

## Characterizing public interventions in research and higher education

Benedetto Lepori, University of Lugano

Amsterdam, 2nd September 2009

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## The next indicators conference

- ▶ **“STI Indicators for Policymaking and Strategic Decision”**
  - ▶ Paris, 3rd-5th March 2010
  - ▶ The third conference in this series organised by the European Network of Indicators Designers, a spring-off of PRIME
  - ▶ [www.enid-europe.org](http://www.enid-europe.org)
- ▶ It is basically open to contributions on STI indicators (see topics on the conference website)
  - ▶ Both for posters and full papers
- ▶ You are strongly encouraged to participate and submit your work
  - ▶ Based also on comments from this school
  - ▶ Submit extended abstracts (2-3 pages) to [blepori@unisi.ch](mailto:blepori@unisi.ch) at latest by 15th of September



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## Theme of the lecture

- ▶ **The use of S&T indicators in order to characterise public interventions in research and higher education policies**
  - ▶ Focusing on the use of (different) measures of funding as tools for characterization.
  - ▶ Presenting a general framework for constructing indicators, but also what is currently available and what is planned in the next future.
- ▶ **Most of these topics are largely qualitative**
  - ▶ Addressed with methods current in political and social sciences like case studies, interviews, comparative analyses
  - ▶ Nevertheless, I will show that there is a big potential of using indicators to complement these analyses and allow for systematic comparisons



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### Acknowledgements

- ▶ This presentation is the outcome of a work on indicators for public funding of research done in the PRIME network of Excellence in the last 5 years
- ▶ A largely collective work with many colleagues participating
  - ▶ Peter van den Besselaar and Jan van Steen (NL)
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  - ▶ Stig Slipersaeter (NO)
  - ▶ Michael Dinges (AT)
  - ▶ Emanuela Reale (IT)
  - ▶ Jaan Masso and Kadri Ukrainski (EE)
  - ▶ Julita Jablecka (PL)
  - ▶ Karel Sima (CZ)




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### Public interventions

- ▶ The State intervenes in research and higher education with different instruments / at different levels
  - ▶ Defining policy goals to be achieved (especially in the public sector)
    - ▶ For example economic growth
  - ▶ Setting basic rules and institutional arrangements
    - ▶ For example for the governance and functioning of higher education institutions
- ▶ Nevertheless, research and higher education policy is by large a distributive policy
  - ▶ Implemented through selective distribution of funding for different goals
  - ▶ Setting incentives through funding to research performers (both monetary and normative)
- ▶ This explains why indicators on public funding are highly relevant to characterize public policies
  - ▶ If related to a suitable framework and categories to classify funding flows
  - ▶ Useful not only to measure allocation, but also to characterize policies and their priorities




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### Outline of the lecture

- ▶ First draw a general framework on public funding of research
  - ▶ To identify actors, instruments and institutional context.
- ▶ Then systematically analyse which indicators can be constructed for the different functions
- ▶ Looking what is already existent
  - ▶ For example in R&D statistics based on the Frascati manual
- ▶ Devise methodologies to produce the required indicators
  - ▶ Taking into account issues of feasibility, data availability, etc.
- ▶ Draw some general conclusions on S&T indicators
  - ▶ Related to the concept of positioning indicators and the general concepts presented in Rémi's lecture




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### A general framework for public funding

- ▶ We can consider public funding as interfacing the State with research performers
  - ▶ Funding is conducive to the achievement of public policy goals
  - ▶ But at the same time research performers are by large autonomous strategic agents with their own objectives
- ▶ Given the impossibility of managing research through command and control like in public bureaucracies
  - ▶ Use of delegation and incentives is widespread
  - ▶ Creation of intermediary organisation to manage the relationship between state and researchers (research councils)
- ▶ Diversity of goals and complexity of steering drives also diversity of funding instruments
  - ▶ Based on complementarities between their characteristics (for example between core and project funding)
  - ▶ No simple recipe to fund and steer research

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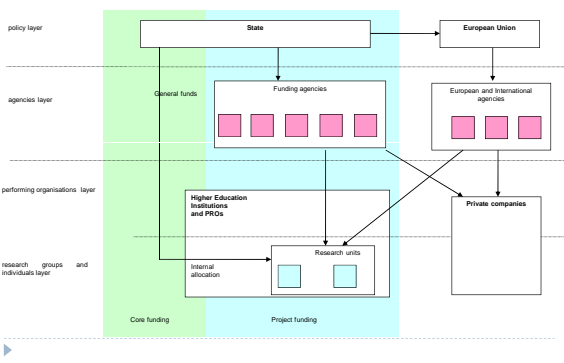
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### The overall conceptual framework




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### Four layers of research funding

- ▶ The policy layer (government, ministry) where the general objectives, but also in most cases the overall volume of resources are decided
  - ▶ Note that research policy is increasingly becoming multilevel (since the ERA debate)
- ▶ The agency level which assume most of the tasks in managing funding instruments, but also in some cases in regulation (higher education agencies)
  - ▶ Also multilevel (national, European, to some extent regional)
- ▶ The level of research organisations, like PRO's and universities
  - ▶ Manage institutional funding and are increasingly relevant also to drive project funding through reputation and researcher's behaviour
- ▶ The level of individual researchers and research groups
  - ▶ For example applying for project funding, but also competing inside organisations for core funding

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### Two basic modes of allocation

- ▶ **Despite differences most funding is channelled through two main organisational forms**
  - ▶ Core funding attributed to research organisations and universities as a whole
  - ▶ Project funding attributed to research groups and individual researchers directly from the agencies
- ▶ **A few cases which do not fit into this classification**
  - ▶ Large PRO's functions as funding agencies at the same time (like CNRS)
  - ▶ Centres of competences and networks of excellence
- ▶ **But internal variants in the specific arrangements**
  - ▶ Who manages the funding
  - ▶ Allocation criteria
  - ▶ "market" structure

