

Convergence versus national specificities in research policies. An empirical study on public project funding

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Draft – data and analyses for Netherlands to be introduced and conclusions to be updated after the conference.

1 Introduction

An important debate in research policy studies in the last years has concerned the existence (and reasons) of similarities and differences between national research policies, respectively to which extent there has been in the last decades a convergence between them or national specificities are keeping their importance.

Advocates of the convergence thesis have pointed to the globalization of economy and research systems, which confronts national research policies to similar issues to be addressed, to the importance of imitation effects in this context (isomorphism; Powell and Di Maggio 1983) and to the normative pressure put by international organizations like the OECD in the definition of policy objectives and measures (Lemola 2002; Braun et al. 2003). Since the '90, we should consider also the increasing role played by the European Union in defining the framework for a European research policy, in benchmarking and proposing models for the policies of member countries, in promoting the cooperation between national initiatives and through direct funding instruments as the European Framework Programs; this development is leading to a considerable debate on future governance models for research and innovation policy in Europe (Kuhlmann 2001).

Other authors have rather emphasized the profound differences in national policy styles and institutional structures between individual countries and their presumable impact on actor's choices in a context where most decisions are still taken at the national level and, concerning research, most of the funding for public research organizations comes from the national state (Elzinga and Jamison 1995); as one of the few comparative studies on national research policy outlines, since national decision-makers are constrained by different institutional structures, they might adopt different answers to the same issues even in a context of international interdependencies (Senker et al. 1999).

At the empirical level existing comparative studies display a complex pattern where similarities and imitation between countries exist for some aspects - for example concerning the main policy rationale and some funding instruments adopted -, while for others differences between countries remain very large (think for example to the organization of the public administration and funding agencies; Larédo and Mustar 2001; Braun et al. 2003).

However, in our view a major limitation of this debate has been the lack of systematic comparisons between countries and across time based on a well-defined metrics; namely, almost all studies have been based on a subjective evaluation of policy documents or of characteristics of funding instruments, but without trying to find a measure of their relative importance. This is in our view problematic since it is well-known from organizational studies that organizations, faced from external normative pressures, might well adopt mimetic behaviors which legitimate them without necessarily changing radically their practices (Oliver 1991; Godin et al. 1999).

In this paper, we systematically compare for six European countries (Austria, France, Italy, Netherlands, Norway and Switzerland) an important component of national research policies, namely the organization of public project funding and we look in detail to similarities and

differences between countries, respectively to convergence or divergence during the last three decades. To this aim, we make use of a methodology which has been developed inside the PRIME Network of Excellence to produce comparative indicators concerning public project funding based on the measure of the volume of funds granted each year by instrument and funding agency. Thus, the paper is also an example of how science and technology indicators can be designed and used for comparative purposes.

In part 1, we define more precisely our object of study, the methodology and the data sources and we introduce some theoretical categories useful for the comparison. Part 2 of the paper provides a detailed comparison of today's project funding systems in the six concerned countries, while part 3 quantitatively looks at convergence and divergence patterns during the last thirty years and gives some indications on specific national trajectories. Finally, the last section of the paper draws some general lessons for comparative studies of research policies.

2 Framework and research questions

In today's research policy and funding systems, project funding plays a quite relevant role. Namely, it can be considered as the second main allocation mechanisms for public research funding alongside institutional funds attributed to universities and research organizations (Millar and Senker 2000) and in most European countries it covers between $\frac{1}{4}$ and $\frac{1}{3}$ of total public research funds. Moreover, since the II World War, it has been a choice mechanism used by governments to implement research policy and thus it is believed that instruments and allocation models for project funding reflect more directly political priorities than general funds (Braun 2003; Guston 1996); this is even more true in the European context where institutional funding is mostly composed by general funds to higher education institutions allocated jointly for education and research and thus is more linked to educational policy than to research (Lepori et al. 2007). Hence, the relevance and the interest of studying research project funding with the more general aim of understanding research policies in a comparative perspective.

A further feature making project funding suitable for a comparative work is that the distinction between general and project funds is rather clear in most in European countries and, as we shall see, the borderline cases are relatively limited; as a matter of fact, the only case in our sample where a more detailed discussion was needed is France. Thus, we are comparing a domain in research policy which can be rather clearly delimited using similar criteria across country.

2.1 Project funding: delimitation and organization issues

In very general terms, we define project funding as money attributed to a group or an individual to perform a research activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be done. The fact that the process of allocation is competitive or not is not decisive, since project funds can be also attributed through direct contracts. Thus belong to this category research council projects, European framework programs, most technological funds and research contracts of ministries (for details on coverage see Lepori et al. 2006).

In organizational terms, the decisive feature of project funding (as defined here) is the existence of some kind of agency selecting the project to be funded and allocating money to a research group (Figure 1). Examples are *research councils*, agencies managed by the scientists themselves and enjoying of a rather large autonomy from the state (Braun 1998), services and committees inside the different ministries (Sanz et al. 2005), technological agencies, international organizations like the European Space Agency and, finally, charities. We notice that, in this domain, delegation to quasi-independent agencies is very widespread (Braun 2003 and 2006); hence the frequent use of the principal-agent theory to analyse funding agencies (Guston 1996, Braun and Guston 2003).

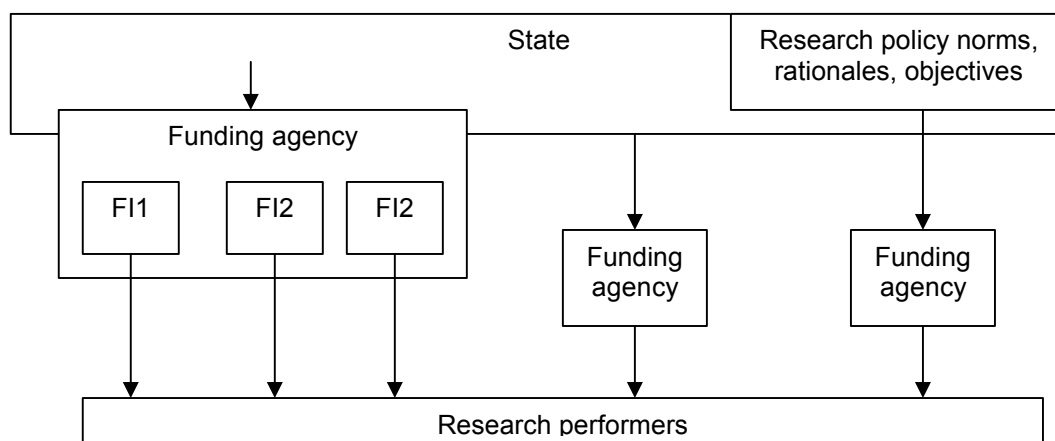


Figure 1. A framework for the analysis of project funding

In many cases, funding agencies manage different instruments, as it has become typical for research councils in some countries; this differentiation depends largely on multiple objectives attributed by the State to these agencies – for example promoting academic research alongside strategic research or structural programs to reinforce the national research system (the Norwegian research council being an extreme case; van der Meulen 2003); this means also that in many cases delegation of project funding to agency is bound to some conditions, like programs explicitly directed to specific research themes and that the degree of autonomy of the agency might vary according to the instrument considered. Also, joint management of programs between the state and research council is present in some cases (like the National Centres of Competence in Research in Switzerland; Braun and Benninghoff 2003). We assume that each funding instrument possesses its specific objectives, rules and allocation mechanisms (either explicit or to some extent tacit). In some cases, these are directly related to the norms and objectives of the agency itself – as for academic instruments for research councils –, while in the case of research programs managed by research councils these can be described as a sort of compromise between state objectives and agency objective (Shove 2003).

