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Conceptualizing and Measuring Performance Orientation of Research Funding Systems

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BACKGROUND AND AIM

The "new funding regime" toward competition (Geuna, 2001; Slaughter and Rhoades, 2004)

• Increasing the share of project funds assigned to research teams within universities and public research organizations (Lepori *et al*, 2007) – select the best research group;

• Performance-based research funding systems (PBRF) based on the assessment of the research performance at the organizational level (Hicks, 2012; Geuna and Piolatto, 2016) - supporting the best research organizations;

• Increasing costs of evaluation and gaming by researchers (Laudel, 2006).

Aim: to propose a replicable synthetic indicator for the *performance orientation* of public research funding, which would allow for quantitative comparisons across countries and over time, and to develop an operational methodology for its computation and validation

• Countries involved in the analysis: AT, CH, DE, DK, FR, FI, IT, NO, PL, PT, SE, UK.

• The paper is developed in the framework of a large-study funded by the European Commission on the characteristics of public R&D funding in European countries (PREF, EC- JRC contract PREF no. 154321).

DEALING WITH PERFORMANCE ORIENTATION

Competitive funding is a difficult concept
- instruments where performers struggle for a limited amount of resources
- allocation linked to the achievement of certain levels of performance. In this case, the deployment of available resources may exclude beneficiaries with a low performance, or equally allocate funding resources to the achievement of a certain level in performance values

The consistency of the relationship between competiveness of funding and performance is a problematic issue (Sandstrom et al., 2016)

Distortions may affect the allocation to performers (peer review functioning, traditions, market effects, Van den Besselaar et al, 2009; Aagaard et al., 2015; Reale and Zinilli, 2017)

Performance orientation
The extent to which performance is taken into account in the decision concerning the allocation of funding
- Attribute of policy design of the process and criteria for allocating
- Not the outcome of the funding distribution between performers

BASIC CONCEPTS (1/2)

Project funding vs Institutional Funding (Lepori *et al*, 2007)
- Basic division between type of public R&D funding

Frascati Manual (FM) approach of Global Budgetary Appropriations for R&D (GBARD) (OECD, 2015)
- Good for cross-country comparison
- Allowing a benchmark for controls of robustness
- Decomposition of GBARD by funding lines and funding instruments

Focus on instruments
- Distinct funding schemes and funding components with similar characteristics in terms of goals and criteria

Consider that a share of research funding is mixed with other tasks (e.g. education, Jonbloed and Vossensteyn, 2016)

Extension of the Hicks' definition of PRFS
- Instruments can include a share of performance orientation
- Performance orientation can apply also in an indirect way (e.g. negotiation)
- Need to rely on experts' judgement when formal criteria are not clear and to unpacking formula

***Ex-ante* performance orientation (Nieminen and Auranen, 2010)**

➤the allocation of funding is based on some expectations of future knowledge production or performance (competitive bid)

***Ex-post* performance allocation**

➤funding allocation is based on some measures of past performance of a research organization using ex-post evaluation of research outputs

Allocation mode

Process through which funding is allocated to beneficiaries

- *Competitive bid* (e.g. project funding , Lepori et al., 2017)
- *Historical* (dominant in HEIs and PROs, Jongbloed and Lepori, 2015)
- *Negotiated* (mixing historical and contracts, Boer et al., 2015)
- *Formula* (mathematical formula based on a set of indicators, Hicks, 2012)

Allocation criteria

Criteria used to allocate finding, which can reward

- the 'merit' of the proposal (Viner et al., 2006; Grimpe, 2012; van den Besselaar and Leydesdorff, 2009),
- the research performance of an organization using input and output measures (Jonkers and Zacharewicz, 2016)

OPERATIONALIZATION OF THE INDICATOR / 1

Public research funding was decomposed into **funding instruments** associated with their amounts for each year of reference (2005-2014). Each instrument was characterized in terms of allocation mode and allocation criteria, so that **scores** were assigned based on these two classifications.

Allocation mode	Score allocation mode (*fixed*)	Allocation criteria	Score allocation criteria (*based on experts' assessment*)	*Ex-ante* performance orientation (*fixed scores*)	*Ex-post* performance orientation (*score allocation mode* score allocation criteria*)
Project funding	-	Indifferent	-	1	-
Institutional funding: *competitive bid*	-	Indifferent	-	1	-
Institutional funding: *historical allocation*	0	Not applicable	0	0	0
Institutional funding: *negotiated allocation*	0.5	Output or educational criteria	0	0	0
Institutional funding: *negotiated allocation*	0.5	Research criteria	$0 \leq x < 1$	0	$0 \leq x < 1$ **depending on the instrument's characteristics**
Institutional funding: *funding formula*	1	Input or educational criteria	0	0	0
Institutional funding: *funding formula*	1	Research performance	$0 < x \leq 1$	0	$0 < x \leq 1$ **depending on the instrument's characteristics**

In order to test the robustness of the indicator, we will apply *lower* and *higher* bounds on the scores selected by experts for *negotiated* and *formula* allocation, since are likely to be contestable measures, on which experts might disagree.