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### Building indicators on public funding

- ▶ **Indicators can be constructed to characterise different parts of this system**
  - ▶ And thus to answer to different questions for research policy
- ▶ **Some categories I will discuss in the following of the presentation**
  1. Measuring the volume of spending
    - ▶ R&D statistics based on the Frascati manual
  2. Characterising policy objectives
    - ▶ GBAORD data based on the Frascati manual
  3. Analysis of instruments and portfolios of funding schemes
    - ▶ The project funding analysis and its potential extensions
  4. Looking to the structure of performers
    - ▶ Data on individual performers (universities, companies)
  5. Analysing market-space structure
    - ▶ both micro and meso-level

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### Aggregation levels

- ▶ **Data on funding and expenditures can be aggregated at different levels**
  - ▶ Whole countries: mostly just for illustrative purposes
  - ▶ Broad sectors, more interesting but with major problems of delimitation
  - ▶ Funding agencies
  - ▶ Individual organisations (universities, PROs)
  - ▶ Individual research groups
- ▶ **As a rule disaggregated data allow taking better into account the specificity of each unit**
  - ▶ at the price of less ability to synthesize the main trends
  - ▶ And with greater problems of comparability and stability of aggregates
- ▶ **The choice of the perimeter and of the good aggregation level depends on the specific questions, but also on practical considerations**
  - ▶ Indicators, data sources vary correspondingly

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### 1. Measuring the volume: the Frascati system

- ▶ A specific set of indicators has been developed by the OECD from the '60 to answer to a very specific question:
  - ▶ Measure the national effort in research and compare countries in this respect
  - ▶ With reference to the 3% of GDP target (US in the mid-'60)
  - ▶ Formalised in the so-called Frascati manual and implemented through national statistical offices coordinated by the OECD
- ▶ The main goal was to produce national aggregates
  - ▶ Gross Expenditures for Research and development (GERD) as % of GDP as the crown indicator
  - ▶ The national research and innovation system as unit of analysis
- ▶ A limited number of sectoral breakdowns
  - ▶ By performing sector
  - ▶ By field of science or industrial sector
- ▶ Building a matrix of funding flows
  - ▶ Between sectors
  - ▶ No actor-level breakdown
  - ▶ No multilayer structure
- ▶ See the historical reconstruction of the development of this system by Godin (2005)

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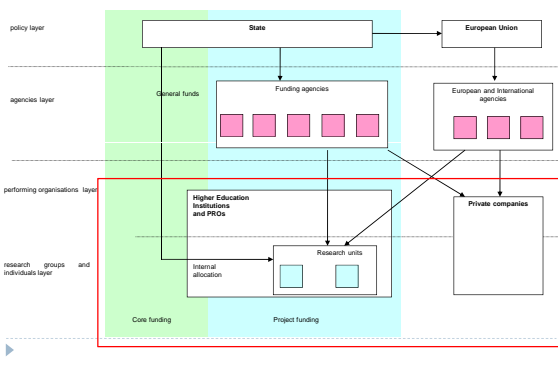
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### The overall conceptual framework




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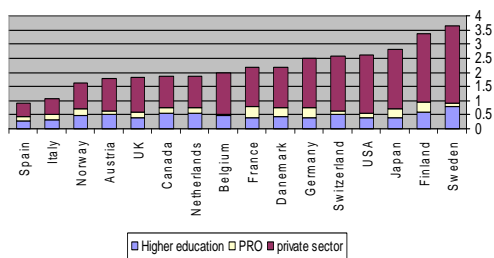
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### Comparing national effort in R&D (% of GDP)




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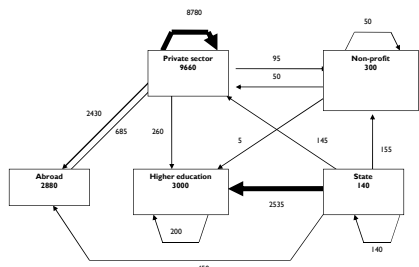
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### Looking to intersectoral flows (SWI)




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### Building an indicator system

- ▶ Indicators production is an “heavy industry” which requires a suitable infrastructure
  - ▶ A “success” indicator has to be inserted in a well-designed production system if it has to go beyond the experimental stage
  - ▶ Choices in this phase are critical to define the indicators we will get at the end
  - ▶ Strong irreversibility and stability of indicators being beyond the experimental stage
- ▶ Choosing definitions
  - ▶ And their operational definitions in a manual
  - ▶ Dealing with unclear cases and classifications
- ▶ Defining simple indicators
  - ▶ GERD/GDP
  - ▶ Aggregation of national data in a few indicators
- ▶ Promoting their use
  - ▶ In policy documents (OECD)
  - ▶ Availability (on-line database)
  - ▶ Standardization and simplicity
  - ▶ Time series

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### Building an indicator system

- ▶ Data collection
  - ▶ Based on a newly-designed standard survey
  - ▶ Based on data collected from the performers themselves, hence much more detailed at the performer level than for funding sources
- ▶ Creating the infrastructure for systematic collection and handling
  - ▶ National statistical offices as the main actor in data collection and national data handling
  - ▶ A coordination group chaired by OECD (NESTI) for the development of methodology (revisions of the Frascati manual)
  - ▶ OECD as the main driver of policy use of these indicators through their systematic integration in research policy analysis
  - ▶ Recently a stronger role of EUROSTAT in this process
- ▶ This system was created in the mid-'60 and is largely unchanged until now
  - ▶ Stability and incremental development as a key features (time series)
  - ▶ However difficulty to answering to new questions because of essential features of the original system design
  - ▶ Limited flexibility since this is largely an ad hoc and very tailored system even when changes are rather obvious (see PROs)