While most of the literature in the field has concentrated on case studies concerning individual agencies and programs (see among others van der Meulen 2003; Braun and Benninghoff 2003), we focus here on the comparison between countries concerning the whole portfolio of project funding. We focus namely on the role and characteristics of the funding agencies and on the type of funding instruments and programs in place in each country (for example objectives, allocation mechanisms, type of projects funded). While qualitative comparisons are of course important, for example between lists of instruments, we use systematically data on funding volumes as a proxy to measure the importance of the different instruments. Thus, we are interested in measuring and comparing across countries the policy mix of funding instruments as well as the importance of different types of agencies (for example research councils vs. ministries). Of course, this requires the development of suitable categories and typologies allowing a comparison across countries.

2.2 Historical evolution and the issue of convergence

Like research policies, funding systems evolve over time and, actually, there is a rather large body of (essentially qualitative) literature on the subject. At a general level this literature identifies two main changes: firstly, a shift in the delegation modes of funding allocation from blind delegation to the scientific community, to the research councils respectively, to more responsive modes where the state sets more specific targets (for example concerning priority domains or research structures; Braun 2003); secondly, a shift in the general objectives from the support to academic science to the support to research more directly oriented to social and economic needs, linked to the evolution of the overall models of research policy from “science push” to policies more oriented to social relevance and later to economic innovation (Brooks 1986; Elzinga and Jamison 1995 ; Guston 2000).

Concerning project funding, it is normally assumed that the share of project funding has increased at least since the beginning of the '80 (Geuna 2001; OECD 2003). Moreover, it is assumed that these trends implied a shift from reactive instruments funding academic research on subjects chosen by the scientists themselves to instruments where the research

subjects or domains are predefined by the state, possibly in cooperation with the economy; thus, we witness the emergence of programs oriented to socio-political needs in the '70 (RANN in the USA, National Research Programs in the Netherlands and in Switzerland) and of technology programs in the '80, including the launch of the European Framework programs (Caracostas and Muldur 2001). Also, some changes have been documented in the agencies managing project funding: research ministries acquiring a role in project funding in some countries (Italy, Germany), the emergence of the European Union and of other international agencies (for example the European Space Agency) as major players in project funding and, finally, changes in the role and organization of research councils in many countries (van der Meulen 2003; Godin et al. 1999). It is generally acknowledged that the "new" funding instruments developed alongside the existing ones, rather than to replace them (Braun 2003) and thus, that, generally, different "funding styles" might coexist in research policy (Benner and Sandström 2000).

However, there are two major limitations of these studies. The first is that most of them are based on the analysis of an individual case at country or even agency-level and thus the possibility of generalizing them, in a context of still largely different national policies, has to be carefully discussed. Secondly, concerning project funding there is a remarkable lack of quantitative indicators and thus thesis like the increase of the share across time cannot be easily verified empirically (Lepori 2006; Lepori et al. 2006); for instance, we do not have any comparable information concerning the quantitative importance of this mode of allocation between countries. This is a major problem especially for historical analysis.

In this context, our objective will be to provide fairly comprehensive descriptions of project funding systems in the six considered countries for the last three decades (focusing on the years 1970, 1980, 1990, 2002) and to complete them with data on the funding volume for each instrument; this will allow to examine empirically both the evolution of project funding volume and its composition by agencies and instruments and to look quantitatively to common trends and to national specificities.

2.3 National embeddedness and path dependency

Below, we briefly elaborate on two useful concepts from institutional and organizational analysis which are relevant for our analysis – namely institutional embeddedness and path dependency - and we provide some hints and possible pathways on their use for the comparative study of research policy in general and of project funding more in particular.

1) *Institutional embeddedness* is a classical argument in organizational analysis and socio-economics since at least two decades (Granovetter 1985; Hollingsworth 2002). In its widest sense, it refers to the fact that actor's are embedded in complex institutional environments which not only constrain, but largely shape them and thus generate regularities of actors and actor's behavior at the macro-level (Hollingsworth 2002). It is important to distinguish between types of institutional arrangements, like social norms and rules, which characterize societies as a whole and display the highest level of stability, general coordination mechanisms of a society like markets and state and institutional arrangements specific to a domain, like the design of research policy and its organizational structure (Braun et al. 2003). For our discussion this implies that the behavior of actors in research policy is influenced also by institutional arrangements outside this domain, which are likely to be society or country-specific and thus it is not possible to deal with the convergence of research policies without considering also the wider societal framework in which these policies are embedded and its differences between countries.

Moreover, in modern society, institutional embeddedness is intrinsically *multi-level*, in the sense that institutional arrangements at different spatial levels – global, macro-regional, country, regional, etc. – are intertwined in a complex way (Hollingsworth 2002a). Thus, some of the institutional arrangements relevant for research policy can be assumed to be largely global, like the economy in high-tech domains or scientific and technological developments in many areas of natural and technical sciences or rationales and norms of research policy diffused by the OECD; others are situated at the European level, like some economic regulations, the general political and normative framework of the European Research and Higher Education Area and funding programs like the European Framework Programs, while some very relevant arrangements for research policy are clearly national, including the organization of the political system and of the public research system (Kuhlmann 2001). Since, the behavior of actors in research policy is influenced *at the same time* by country-level

and by wider-level institutional arrangements, we assume that no general argument can be put forward for convergence or divergence of national policies, but the issue needs careful empirical assessment. Moreover, the importance of different institutional arrangements varies between the types of actors considered: for example, it is well-known that large multinational companies tend to develop global research strategies (Kuhlmann 2001; Meyer-Kramer and Reger 1999), while at least in the European context the frame of reference for public research organizations is still largely national.

In this context, we lack of a systematic framework to analyze the influence of the different institutional arrangements on the characteristics of (national) research policies, a task which goes well beyond the scope of our research and which would require a systematic comparative analysis of national research policies and contexts. The more limited task of this paper will be to analyze empirically similarities and differences between countries concerning public project funding and to propose some possible explanations in terms of their different (and multiple) institutional contexts.

2) In very general terms, a *path-dependent process* is one of which important influence upon its outcome can be exerted by temporally remote events and where there is no automatic convergence to a unique status (an attractor; David 1985); in these cases, historical accidents (and their temporal sequence) cannot be ignored and thus it is not possible to explain today's status without looking to the historical paths and change processes.

The path-dependency argument has been used frequently in the analysis of technological innovation, largely on the basis of the cumulative effect and irreversibility of technological investments (David 1985; Dosi 1982). For research policies and research funding the basic rationale to look for path-dependency has to be sought rather in stability of *national* institutional arrangements, which, once created, can influence durably the behavior of actors. Thus, all studies of institutional changes display a relatively high degree of stability and dependency from the past of existing institutions (Hollingsworth 2002, Scott 2001).