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Synthetic indicators on ex-ante and ex-post performance orientation are computed as follows, for a specific year and national system of 12 countries (AT, CH, DE, DK, FR, IT, NL, NO, PL, PT, SE, UK):

EX-ANTE PERFORMANCE ORIENTATION =

$$= \frac{\sum (funding\_instrument\_amount)_i * (ex-ante)_i}{\sum (funding\_instrument\_amount)_i} = \text{(share project funds)} + \frac{\sum_{institutional}(funding\_instrument\_amount)_j * (ex-ante)_j}{\sum_{institutional}(funding\_instrument\_amount)_j}$$

EX-POST PERFORMANCE ORIENTATION $= \dfrac{\sum_{institutional}(funding\_instrument\_amount)_j * (ex-post)_j}{\sum_{institutional}(funding\_instrument\_amount)_j}$

Where the sum over j runs only on the institutional funding instruments
since, by definition, ex-ante performance orientation is 1 and ex-post performance orientation is 0 for project funds.

Data have been collected in the framework of a large-study funded by the European Commission on the characteristics of research funding systems in European countries (PREF, contract PREF no. 154321). For this study data have been rechecked and sometimes limitedly modified.

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METHODS AND SENSITIVITY ANALYSIS

1. **Performing a cross-sectional comparison of the indicator**

    → Overview on the national systems and consistency check with literature

2. **Checking the coverage of instruments**

    → Check of potential issues with the calculation of funding amounts (differences between PREF GBARD and ESTAT GBARD, missing data, distinction between institutional and project funding)

3. **Finding and extracting the influential instruments**

    → In order to discover which ones have stronger impact on the indicator

4. **Performing a sensitivity analysis**

    → Testing alternative scores and observing effects on the rankings of the countries for ex-post and total performance orientation

STEP 1: CROSS-SECTIONAL ANALYSIS OF PERFORMANCE ORIENTATION IN THE SELECTED COUNTRIES
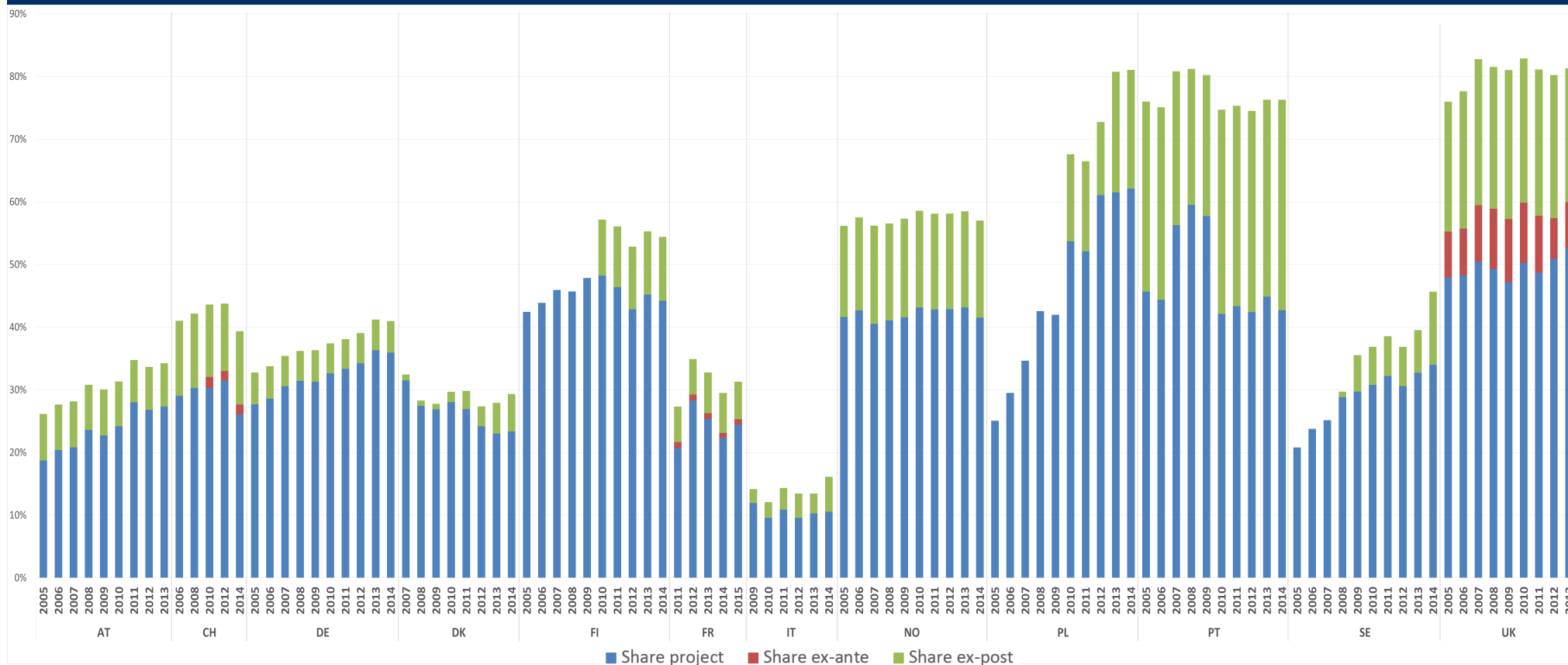
➢ Wide variations among countries

