Research Policy 45 (2016) 260–271

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Research assessment in the UK and Italy: Costly and difficult, but probably worth it (at least for a while)

Aldo Geuna[a,b,*], Matteo Piolatto[c]

[a] Department of Economics and Statistics Cognetti De Martiis, University of Torino, Italy
[b] BRICK, Collegio Carlo Alberto, Italy
[c] Department of Social and Political Studies, University of Milan, Italy

ARTICLE INFO

Article history:
Received 3 June 2014
Received in revised form
15 September 2015
Accepted 22 September 2015
Available online 22 October 2015

JEL classification:
I2
Z18
H5

Keywords:
Higher education policy
Public funding
Research assessment
University research

ABSTRACT

This paper provides a comparative analysis of the development of the UK and Italian university research funding systems with a special focus on Peer Review-Based Research Assessment (PRBRA) and its cost. Much of the debate surrounding the value of performance-based allocation systems hinges on the disadvantages versus the benefits of their implementation, and there is very little evidence on either their absolute cost or their cost relative to other allocation systems. Our objective is to fill this gap, collating the best possible estimates of the costs of alternative research funding methods to inform the ongoing policy debate. First, we compare funding in the UK and Italy during the period 2005–2012 and analyze the development of performance-based allocation in the two systems. Second, based on public reports and documents collected from universities, we discuss the public agency and university costs of RAE2008 and REF2014 and provide some estimates for VQR2012. We find that RAE2008 costs accounted for less than 1% of the total performance allocation in the related period while the VQR2012 efficiency ratio is estimated at around 2.5%. Finally, we compare the costs and efficiency ratios of PRBRA with metrics-based assessment and Research Council allocations and show that costs increase going from metrics to PRBRA to Research Council allocation.

1. Introduction[1]

Since the late 1980s, there has been a significant restructuring of public university governance and funding in various European countries, at various times. The UK was the first country in Europe to move away from a system where university funding was allocated on a historical basis, and to introduce a formula which initially took account of input and output indicators, and by the end of the 1980s, also considered performance-based funding for research (Geuna, 1999). Italy is undergoing an extensive period of change which started also in the late 1980s and is only partially completed, and recently saw the introduction of a performance-based research funding system inspired by the UK system.

The increasing costs of research, swings in public funding (as an effect of the economic downturn), and greater competition among nations have resulted in the need for government/policy to demonstrate that public R&D investments result in positive economic returns for society. Governments in various countries have started to introduce Performance-based Research Funding Systems (PRFSs) to allocate research funding. PRFSs are complex national systems designed to evaluate universities and public research centers and to allocate public funds to institutions according to outputs and outcomes rather than processes and structures (Hicks, 2012).

The first PRFS was introduced in the UK in 1986 with the explicit goal of increasing selectivity in the allocation of public resources (OECD, 2010). Later, PRFSs spread rapidly to other countries (Geuna and Martin, 2003), and by early 2010, 14 countries including Australia, Belgium, Denmark, Finland, Hong Kong, Italy, the Netherlands, New Zealand, Norway, Poland, Slovak Republic, Spain, and Sweden had adopted different forms of PRFSs (OECD, 2010). The implementation of PRFSs varies significantly across countries, ranging from Peer Review-Based Research Assessment (PRBRA) to metrics-based assessment, or some combination of the two. In some countries only a small portion of the recurrent research grant is allocated via PRFS, inputs indicators and historical allocation remain dominant. In a very few countries, grant allocation is based completely on performance measurement. The UK and Italy are the only countries that have implemented a PRBRA system that (potentially) evaluate all academic staff in order to

* Corresponding author at: Department of Economics and Statistics Cognetti De Martiis, University of Turin, Lungo Dora Siena 100 A, 10153 Turin, Italy.
E-mail address: aldo.geuna@unito.it (A. Geuna).

[1] For a more detailed analysis of the development of research funding and assessment in the UK and Italy and the associated costs see Geuna et al. (2015).

http://dx.doi.org/10.1016/j.respol.2015.09.004
0048-7333/

allocate research funding.[2] In the late 1980s, the Netherlands put in place a PRBRA system but this is not linked to university funding; the information gathered is used to support the development of national and institutional strategy and it generates a relative reputation competition.

In this paper we focus on the costs of PRBRA, an issue which despite its being a tacit part of the policy debate, has so far not been discussed in depth. The estimations of these costs allow a comparison of the costs of different research funding methods. In Section 5, based on the scant evidence available, we compare the costs of PRBRA, metrics-based systems, and competitive funding via research councils. Although this is a preliminary discussion and should be further developed as better public information is released, it is an important but missing part of the policy debate on how best to support public research in universities. Better information on the costs of alternative research funding mechanisms – performance-based or not, is needed to enable sound policy choices. Much of the literature focuses on investigating the benefits or shortcomings of performance-based funding compared with other approaches to funding (Geuna and Martin, 2003). For example, some of the advantages of performance-based systems that have been highlighted include increased accountability for expenditure of taxpayers' funds (Frølich, 2008), increased research productivity (Moed, 2008), and concentration of funding (Adams and Gurney, 2010), while the most frequently mentioned disadvantages are the negative impact on staff morale (McNay, 1997), staff selection biased against women (Baty, 2004), and game strategies (Talib and Stelee, 2000). So far, there is no robust comparative evidence of the costs of performance-based allocation in the academic literature. We try to remedy this using information based mainly on the UK and Italian cases. Comparing an established research assessment system with a relatively new one allows us also to make some observations about the difficulties involved in the policy transfer of the UK's Research Assessment Exercise (RAE) to other countries.

2. University funding in the UK and Italy

The UK and Italy offer two alternative approaches to the public funding of Higher Education Institutions (HEIs). The UK government distributes funds to its HEIs through three main independent funding streams: teaching, research, and knowledge transfer. In recent years, non-government sources (private sector, charitable sector, families and individuals) have provided around half of HEIs' total income. In contrast, Italy is characterized by a central government funded system that relies mainly on a single grant, the Fondo di Finanziamento Ordinario (FFO) or Ordinary Financing Fund, for teaching, research, and other infrastructural needs. Non-government sources are becoming important but account for only around a quarter of the funding received. In the following sections, we analyze in detail UK and Italian university funding during the period 2005/12 for which comparable data are available for both countries.[3]

2.1. University funding in the UK

In 2011/12, there were 163 HEIs in the UK (Universities UK, 2013), accounting for the enrollment of 2.5 million students, and employing 117,845 full-time academic employees. Most of these institutions were founded or recognized during the last century as a consequence of the expansion in the sector following the Robbins Report in 1963, and the restructuring that followed the 1992 Further and Higher Education Act.[4] Most HEIs enjoy non-profit organization status, and receive significant public funding.

Public resources for HEIs are distributed through the relevant Higher Education Funding Councils (HEFCE for England and Northern Ireland, HEFCW for Wales, SFC for Scotland, and the Department for Employment and Learning for Northern Ireland), the seven Research Councils, other public bodies accountable to the Department for Business, Innovation and Skills, and other government departments. Teaching funds are allocated by the HEFCs based on a formula that takes account of student numbers in different subject areas (known as price groups),[5] grant rates, and a scaling factor (HEFCE, 2014).[6] Research is funded according to a dual support system: resources are allocated via competitive grants from the seven Research Councils and the recurrent research grant is allocated based on the results of the HEFCs research assessment. Overall, grant based funding is about 1% of GDP. Other public bodies provide some funding for research on a competitive basis. The third stream, knowledge transfer funding, is less important although its significance has increased in recent years. It is allocated according to a formula set by the Higher Education Innovation Funding (HEIF), and is awarded competitively by the Technology Strategy Board (TSB).[7]

In 2011/12 the UK universities' total income was €34.37bn[8] (see Table 1). This income has grown by about 45% in nominal terms since 2005/06, due mainly to increased fees, other income, and research grants and contracts, although recurrent teaching and research grants decreased in the most recent years.

Overall, about 42% of total funds are from government sources (about 52% including the Student Support Maintenance Grant). About 30% of total HEIs income is allocated by the HEFCs on a formula basis (recurrent teaching and research grants), 5.4% is awarded by the Research Councils and other ministries and non-departmental public bodies, and 0.9% is from student support in the form of teaching grants. European Union (EU) funding, originating mostly from the European Commission, has become more significant and accounts for 2.1% of total HEIs income.

The share of other non-government funding in the same period was about 58% (around 48% including maintenance grants). This figure has increased over the past 20 years and especially in the 2000s (Geuna, 2001). Increased tuition fees play a particularly important role (with funds from students accounting for about 35% of total income in 2011/12).[9]

[2] The Swedish Research Council has been asked by the Swedish government to develop a proposal for a national system of assessment and funding to be introduced by 2018. The Czech Republic has embarked on a consultation process aimed at implementing a peer-review based system.