This subject raises a number of issues of interest for our analysis. These concern firstly the degree of stability and of inertia of existing institutional arrangements – for example if subject to external pressures - and differences in this respect between countries, according for example to the organization of their political systems or to their history (including rupture events like wars, changes of regimes, etc.); for instance, our sample includes countries which undergone a change of the political regime during the last century, like France and Italy, and countries, like Switzerland keeping basically the same political structure since the XIX century. Secondly, we should consider the possibility of stable institutional arrangements (“paradigms”) which durably orient national research policies and funding systems and keep them different from other countries even if faced to similar external pressures. For example, long-term work on the German innovation systems shows a high degree of stability of its technological specialization since the XIX century (Grupp et al. 2004; Dominguez Lacasa, Grupp and Schmoch 2003) and thus gives some evidence that some component of the national innovation system might be so stable to survive to major historical changes. Correspondingly, we are interested in the conditions and occurrences of ruptures in research policies and public research funding (“profound institutional change”; Scott et al. 2000) and on their timing; for instance, work on the Swiss case showed a major change in public funding policy at the end of the '60, followed by a long period of stability of the policy priorities and of the institutional arrangements (Lepori 2006). Finally, we are interested in the importance of the initial structuration phase of new organizational fields – in our case of national research policies and public funding systems –, where actors should have more freedom to shape institutional settings, and on their effects on today's systems, a subject which has been repeatedly examined in other domains like education or healthcare (Meyer et al. 1988; DiMaggio 1991; Scott et al. 2000), but quite rarely for research policies for the lack of suitable comparative information. Thus, we provide in the second part of the paper some evidence that public project funding was created in different time periods in the considered countries and that this has some influence on its today's organization.

2.4 Methodology and data sources

Even if, in institutional and organizational terms, project funding appears to be relatively well-defined, the collection of comparable data proved to be a rather complex exercise. Basically our approach was based on the production of national lists of instruments to be included (based on the general criteria outlined before) and on the collection from the funding agencies

themselves of data on the amount allocated each year. Moreover, for each of the six countries involved (Austria, France, Italy, Netherlands, Norway, Switzerland) a detailed report has been produced, containing qualitative descriptions of research funding systems, standard description of funding instruments and, finally, charts of flows for the years 1970, 1980, 1990 and 2002 (Dinges 2005; Lepori 2005; Poti and Reale 2005; Slipersaeter 2006; Theves, Filliatreau and Lepori 2006; van der Meulen et al. 2006). We shortly review in the following the main methodological problems, while for a complete discussion the reader should refer to Lepori et al. 2006.

The main difficulties in this work have been the definition of a comparable list of instruments, the calculation of amounts in some cases (for example European funding) and, most of all, the reconstruction of time series. Generally speaking we have adopted a rather broad approach, extending the scope of project funding beyond individual grants and projects to include also more long-term schemes like centers of excellence if allocated competitively and for a limited period of time (for example 8 to 10 years). Moreover, we have included also technological development programs even if to some extent they probably finance also activities outside R&D (as in the case of some European Space Agency programs). A major classification problem has emerged for France, where a large part of public funds is allocated through the CNRS to the joint laboratories between CNRS and universities; these funds present some characteristics similar to project funding since they contain a competitive element through the labeling of the laboratories, but display also some very important differences (first of all, that allocation is given in form of CNRS personnel rather than of money). We thus provide two sets of data for France, including or excluding these funds (for a in-depth discussion see Theves et al. 2006). A further major issue has been the definition of categories for the comparative analysis concerning agencies and instruments; the classification we will present in the section proved to be more or less usable, but the reader should be aware that not all instruments fit very well into the defined categories.

The methodology has proved to be usable for constructing time series over the last thirty years, since it has been possible to retrieve data on the funding volume for most instruments. However, as for most long-term time series (Grupp et al. 2004; Dominguez Lacasa, Grupp and Schmoch 2003), we were faced to a number of consistency problems, including the difficulty in validating older data (since we make largely used of non statistical sources), problems in identifying the existing instruments and, most of all, in classifying correctly the instruments since some of them might have changed their rules over time. Moreover, since project funding data were not systematically collected in the past, we observed wide variations across time in the quality and detail of the available data: for example, in Norway quite detailed data exist on government funding for a ten years period in the '70/'80, while this series stops later; in Switzerland, project funding data have been systematically collected for the years from 1988 to 1999 by the Swiss Science Council, but later data have to be compiled from different sources. These changes in data sources and availability might well impact on the reconstructed series. Thus, while we believe that the analysis which follows correctly depicts the main trends, the reader should be aware that these data cannot be used for further analysis without validation and cross-checking with other information.

3 Public project funding: a comparative view

In this section we compare the organization of project funding for the six countries participating to the project for the baseline year 2002. Of course, these countries are not fully representative of the European situation, especially for the lack of countries like Germany and the UK, but they already represent an interesting sample covering most of Western Europe. We organize the analysis in four main themes: the overall level of project funding, the role of managing authorities, the portfolio of funding instruments and, finally, the repartition by beneficiaries. We conclude with a more general characterization of the different systems.

	Total project funding (mio current PPP \$)	Total project funding as % of GERD GOV	Total project funding as % of GDP
Austria	495	29	0.20
France	3459	24	0.20
France (with CNRS)	5262	36	0.31
Italy	2467	24	0.16
Netherlands			
Norway	529	46	0.32
Switzerland	464	32	0.19

Table 1. Basic data (2002)

Sources: OECD except project funding data (produced in this study).

Table 1 shows some data on the overall level of project funding. For France, we provide two different figures including or excluding the CNRS allocation to joint laboratories (Theves et al. 2006). Overall, the differences between the countries are rather gradual than fundamental: in all the examined countries project funding plays a significant role in public research funding, but in none of them appears to be the dominant mode of allocation of resources; this despite we are considering here quite different countries for their size, the organization of the research system and science productivity indicators. In a sense, we are identifying here a regularity which seems to characterize European countries and differentiates them from the US situation where, for example, institutional funds account for only about 20% of the R&D funding in academic institutions (National Science Foundation 2003).

3.1 Organization and funding instruments

When we analyze the portfolio of funding instruments, the managing agencies and the categories of beneficiaries quite differences between the considered countries emerge more clearly.

3.1.1 Role of managing agencies

For the managing agencies we used a quite simple classification between national government administration (ministries and program committees inside the different ministries), intermediary agencies with a large autonomy from the state (research councils, but also some technological agencies) and international organizations, including the European Union and the European Space Agency.