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### Definition of research

- ▶ **The is no "obvious" or unique delimitation of what is research**
  - ▶ Different perimeters might be chosen depending on the specific questions
  - ▶ Different actors might have different definitions (according also to their goals and missions)
  - ▶ Definitions shape the world we observe (based on underlying assumptions)
- ▶ **The choice of the Frascati manual: R&D**
  - ▶ Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.
- ▶ **This definition is at the basis of what is commonly know as statistics on research expenditures (R&D)**
  - ▶ A "broad" definition including a large part of industrial development since the main focus is on R&D as driver of innovation
    - ▶ Shapes our vision of a research system dominated by private companies
  - ▶ Focus on "systematic" research conducted in specialised laboratories considered as the main driver of innovation
    - ▶ Exclusion of knowledge developed during other activities, for example related to user-innovation (increasingly important in the knowledge economy)

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### Measurement problems

- ▶ **Money as the unique measure of R&D**
  - ▶ To build national aggregates and for comparisons
  - ▶ Like in the economical statistics and subject to the same criticism and limitations
- ▶ **However it raises a number of problems**
  - ▶ For international comparability: general PPP's series to not reflect correctly cost differentials between countries for the research and higher education sector
  - ▶ Accross time, since GDP deflators have the same type problems
  - ▶ For comparisons between sectors: 1 euro of R&D expenditures in a private companies means a completely different thing than the same expenditure in an university
- ▶ **National aggregates vs. individual actors**
  - ▶ The logic of the Frascati system is to measure R&D accross sectors splitting up institutions which perform different tasks
  - ▶ For example splitting research and education in universities using time sheets
  - ▶ Thus inability to look to research performers as actors combining different tasks in their strategies and functioning
- ▶ **R&D data are more gross estimates of the research volume than precise numbers**
  - ▶ Data on corporate R&D are of problematic quality because R&D is not a budget item in their accounts
  - ▶ Data on universities are also difficult if systematic surveys of time budget are not performed

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### Measurement problems

- ▶ **Since implementation is left to national statistical offices and performers there are many differences despite uniformity of definitions**
  - ▶ See the sources & methods annex to the R&D statistics
- ▶ **R&D data are more gross estimates of the research volume than precise numbers**
  - ▶ Data on corporate R&D are of problematic quality because R&D is not a budget item in their accounts
  - ▶ Data on universities are also difficult if systematic surveys of time budget are not performed
- ▶ **Comparability issues of funding volume**
  - ▶ For international comparability: general PPP's series to not reflect correctly cost differentials between countries for the research and higher education sector
  - ▶ Accross time, since GDP deflators have the same type problems
  - ▶ For comparisons between sectors: 1 euro of R&D expenditures in a private companies means a completely different thing than the same expenditure in an university
- ▶ **National aggregates vs. individual actors**
  - ▶ The logic of the Frascati system is to measure R&D accross sectors splitting up institutions which perform different tasks
  - ▶ For example splitting research and education in universities using time sheets which is problematic from the perspective of universities functioning.
  - ▶ Thus inability to look to research performers as actors combining different tasks in their strategies and functioning

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### Transborder flows

- ▶ **Frascati system has been designed in a time when research policy was essentially a national issue**
  - ▶ With very limited role of international organisations both in designing policies and funding
  - ▶ With limited internationalisation of private economy
  - ▶ This assumption is increasingly problematic today
- ▶ **International flows are handled in a very simplified way in R&D statistics**
  - ▶ To/from abroad flows with no distinction between private and public sources
  - ▶ No place for a performing sector "abroad" including true international performers (like CERN)
- ▶ **This is an highly complex issue**
  - ▶ See following scheme

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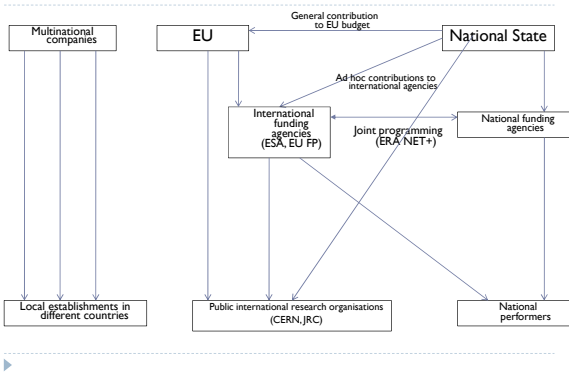
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### Transborder flows




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### Three major issues

- ▶ **International R&D performers and their funding**
  - ▶ CERN, JRC, etc.
  - ▶ EUROSTAT plans to develop a specific survey of R&D expenditures of these organisations and to include them in a separate sector
- ▶ **Public international funding**
  - ▶ International funding agencies financing mostly national performers
  - ▶ But themselves funded from national budgets (directly or indirectly through the EU budget)
  - ▶ An issue basically impossible to handle without introducing funding agencies as a separate layer in the design of the system
  - ▶ Joint programming makes the whole issue much more complex
- ▶ **Private companies transborder flows**
  - ▶ Frascati follows a strict territorial principle (the country where R&D is performed)
  - ▶ The enterprise as a strategic actors is at a different level especially for multinational companies
  - ▶ An attempt to complete R&D statistics with data on R&D performed by subsidiaries abroad, but only aggregated national data available because of confidentiality requirements
  - ▶ No matching possible between countries

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### Multinationals as global research players