[3] The introduction in 2012/13 of an Income Contingent Loan scheme in the UK makes comparison of more recent years difficult.

[4] The Further and Higher Education Act introduced changes to both the administration and funding of HEIs. It set up four main higher education funding bodies for the four UK nations, and recognized 35 polytechnics as universities.

[5] There are price groups for (a) the clinical years of medicine, dentistry and veterinary science, (b) laboratory-based science, engineering and technology, (c) intermediate-cost subjects with a laboratory, and (d) classroom-based subjects.

[6] The scaling factor is a multiplier that ensures matching between allocations and available funding (HEFCE, 2014).

[7] TSB is the UK's innovation agency and focuses on stimulating economic growth by supporting business-led innovation, and creating networks among technology centers. It operates through different innovation programs, e.g. the Small Business Research Initiative (SBRI) and the Collaborative R&D Program which co-fund projects involving partnerships between business and academia.

[8] All amounts are presented in euros; we used the average PPP conversion for the related year.

[9] Due to the rise in non-EU student numbers resulting in some 33% of fees from non-EU students (Universities UK, 2013). In 1997, the UK parliament introduced tuition fees of £1000 and increased these from £1000 to £3000 in 2006. In 2012/2013 the cap on tuition fees (in England, Wales and Northern Ireland but not Scotland) increased to £9000. The student support system was reshaped with the introduction in 2012/13 of an Income Contingent Loan scheme in addition to the existing grant system. To enable students to pay the new higher education fees, a graduate contribution combined with an income-based loan scheme was introduced. The

Table 1
UK HEIs' income (€bn) by source 2011/12.

Home & EU HE fees	7.03
Non-EU HE fees	3.94
Other	0.86
Tuition fees and education contracts	11.83 (34.7%)
Recurrent (teaching)	6.66
Recurrent (research)	2.34
Other	1.23
Funding body grants	10.23 (29.6%)
Research Councils and other ministries and non-departmental public bodies	1.85 (5.4%)
EU sources	0.74 (2.1%)
Student support grants	0.31 (0.9%)
UK-based charities	1.15 (3.4%)
UK industry	0.35 (1.0%)
Other	1.14 (3.3%)
Research grants and contracts	5.54 (16.2%)
Residence and catering operations (including conferences)	2.03 (5.9%)
Other services rendered	2.61 (7.6%)
Income from knowledge transfer activities	0.07 (0.2%)
Other operating income	1.7 (4.9%)
Other income	6.41 (18.6%)
Endowment and investment income	0.36 (1.0%)
Total income	34.37

Source: Authors' elaboration of HESA (Higher Education Statistics Agency) HE Finance Plus 2011/2012 (HESA, 2013).

Other private income such as income from student residences, income from conferences, income from knowledge transfer activities, income from other services rendered and sales of other products and services, accounts for 18.6%. Finally, research grants and contracts financed by charities (slightly less than €1.16bn) and private companies (about €351m) make up 4–5% of total HEIs income. Charities have become more important in the funding of academic research in the UK, especially for biomedical research where funding from the Welcome Trust is second only to Research Council funding.

Once we take account of various second level contributions from diverse public bodies not flowing directly into universities, and the importance of charitable funding, the role of real private funding (private sector and families) diminishes considerably although it is still much higher than in other OECD countries.

Table 2 shows the changes in funding councils' grants in the period 2005/06 and 2009/10 to 2011/12. Funding body grants are split between recurrent teaching (€6.7bn), recurrent research (€2.3bn), and other (€1.2bn) which includes third mission, capital funds, and other specific funds.[10] The recurrent research grant was allocated on the basis of the results of the RAE 2008 (see Section 3 for further details). The budget increased significantly up to 2009/10, after which time, as a result of budget deficit problems due to the 2008–2013 economic recession, grant allocations from the funding councils decreased, and in 2011/2012 total government resources allocated decreased from €10.4bn to €10.2bn. This reduction was due mainly to cuts to teaching grants (although the HEFCE cutback was greater than those imposed by HEFCW and SFC), capital grants, and specific funds, while research funding allocated mainly via the RAE remained mostly unchanged. Despite the widespread reduction in grants, government resources dedicated to knowledge transfer activities increased (12%) in the period under consideration (especially in England).

Table 2
Funding councils' grant allocations (€bn) by source 2005 and 2009–2012.

	2005/06	2009/10	2010/11	2011/12
Teaching	7.0	6.7	6.5	6.7
Research	2.2	2.3	2.2	2.3
Third mission	0.3	0.1	0.2	0.3
Capital grants	0.9	0.7	0.7	0.4
Specific funds	0.5	0.6	0.6	0.5
Total funding council grants	10.9	10.4	10.2	10.2
Total income	28.47	30.97	31.62	34.31

Source: Authors' elaboration.

2.2. University funding in Italy

According to data from Agenzia Nazionale di Valutazione dell'Università e della Ricerca (ANVUR), in Italy, there were 67 public universities and 29 private universities (11 of which were online) in 2013, accounting for enrollment of 1.75 million students and 54,929 tenured public academic employees. In 2012, private universities accounted for approximately 8.2% of total students, and received about 1.2% of total public funding.[11] The Italian university funding system has experienced two periods of major restructuring. The first began in 1993 with the creation of a new public funding system based on the allocation by the Ministry of Education (MIUR) of public resources to universities, primarily via the main FFO bulk grant. The second began in 2008 and continued to 2010, based on Law 240/2010 which significantly reshaped the governance of the Italian university system and triggered a parallel period of significant budget cuts.

The incorporation of Italian public universities as autonomous state regulated institutions was linked to the introduction of FFO in 1993. The FFO was allocated according to a mixed model based on historical data and a formula-based adjustment component which was introduced to offset the historically-based funding allocation. The formula-based component takes into account output indicators for teaching and research. It has changed several times and initially was based mainly on input indicators such as student numbers, and only recently has considered competitive research funding but to a very small extent. However, the quota allocated via the formula was very low until 2008, only occasionally reaching values of around 6–8%. Since then, a growing share of funds has been based on teaching and research performance indicators (Geuna and Sylos Labini, 2013).

Since its creation, block grant based funding from the FFO has remained at around 0.42% of GDP. The importance of FFO in total university funding in Italy decreased from 57.8% in 2005 to 53.7% in 2012 alongside an increase in the relative importance of contractual funding and student fees (see Table 3). Contractual funding comprises contracts from MIUR (8.6%), whose level has been stable over the eight years considered, and contracts from other organizations which have increased by 4 percentage points to reach 18% of total income. MIUR contractual funding includes competitive

Tuition Fee Loan, available to all households, is repayable by students at the rate of 9% of their income above an income threshold of £21,000. Maintenance Grants and Maintenance Loans are also provided. The former is an income-assessed grant available to households with incomes below a maximum of £42,600; the latter is a loan that depends on the student's place of residence and university location.

[10] This source includes resources earmarked by the funding bodies for knowledge transfer programs, miscellaneous funds, and improvements to the local higher education system.

[11] The percentage is calculated as the ratio of MIUR resources awarded to non-public universities, to total ministry grants to public institutions.

Table 3
Italian HEIs' income (in €bn) by source 2005, 2010–2012.

	2005	2010	2011	2012
Tuition fees	1.44 (12%)	1.69 (13%)	1.75 (13.3%)	1.77 (13.7%)
Recurrent grants (FFO)	6.89 (58%)	7.11 (54.6%)	6.90 (52.3%)	6.91 (53.7%)
MIUR contractual funds	1.08 (9%)	1.13 (8.7%)	1.51 (11.5%)	1.10 (8.6%)
Contractual funds from others	1.73 (14.5%)	2.33 (18%)	2.39 (18.2%)	2.27 (17.6%)
Endowment and investments	0.42 (3.5%)	0.35 (2.7%)	0.16 (1.2%)	0.39 (3%)
Other income	0.35 (3%)	0.39 (3%)	0.45 (3.5%)	0.43 (3.4%)
Total	11.91	13.03	13.18	12.89

Source: Authors' elaboration of ANVUR (2014).

research funding and funding related to institutional agreements between universities and the ministry to pay for development and investment plans, scholarships, and other specific objectives. Other sources of contractual funds include both government and non-government providers; details of these sources are not available at the national level. For example, in the case of the University of Turin in Piedmont, contracts from other organizations accounted for 25% of its total income, and came from regional public bodies (7%), EU funding (1%), public and private business (2%), sales of other goods and services (3%), and other – mainly charity – funding (3%) (Geuna and Sylos Labini, 2013). Even in a highly industrialized region such as Piedmont, private companies and other private commercial sources account for less than 5% of total funding. The importance of other contractual funding varies across regions, with the share received by universities in northern Italy being almost twice that received by universities in the central or southern parts of the country (ANVUR, 2014). In some regions of northern Italy such as Piedmont, Lombardy, and Emilia Romagna, regional public funding plays a significant role in supporting university research, based on competitive funding primarily for applied research projects resulting from the devolution in 2003 of government technology policy to the Italian regions. Student fees have increased and accounted for 13.7% of total funds in 2012. Student maintenance grants are available, financed mainly by the regional governments. Central government provides specific funding for student support, which is included in the MIUR contractual funds. In 2012 despite a decrease after 2009, these funds accounted for about 2.3% of total resources (ANVUR, 2014). Approximately 24% of total university funding (26% excluding maintenance grants) was from non-government sources.