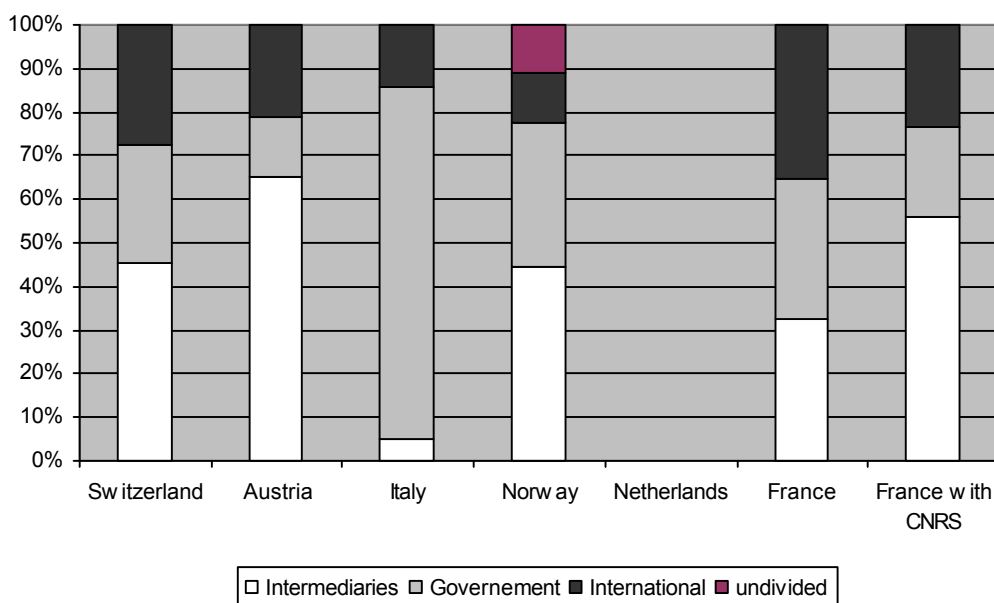


Figure 2. Role of managing agencies (2002)

The pattern we get here is of very strong differences between countries in the organizational structures and role of agencies: namely, we find a case, Italy, where intermediaries are practically absent and project funding is managed directly by the research ministry (Poti and Reale 2005a), a situation which seems also to characterize other Mediterranean countries like Spain and Portugal (Sanz et al. 2005). Four countries possess research councils, but with quite different roles and quantitative importance: project funding in Switzerland is clearly dominated by the Swiss National Science Foundation, which keeps most features of the academic-driven model, while in Austria the system is dual, with an independent technological agency which is larger than the Austrian Science Fund. Norway has a very large research council, which however assumed since its creation at the mid-'90 through the merger of the existing research councils a much larger palette of instruments, including for example instruments devoted to technological innovation (Slipersaeter 2006).

Finally, in France intermediary funding agencies *stricto sensu* play a rather limited role (with the exception of the space sector), while most project funding is managed by the ministries, but the CNRS takes some of their functions using a very specific funding model for joint laboratories through allocation of human resources (see Theves et al. 2006 for details).

3.1.2 Instrument types

The mapping and classification of instrument types proved to be more difficult because of the intrinsic multidimensionality and because a number of instruments are, at the level of aggregation considered here, rather heterogeneous. We resorted to a classification distinguishing two extreme cases – academic-oriented instruments mostly in responsive mode and innovation-oriented instruments –, alongside a more heterogeneous set of instruments where themes are defined from the beginning. With all its limitations, this classification scheme proved to be usable for comparative purposes (for full details see Lepori et al. 2006).

The first relevant remark is that practically all cases in Table 2 are filled, except for the space domain where small countries have delegated it almost completely to the European Space Agency. Thus, the size of the country appears to matter since it favors the delegation of domains requiring large-scale facilities – like space, nuclear energy, particle physics – to international organizations. With this exception, the examined countries appear to have developed similar policy mixes where both the production of basic knowledge, social relevance and economic innovation are promoted through specific instruments. We could then speak of a composite policy model trying to find a balance between the different rationales for public support to research.

	Academic	Innovation	Thematic	
International	European Research Council (from 2007).		General EU FP	Space ESA
Austria	Austrian Science Fund; some grant programs of the Federal Ministry	General programs of the Austria Research Promotion Agency	Programs of ministries Thematic programs of the Austria Research Promotion Agency	Aerospace program (Austria Research Promotion Agency)
France	FNS; Doctoral Grants from research ministry; FRT (RRIT); CNRS (if included)	ANVAR	Programs from Ministries of Industry /Defense	CNES
Italy	COFIN; FIRB; CNR	FAR; FIT; L488	Mismez; Fisir ; Pus ; Maf ; Mis ; Pon ; Cnr finalised projects	ASI
Netherlands	To be inserted	To be inserted	To be inserted	
Norway	RCN free projects, grants, basic research programmes and centers of excellence	RCN user-directed innovation programs and centers for research-based innovation	RCN Large Scale Programmes and Targetede programmes National administration contracts	
Switzerland	SNF free research projects; grants; National Centers of Excellence	CTI projects (including Eureka)	National Research Programs Priority Programs National and regional administration contracts	

Table 2. Classification of instruments by country

The situation is slightly different when considering the quantitative importance of the instrument types, since in this case differences between countries emerge rather clearly (see Figure 3). For example, even excluding the very specific French case, the share of academic instruments varies between more than 40% for Switzerland and little more than 20% for Austria Italy and Norway, while innovation-oriented instruments account for 40% of the total in Austria, 20% in Italy, 17% in Norway, but less than 10% in France and Switzerland. Some national specificities emerge also like the very strong role of space research in France and the use of thematic national programs in Norway. Thus, while the ingredients of project funding are largely the same, the weight given to the different components seem to depend largely on country-specific factors. We notice that this classification is related to the labeling of instruments and to policy intentions, but not necessarily to the research performed, e.g. thematic national programs in Norway and in Switzerland can partly function as an academic instrument even if the overall structuring principle is thematic.

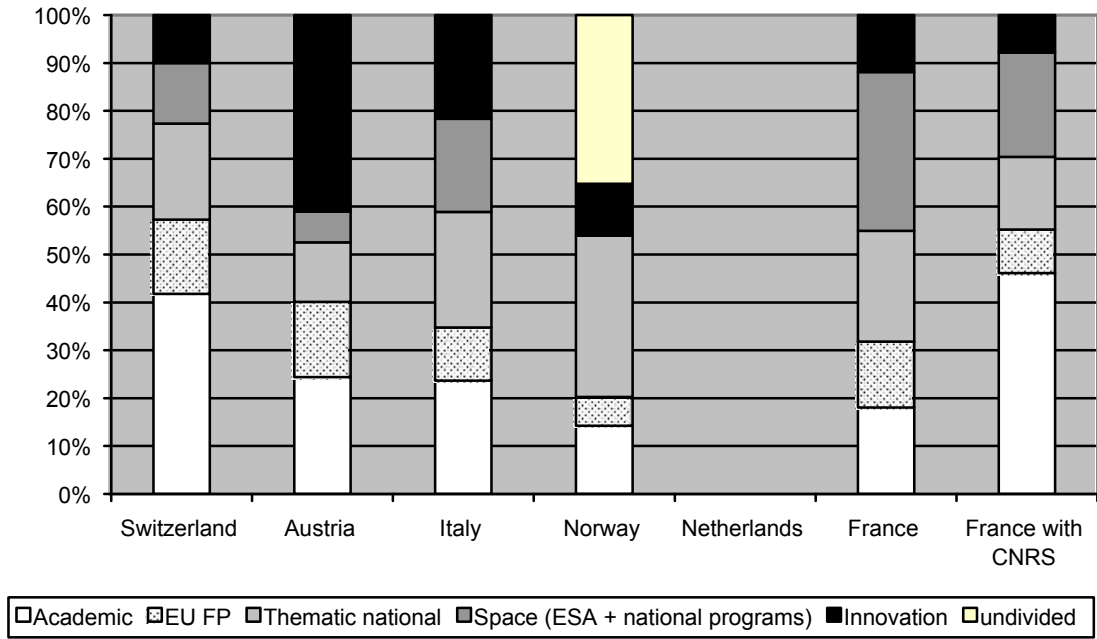


Figure 3. Share of instrument types (2002)

3.1.3 Shares of beneficiaries

A further important aspect is looking to beneficiaries and, especially, to the relative share of funds received by public vs. private performers (Figure 4).

