Can Horizon Europe help to close the competitiveness gap?

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Contents

Abstract

The 100 bn euro Horizon Europe program of the European Union (and its predecessor, Horizon 2020) have not succeeded in narrowing the competitiveness/productivity gap between the US and the EU. For the collaborative projects that receive the largest part of Horizon funding one finds only a temporary impact on the beneficiary enterprises. This is likely due to the excessive size of the consortia (often more than 20).   Only the relatively small part of funding going to single beneficiaries, like the SME program of Horizon 2020 and the European Innovation Council show some positive long-term impact on beneficiary enterprises.

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1 Introduction

Competitiveness has returned to the top of the EU agenda. The Commission launched its Competitiveness Compass in January 2025 with many elements inspired by the Draghi Report. A key insight of the Draghi Report is that there is no difference in productivity between the EU and the US in manufacturing industry. The transatlantic gap in GDP growth and productivity derives almost entirely from the emergence of strong high-tech sectors in the US, that are more productive than the rest of the economy and grow faster.

The Commission thus proposes '*A new competitiveness model based on innovation-led productivity*'. The aim is clear, but the key question is how 'innovation-led productivity' could be achieved. The easy answer seems to be more investment in Research and Development (R&D). This is also the direction the Competitiveness Compass recommends:

"Europe will also support the innovation pipeline with a new focus on raising R&D spending and coordinating it on high-impact projects."

To increase R&D spending has been a priority for a long time. Already the Lisbon Agenda of 1999 gave R&D spending of 3 % of GDP as a goal. But spending on R&D is not a useful KPI. Spending on R&D is only an input, not an end in itself. What counts is the output that increased spending on R&D yields. The purpose of this contribution is thus to look at two key aspects of how EU R&D policy can improve competitiveness.

In discussing R&D spending it is important to keep in mind the relevant orders of magnitude, especially the public and private components. In the EU, public and private spending on R&D are of a similar order of magnitude. (Gross) spending on R&D in the EU amounted to about 380 billion euro in 2023, or about 2.2 % of GDP, of which about 70 % was performed by the private business sector (so called BERD). These proportions have changed little over the last decade. Between 2013 and 2023 the R&D intensity of the EU increased only by little more than 0.15 percentage points (from 2.08 to 2.25 % of GDP). By contrast, in the US R&D intensity increased by 0.9 percentage points of GDP, from 2.7 to 3.6 % of GDP. The difference between the US and the EU thus more than doubled from 0.6 to 1.3 percentage points of GDP. This deterioration even though increasing R&D remained officially a priority means that the approach used so far has been a failure.

The widening transatlantic R&D gap is mostly due to the surge in business R&D in the US, which went from about 2% to almost 3% of GDP, while it has increased little (1.2 as a % of GDP) in the EU. Public support for R&D is similar, but in the EU, it comes mostly from national sources.

Only about 13 billion euro of the annual EU budget go towards the Horizon Europe program that finances research and development throughout the EU. 13 billion euro represents less than 0.1 % of EU GDP, and also a minuscule proportion of the overall 380 billion euros spent by private and public bodies. Moreover, direct EU funding of R&D represents only about one tenth of total government funding in the EU as national funding is about 10 times larger.

The Competitiveness Compass thus proposes the creation of a Competitiveness Coordination Tool aimed at aligning industrial and research policies and investments between the EU and its Member States, particularly in areas of strategic importance and projects deemed of common European interest.

The problem with this approach is that it has been tried before, with very limited success as shown in the next section. The following section 3 then argues that the reason for these repeated past failures is that the gains from coordination are likely to be limited. Section 4 then shows that EU support for innovation is more important than often thought because it provides the only source of competitive research funding for enterprises at a European scale. Section 4 then provides a short overview of the structure of the two Horizon programs. Section 6 then provides evidence that Horizon funding has had a very limited impact on the competitiveness of the beneficiaries. This evidence has to be based on the enterprises that participated in only one project. However, section 7 shows that most Horizon funding goes to enterprises that participate in multiple projects, with a particular concentration among large enterprises, like Airbus or Siemens, that participate in hundreds of projects.

2 A brief history of attempts to coordinate national R&D policies

The quest to coordinate national science policies in Europe has a long history. A first attempt dates already to 1974 when the Council called for coordination of science and technology policies. Kastrinos 2024, Brinkman 2009.