Before the most recent simplification of the funding mechanisms in Italy in 2013, government resources were distributed via a three-stream model comprised of the FFO which financed teaching and research activities and was used mainly to cover payroll costs, and two special funds for structural investments. The Fund for Development Planning (FPS) financed specific projects to improve the university system, and the Fund for University Building and Construction (FEU) was for the procurement of scientific facilities and buildings. In 2012, these two special funds accounted for a small share of total resources, respectively 0.3% and 0.16%. In 2013, the funding mechanism was adjusted and the current model is a two-stream systems comprised of the FFO and a miscellaneous fund which includes FPS, FEU, and post-graduate and under-graduate grants for students studying away from home.

Table 4 shows the funding changes in the period 2009–2014. In most years the share based on performance grew between 0.5% and 2.9% annually, with the exception of 2014 when legislative changes imposed a significant increase in the performance component. Taking account of changes to the funding that depends on special

Table 4
FFO funding flows (percentages) 2009–2014.

	2009	2010	2011	2012	2013	2014
Historical component	86.7	80.8	84.3	78.5	81	72
Performance	7.2	10	12	13	13.5	18
Specific funding	6.1	9.2	3.7	8.5	5.5	10

Source: Authors' elaboration.

programs which can change annually, the historical component has decreased by about 14 percentage points. Since its introduction in 2010, the share for performance has been divided into research and teaching. In 2014, €1.09bn (equal to 90% of the performance share) was allocated based on research quality and the quality of new recruits and promotions, with the remaining 10% allocated according to teaching quality. Thus, the overall performance share for 2014 was about €1.21bn, around 18% of FFO funding. In 2016, following implementation of the 2013 legislation which imposed a minimum 2% per year increase, the performance share will vary between a minimum of 22% and a maximum of 30% of the total. Meanwhile, the allocation of performance quota funding in 2010 to 2013 was capped by law at a maximum 5% reduction (3.5% since 2014) in the allocation to underperforming universities, and a maximum allocation to the top institutions equal to the previous year's allocation. Thus, performance-based funding results in a reallocation of resources from poor to less poor institutions, rather than the allocation of extra funds to top quality institutions.

3. Peer review-based research assessment funding in the UK and Italy

The UK was the first country to introduce research funding based on PRBRA. The UK's experience, errors, and improvements since 1986 have been used to inform policies initiatives in other European and world countries. In Italy a system inspired by the UK scheme was introduced only recently, although attempts to introduce research evaluation have been ongoing since the early 1990s.

3.1. Research assessment in the UK

The first RAE, then called the Research Selectivity Exercise, took place in 1986. Its purpose was twofold: (1) to define the budget allocation to the university system during a period of budgetary restrictions, (2) to provide an assessment of research quality in UK universities. Subsequent exercises took place in 1989, 1992, 1996, 2001, 2008 and 2014. These were based mostly on periodic ex-post research assessment via informed peer review[12] judgment by sub-panels, for all Units of Assessment (UOA) or subject areas. These sub-panels included academics expert in the relevant discipline, and had a degree of autonomy to define specific assessment criteria. Ratings for each UOA were based on fixed-point scales (7 levels in 2001, 4 in 2008 plus an "unclassified" level). In 2014, as a result of several consultations on the new assessment system launched by HEFCE in 2007, the Research Excellence Framework (REF) was implemented after postponement for two years to allow proper involvement of all stakeholders. The discussion and feasibility analysis resulted in the use of bibliometrics in Natural and Bio-Medical Sciences, and Economics and Statistics. Bibliometrics was used as an instrument to inform peer review, which remained the dominant method of assessment. Public discussion and pilot

[12] As in classical peer review, recognized researchers and non-academic research users (especially for the assessment of impact in the 2014 assessment) act as evaluators. Their activity is supported by first-order indicators aimed directly at measuring research performance, and second-order indicators to summarize the indexes aimed at providing simple measures of effect (OECD, 2010).

Table 5
Comparison of 1992, 1996, 2001, RAE2008 and REF2014 ratings.

Rating 1992	Submissions 1992	Rating 1996	Submissions 1996	Rating 2001	Submissions 2001	Rating 2008 Unclassified	Submissions 2008 47 (2%)	Rating 2014 Unclassified	Submissions 2014 19 (1%)
1	423 (15%)	1	236 (8%)	1	18 (1%)	1*	261 (11%)	1*	57 (3%)
2	613 (22%)	2	464 (16%)	2	140 (5%)	2*	781 (33%)	2*	382 (20%)
3	837 (30%)	3b	422 (15%)	3b	278 (11%)	3*	876 (37%)	3*	879 (46%)
		3a	528 (18%)	3a	499 (19%)				
4	560 (20%)	4	671 (23%)	4	664 (26%)	4*	403 (17%)	4*	573 (30%)
5	350 (13%)	5	403 (14%)	5	715 (28%)				
		5*	170 (6%)	5*	284 (11%)				
Total	2783		2894		2598		2368		1911

Source: Bence and Oppenheim (2005) and authors' elaboration of RAE2008 and REF2014.

studies led by HEFCE resulted in the inclusion of a new social-economic impact criterion. The inclusion of impact in the evaluation criteria was the subject of much debate since all previous assessments had been concerned only with research quality (Martin, 2011); concerns were raised about the costs to universities of producing impact studies (Adams, 2014). Compared to previous exercises, REF had fewer panels (36 down from 67 sub-panels, and 4 down from 15 main panels), and was designed to reduce activity costs and increase comparability. Submissions were judged for quality of research output (65%), impact on the economy, society, and culture (20%), and research environment in terms of vitality and sustainability (15%). Compared to RAE2008, the number of units that made submissions fell (from 2363 to 1911) with the involvement of only a slightly smaller number of academic staff, indicating higher concentration. However, the number of products submitted declined significantly from around 215,000 to 191,000 indicating greater selectivity (Adams, 2014).

Table 5 presents the ratings scales used for the five research assessments, and the distribution of submissions. It shows a positive trend in department rankings with an increasing share of departments doing internationally excellent research. Although we cannot compare RAE and REF results directly because of changes in assessment practices, there was a relevant increase in the share of 4* (+70%) and 3* ratings (+24%). While the increased share of departments doing internationally excellent research might signal increased quality of UK research activity, it could be due to "learning by doing". That is, institutions learnt how to play the game and to obtain the best results through significant investment of resources in the selection of outcomes and the preparation of submissions, resulting in a grade increase rather than a real increase in research quality (Bence and Oppenheim, 2005). Adams and Gurney (2010) provide some evidence of an increase in the quality of UK research measured by the increase in relative citation impact in the period 2002–2006. However, the increase in output measures could be due to changes in input factors rather than to changes in policies and incentives such as assessment exercises. For example, Crespi and Geuna (2008) show that growth in total productivity in the UK university system dropped in the period 1996/2001 compared to 1991/1996. They suggest that this might be due to an institutional shock caused by the RAE, which affected the level of productivity (rather than the growth rate) before the system returned to its average growth rate. In other words, the impact of the RAE was comparable to a shock that fades over time.

Since a large number of research units were successful in achieving higher ratings with each successive RAE, government decided to change the weight distribution applied in RAE1996 to maintain a high level of selectivity. Based on the RAE2001 results, from 2002/2003 onward the weights were skewed toward the top rating with more than 85% of mainstream Quality-Related (QR) funding going to the top 5 and 5* scoring departments. In 2004/05 with the introduction of an extra funding stream of €35m for the 'very best' 5* departments, 25 institutions received about 80% of HEFCE funding (Brown and Carasso, 2013). The first mainstream QR allocation based on the results of RAE2008, with weights 1, 3, and 7, went to the three top profile ratings featuring international level research. This was less selective than expected, with a lower (though still high) concentration compared to the allocation in 2008/09 when 90% of mainstream QR funding was allocated to 48 institutions compared to 38 the previous year (Adams and Gurney, 2010). Government again decided to skew the weights distribution, and since 2012/13 the top two classes have had weights of 1 and 3 respectively (see Table 6). In 2011/12, 73% of mainstream QR funding was allocated to the top 20% of the distribution, while Research Council funding was even more concentrated with 84% going to the top two deciles (Hughes et al., 2013). After the change in weights, in 2012/13, 76% of mainstream QR funding was allocated to the top 20%. The first QR allocation based on REF results will be made in 2015/16; given the major increase in top performing units the government has decided to skew the weights distribution again by increasing those for 4* submissions (see Table 6).