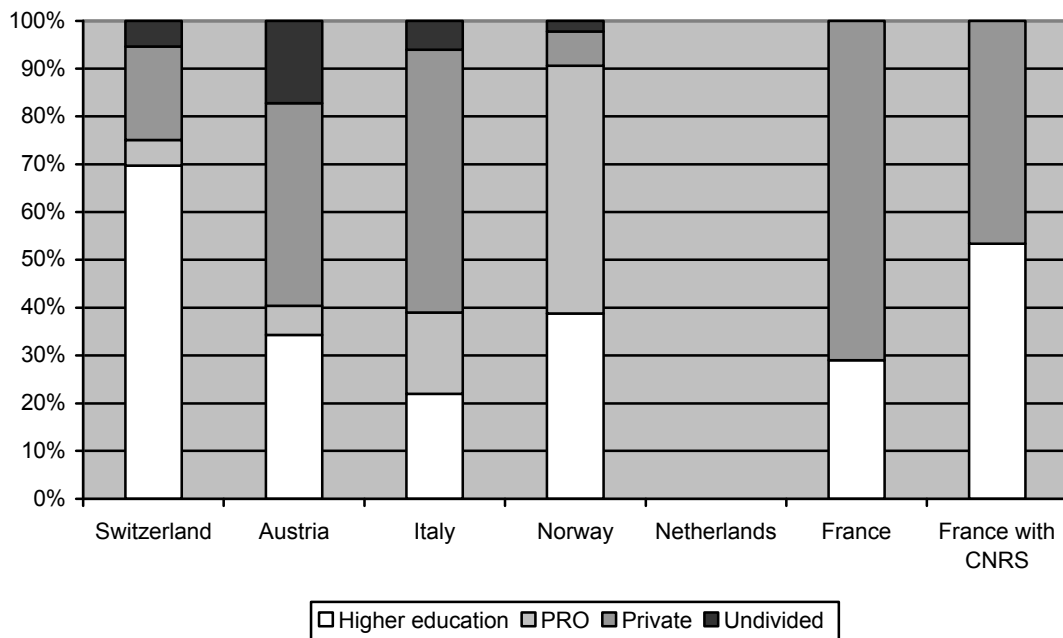


Figure 4. Shares of beneficiaries (2002)

France: Higher education includes also PRO since no separation is possible

In this case also differences are rather large, since the share of project funds to private companies ranges between 19% in Switzerland (being mostly international funds) and 55% in Italy. In this respect, national specificities appear to be the most important explaining factor: thus, Switzerland has a research policy model where it is assumed that the state should not directly finance industrial R&D and this model has survived strong pressure from the OECD during the '80 (Lepori 2006). At the contrary, in the Italian case project funding has been a choice instrument to support private research activities in a context where private investments are much lower than in other countries (see Table 3). Norway is also a very specific case, since there is a large sector composed by research institutes, mostly oriented towards applied research; about half of them perform research relevant for industry, are financed by it and, actually are included in the private sector in the R%D statistics. This explains largely the low share of the private sector in our data, since we consider the research institutes sector separately.

Finally, France is a case for strong direct support to the private sector, both in absolute and relative terms; as a matter of fact, France has a tradition of direct support to public companies through large technological programs, which have been progressively replaced in the last two decades by project funding instruments (Mustar and Larédo 2002; Theves et al. 2006). Hence, we can conclude that national specificities both in the overall model concerning public intervention in the private economy – for example the “colbertist” model in France or the liberal model in Switzerland – and specificities of the national research systems were stronger than international normative pressures in determining the degree of support for private research.

	Austria	France	Italy	Netherlands	Norway	Switzerland
BERD as a % of GDP	1.42	1.41	0.54	0.98	0.96	1.90
Percentage of BERD financed by government	5.60	10.30	12.20	4.30	10.30	2.30
BERD financed by government as % GDP	0.08	0.15	0.07	0.04	0.10	0.04
Project funding to private as % of GDP	0.09	0.14	0.09		0.02	0.04

Table 3. Public funding to private companies 2002

Source: OECD. Swiss data refer to the year 2000.

3.2 A summary view and some conclusions

Table 4 summarizes some of the main features of the project funding model in the considered countries.

	Funding instruments	Managing authority	Beneficiaries
Austria	A balanced portfolio with a large instrument for academic research, a large instrument for industrial research aiming at research geared towards innovation and a set of thematic programs.	Two main agencies, one for the academic research, and one for innovation and thematic purposes since (2004) manage most of the project funds.	A balanced portfolio, when neglecting the European Framework Program for which accounting to beneficiaries was difficult.
France	Two sets of instruments. Project funding in thematic programs or innovation for the companies, allocation of funds through human resources in the public sector.	Ministries play a very strong in technological programs, alongside with the Agency for innovation (ANVAR). CNRS as the dominant player in the public sector.	Project funding directed mostly to private companies, human resources funding the public sector.
Italy	Instruments oriented at technological innovation in companies and policy-oriented programs are most important; the ministry has some instruments oriented to academic research	Most project funds are managed directly by ministries through ad hoc committees; the role of intermediaries is marginal.	70% of funds benefit to private companies. The share of universities is below 15%
Norway	A heterogeneous set of	Intermediary organization	Small part of funding

	instruments for both small scale and large scale academic research, for funding of thematic programs mainly at PROs, and some instruments directed towards innovation in industry.	(Research Council of Norway) dominant at national level since it funds all domains, including innovation and thematic programs. Some programs funded by ministries are also managed by RCN, while some ministries operate their own thematic programs and a project portfolio.	directed towards industry. The role of research institutes (public and private) is more dominant.
Netherlands	Insert	Insert	insert
Switzerland	At national level academic instruments account for the largest share of funds, but there are also some policy-oriented instruments. Innovation oriented instruments are limited to cooperative projects with HEI and to some international programs (especially European Space Agency).	Intermediary organization (Swiss National Science Foundation) dominant at national level and taking also the management of policy-oriented programs. The only significant competition comes from European union programs. Role of the ministries is largely marginal.	¾ of all project funds benefit to the higher education sector; if we exclude European Space Agency Funds the share of private companies is very small.

Table 4. Comparison of national project funding systems (2002)

In our view, these results support an interpretation based on the combination of two main components. Firstly, we find a set of rationales, policy models and instruments specific to research policy which is largely the same for all considered countries. This includes the use of project funding as the *second* channel for allocation of public research funding, thus with a significant share, but not as the predominant mode of allocation, the identification of three major rationales for the allocation of funds – thus, the development of scientific knowledge, the resolution of social and political problems – and the set-up of the corresponding instruments (with many similarities between countries in their labeling, but also in their organization).

However, the choice of the mix concerning objectives, instruments and beneficiaries depends to a large extent on national specificities, for example concerning the degree of the intervention of the state to support private research, and thus inside the space defined by the (internationally accepted) model of research policy each country is able to define its own specific profile. Finally, the organizational structure for the allocation of project funding appears to be completely specific to each country and, as we shall see later, is largely dependent on the history; thus, even in our limited sample we find countries with a strongly academic oriented research council (Switzerland and Austria) alongside an innovation agency, countries with a generalist research council (Norway) and a case where project funding is managed directly by the ministry (Italy), not to speak to the very specific French model with the CNRS taking some of the functions of a funding agency.