Novartis Pharmaceuticals Research Worldwide Community 2002




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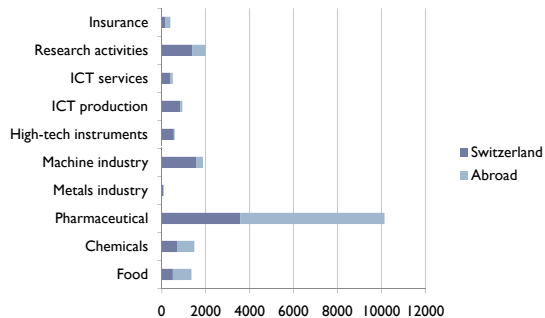
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### R&D expenditures of Swiss companies by industrial sector




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### EU Industrial R&D Investment Scoreboard

- ▶ A different approach based on the company as the main observation unit
  - ▶ Using self-declared data on R&D investment in audited company account
  - ▶ Covering all establishments of a company independently of their localisation
  - ▶ Attributing data to the country where the company is located
- ▶ Data are completely different than R&D statistics
  - ▶ Especially for small countries with large SMEs
  - ▶ Reconciliation is impossible since R&D data are not public
  - ▶ There might be differences also in the identification of R&D
- ▶ This approach based on strategic units is very relevant
  - ▶ But then it is difficult to make the link with national policies / research organisations
  - ▶ Some attempts to analyse localisation of business R&D for example using patents
- ▶ See [http://iri.jrc.ec.europa.eu/research/scoreboard\\_2008.htm](http://iri.jrc.ec.europa.eu/research/scoreboard_2008.htm)

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### GBAORD- Distribution by Socio-Economic Objectives

- ▶ R&D should be classified according to the primary objectives (SEO - NABS) like defence, health, environment, etc.
- ▶ Two approaches for distributing funding are allowed:
  - ▶ According to the purpose of the R&D programme/project
  - ▶ According to the general content of the R&D programme/project
  - ▶ Residual criteria: direct derivation (a project which is directly derived from another project can be classified with it) and indirect spin-off (the results of a project have been relevant for subsequent projects related to another objective)
- ▶ There are some basic problems in this approach
  - ▶ Funding goal does not necessarily match R&D performed
  - ▶ How to classify "generic" sources (like investigator driven research or general university funds)

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### GBAORD and GERD data

- ▶ Common features: same definitions of R&D, all science fields, both capital and current expenditures
- ▶ Differences:
  - ▶ GERD is based on reports by R&D performers, GBAORD is based on reports by funders
  - ▶ GERD refers to R&D performed on national territory, GBAORD includes payments to foreign performers
  - ▶ GERD refers to the calendar year, GBAORD to the fiscal year
  - ▶ Money can be spent by the performer in a different year than the one in which it is committed by the funder
  - ▶ Accuracy of the performer supplying R&D data
  - ▶ GERD covers all sources of funds on national territory included local government, GBAORD only R&D financed by government (including abroad)
- ▶ Overall R&D data are more reliable
  - ▶ GBAORD data are much less used in practice

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### Summing up

- ▶ The Frascati Manual is one of the most successful initiative in the development of S&T Indicators (six editions from 1963 to 2002)
  - ▶ What are considered the prototype of "old-style" STI indicators
- ▶ It measures the national effort in R&D (data on expenditures on R&D collected through specific surveys developed by the national Offices of Statistics)
- ▶ Scarce interest on source of funding as well as for the allocation mechanisms
  - ▶ Lacks a suitable conceptual framework based on layers
- ▶ Some statistical problems (higher education funding, differences in the delimitation of sectors between countries, break in series of data, lack of indicators for policy analysis)
  - ▶ Broad aggregates but not precise numbers
- ▶ Aggregated data from MSTI database are useful to provide broad comparisons of national efforts and sectoral composition
  - ▶ But micro-data collected by national statistical offices are an extremely valuable source of information which can be exploited also for other purposes

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### Characterising funding instruments and portfolios

- ▶ There is a wide body of literature on different methods of allocation of research funding discussing their impact on research performance
  - ▶ Changes in allocation of core funding (historical vs. performance-based)
  - ▶ Increase of the share of project funding
  - ▶ Changes in portfolio, for example shifts towards economic-oriented research
  - ▶ Changes in organizational of funding, for example different structure of funding agencies or intermediaries vs. ministries
- ▶ Some reasons to assume that the allocation mode is as important as the overall volume of public funding
  - ▶ Setting the right incentives
  - ▶ Especially in time of austerity where the overall volume is limited
- ▶ However, there is very little quantitative evidence
  - ▶ R&D statistics is not very suited for these purposes
  - ▶ Data scattered in official documents at national level
  - ▶ No comparability between countries and across years

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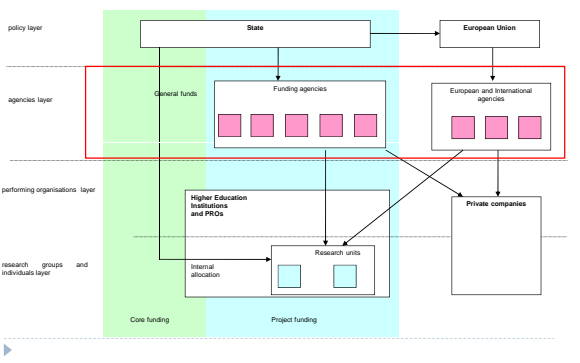
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### The overall conceptual framework




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### Develop indicators on public funding

- ▶ In PRIME we started a specific research line devoted to the development of indicators to characterise quantitatively allocation modes of public funding
  - ▶ Starting with project funding
  - ▶ With a number of very interesting future developments
  - ▶ A specific instance of the "positioning indicators" characterizing actors (in this case funding agencies)
- ▶ What you need to this purpose
  - ▶ A conceptual framework guiding the definition of categories
  - ▶ Well-defined research or policy questions
  - ▶ Data sources
  - ▶ Procedures to build from these sources indicators
  - ▶ Organizations taking care of this work
- ▶ PRIME "project funding" is an excellent example of how you build step by step this infrastructure
  - ▶ And convince relevant stakeholders that this is highly relevant for policy purposes