Table 6
Weights in QR formula allocation. RAE2008 and REF2014.

	RAE08 2009–10	RAE08 2010–11	RAE08 2011–12	RAE08 2012–13 2013–14 2014–15	REF14 2015–16
Unclassified	0	0	0	0	0
1*	0	0	0	0	0
2*	1	1	0.294	0	0
3*	3	3	3	1	1
4*	7	9	9	3	4

Source: Authors' elaboration.

3.2. Research assessment in Italy

In 2014, Italy was the only other European country in addition to the UK that had conducted a comprehensive national assessment of university research performance based on peer review aimed at allocating a significant part of the public grant. PRBRA was first introduced in Italy in 2006 with the Valutazione Triennale della Ricerca (VTR), carried out by Comitato di Indirizzo per la Valutazione della Ricerca (CIVR), the government agency responsible for research assessment in Italy. The VTR was inspired by the UK RAE, it was an expert review organized in 20 panels, to assess the quality of submissions from researchers in all Italian universities and research organizations.[13] The first evaluation exercise covered the three-year period 2001/03. However, the results were used to allocate only a very small portion of public funding – about 2% since 2009.

[13] For a detailed analysis of the VTR process see Franceschet and Costantini (2011).

Table 7
VQR ratings.

Rating (judgment)	Submissions
Penalized products	2,076 (1%)
1* (Limited)	42,362 (23%)
2* (Acceptable)	25,542 (14%)
3* (Good)	47,925 (26%)
4* (Excellent)	66,973 (36%)
Total	184,878 (100%)

Source: ANVUR (2014).

In 2010, CIVR and the Comitato Nazionale per la Valutazione del Sistema Universitario (CNVSU) the government agencies responsible for overall university assessment, were merged to create ANVUR, a national agency which began its operations in May 2011 and is responsible for all aspects of university appraisal. This was the last step on the path to reform initiated in 1993 through the incorporation of Italian universities and the legal requirement to develop a university evaluation system.

ANVUR introduced the new round of research assessment, or Valutazione della Qualità della Ricerca (VQR), relying for its implementation on help from CINECA.[14] Similar to the UK system, the number of panels was reduced from 20 to 14. The VQR evaluated the research produced by all permanent scientific staff on government contracts in 96 universities and 38 research organizations in the seven-year period 2004–2010. A total of 61,822 researchers submitted their best outputs, 3 for each university researcher, and 6 for each scientist employed in a public research organization. Ultimately, 184,878 products were submitted compared to a potential 194,763 – the total if every researcher had submitted the maximum number of outputs.[15] About 70% of these outputs were journal articles (ANVUR, 2013; Ancaiani et al., 2015).

Peer review was the dominant method of assessment in the fields of Arts, Humanities, most of the Social Sciences (excluding Economics), Civil Engineering, and Architecture. In the Natural and Bio-Medical Sciences, some Engineering disciplines and Economics and Statistics, bibliometrics were more predominant although in these fields a significant number (between 25% and 48%) of outputs were peer reviewed. Outputs not submitted for peer review (indexed on the Web of Science or Scopus) were evaluated automatically via a bibliometrics-based algorithmic method. This method counted journal impact (impact factor for the Web of Science and equivalent indicator for Scopus) and number of citations to the article up to 31 December 2011. If these indicators converged the article was ranked automatically in one of the four relevant classes. If the information supplied by these two indicators did not converge, the relevant article was peer reviewed (ANVUR, 2013).

The research quality of the outputs submitted was judged on a four point scale (see Table 7) based on three criteria: (1) relevance to the field, (2) novelty, and (3) internationalization. Negative points were assigned to very low quality outputs, to cases of plagiarism, and cases of failed submission, i.e. researchers who failed to submit the required number of scientific outputs. The final indicator of unit research quality (IRFS1) was calculated using a formula comprising quality and quantity of submitted outputs (weighted 50%), amount of external research funding (weighted 10%), quality of new recruits and promotions (weighted 10%), internationalization (weighted 10%), number of doctoral students and postdocs (weighted 10%), propensity to finance projects with endowment funds (weighted 5%), and performance improvement compared to the VTR 2001–2003 evaluation (weighted 5%).

It is clear that the VQR structure was informed by discussions in the UK on the use of bibliometrics when defining the REF. However, the VQR, although a mix of peer review and bibliometrics assessment, depends more heavily than the REF on automatic bibliometrics. For example the panels for mathematics and industrial engineering chose to use bibliometric in the VQR but not in the REF. The VQR approach is more mechanistic than the REF. In the REF citation count is used as additional information to guide judgment, not as an automatic measure to assess quality (though undoubtedly panel members may be steered in their judgment by the bibliometrics indicator). As a pilot exercise and for methodological purposes, in areas where the VQR relied mainly on bibliometrics, ANVUR extracted a random 10% sample of papers for peer review by two reviewers. The results of this peer review revealed discrepancies (especially in the case of products ranked by one or other method as excellent) with a modest correlation between the two methods of evaluation. On average, the bibliometrics scores were higher than the peer review outcomes. Interestingly, the correlation between the rankings of the two reviewers was also modest (ANVUR, 2013).

Another important difference between the REF and VQR implementations was the lack in the case of the VQR of major public consultation. Its hasty introduction in part can be justified by the need for a new evaluation process following the lengthy dismantling of the CIVR. The lack of stakeholder involvement and open public consultation beyond minor involvement of some scientific institutions in the selection of the publication lists used for the evaluation, and the rush to implement a new evaluation system, led to some mistakes and evoked criticism of and opposition to the evaluation.

The concentration of research funding in Italy based on the 2013 FFO performance-based research allocation and the VQR assessment, shows that the level of selectivity in the Italian system is lower than in the UK. In Italy in 2013, about 63% of performance-based resources were allocated to institutions in the top 20%, compared to 76% in the UK. The former level of concentration is only slightly higher than in the case of FFO basic funding (62%). These differences in the concentration of resources in Italy and the UK, and the increased concentration in the UK (Hughes et al., 2013) are substantial.

4. Costs of peer review-based research assessment funding

In assessing the costs of implementing a PRBRA system, we looked at: (1) the public funding agency's internal costs, and (2) the direct costs incurred by the university system. The former can be estimated quite reliably based on available public documents but estimating university costs is more difficult; they can vary significantly depending on the time and effort invested in selecting departmental outputs.

Based on HEFCE manager's reports (HEFCE, 2009, 2015), and the accountability review conducted by PA Consulting Group (PA Consulting Group, 2009) we first compare the costs of the UK REF2014 with previous RAE rounds, then using a similar methodology, we estimate the costs for the Italian case.

4.1. UK RAE/REF costs

Table 8 shows that the public funding agency's internal costs to carry out the research assessment scheme have grown significantly, reaching €15m for RAE2008 and €17.7m for REF2014. The main reasons for this increase are: (1) changes to the panel structure, (2) consultations conducted by HEFCE in the start-up phase and pilot

[14] CINECA is an inter-university consortium which reports to MIUR and provides support services for research activities (e.g. supercomputing) and managerial systems to assist MIUR and universities' activities.

[15] There were several reasons for this difference in the expected and actual number of submissions e.g. staff on maternity leave, recent appointments, or researchers without the minimum number of outputs required to make a submission.

Table 8
Increase from previous round in the internal costs of the UK RAE/REF.

	Costs (€)	Increase in nominal terms (based on £ value)	Increase in real terms (based on £ value)
RAE 1996	4,290,000	–	–
RAE 2001	8,160,000	+70%	+54%
RAE 2008	15,000,000	+135%	+113%
REF 2014	17,712,000	+20%	+7%

Source: Authors' elaboration of HEFCE (2009) and HEFCE (2015).

exercises, (3) improvements to and monitoring of supporting IT systems and of experts, (4) increase in the number of outputs submitted due mainly to increased involvement in academic research, and (5) the inclusion of impact in REF2014.

The RAE panel structure changed between 1996 and 2008, becoming heavier and pyramidal. The number of main panels decreased, and a two-tier system was introduced; in RAE2008 67 sub-panels of experts worked under the guidance of 15 main panels. At the same time, the number of panel members increased from 560 in RAE 1996 to over a thousand for RAE2008. The panel structure for REF2014 was redefined and the total number of UOAs was reduced to 36 grouped in 4 main panels.