4 International tendencies and national trajectories

The available data allow a reconstruction of the main changes in the project funding during last thirty years in the six considered countries. We follow the same procedure as in the previous section, by firstly looking to changes in the overall level, then to the portfolio of instruments and to the managing agencies and, finally, we draw some general conclusions and we look to main change events during this period. The reader should be aware that the quality of the historical data is not always as good as for more recent year and thus some care is needed in the interpretation of the results presented in this section.

4.1 Overall level of project funding

All countries considered show a considerable increase of the volume of project funding over the last thirty years, but with some differences between them. In Figure 5 we present the evolution both in absolute terms (using GDP deflators) and as a % of GDP; the latest is the simplest relative measure since time series of total public funding of research (measured as GERD GOV in the R&D statistics) are not very reliable over such a long period of time, especially due to difficulties in measuring the R&D share in the higher education sector and to frequent break in series (Lepori 2006b).

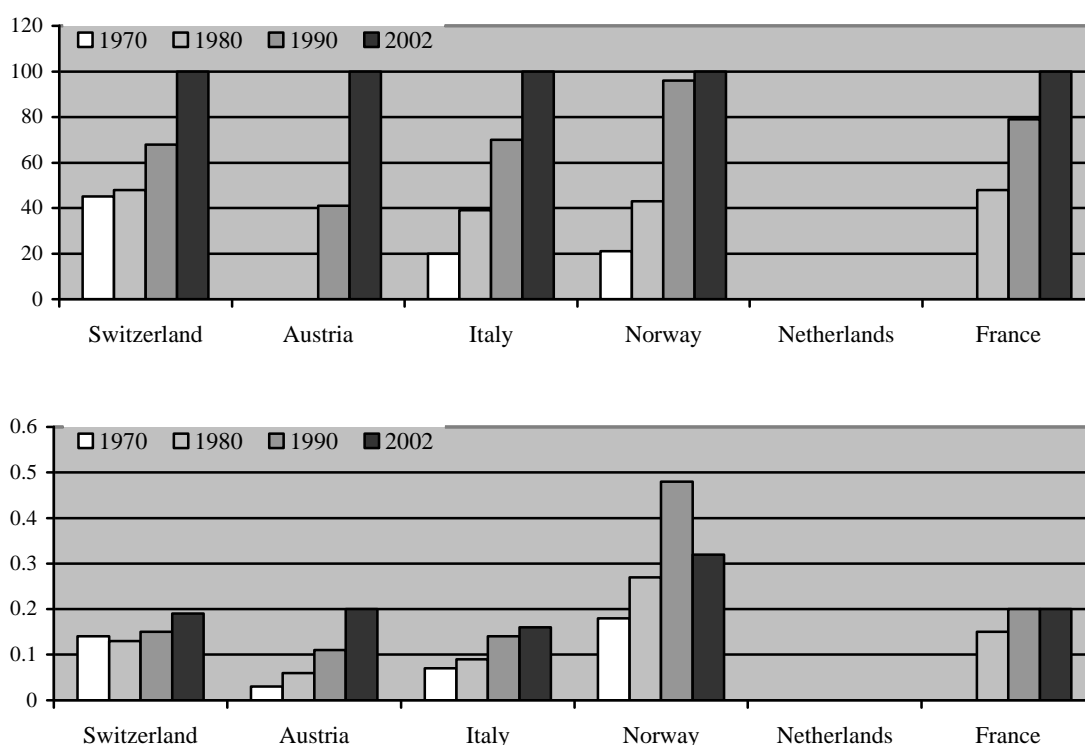


Figure 5. Evolution of project funding in real terms (2002=100) and as % of GDP

Italy: 1970 refers to 1971 (first year available)

France: 1980 refers to 1982 (first year available)

These data show an overall strong increase in the volume of project funding, both real and measured as a percentage of GDP; since, there is some evidence that public research funding did not strongly increase during these thirty years as a percentage of GDP, we can assume that the trend of increasing share of project funding is robust. In our sample, we can however identify two groups of countries. Namely, Switzerland and Norway created their research councils already in the early post-war period (1952 for the Swiss National Science Foundation; Lepori 2006; between 1946 and 1949 for the Norwegian Research Councils; Skoie 2000); in 1970 these countries show up with a significantly higher level of project funding (as percentage of GDP), than the other three countries. In Austria, the main funding agencies (Austrian Science Fund and Austrian Innovation Agency) were established in 1967, while while the main managing agency in the Italian case – the ministry of education and research – has been created only in the '70 and clearly the building up of a project funding system took place only from the '70. According to some available data, it seems that a similar evolution has taken place in Spain and Portugal during the '80 and the '90 (Sanz et al. 2005). Finally, in the French case only the reforms at the beginning of the '90 substantially modified a system based on institutional funding of public research through CNRS and joint technological programs with public companies towards a system with a more important component of project funding (Theves et al. 2006).

4.2 Diversification of instruments

A very general trend across countries has been a strong increase in the number of project funding instruments starting generally in the '70. This is displayed by an increase in the overall number of instruments (as shown by all country reports), but also in the number of *significant* instruments. In the following table we tried to measure this development by counting the number of instruments covering more than 5% of the total project funding volume. Even if the data are to some extent problematic, the overall trend is quite robust:

while in 1970 in most countries there were only 2-3 instruments covering more than 5% of the total funding volume, in 2002 this number was of 8 to 9 in most countries.

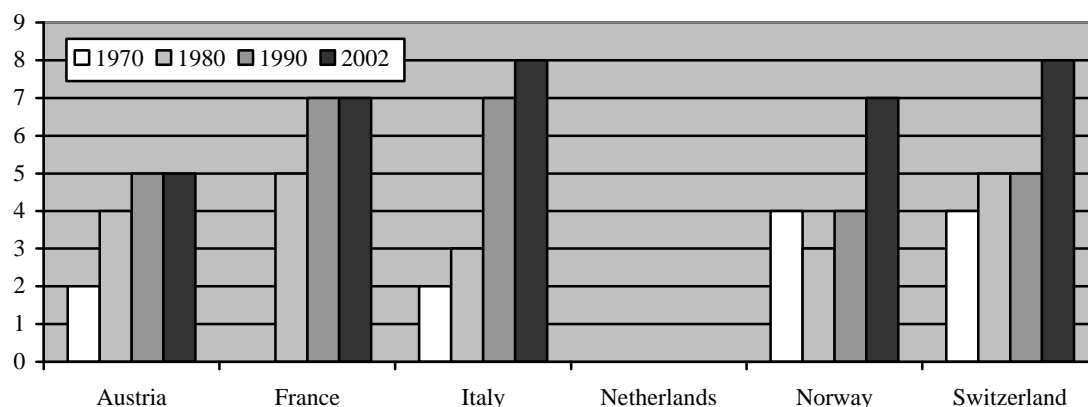


Figure 6. Diversification of project funding instruments

Number of instruments with a share > 5% of the total volume of project funding
ESA and EU FP and public administration contracts are considered as a single instrument.

