentially detrimental for the long-term cohesion of European research.

Which could these entry barriers be? The relationship between a country's wealth and UIC activity is

not simple — and we are not claiming here a direct causal link. Among other things, wealthier countries tend to have a longer historical experience with, and spend more on, R&D. Additional reasons relating to institutional differences and sectoral specialisations may also play a role.

For instance, it may be that leading countries have learnt how to alleviate tensions between university and industry. Ongoing research shows successful stories in leading countries regarding the creation of joint research centres (Rohrbeck and Arnold, 2006; Andrisano *et al*, 2006), cooperation with local service providers (Monypenny, 2007) and engagement with research on emerging technologies (Xiao, 2008). It would be worth studying if the faster development of these instruments and practices in peripheral countries could help reducing disparities due to UIC.

Actually, weak UIC links in Central and Eastern European countries may be due to the poor research capabilities in universities, which are mainly teaching institutions — not a problem *per se*, if they can develop and teach entrepreneurial courses that are relevant to industry or help promote entrepreneurship indirectly. But this development is actually very rare, because there is little relevance/demand for that in some countries, and that can be a problem (Ranga and Etzkowitz, 2010). One may also wonder whether the number of conflicts related to the ambiguity of 'Third Mission' indicators (Molas-Gallart and Castro-Martínez, 2007) is also higher in these contexts.

Further research would be needed on whether a *juste retour* effect biases our data, and adds to the Matthew effect and other reasons in creating cumulative advantage. Since FP evaluators are thousands and do not give credit to projects according to geographic criteria, if a *juste retour* logic exists, it must be self-organic. It would explain part of our results: those member states that give more money to the EC, get more funds in return from the FP. However, our results do not show that yet — controlling for more factors through an econometric analysis would be necessary.[8]

Our results should not be seen as a normative appraisal of the FP: the FP is designed to fulfil the goal of industrial competitiveness, and comprehensive evaluations that go beyond the scope of this article can be found elsewhere (Marimon, 2004; Rietschel, 2009). Our reading of the results is that if promoted under the criteria of scientific excellence, UIC in the form of joint research might increase national disparities because of the cumulative advantage in UIC and not because of the bad design of the instruments. We believe that this property will apply not only to FP data but to other data, and not only to EU financial instruments but also to national instruments among regions within a country. And we have seen that it is possible to nurture concrete thematic priorities and instruments with a progressive effect on UIC even if the whole design favours a regressive effect. Complementary interventions by instruments that support capacity-building and equality of opportunity would seem a sensible policy choice. At an EU level this is — to an extent — already addressed by cohesion instruments. The present study, though, highlights the value of tailoring such instruments to UIC-related capabilities and doing so in a magnitude that is comparable to the FP. In that respect the reorientation of EU Structural Funds to better serve Europe's ambition to transform into a knowledge-based economy present an invaluable opportunity.

## Acknowledgements

This research has taken place under the framework of ERAWATCH, a joint initiative of the European Commission's Directorate General for Research and the Joint Research Centre Institute for Prospective Technological Studies. Our gratitude goes to René van Bavel and Xabier Goenaga for their support. Marina Ranga gave substantial comments to a previous version, which considerably increased the quality of the paper. Bart van Looy's advice on orientation is also appreciated. The views expressed in this article are the authors' and do not necessarily reflect those of the European Commission (EC). Neither the EC nor anyone acting on behalf of the EC is responsible for the use that might be made of the information.

## Notes

1. This is a reference to a recent work that complements with case studies and updates previous reviews by Martin *et al* (1996), Salter and Martin (2001) and Scott *et al* (2002).
2. Notice that this does not imply a causal interpretation, which would require controlling for other factors that cause national disparities in R&D potential, such as R&D resources, the institutional and legal framework, etc.
3. The first project commenced in February 2003 and all but one project had commenced by December 2007. Project durations were distributed as follows: 699 (one year or less), 7,867 (between just over one and four years) and 295 (greater than four years).
4. A widespread belief is that, moreover, in many cases, institutions from Central and East European countries are invited to join a project just to increase the chances of success of the proposal rather than based on the expectation of a substantial contribution to the project. As argued in the section 'Context of the research' and further discussed in the Conclusions, there are no substantial reasons to support that statement, which is anyway not necessary to motivate the existence of cumulative advantage in UIC.
5. The academic audience of this article may be curious to know that the popular instrument 'Networks of Excellence' (NoE) is among those with a progressive effect, although the number of NoE projects with UIC is small.
6. Within the hypothesis explaining the high correlation found in the IST sector, we could point at its *distributed* and *systemic* nature which, more than any other sectors, requires across-the-board collaboration on an international basis (equipment manufacturers, network operators, etc.).
7. And who should be the architect to incline the columns in this case? The possible instruments, modalities and side-effects of such policies are beyond the scope of this article. What we have hopefully demonstrated here is the need for more policy attention and academic research.
8. The findings of studies on overall (i.e. not just UIC) participation to the FP can provide some hints. Using data on FP3, Geuna (1998) finds that university participation was determined by scientific research productivity, size and differences among countries and scientific fields. A recent study on the determinants of FP6 participation of leading European universities also finds that indicators of scientific output are major determinants but detects neither a *juste retour* nor a *cohesion* logic

(Henriques *et al*, 2009). These studies though do not take into account the role of industry (much less UIC), leaving ample room for further study.

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