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### The public funding project

- ▶ **Design an approach suitable to measure "project funding"**
  - ▶ Based on its relevance for research policy
  - ▶ Request from stakeholders of data on this topic (for example OECD, European Commission)
- ▶ **A few questions**
  - ▶ Comparison between countries in the share of PF
  - ▶ Changes accross time
  - ▶ Composition of project funding
- ▶ **Test its applicability in a small number of countries (3 + 3)**
  - ▶ Also to address methodological and comparability problems
- ▶ **Produce first results on international comparisons**
  - ▶ To assess some hypotheses on the changes in research policy
  - ▶ Make the proof of feasibility of the concept
  - ▶ Get academic recognition




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### Definitions and hypotheses

- ▶ **Public project funding can be broadly defined as money attributed to research groups or individual for activities limited in time and scope from agencies external to their research organisation**
  - ▶ Three basic criteria for delimiting it: allocation directly to groups, limitation in time, presence of an external agency
  - ▶ No reference to competition
- ▶ **We need to show that it can be identified rather unambiguously and distinguished from core funding**
  - ▶ In-depth discussion of borderline cases
- ▶ **We assume that in each country there is a rather small number of public funding agencies and instruments**
  - ▶ Which can be identified rather easily by knowledge of the national system
  - ▶ For which we can retrieve from reports and official documents the information on the funding volume they grant each year




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### Definitions and hypotheses

- ▶ **the whole approach is based on building for each country a list of funding agencies and instruments**
  - ▶ And measuring their funding volume
  - ▶ As well as devising a few categories for classifying project funding
- ▶ **Expert knowledge is essential in this phase to make reasonable choices**
  - ▶ Choice of the relevant instruments (based on the volume)
  - ▶ Identification of the sources of information
  - ▶ Indicators development involves a lot of tacit knowledge about data sources
- ▶ **Simplification is essential for indicators development**
  - ▶ Reducing also substantially the amount of work
  - ▶ Feasibility of the project is an outcome of these sensible choices
  - ▶ But not losing the main structural characteristics




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### National charts of agencies and instruments

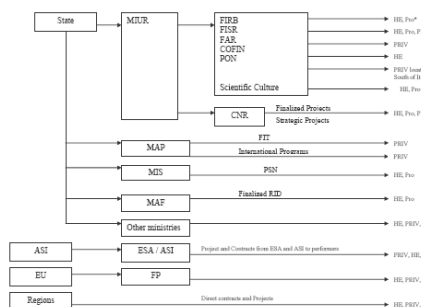


Figure 3. Project funding overview (2002)

### Instrument descriptions

<b>Name of instrument</b>	FIRB Projects
<b>Time coverage</b>	2000 - 2003
<b>Budget (2002)</b>	12.520 (thousand Euros)
<b>Performers</b>	special funds devoted to Projects in strategic areas
<b>Scientific domain</b>	All domains. The projects are linked to multidisciplinary sectors.
<b>Type of projects</b>	Mostly collaborative projects (cooperation between public and private teams) Duration: two year. Projects at national level; no funding available for partners in other countries. Oriented and applied research; there are special priority research themes indicated by the Miur.
<b>Selection procedures</b>	Proposals can be submitted one times a year on standard form. Evaluation is performed by external experts within a special Committee (see below). The selection is done by the Miur. The most important criteria for evaluation are: the scientific quality of the proposal, the coherence with the Miur strategic objectives and the socio-economic impact of the expected results.
<b>Selection Committee</b>	Evaluation Committee, nominated by Miur on agreement with the Ministry of Economy and Finance, and composed by scientists and high level experts coming from the public and private sectors.
<b>Availability of data</b>	Aggregated data by projects available from 2001; data on beneficiaries are also available from 2001.
<b>Sources</b>	Miur statistical offices.
<b>Discussion</b>	Overall, this is the funding instrument for public-private collaborative research, specially devoted to develop research on strategic sectors established by the Pnr. The selection is performed by the peers integrated with a representative of stakeholders.

### Data Italy 2002 by instrument and agency

Funder's	Miur	Cnr	Other Ministries (Map, Mef, Mis)	Asi	Abroad	Total
<b>Instruments</b>						
Fir	68.059					68.059
Asi contracts				167.748		167.748
Map/92	250.498					250.498
Mis finalized research			68.735			68.735
Pon	104.736					104.736
CoFin			1.251.536			1.251.536
FP	128.537					128.537
Pus	9.827					9.827
<b>Map finalized research</b>			291.651			291.651
Cnr strategic projects		724				724
Cnr finalized projects		4.233				4.233
EUCP				226.071		226.071
Ew				226.851		226.851
Fir	11.835					11.835
Firb	354.556					354.556
<b>Total</b>	926.046	4.957	1.611.022	167.748	453.052	3.163.723

## Definitions and delimitations

- ▶ **Delimitation issues**
  - ▶ Use for research activities (since we are not looking to performers) – difficult to assess for example for contracts and for support to private companies
    - ▶ Typical case the European Space Agency
    - ▶ But this is already to some extent a problem with the Frascati manual
  - ▶ Long-term competitive schemes (centres of excellence)
    - ▶ Should be considered as a category on their own
  - ▶ Internal competitive schemes to research organizations (or vertically integrated organizations like academy of sciences)
    - ▶ We exclude them but this might be a problem in the future
- ▶ **Overall the distinction works and is usable but**
  - ▶ One needs much care in the comparisons especially for time series
  - ▶ We should try to develop a finer typology of funding instruments in the future
  - ▶ In-depth knowledge of national systems was essential for this exercise