➢ Limited role of ex-ante PO

➢ Change in PO due to emergence of ex-post

➢ Substantial share of non-competitive institutional funding

STEP 2: CHECKING THE COVERAGE OF GBARD

To which extent data cover adequately public national funding? Differences in the perimeter are likely also to affect the comparability of the performance-orientation indicator.

I. PREF total for total funding are identical to EUROSTAT GBARD data for seven countries, i.e. AT, CH, FI, IT, NO, SE and UK. The PREF total is 16% higher in DE, 12% in DK and 19% in FR. For two countries, PREF total is below the EUROSTAT figures: Poland (-34%) and Portugal (-16%).

II. The main issue concerns so-called exchange funds (i.e. contracts for services awarded by the state, usually by different ministries), which lowers the share of project funding.

III. The distinction between *institutional funds* and *project funds* was further checked in order to single out ambiguous cases.

PREF data provide, with few exceptions, a <u>reasonably good coverage</u> of the main funding instruments expected in public funding.

Diverging cases were taken into account in the sensitivity analysis (e.g. subtracting/adding a share of institutional/project funding to the total GBARD).

| Country	Funding instrument name	Share total funding (>20%)	Share performance ex-post (>20%)	Share non performance (>20%)	FI mode	FI criteria	Level of uncertainty	Score	Low	High
AT	Funding for HE	■			0.50	0.20	High	0.10	0.00	0.30
CH	Transfer funds for Federal Institutes of Technology		■		0.50	0.50	High	0.25	0.05	0.45
	Transfer funds for Cantonal Universities (regional)	■			0.50	0.20	High	0.10	0.00	0.30
DE	Funding for HE (regional)	■			0.00	0.00	High	0.00	0.00	0.20
	Funding for HGF (national)		■		0.50	0.80	High	0.40	0.20	0.60
	Funding for FGh (national)		■		1.00	0.60	High	0.60	0.40	0.80
DK	Transfer funds to national universities and university colleges		■		1.00	1.00	Low	1.00	1.00	1.00
	Transfer funds to national universities and university colleges		■		0.00	0.00	Low	0.00	0.00	0.00
	Intra-mural R&D expenditure of the governement			■	0.00	0.00	Medium	0.00	0.00	0.10
FI	Basic grants to universities and polytechnics		■		1.00	1.00	Low	1.00	1.00	1.00
	Basic grants to universities and polytechnics	■			0.00	0.00	Low	0.00	0.00	0.00
	Public funding to the PRO sector			■	0.00	0.00	High	0.00	0.00	0.20
	Intra-mural R&D expenditure of the governement			■	0.50	0.00	Medium	0.00	0.00	0.10
FR	Basic state contribution to higher education institutions	■			1.00	0.15	Medium	0.15	0.05	0.25
	State funding to Public Research Organizations			■	0.00	0.00	High	0.00	0.00	0.20
	State funding to CNRS			■	0.50	0.30	High	0.15	0.00	0.35
IT	General University Fund		■		1.00	0.50	Low	0.50	0.50	0.50
	General University Fund	■			0.00	0.00	Low	0.00	0.00	0.00
NO	General funds to Universities and University colleges		■		1.00	1.00	Low	1.00	1.00	1.00
	General funds to Universities and University colleges	■			0.00	0.00	Low	0.00	0.00	0.00
	General funds to other research institutes and PROs			■	0.00	0.00	High	0.00	0.00	0.20
	Transfer funds for Regional Health Authorities (regional)	■			1.00	1.00	Low	1.00	1.00	1.00
PL	Funding for HEIs	■			1.00	0.50	Medium	0.50	0.40	0.60
PT	General University Funds for R&D	■			1.00	0.70	Medium	0.70	0.60	0.80
SE	Transfer funds to national universities and university colleges		■		1.00	1.00	Low	1.00	1.00	1.00
	Transfer funds to national universities and university colleges	■			0.00	0.00	Low	0.00	0.00	0.00
UK	HEFCE funding to research in HEIs		■		1.00	1.00	Low	1.00	1.00	1.00
	Other funding streams			■	0.00	0.00	Medium	0.00	0.00	0.10