RAE costs are mostly incurred towards the end of the exercise – the period of assessment and reporting. The costs in the previous phase mostly refer to framework improvements, meetings, tests, and consultation with the academic community on criteria and panel working methods. The sharply increased costs of RAE2008 and REF2014 were due also to the introduction of a set of significant modifications for public discussion. HEFCE ran a series of consultations, starting with a public consultation which resulted in the publication in February 2004 of *RAE2008: Initial decisions by the UK funding bodies*,[16] followed by meetings with the academic community on the constitution of panels and nominations for panel members. In 2007, HEFCE launched another public consultation on a new framework of research assessment, and conducted a series of pilots on the use of bibliometrics and implementation of impact studies.[17]

Considerable resources and expertise were invested in the implementation of RAE2008 to develop a useful and fit-for-purpose data collection system. This and other information technology (IT)-based systems have been redefined to support implementation of the REF.

Finally, the UK higher education system has grown significantly since the 1996 research assessment. Using HESA statistics, we estimate a 38% increase in full-time academic personnel in the research only and the teaching and research functions (i.e. excluding 'teaching only' staff) in the period 1996–2014. In the period 1996–2008, the increase in full time academic personnel resulted in an increase in the number of active academic researchers submitting outputs, and thus an increase in the number of outputs submitted. The number of researchers submitting increased from 63,279 to 68,563 (+8.35%), and the number of outputs submitted increased from 212,553 to 216,497 (+1.85%) (HEFCE, 1997, 2009). In the case of REF2014, a change in the regulations regarding eligibility of staff for assessment purposes[18] resulted in a decrease in the number of active academic staff to 56,070 (−18.24%) and a decrease in the number of outputs to 191,150 (−11.71%) (HEFCE, 2015).

Table 9
RAE2008 direct costs incurred by the university system in the UK.

	Overall costs (€)	Annualized costs (€)	Costs – percentage of funds distributed
England	59,169,632	8,452,805	0.5%
Scotland	9,189,276	1,312,753	0.077%
Wales	3,578,225	511,175	0.03%
Northern Ireland	1,589,070	227,010	0.013%
Total costs for UK HEIs	73,526,203	10,503,743	0.62%
Total internal costs	15,000,000	2,142,857	0.13%
Total costs of RAE2008	88,526,203	12,646,600	0.75%

Source: Authors' elaboration.

PA Consulting Group's (2009) accountability review provides an estimate of the direct costs incurred by the institutions involved in RAE2008. Based on a detailed analysis of the costs incurred by 20 universities, PA Consulting Group estimated that English institutions spent €58.7m. The number of FTE Category A researchers in the institutions that participated in RAE2008 enables us to calculate individual costs for the UK, and then estimate the total direct costs to the UK higher education system, which are €73.5m (see Table 9). The three most important costs are management of scientific research output submissions (validating publication information, and writing submission), faculty review groups to select outputs for submission, and central project management.

We can expect an increase in direct university costs for REF2014 due to the efforts invested by universities in producing the impact case studies. A report by the Technopolis Group (2010) on the pilot REF impact exercise shows that the most time consuming activities for universities are: (a) collecting evidence of impact (citations, books, etc.), and (b) drafting impact case studies. They suggest an estimated cost of impact studies of a maximum of 20% of total direct university costs. Adams (2014), by counting €4340 for each case study, provides a preliminary estimate of €29.5m for the university costs required to carry out impact studies. The figure is higher in the RAND Europe report which identifies the average cost for each case study at €9300, yielding a total estimate of €63m for this activity. Thus, we estimate the total cost of RAE2008 to be around €88.5, while estimates for REF2014 range from €130m to €164m.

4.2. The costs of the Italian VQR

In estimating the costs of the Italian research evaluation system we have tried to follow the approach used in the UK. We first estimate the internal costs of core activities carried out by the national evaluation agency and other public institutions involved in the VQR process, based on available public documents. We also provide three alternative estimations of the direct costs incurred by the institutions assessed.

[16] See http://www.rae.ac.uk/pubs/2004/01/rae0401.pdf.

[17] In 2014, after completion of the REF, a new consultation on the use of metrics was launched by HEFCE.

[18] Category B and D staff were no longer eligible for assessment purposes, thus we refer to the RAE08 definition for these categories. Category A staff were defined as academic staff with an employment contract of a minimum 0.2 FTE on the payroll of the submitting HEI at the census date (October 31, 2013), whose primary employment function was either research only or teaching and research. Category B staff were defined as academic staff who held a contract with the institution after 1 January 2001 and who left the institution after that date and before the census date, and who otherwise would have been eligible for inclusion in Category A. Category C staff were defined as individuals employed by an organization other than an HEI whose contract includes the undertaking of research, and whose research is primarily focused in the submitting unit on the census date (October 31, 2013). Category D staff were defined as independent investigators who met the definition for Category C staff of RAE2008 during the period January 1, 2001 to October 31, 2007 but were not included in the census.

Table 10
Costs of VQR as a percentage of funds allocated (in euros).

		Costs – percentage of funds distributed
Peer review	5,940,000	
Bibliometrics	*250,000*	
GEV[a] chairman	98,280	
GEV members	2,550,600	
GEV assistants	858,203	
CINECA's total costs	9,697,083	0.30–0.40%
Board of Directors	626,535	
ANVUR Director	35,712	
Manager	85,680	
Director's assistant	26,924	
GEV Chairman	98,280	
Total costs of ANVUR	873,131	0.03–0.04%
Total internal costs	10,570,214	
Total cost for Italian HEIs[b]	60,084,638	1.86–2.48%
Total cost of VQR	70,654,852	2.18–2.91%

Source: Authors' elaboration.
[a] Gruppi di Esperti della Valutazione – Expert evaluation group.
[b] This is the average of three estimates of university costs presented in this section.

Two main public agencies, ANVUR and CINECA, were involved in the management of the VQR. Four main categories of internal cost can be identified:

- cost of VQR panel members which can be split into three subcategories based on contracts and roles (panel chairman, panel members, and panel assistants). VQR panels are called Gruppi di Esperti della Valutazione or GEV. The gross payment reported includes social security contributions;
- peer review: costs of the external peer review process;
- bibliometrics: estimated costs of IT support and licenses to access Scopus and ISI Web of Science databases;
- central governance/central project manager conducted by ANVUR managers and members of its board of directors involved in the VQR process.

Implementation of the VQR was managed by CINECA, which received an initially inadequate ministry budget allocation of approximately €6.5m. From the 184,878 research outputs submitted to the VQR process, only 99,000 were subjected to peer review assessment. Research output reviewers received a nominal payment of €30 from CINECA whereas the opportunity costs for a reviewer were much higher especially in 'soft sciences' where an output might be a book. Each output was examined by two reviewers which works out at €60 per output submitted for peer review. Total peer review costs were around €5.94m. In the case of the metrics-based assessment, in addition to CINECA's internal costs for the development and implementation of the bibliometrics software, there was a cost for ISI Web of Science and Scopus database licenses. Since we do not have details of the personnel employed, we have made a tentative minimum estimate of around €0.25m for personnel, and database licenses. The VQR process involved 14 panels of experts and a president, accounting for 14 panel chairpersons and 436 panel members. Each panel chairperson was on a €6000 12-month consultancy contract with CINECA, and each panel member had a contract for €5000 for 12 months. Panel members were supported by 17 full time assistants hired for a period of 18 months. For each assistant we estimate a gross annual contract of €33,655, giving a total expenditure for panel assistants of about €0.86m. Table 10 presents a breakdown of the €9.7m costs incurred by CINECA.

Table 11
VQR costs by category for a large university.

	Univ. Florence Costs (€)	Univ. Turin Costs (€)	Italy Costs (€)
Central administration (staff)	330,990	97,350	
Department support (staff)	318,010	356,950	
University steering group (academic)	34,569	8363	
Department steering group (academic)	–	156,880	
Submission activity (academic)	1,138,727	1,185,475	
Total cost per HEI	1,822,296	1,805,019	
Total cost per researcher	960	912	935
Total cost for Italian HEIs			51, 432, 954

Source: Authors' elaboration.

Expenditures sustained by ANVUR detailed in Table 10, include the costs of the board members and managers involved in the VQR process based on their ANVUR contracts. We think that implementation of the VQR process, including management and coordination of the work carried out by the panels, could be approximated by the equivalent of three FTE members of the Board of Directors. Their yearly contract cost was €178500 each. Also involved were the Director of ANVUR (not a board member but a public official in charge of internal organization), his personal assistant, and another manager working for VQR. We estimate that the Director, who was involved in all ANVUR activities, spent about 25% of his time on the VQR process, while one manager was 100% involved. On the basis of publicly available information on their salaries, we estimate their total costs at around €120000. We estimated the personal assistant's salary based on the mean of the national government salary for this role, at €27000 gross. Table 10 also reports the cost of panel chairpersons employed by ANVUR. The chairpersons acted as consultants for ANVUR on various subjects (not just the VQR), and were employed on a collaboration contract of €10000; we estimate about 60% of their costs to working on the VQR. The total costs to ANVUR of organizing the VQR are about €0.9m, giving a total of internal costs for the implementation of VQR by the Italian agencies of about €10.6m.