Looking at the new instruments there have been two dominant motors of this differentiation: at national level, the emergence of more specialized funds to answer to specific needs, either to promote specific research domains (like technology, agriculture or health) or to answer to policy needs (especially for industry support and innovation). The main development model has thus been the *addition* of new instruments either to answer to new policy needs or as an effect of the emergence of new actors (international agencies).

We notice that this model of development has been made possible by the strong increase in the overall volume of project funding, where additional funds have been provided for new instruments while at the same time the budget of existing instruments increased also; the composite policy model we identified in the previous section was then largely made possible by the expansion of the overall volume, which provided room for accommodating the different policy objectives.

4.3 Changes in the portfolio

Changes in the portfolio are also a major point of interest, since the shifts in policy rationales are well documented in the literature on research policy (Elzinga and Jamison 1995 ; Guston 2000). Our methodology allows performing some quantitative comparisons during the last thirty years, even with the limitation that we disregard for the moment changes in the objectives and allocation criteria inside the same instruments (see Poti and Reale 2006 for a more detailed discussion). The following figures display the share of academic oriented instruments and, jointly, the share of thematic instruments.

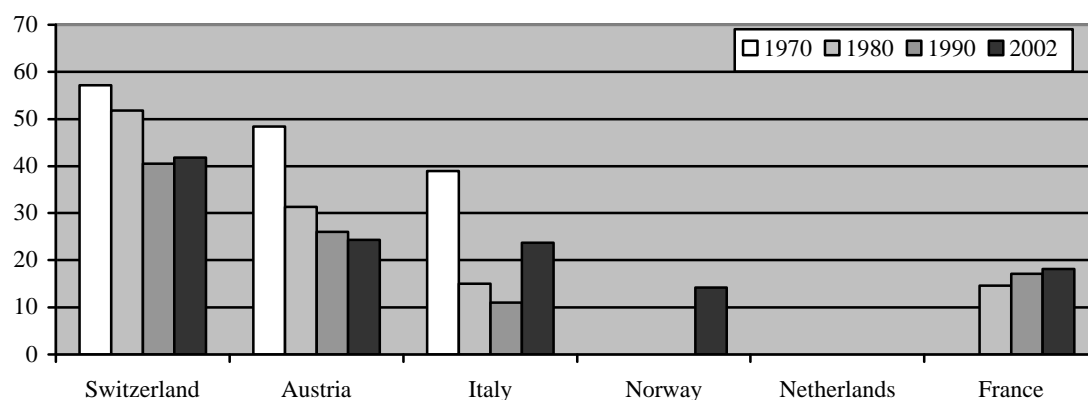
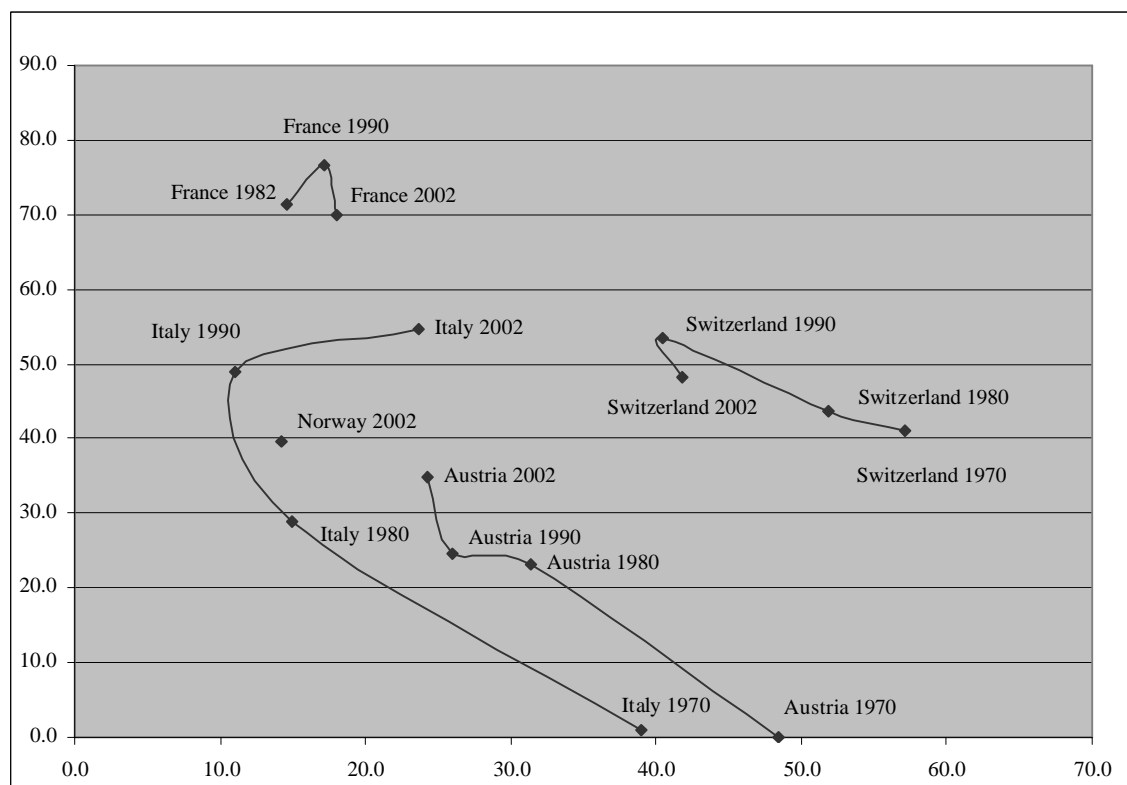


Figure 7. Share of academic-oriented instruments by country 1970-2002**Figure 8. Share of instruments types by country 1970-2002**

These figures display a common trend for the countries for which we have data, namely a much stronger increase of thematic instruments replacing progressively in the portfolio the academic instruments (even if, in real terms, also these instruments have continued to increase). This confirms quantitatively the trend identified in the literature on research policy. However, we notice also that the different countries move to a large extent on parallel trajectories, where the differences between them do not decrease and, finally, end up in quite different positions in the diagram. Thus, given the composite nature of research policies and research funding systems, the existence of similar trends across countries is still compatible with the keeping of strong national specificities, a lesson which has to be carefully considered in future comparative studies. In a sense, we could argue that the composite model has proved flexible enough at the same time to respond at general objectives of research policy (largely defined internationally) and to take into account of national specificities.

A final remark concerns the fact that most of this change occurred in the '70 and '80, while the '90 have been characterized by a greater stability or, even, an increase in the share of academic instruments, a turn which is for example well-documented in the Swiss case (Lepori 2006). It is for the moment not fully clear to which extent this has to be seen as new policy shift back to the support to basic research – as initiatives like the creation of a European research council could indicate – and if this shift will be durable.

4.4 Stability and change in the managing authorities

A look to the managing agencies display a complex pattern where not only national specificities are largely prevalent, but also each countries seems to follow quite different paths in developing project funding and implementing policy changes.

Thus, in Switzerland, SNF constructed his monopoly on project funding during the '60 and kept to a large extent his role at national level until today still accounting for 2/3 of the total volume of project funding at the national level. Actually, the SNF felt a strong pressure to change its structures and priorities during the '70, but succeeded in avoiding major changes or the creation of competing agencies by accepting to jointly manage with the public administration some policy-oriented and, later, technology-oriented programs (Lepori 2006);

however, these programs never took a large share in its funding volume and the SNF avoided any major reorganization and change of its objectives; actually, its original academic orientation was reinforced with the revision of the statutes in 2000, excluding any political representatives from its main decision-making body.