For each influential instrument we assigned a certain **level of uncertainty** on the experts' assessments.

We focused particularly on instruments based on *negotiated* or *formula* allocation mode, whose scores are likely to be contestable examining the available information.

In order to test the robustness of the indicator, we set higher and lower bounds by increasing/decreasing the score by 0.1 for **medium** and 0.2 for **high** uncertainty.
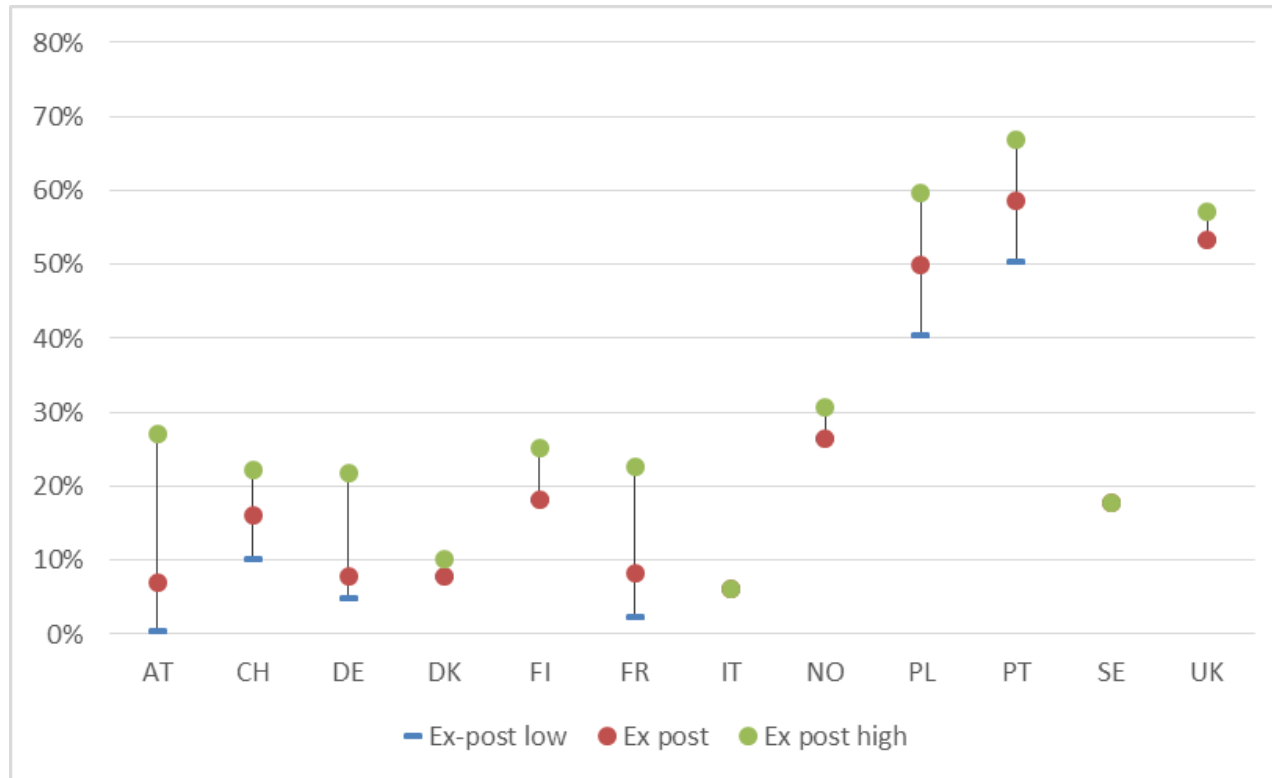
➢ Differences between the countries with high ex-post performance orientation in institutional funding and the remaining countries is maintained.