Estimating the costs incurred by the institutions assessed is difficult since this was the first assessment of all academic staff carried out in Italy (only 17,329 outputs from selected academic staff were evaluated in VTR2006). We propose three alternative estimates of internal costs. First, we collected internal information for the Universities of Turin and Florence, which are among the 11 largest Italian universities accounting for 5.5% of total submissions (Table 11). Based on interviews with the Pro-vice Chancellor (Vice Rector) for research and administrative personnel at the University of Turin, and administration documentation from the University of Florence, we estimated the involvement of 15 non-academic staff working on central administration activities for an equivalent 2 months per person on VQR coordination tasks, and 2 non-academic staff per department, working for an equivalent of 1 month per person on support tasks.[19] Academic staff were also involved in

[19] We estimate an average wage of €38,040 for non-academic staff.

the process; we calculated academic staff time spent on (a) submission activities, (b) participation in university steering groups, and (c) for the University of Turin only,[20] participation in departmental steering groups. We estimate one day of a professor's time for submission activities; for cost purposes we estimate the average wage of an associate professor. Departmental steering groups worked for about one day of meetings, one per each department, involving between six and eight professors. The university steering group involved 12 full-professors for a maximum 10 h of work at the University of Turin, and 6 full-professors for a maximum of 18 days of work at the University of Florence. Based on this information and the relative sizes (total submissions) of the two universities, we estimate a minimum[21] university system cost for VQR2012 at around €51m, giving a total cost of about €62m.

We tried also to adjust the UK estimate of university costs to the Italian context. The total number of outputs submitted to RAE2008 was 216,497 and 184,878 for the Italian VQR, so the Italian exercise was slightly smaller than the UK's for submitted outputs. Similarly, in RAE2008, 68,563 active researchers were assessed, while the number for the VQR was 61,822. In terms of the combined number of research staff assessed and products presented, the VQR was 10–15% smaller than RAE2008. However, the funding associated with the RAE is more important than the share of VQR funding in Italy (as discussed in Section 5). Moreover, due to the ongoing and established implementation of the RAE in the UK, the reputational effect is more important than in Italy. Thus, we can assume that more effort is put into the presentation of submissions by UK universities, and their central administration and units, with UK department heads initiating work on the RAE submissions well in advance (Geuna and Martin, 2003). This type of assessment was new to Italian institutions, and most had no infrastructure in place to support it. Moreover, while learning-by-doing efficiency gains could be expected, between the 2001 and 2008 assessments, these were very limited (PA Consulting Group, 2009). Overall, we would estimate Italian university costs at around 80% of the UK costs. The university system cost for VQR2012 can be estimated at €58.8m, giving a total cost of about €69.4m. Sirilli (2012), using an estimate of the time devoted to the preparation and management of submissions, gives a higher estimate for university system costs of about €70m making total VQR2012 costs around €80.6m. Taking the average of the three estimates of university costs, the estimated total internal and university system cost of the VQR2012 would be around €70.6m.

The estimates in this section do not take account of the opportunity costs of external referees and panels of academic members. The total full costs of refereeing could potentially be much higher than the compensation paid to referees and panel members. However, robust estimates are difficult since the activities of refereeing and membership of academic panels are components of academic work. Estimates will vary depending what is considered. Two crude calculations of full costs were proposed recently. One for the UK that ranges between a minimum of €600m and a maximum of €1.4bn (THES, 2015), and one for Italy of €300m (Sirilli, 2012).

5. Comparison of the costs of different research funding methods

Governments have to decide which mechanism to choose to allocate basic research funding to universities. There are three main models in Europe. The first is allocation on a historical basis (i.e. a percentage of the salary of the academic staff employed by universities). This was the method employed by most European university systems until the 1970s, and the method that continues to be used by several of them. The second is allocation based on quasi-market mechanisms and evaluation of past performance according to informed peer review as in the case of research assessment-type allocation, or according to metrics. The third is competitive program-based allocation such as the method used by the UK Research Councils. *Ex-ante* R&D prizes are being used increasingly by private and public organizations but the share of such funds in total research funding is small.[22]

In Section 4 we offered an estimation of the costs of PRBRA; here we discuss some of the evidence on the costs of metrics-based systems and Research Council funding, and compare the three main allocation mechanisms along the dimensions of costs and efficiency.

5.1. The cost of metrics-based systems

Although some studies suggest that indicator-based systems are cheaper than peer review assessment (Franceschet and Costantini, 2011), we found no published material detailing the costs of a metrics-based system. To fill this gap, we interviewed managers and experts in Norway and Sweden where metrics-based systems are used to allocate part of their research budgets. We also provide some information on the cost of the indicator-based support applied to REF2014 in the UK.

In 2005 Norway introduced a performance based funding system (to allocate a small portion of institutional funding) based on bibliometric indicators constructed using bibliographic data provided by the institutions in all areas of research (Sivertsen, 2010). The Norwegian model was adopted by Denmark, Belgium, Finland, and Portugal. The data for the indicator are collected via the current national research information system, CRISTIN, which also serves several other purposes (Sivertsen, 2015). The estimate presented here is a minimum estimate which includes the costs of developing and running a central system and the costs to the HEIs. Development and implementation of CRISTIN cost around €5m during the period 2003–2011. Annual running costs associated with 17.5 FTE personnel in various organizations (central government, HEIs, Norwegian Association of Higher Education Institutions, CRISTIN, Norwegian Social Science Data Service) needed to maintain the indicator and collect quality assurance bibliographic data (22,000 publications – journal articles and books) are estimated at €2m.[23]

In 2009, Sweden introduced a performance-based model to distribute resources to HEIs. In 2014, about 20% of the block grant (initially 10%) was allocated on a competitive basis, 50% based on bibliometrics indicators, and 50% based on an external funding indicator. The bibliometrics indicators weight both publications and citations from the ISI Web of Science database (weights vary for social sciences and humanities). The cost of the Web of Science license, engineering support for the database, and citation analysis is about €0.19m annually.[24] This figure does not include the cost of the time devoted by researchers and administrators of HEIs. This mechanism is currently under revision; in 2013 the Swedish Government commissioned the Swedish Research Council to develop

[20] We do not have detailed information for the University of Florence but it is likely academic staff time was also spent on VQR departmental meetings in that university.

[21] We can assume that some costs are fixed, regardless of the number of submissions; given that most Italian universities are medium or small sized, our estimations based on two large universities underestimate total university costs.

[22] See, e.g. the Google Lunar X-Prize, offered jointly by the private-funded charity X-Prize Foundation and Google. The Longitude Prize supported by Innovate UK, an executive non-departmental public body sponsored by the Department for Business, Innovation and Skills, and prizes offered by the UK Research Councils are examples of public funded competitions.

[23] We thank Gunnar Sivertsen of NIFU STEP for providing us with useful information and the cost estimate.

[24] We thank John Tumpane of the Swedish Research Council for this information.

and propose a model involving peer reviewed research quality and research relevance (SRC, 2014).

In the UK, there was no direct information available in the HEFCE (2015) manager's report on the costs of bibliometric information for citation analysis. Eleven out of 36 sub-panels (hard sciences plus computer science and informatics and economics and econometrics) chose to use citation data to inform their review. Based on personal communication with the REF Manager the cost to HEFCE of procuring the citation data from the Scopus database can be estimated at about €0.15m. There were some additional costs associated with HEFCE staff time used to integrate the citation data into the REF submission, and some costs to institutions for preparing their submissions but these are difficult to estimate.[25]

5.2. Research Council funding costs

Details of Research Councils' funding costs are not readily available although there are some reports of UK and other countries' activities. The most recent report on the UK (RCUK, 2006) provides details of internal and external costs for the UK although they are not fully comparable with our estimates for PRBRA. The Research Councils UK report also provides some interesting international comparisons of administrative costs. For the academic year 2005/06 upper limit estimates of UK Research Councils' total costs are around €281m to allocate some 1,872m of funding. Internal administrative costs for managing the refereeing process are relatively low, about 5% of the total.[26] The full costs (opportunity costs) of refereeing (21%) are around four times the internal costs, while producing and processing full proposals accounts for 74% of the total. The weight of internal costs seems to be consistent across countries; a benchmarking study quoted in the RCUK report, of six funding agencies from Europe and the USA (15 including data from secondary sources) suggests administrative agency costs (internal direct costs plus other administrative costs) are between 2% and 7% of the total budget allocated, with UK Research Councils costs at 4%.

In the period 1988–2005, the increased share of research funds allocated via the Research Councils meant that the number of proposals more than doubled, and the success rates fell from 41% to around 28% (RCUK, 2006).[27] The high cost of producing a proposal combined with the decreasing probability of success has made applications for Research Council funding a risky strategy for academics.