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## French CNRS

- ▶ **A very large organization with a double role**
  - ▶ Funding its own laboratories (10%)
  - ▶ Funding joint laboratories with universities (thus partially outside the CNRS perimeter)
- ▶ **A partially competitive allocation mechanism**
  - ▶ Labelling by CNRS gives access to its resources and there is a rather high turnover
  - ▶ Mostly in form of personnel, but no mandatory allocation: personnel moves to laboratories which receives the label
- ▶ **It is something intermediary between general and project funds**
  - ▶ Accounting for nearly 10% of public research funding in France, thus impossible to put in a footnote
- ▶ **Our picture of the French system largely depends on the choice we do concerning these funds**
  - ▶ Considering CNRS as a classical research organisations provides a picture very different if we consider it as a little bit similar to a funding agency financing laboratories which are hosted by universities
  - ▶ Indicators shape our representation of the reality
- ▶ See the paper by Theves, Lepori and Larédo

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## Categories

- ▶ **Comparative analysis clearly needs common categories**
  - ▶ Beyond individual list of instruments/agencies at national level
  - ▶ Categories need to be based on sound knowledge reality to identify the main classes
- ▶ **We devise three classifications**
  - ▶ By type of agency
    - ▶ Ministries vs. intermediary agencies
  - ▶ By instrument type
    - ▶ See next slide
  - ▶ By beneficiaries
    - ▶ Using Frascati sector (private vs. higher education vs. government)

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### Instrument types

- ▶ Intuitively it is clear that there are different instruments concerning their orientation / type of research they fund
  - ▶ But designing a clear classification is very difficult since these concepts are largely multidimensional
  - ▶ It is not always clear if we refer to the aims of the instrument or to the type of research performed
- ▶ We end up with a simple distinction
  - ▶ Academic instruments (investigator-driven)
  - ▶ Thematic instruments
  - ▶ Innovation oriented (industry driven)
- ▶ However, this is just a rough approximation of policy intentions, but not necessarily of the research done
  - ▶ Different features need to be combined to better understand the significance of instruments for the research system
  - ▶ Granularity is a problem since the level of aggregation is rather high
  - ▶ A classification of some use but not really satisfactory and difficult to implement

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### Data sources and data collection issues

- ▶ There is no unique source of these data, but they had to be compiled from:
  - ▶ State accounts (France)
  - ▶ Research ministry reports
  - ▶ Agency reports
  - ▶ Some existing databases
  - ▶ Surveys (for example the Swiss R&D survey)
  - ▶ Direct inquiry to ministries
- ▶ Most data are available but with limitations/problems in many cases
  - ▶ In most cases it was possible to come back to the '70
- ▶ Data problems and solutions
  - ▶ Funding to companies through loans: estimate of cash value
  - ▶ Project decisions instead of allocations: one needs some kind of averaging
  - ▶ European Space Agency: use national contribution as proxy (national return rule)
  - ▶ Contracts from ministries: coverage is problematic outside the formal programs
- ▶ Even if the methodology is simple there is a lot of dirty work to get usable data
  - ▶ Different choices are possible, but need to be motivated
  - ▶ Have coherency in data treatment across countries

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### Some selected results

- ▶ PF as the second stream of research funding in the six considered countries
  - ▶ 1/4 to 1/3 of funding volume, the "second" allocation mode of research funding (alongside core funding to universities)
  - ▶ Strong increase in the role in the last two decades, thus confirming what is said in the qualitative literature
- ▶ A composite model of funding instruments
  - ▶ Some academic, some thematic, some innovation
  - ▶ A shift towards thematic instruments, but back after 2000 towards some more investigator-driven funding
- ▶ Differences between countries remain quite large
  - ▶ In the organisation of funding agencies and the type of funding
  - ▶ Path-dependency and national specificities are very relevant
- ▶ One needs to consider carefully this context when designing European funding policies

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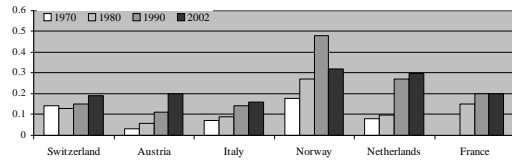
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PF as % of BIP




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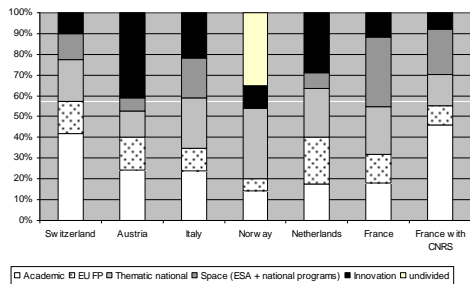
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Type of PF instruments




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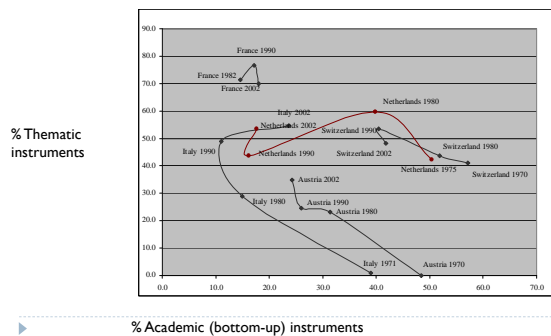
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From academic to thematic and back...