In Austria, the two funding agencies created in 1967 still largely keep their role and organization and dominate project funding. Thus, the Austrian Science Fund maintains its role as funder of academic bottom-up project with little organizational change and, while other instruments have been launched, in 2002 individual research projects still accounted for 75.4% of total FWF funding volume (van der Meulen 2004). Bottom-up project funding has also remained the dominant funding instrument for industry sector throughout the last three decades (Jörg 2004) and the Austrian Research Promotion Agency (2004), kept the former FFF industrial research grant scheme as main pillar "Basisprogramm" of the programme portfolio. However, since the mid-eighties alternative research and innovation promotion schemes different from bottom-up project funding have been introduced E.g. The Kplus competence centres programme (launched in 1998) and the Christian Doppler Laboratories (since 1989) target science and industry co-operations in a new institutional manner. Furthermore thematic targeted research programs have been launched by ministries addressing specifically issues as Genomics Research, the Information society etc. Thus, rigidity of the funding agencies was to a large extent overcome with an increase of the thematic programs directly managed by the ministries.

In Norway, the situation was characterized by 4-5 research councils during the 1970s and -80s before a major restructuring came in 1993. The two main research councils, The Norwegian Research Council for Science and the Humanities (NAVF) that mainly served academic research within all domains and The Royal Norwegian Council for Scientific and Industrial Research (NTNF) mainly serving innovation and industry-relevant research, were both established in the early post-war period. So was also a smaller specialized council for agricultural research. In 1972 came a specialized council for research related to fisheries, while another specialized council for applied social research was established 1987 (Skoie 2005). The NAVF maintained a traditional way of working among academically oriented research councils, namely maintaining a portfolio of grants and responsive-mode projects, while NTNF was more geared towards research institutes and programs for applied industrial research and innovation. Special for this council was its ownership of as many as 14 research institutes with more than 2300 employees. Through the direct ownership the council could direct a large part of its funding directly to selected institutions, a situation which changed during the 1980s as the institutes' status was changed towards independent organizations with their own statutes and boards. In 1993 the former councils was merged into The Research Council of Norway, which got the responsibility for a very large portfolio of instruments, targeting the full specter of disciplines as well as applied research and innovation. The portfolio of instruments reflects the broad responsibility, as the council maintains traditional projects and grants as well as centers of excellence, centers of innovation and large programs for industrial research. Thus, the Norwegian case is unique in the European context for the degree of centralization of project funding and for the depth of the reform during the '90 (Skoie 2000 for a detailed account).

The Italian situation is different in that Italy never possessed a strong research council; even at the beginning of the '70, with a very low level of project funding, the CNR was not dominant and, actually, its funding agency role was always secondary with respect to its main role as public research organization (Potì and Reale 2005a). Thus project funding was from the beginning developed inside the ministry of university and research through the creation of expert committees; at a same time, the Italian case has been characterized by a stronger instability concerning the funding volume and instruments, which has been repeatedly modified over time.

Finally, France has followed a complex path from a system dominated by a very large PRO, namely CNRS, towards a system more similar in the organization of the research system and in the allocation of funding to the other European countries; however, this has been done not by the creation of new agencies but by a progressive reshaping of the existing structures and allocation mechanisms, with the model of the joint laboratories between university and CNRS from one side, and with an allocation model for CNRS funds through the (competitive) labeling of the joint laboratories and the allocation to them of human resources rather than funds (Theves et al. 2006). The resulting model is an astonishing mix between the features of

the allocation model based on project funding from one side, of (historically-related) national specificities to other side.

Finally, we notice that a major common innovation in these countries concerning organization of project funding has been the emergence of international agencies – namely the European Space Agency and later the European Union – as major players also in quantitative terms; as Figure 9 shows their share in project funding is between 15 and 20% for large European countries and even more for small countries (with the exception of lower rates in Norway). If we consider the future development, like the creation of an European Research Council which will enter also in the funding of academic research (Dinges and Lepori 2006), as well as the continuous increase of the EU framework programs budget it is not unlikely that in the medium term project funding is likely to be mostly allocated and managed at the European rather than at the national level and this would represent a major structural change in research funding allocation.

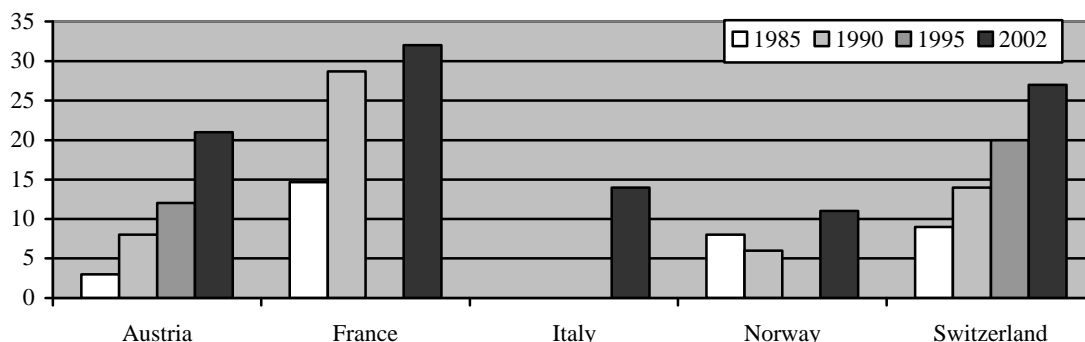


Figure 9. Share of international programs (ESA + EU FP)

France: 1985 data refer to 1982.

Norway: Data specifies EU only from 1997. Data in the figure includes all funding from abroad, EU included. 1995 omitted due to poor data.

5 Conclusions

The main conclusion of this analysis is that we do observe a stance of convergence of the considered national research policies towards an allocation model where project funding takes between $\frac{1}{4}$ and $\frac{1}{3}$ of the total public funding (even more in the Norwegian case) and where basically there is a composite mix of policy objectives and instruments; at the same time we find also some instances of instrument convergence, like Centers of excellence, large programs within the information technology, genetics, nano-tech etc that most countries seem to maintain. However, at the same time, this composite model leaves a large room for national specificities concerning the (quantitative) importance of the different rationales, but also in maintaining instruments reflecting national needs and production, like in the case of Norway fisheries, oil and gas, polar environments or in the case of France space research.

Moreover, we could show that in this process the different countries followed essentially an evolutionary path largely based on the reshaping of existing managing structure and, to some extent, on the addition of new instruments alongside the existing ones. As a consequence, when we look to the today's organization of project funding, we still are faced with quite different managing structures in which we can clearly identify the long-lasting effect of the history and, in particular, of the agencies created before the '70. However, at the same time, countries strongly different in their ability to restructure managing agencies as a comparison between Austria and Switzerland from one side, Norway to the other side clearly displays. This of course opens an interesting question for policy analysis, namely to understand to which extent this is due to specificities of national political system (respectively, to which specificities).

6 Acknowledgements

The authors would like to thank the European Union through the PRIME network of excellence for funding this project.

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