5.3. Efficiency ratio

Selective allocation is justified if the potential efficiency gains from a competitive system are higher than the costs of implementing the evaluation. A cost-benefit analysis of funding allocation models is an extremely complex exercise that is beyond the scope of this paper. However, a rough but informative way to gauge the efficiency of public policy program evaluation is to compute the ratio between the cost of the evaluation and total public funding allocation. The lower the ratio, the higher the probability that the benefits from the selective system will be higher than the cost of the evaluation.

To compare the efficiency of the UK and the Italian PRBRA systems, we analyzed the ratio of the estimated assessment costs (internal and university) on total funds allocated through these mechanism. In the period 2009/2010 to 2014/2015, RAE2008 results were used to inform funding councils in the context of a QR allocation of about €11.875bn to universities in the UK, representing about 32% of total public research funds, approximately 20% of total funding council grants, and 14% of UK HEIs' total government funding. The total estimated internal and university costs for RAE2008 were €88.5m, accounting for 0.75% of the QR allocation over the period considered.

As the expected next round of VQR in Italy will be in 2015–16 (for 2011–14 research outputs), it is possible to forecast the research funding allocations to Italian universities for the period 2014–2016. On the basis of the 2014 FFO performance-based research allocation of €1.093bn, and recent regulatory changes mandating that research funding based on VQR results should range between 60% and 80% of the total performance share, FFO research performance based allocation is likely to fluctuate between a minimum of €2.422bn and a maximum of €3.230bn. This is significantly lower than in the UK scenario, and accounts for 11.5–15.3% of total government grant allocation (FFO), and some 8.5–11.3% of total government university funding. Based on estimates of €70.6m for the total internal and university costs of the VQR, the efficiency ratio could vary between 2.2% and 2.9% of total resource allocation.

Efficiency ratios can be calculated also for Research Council-type allocations. However, it is not possible to calculate the same ratio since the available cost information is not comparable. For the UK Research Councils, based on the data presented in RCUK (2006), we estimated a ratio of 0.7% for direct internal costs (the ratio for RAE2008 internal agency costs would be 0.1%), and total full costs ranging between 13.5% and 15% which can be compared to the 5–12% range of the full cost estimates of REF2014 (THES, 2015). Overall, efficiency ratios are higher for Research Council-type allocations.

Table 12 presents evidence on costs and efficiency ratios. Among alternative ways to allocate government funds to universities, PRBRA appears less expensive than Research Council allocations, although it is more expensive than historically based allocation. Metrics-based allocation is cheaper than informed peer review. However, when used to replace PRBRA to allocate funding to all disciplines, such as in the case of Norway, the costs are significant. For example, a six year allocation (similar to RAE2008) would cost about €12m in Norway. Although not perfectly comparable, the efficiency ratios indicate higher efficiency for PRBRA allocation compared to Research Council allocation. However, one of the reasons for this is the high costs related to preparing proposals (about 70% of total costs). If we were to assume some recycling of rejected proposals, and the fact that proposal writing is part of the development of better research ideas, Research Council costs and their ratio would be lower.

Table 12
Comparison of main features of different research funding models.

	Historical basis	Metrics-based	PRBRA	Research Council
Costs	****	**(*)	**	*
Efficiency ratio			1–3%	
			5–12%	13.5–15%

Source: Authors' elaboration.
****: best performance; *: worst performance.

6. Conclusions

European university funding systems have experienced significant changes in the last 30 years. In all countries, non-government funding sources and performance-based competitive allocation systems have increased. The UK and the Italian models would seem

[25] We thank Graeme Rosenberg, REF Manager, for this information.
[26] A report from Higher Education Policy Institute (2006) estimates internal agency costs averaging 9% of the total, ranging between 4% and 11%.
[27] Also in the US, success rates for competitive funding from the National Institutes of Health (NIH) and the National Science Foundation (NSF) have dropped significantly as applicant numbers have grown (Stephan, 2013).

to represent two extremes cases; the UK is a more competitive system involving more private funding (about 50% of total university funding), while Italy depends mostly on public funding (about 75% of total university funding) and especially on the central government bulk grant. However, the Italian HEI system, like those in other European countries, is following the UK model and generally introducing more autonomy for universities (despite a reversal in this trend in the most recent years) accompanied by more competitive allocation of public resources. One such system is Peer Review-Based Research Assessment, the focus of the analysis in this paper.

Much of the debate surrounding the value of research assessment and allocation systems is around the pros and cons related to their implementation although there is very little evidence on their absolute cost or the cost relative to other allocation systems. The aim in this paper was to provide best estimates of these costs to inform the ongoing debate. Costs are an important parameter in decisions about which funding system to choose, and have to be considered alongside the potential benefits such as flexibility, typical of selective allocation systems. Competitive models are more flexible since they are based on different assessment methods across disciplines. Historical allocation based on student numbers or university salaries takes into account differences among disciplines only in terms of unit teaching costs, and tends to replicate allocations to dominant disciplines which may have ceased to respond to societal needs. Allocation of resources via Research Councils is the most flexible system because it directs funding towards the best researchers based on their performance in specific areas of research prioritized by the Research Councils or based on original research. However, Research Council allocation is the most costly.

As experience of the RAE in the UK shows, performance-based research funding systems are not easy to either develop or implement, and are less acceptable to the academic community. A complex and expensive system such as the RAE can produce benefits in terms of creating incentives and reputation but care needs to be taken in its development if its negative consequences are to be avoided (Geuna and Martin, 2003).

Our analysis of PRBRA as a tool for allocating resources in the UK and in Italy has provided a set of interesting insights into critical aspects of its development. First, internal and direct university cost estimates are high, and if the opportunity costs of refereeing and panel membership are included in the estimation, the total cost increases dramatically.

Second, the costs of PRBRA are significantly higher than both historical and metrics based allocation systems. However metrics based allocation mechanisms depend on the availability of commercial data and correction systems that take account of the specificities of social and human sciences such as are applied in Sweden. In the UK (less so in Italy) metrics information is exploited only by a subset of panels since it is not considered reliable for humanities and social sciences (excluding economics and econometrics).

Third, when the internal and direct costs of PRBRA are considered in relation to the funding allocated, the ratio is lower than in the case of project based allocation systems such as in the case of the Research Councils in the UK.

Fourth, research assessment-type national evaluations systems should be coupled with significant funding to avoid system costs becoming overly high in comparison to the funds allocated. Italy is an example of insufficient allocation combined with too short a time between evaluations resulting in an efficiency ratio of around 2.5%. This ratio will rise further without an increase in the performance-based quota of FFO. Our estimation of the efficiency ratio for Italy is based on the idea of an increase in the performance-based component of public funding, however, this assumption (although a legal requirement) may prove to be mistaken. Indeed, given the macro-economic situation in Italy, an increase in university public funding is unlikely, therefore the increase in performance-based funding will result in a reallocation of funds from lower performing universities which however, are already very stretched having received decreased public funding since 2008.

Fifth, research assessment might not be linked to funding (such as in the case of the Netherlands) when it is justified by other strategic reasons or on the basis of the positive effects stemming from relative reputation competition (Hicks, 2012). However, it is clear that other cheaper systems such as prizes can be used to make competition based on reputation. Peer reviewed based research assessment used only as a tool to increase reputation competition works best in small countries such as the Netherlands, where network effects are stronger.

Sixth, the significant fixed costs can discourage implementation of PRBRA in small research systems. Finally, a performance-based allocation system is much easier to introduce in systems experiencing a growth in total public funding. In an expanding system, evaluation will likely result in increased resources for a few top institutions, and fewer if any sharper cuts for less research-led institutions.

Following the massification of higher education and the ensuing constraints on public budgets in Europe, governments moving away from historically based allocation, have made increasing use of selection in the allocation of research funding. All things being equal, the potential benefits of reliance on more competitive models such as funding based on informed peer review research assessment and Research Council funding, depend on the volume of resources allocated through selective systems and the extent of these systems. The two countries analyzed in this paper provide a perfect juxtaposition. Currently, Research Council funding has overtaken QR mainstream in the UK, and the concentration of resources is very high in both selective sources (with Research Councils being more concentrated). In contrast, in Italy, MIUR competitive funding is limited, and concentration of VQR-based funding is significantly lower than in the UK. These differences are a result of both increased Research Council funding which is now more than block grant funding in the UK, and the redirection since the early 1990s of funding from the latter to the former together with allocation of a block grant via research assessment. Italy and some other European countries have shifted only recently toward a more selective-based funding system. Thus, we would expect that in countries such as Italy there are margins for efficiency improvements, and therefore the benefits gained through selective systems could outweigh the costs. However, greater use of selective systems in the UK might well result in minimal benefits that do not justify the additional costs.