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### Our results

- ▶ **A set of definitions and methodologies to produce these indicators**
  - ▶ Presented in a paper on Research Evaluation
  - ▶ Basis for further work
- ▶ **Some new results on public research policies**
  - ▶ Combining our data with some more qualitative information
  - ▶ A special issue of Science and Public Policy on this topic
- ▶ **A large diffusion of these results among stakeholders**
  - ▶ For example cited in the EC research key figures
  - ▶ Endorsed in the Expert group on ERA monitoring
- ▶ **You need to sell our your new indicators**
  - ▶ In the academic community to get recognised and get a label of quality
  - ▶ Among the stakeholders to get them used and to get institutional support for long-term development
  - ▶ A lot of diffusion and networking activity to this aim

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### Getting project funding institutionalised

- ▶ **This approach is suitable for an experiment but not for long-term data collection**
  - ▶ Both in the composition of the group and the way of working
  - ▶ In the rather informal definitions
  - ▶ As well as covering just a few countries
- ▶ **Institutionalising requires many changes**
  - ▶ Entrusting an organization with the suitable organisation, means and culture for long-term development
  - ▶ Adapting definition and approach to the new conditions
  - ▶ Finding a suitable data source or data collection approach
- ▶ **OECD launched an experimental project to develop these indicators**
  - ▶ See Jan van Steen poster
  - ▶ Based on data underlying GBAORD
  - ▶ Limiting the cope of these indicators to what can be codified and standardised
  - ▶ Hopefully, inserting these indicators in the next revision of the Frascati manual
- ▶ **It will be less exciting than the work we did**
  - ▶ But more adapted to long term-production

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### Conclusions

- ▶ **Overall, this was a successful exercise**
  - ▶ First systematic comparison of project funding portfolios between countries and across time
  - ▶ Confirmation of some hypotheses, but also some new results
- ▶ **This results was largely due to**
  - ▶ Well defined starting questions
  - ▶ Limitations of the scope of the analysis
  - ▶ A realistic design of methodology
- ▶ **Success factors**
  - ▶ Careful exploitation of secondary data and of their characteristics (mandatory if looking to the past)
  - ▶ Devising reasonable simplifications based on expert knowledge and qualitative information
- ▶ **Limitations/problems**
  - ▶ Ad hoc data with limited standardization and reusability (no off-the shelf indicators)
  - ▶ Going towards institutionalisation in the official indicators system requires changes and skilful policy

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### Extensions

- ▶ The same approach can be used to characterise more in-depth specific parts of the allocation of public funding
  - ▶ For example characterising portfolios of funding agencies by type of instruments and their changes across time
  - ▶ Using more detailed data from funding agencies themselves
- ▶ At the end is a political issue which indicators will get standardised and then produced regularly
  - ▶ This might be the case of joint programming in the next future
  - ▶ An headline indicators for monitoring the ERA

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### Looking to individual performers

- ▶ Characterise the funding structure of different performers
  - ▶ For example universities
- ▶ Looking to
  - ▶ Absolute level of funding as an indicator of competitiveness
  - ▶ Composition of funding affinity towards different sources
- ▶ Highly relevant to monitor the structuring of the research performers space
  - ▶ Concentration
  - ▶ specialisation
- ▶ See the presentation of Cinzia Daraio on the AQUAMETH project

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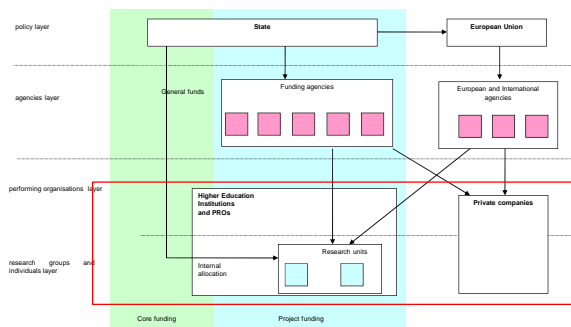
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### The overall conceptual framework




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### The next step: from funders to market structure

- ▶ **The main limitation of project funding work**
  - ▶ Disregarding the use of money
  - ▶ Except a very broad repartition of funding by sector
  - ▶ Yet project funding can mean different things depending on beneficiaries
- ▶ **Example: Switzerland vs. Italy**
  - ▶ Switzerland: 80% of project funding benefits to universities, thus a choice instrument to improve the quality of public research through selective allocation of resources
  - ▶ Italy: more than 50% of project funding benefits to private companies, thus an instrument to strengthen private research in a context of low investment
- ▶ **Without taking this into account it is difficult to understand complementarities between types of funding**
  - ▶ For example between core and project funding
- ▶ **Can we devise indicators to look to this kind of relationships?**
  - ▶ An experiment on CEEC
  - ▶ Some ideas on how to go further on the micro-structure of funding markets

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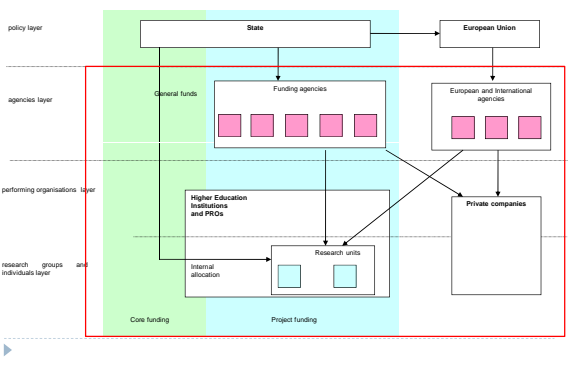
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### The overall conceptual framework




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### CEEC project

- ▶ **To analyse the changes in the organization of public funding in CEEC**
  - ▶ Three countries as a test (Czech Republic, Estonia, Poland)
  - ▶ Look also for availability of data (including time series)
- ▶ **Approach**
  - ▶ Identify the main funding streams and to characterize them
  - ▶ Draw structural diagrams
  - ▶ An overall characterization of the structure of national funding systems using funding streams as quantitative measures
- ▶ **System-level features**
  - ▶ Market-space structure
  - ▶ Segmentation in domains vs. centralisation
  - ▶ Level of delegation