➢ The relative position of the low ex-post performance orientation countries is highly uncertain.

Expectedly, countries that have introduced formula-based models by clearly distinguishing between an *historical* and a *performance-oriented component*, the measure is subject to limited uncertainty, while in countries where some performance elements have been introduced within *negotiated allocation* (AT and DE) and country where PROs are more important (FR) the indicator is much more uncertain.

Adding the low/high scores to the share of ex-ante performance orientation from the previous figure, we performed the sensitivity test on total performance orientation.
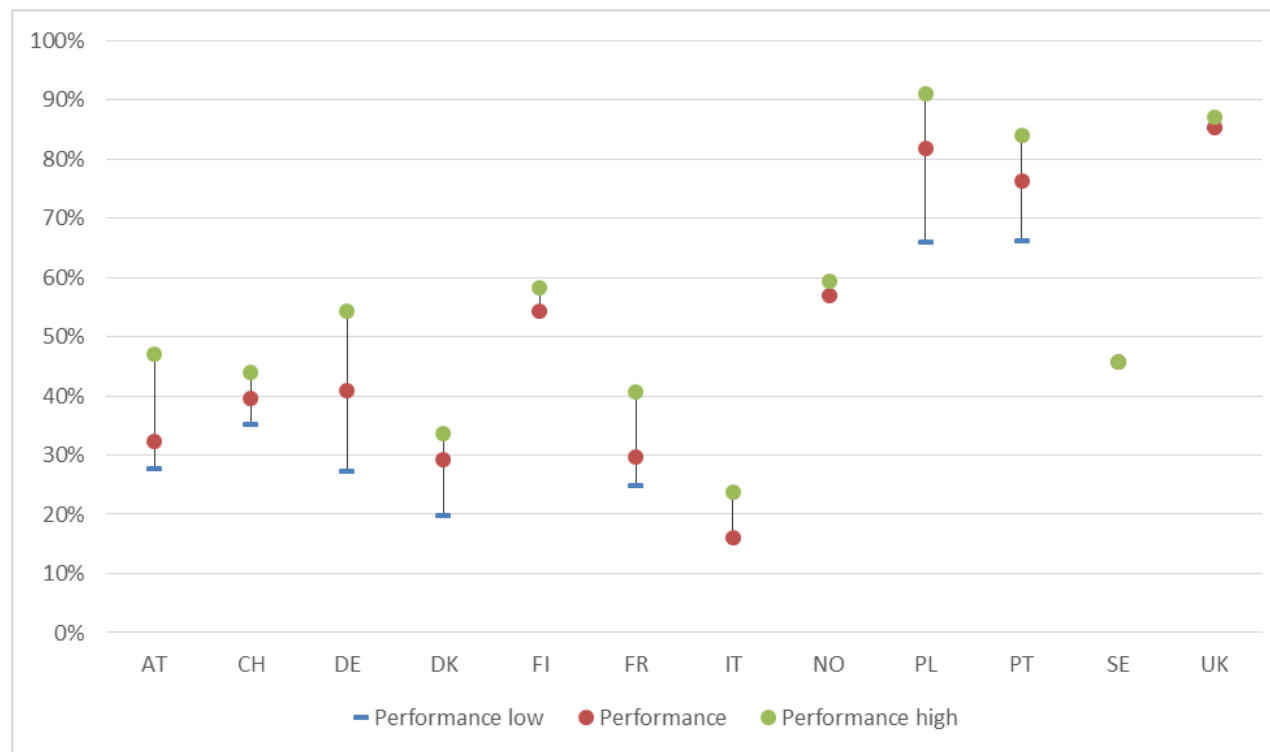
Since the uncertainty in the measure of project funding is smaller, the aggregated indicator proves to be more stable, particularly for what concerns the ranking of countries.

CONCLUSIONS

A synthetic indicator of performance orientation to figure out the policy designs of the decision makers, and how they balance allocations driven by *ex-ante* and *ex-post* assessment.

•Importance of setting reproducible and robust procedures to avoid misleading interpretations.

The robustness was controlled by:
•Checking the coverage of public national funding instruments;
•Testing the level of uncertainty of the funding criteria scores for the most influential instruments;
•Using sensitivity analysis.
•Next step will include the analysis of changes over time

Uncertainties exist, affecting countries where data are problematic, or suffering from missing values, or where the research system is really complex and the decomposition of performance orientation strongly relies on experts' appreciation.

However high/low scores generated through the sensitivity analysis do not produce a different positioning between countries.

There is room for improving the strength on the experts' appreciation (e.g. a small survey).