Our discussion of the implementation of PRBRA in Italy shows that although Italy has learned from implementation of the UK research assessment, transfer of learning related to the UK RAE to the Italian context has not been straightforward. There are two main reasons for this. First, culture matters. While in the mid 1980s and early 1990s the UK system was characterized by autonomy and a significant share of funding allocated on a competitive basis by the Research Councils, the Italian university system was a centralized ministerial system until the mid 1990s, with little competitive funding, and university professors were relatively prestigious public servants with high levels of individual autonomy. Thus, independent external evaluation was strongly resisted in Italy. Second, although research evaluation has been the subject of academic and policy discussions for several years, its implementation requires specific skills that can be gained only through experience. The rapid introduction of the VQR to try to compensate for the previous wasted years, suffered from lack of skilled

employees in the ministry, the evaluation agency, and the universities. Development of a culture of evaluation and evaluation competence takes time and is country specific.

Acknowledgments

The authors are grateful to Andrea Bonaccorsi, Giorgio Longo, Adalberto Merighi, Graeme Rosenberg, Giorgio Sirilli, Gunnar Sivertsen, Mauro Sylos-Labini, Roberto Torrini, John Tumpane, and Jesper Wilborg Schneider for comments and suggestions. Financial support from the Collegio Carlo Alberto Project 'Researcher Mobility and Scientific Performance' is gratefully acknowledged. Aldo Geuna thanks the Stanford Institute for Economic Policy Research (SIEPR) for support provided during his Sabbatical stay at Stanford University.

References

Adams, J., 2014. The chosen ones. Research Fortnight, Feb. 26.
Adams, J., Gurney, K., 2010. Funding Selectivity, Concentration and Excellence: How Good is the UK's Research? Higher Education Policy Institute, Oxford.
Agenzia Nazionale di Valutazione dell'Università e della Ricerca (ANVUR), 2014. Rapporto sullo Stato del Sistema Universitario e della Ricerca 2013. ANVUR, Rome.
Agenzia Nazionale di Valutazione dell'Università e della Ricerca (ANVUR), 2013. Rapporto Finale VQR. ANVUR, Rome, available at http://www.anvur.org/rapporto/.
Ancaiani, A., Anfossi, A., Barbara, A., Benedetto, S., Blasi, B., Carletti, V., Cicero, T., Ciolfi, A., Costa, F., Colizza, G., Costantini, M., di Cristina, F., Ferrara, A., Lacaterna, R., Malgarini, M., Mazzotta, I., Nappi, C., Romagnosi, S., Sileoni, S., 2015. Evaluating scientific research in Italy: the 2004–10 research evaluation exercise. Res. Eval. 24 (3), 242–255.
Baty, P., 2004. Sex bias limits women in RAE. THES, July 16, available at http://www.timeshighereducation.co.uk/news/sex-bias-limits-women-in-rae/190047.article.
Bence, V., Oppenheim, C., 2005. The evolution of the UK's Research Assessment Exercise: publications, performance and perceptions. J. Educ. Admin. Hist. 37 (2), 137–155.
Brown, R., Carasso, H., 2013. Everything for Sale? The Marketisation of UK Higher Education. Routledge, London.
Crespi, G., Geuna, A., 2008. The productivity of UK universities. In: Schmidtchen, M.A.D., Voigt, S. (Eds.), Conferences on New Political Economy, Scientific Competition. Mohr Siebeck, Tubingen, pp. 71–95.
Franceschet, M., Costantini, A., 2011. The first Italian research assessment exercise: a bibliometric perspective. J. Infometr. 5 (2), 275–291.
Frølich, N., 2008. The Politics of Steering by Numbers. Debating Performance-Based Funding in Europe. NIFU STEP, Oslo.
Geuna, A., 2001. The changing rationale for European university research funding: are there negative unintended consequences? J. Econ. Issues 35, 607–632.
Geuna, A., 1999. The Economics of Knowledge Production: Funding and the Structure of University Research. Edward Elgar Publishing, Cheltenham.
Geuna, A., Piolatto, M., Sylos Labini, M., 2015. University funding and research assessment: an analysis of the Italian and British cases. In: Geuna, A., Rossi, F. (Eds.), The University and the Economy: Pathway to Growth and Development. Edward Elgar Publishing, Cheltenham, pp. 102–138.
Geuna, A., Sylos Labini, M., 2013. Il Finanziamento dell'Istruzione Terziaria e della Ricerca Universitaria in Italia. BRICK Working Paper No: 07/2013. Department of Economics and Statistics Cognetti de Martiis, University of Torino, Torino.
Geuna, A., Martin, B., 2003. University research evaluation and funding: an international comparison. Minerva 41, 277–304.
Higher Education Funding Council for England (HEFCE), 2015. Research Excellence Framework 2014: Manager's Report. HEFCE, Bristol.
Higher Education Funding Council for England (HEFCE), 2014. Guide to Funding and Student Number Controls 2013–14 and 2014–15. HEFCE, Bristol.
Higher Education Funding Council for England (HEFCE), 2009. RAE 2008 Manager's Report – April 2009. HEFCE, Bristol.
Higher Education Funding Council for England (HEFCE), 1997. RAE 1996 Conduct of the Exercise: Manager's Report – May 1997. HEFCE, Bristol.
Higher Education Policy Institute (HEPI), 2006. Using Metrics to Allocate Research Funds. A Short Evaluation of Alternatives to the Research Assessment Exercise.
Higher Education Statistics Agency (HESA), 2013. Higher Education Finance Plus 2011/2012. HESA, London.
Hicks, D., 2012. Performance-based university research funding systems. Res. Policy 41, 251–261.
Hughes, A., Kitson, M., Bullock, A., Milner, I., 2013. The Dual Funding Structure for Research in the UK: Research Council and Funding Council Allocation Methods and the Pathways to Impact of UK Academics. UK Innovation Research Center, Cambridge/London, available at http://www.lms.ac.uk/sites/lms.ac.uk/files/Mathematics/Funding.pdf.
Martin, B., 2011. The Research Excellence Framework and the 'impact agenda': are we creating a Frankenstein monster? Res. Eval. 20, 247–254.
McNay, I., 1997. The Impact of the 1992 RAE on Institutional and Individual Behaviour in English Higher Education: The Evidence from a Research Project. HEFCE, Bristol.
Moed, H.F., 2008. UK Research Assessment Exercises: informed judgments on research quality or quantity? Scientometrics 74 (1), 153–161.
Organization for Economic Cooperation and Development (OECD), 2010. Performance-Based Funding for Public Research in Tertiary Education Institutions: Workshop Proceedings. OECD Publishing, Paris.
PA Consulting Group, 2009. RAE 2008 Accountability Review. PA Consulting Group, London.
Research Councils UK (RCUK), 2006. Report of the Research Councils UK Efficiency and Effectiveness of Peer Review Project. RCUK, Swindon.
Sirilli, G., 2012. Si Può Stimare che la VQR Costerà 300 Milioni di Euro - E a Pagarli Sarà l'Università. Available at www.roars.it; http://www.roars.it/online/si-puo-stimare-che-la-vqr-costera-300-milioni-di-euro-e-a-pagarli-sara-luniversita/.
Sivertsen, G., 2015. Publication-based funding: the Norwegian model. In: Ochsner, M., Hug, S.E., Daniel, H.D. (Eds.), Research Assessment in the Humanities. Towards Criteria and Procedures. Springer, Dordrecht (forthcoming).
Sivertsen, G., 2010. A performance indicator based on complete data for the scientific publication output at research institutions. ISSI Newsl. 6 (1), 22–28.
Swedish Research Council (SRC), 2014. Research Quality Evaluation in Sweden – FOKUS. Report of a Government Commission regarding a Model for Resource Allocation to Universities and University Colleges involving Peer Review of the Quality and Relevance of Research. Swedish Research Council, Stockholm.
Stephan, P., 2013. The Endless Frontier: Reaping What Bush Sowed? NBER (National Bureau of Economic Research) Working Paper No. 19687, Cambridge, MA.
Talib, D., Stelee, A., 2000. The Research Assessment Exercise: strategies and trade-offs. High. Educ. Q. 54, 68–87.
Technopolis Group, 2010. REF Research Impact Pilot Exercise Lessons-Learned Project: Feedback on Pilot Submissions. Technopolis Group, Brighton.
Times Higher Education Supplement (THES), 2015. Academic estimates 'real' costs of REF exceeds £1bn. Times Higher Education Supplement, Feb. 12, available at http://www.timeshighereducation.co.uk/news/academic-estimates-real-cost-of-ref-exceeds-1bn/2018493.article.
Universities UK, 2013. Patterns and Trends in UK Higher Education. Universities UK, London, available at http://www.universitiesuk.ac.uk/highereducation/Documents/2013/PatternsAndTrendsinUKHigherEducation2013.pdf.