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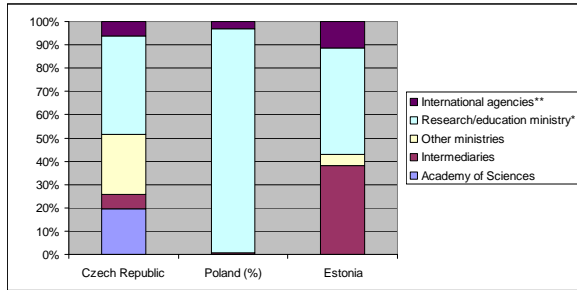
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### Role of funding agencies




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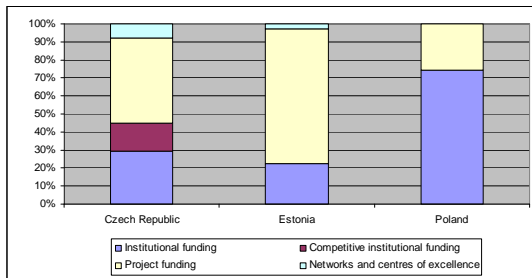
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### Allocation modes




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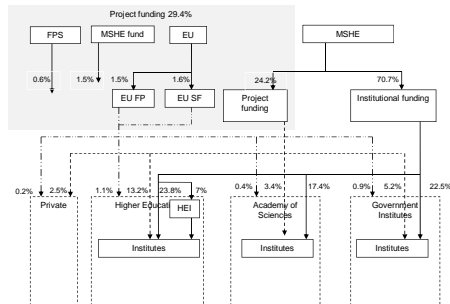
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### Poland: old wine in new bottles. The centralised model revisited




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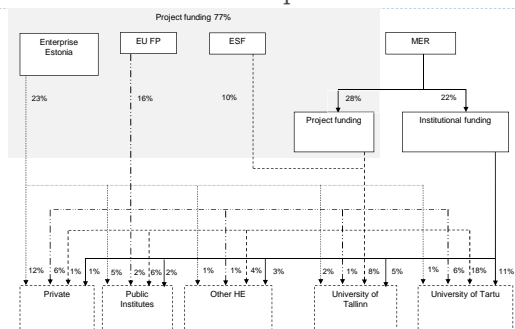
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### Estonia: oligopoly of performers thanks to cumulative effects of competition




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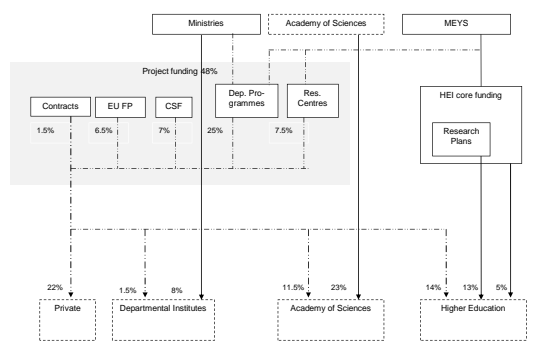
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### Czech Republic: the fragmented model by sector




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### Results

- ▶ Three completely different funding systems
  - ▶ No convergence towards a western European model
  - ▶ Breakdown of the communist regime was a source of strong divergence towards stable national paths related to local conditions at the moment of the reforms (see the Polish case)
- ▶ Allocation of funding is not about optimal design of funding schemes
  - ▶ But in promoting structural relationships between funding agencies and performers keeping diversity and creating competition
  - ▶ The best solution is strongly dependent on local conditions
- ▶ This example shows how even simple indicators can be useful to describe the structure of funding systems
  - ▶ And to show unexpected pitfalls (see the Estonian case)

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### Further developments

- ▶ This approach could be developed at a lower level of aggregation
  - ▶ If we consider that the "funding market" is highly segmented
  - ▶ Going to the level of individual research organisations or even performers
  - ▶ Focusing on individual sectors and domains
- ▶ Adopting techniques current in economics and organisational studies
  - ▶ Analysis of market shares
  - ▶ Analysis of concentration
  - ▶ Matrices of funding agencies – performers relationships and their evolution across time
- ▶ There is an enormous potential of work in this area
  - ▶ Going beyond existing mostly qualitative studies on funding and competition for it

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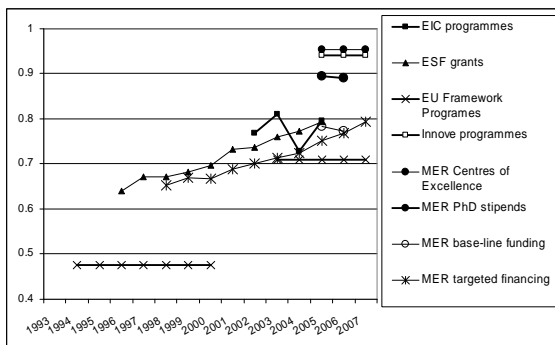
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### Estonia. Market share of the three largest performers by instrument




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### Conclusions

- ▶ Research fund and expenditures looked as the most well-developed and traditional domain of S&T indicators
  - ▶ With an established system routinely producing indicators
- ▶ However, an analysis based on actors makes the picture much richer and more interesting
  - ▶ One can devise different types of positioning and customized indicators
  - ▶ The project funding work opened the box of possibilities
  - ▶ But there is a wide domain for new experiments adopting quantitative techniques current in economy and organizational studies
- ▶ It is largely open which kind of indicators will come up to the political debate
  - ▶ And which one will remain mostly for scholarly use

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