A more concrete initiative was the European Research Area (ERA) launched in 2000, to create a "single market for research" in Europe. As the name suggests, the aim of ERA was to coordinate and align national research programs, reduce duplication, and pool resources. ERA also comprised a concrete toot, the ERA-NETs: networks of national funding agencies to launch joint calls. The few ERA-NETs that were launched remained limited in scope and impact. The one permanent legacy of ERA is the Eurostars program that is managed in a complex structure involving Member States via the Eureka network. Eurostars finances projects of research-intensive SMEs (R&D > 10 % of revenues) that involve at least two (independent) SMEs from two different partner countries. Horizon Europe provides about 200 million euro annually for Eurostar/Eureka with Member States matching this sum in the aggregate.

In 2008/9 the Joint Programming Initiatives (JPIs) were launched to tackle "grand societal challenges" by aligning national programs. Only about 10 Joint Programming Initiatives were launched, covering areas like the environment and energy. But their impact has been limited as well.

There exists a Treaty based provision for coordination of national research policies in the form of Article 185 TFEU. But it requires that member countries themselves take the initiative. The few initiatives based on this article that have been launched were small and did not provide examples that could be followed on a larger scale.

This disappointing experience is likely the main reason that Article 185 is not even mentioned in the Competitiveness Compass. It is telling that the one existing Treaty provision does not play a role in the vision of the Commission for innovation led growth.

3 Elusive gains from coordination

From a political economy point of view, it should not be surprising that Member States have been reluctant to coordinate their R&D policies. Financing for research is always tight, and it is difficult to convince domestic political actors that national priorities should be put aside in the interest of EU-wide coordination. National research institutions and domestic industries naturally put their own interest first. The value of EU-wide coordination is not evident for them, except in the case of large infrastructures like CERN (which has a wider participation than the EU).

The wider question is whether one should expect coordination of national programs to yield large benefits. Except for a few specific areas in hard sciences there is little evidence that larger projects are more effective than smaller ones. (Vonortas et al. 2011).

The next question is then whether coordinating national policies (as opposed to individual projects) should yield large benefits. Research has well-known external effects since the additional knowledge discovered is available to everybody (Acharya 2014). Patents can privatize these benefits only temporarily. A priori this would suggest that international coordination of R&D spending should be beneficial. Higher spending by everybody would leave everybody better off. However, the cross-border benefits are very difficult to measure and may vary from industry to industry and the type of government support. It is thus difficult to overcome the tendency to follow national interests in setting national R&D policies.

Given this experience and the absence of clear, visible gains from coordination, the key question is why this time it should be different. R&D is very different from the defense sector where the need for coordination is much clearer. Every country needs some fighter planes, but very few can afford to develop and build a new type alone.

More in general, a comparison across EU Member States in terms of R&D does not suggest any link between country size and either the quantity or quality of national R&D spending.

Some of the smaller EU Member States are those spending most on R&D and are also those that have strong innovative sectors. Policy makers in these countries thus have not diminished their support for innovation for fear of the benefits accruing mostly abroad.

A priori one would expect that R&D is more competitive and effective in larger countries (and at the EU level) because the pool of potential researchers is larger and there is less danger that the evaluators are politically or otherwise related to the researchers that submit proposals. However, given the success of the smaller Northern EU Member States in developing strong innovative sectors with a high intensity of R&D indicates that these obstacles can be overcome by a combination of specialization and the involvement of international experts as evaluators. Conversely, there is also little evidence that the larger EU Member States spend more on R&D and are better at allocating it in terms of their competitiveness.

Size is thus no obstacle to strong national R&D policies. This also implies that the case for EU spending on R&D must be based on its effectiveness, not just the general idea that R&D spending in general is better done at the EU level. This is the key issue to be addressed here.

The strong innovative economies of some small Member States are of course not only the product of strong national research and innovation policies but also the result of other supporting factors such as the availability of venture capital (sometimes support by the government, Testa et al 2024). A more integrated EU capital market that increases the availability of risk capital, especially for new companies (start-ups and scale-ups) as argued by the Draghi and Letta reports would certainly also contribute to strengthening innovation and competitiveness. But analysing this broader issue would go beyond the focus of this contribution.

4 Horizon versus national R&D funding

The strategic importance of EU Framework programs is often underrated. It is true that EU expenditure for R&D amounts to about 1/10th of national R&D support. But Horizon Europe and its predecessors consist almost exclusively[2] of programs that fund research on a competitive basis. By contrast, a larger part of national government R&D funding goes to national research performing institutions, leaving less room for financing outside projects on a competitive basis.

The distinction between research funding and research performing institutions is important. The latter can be very important to pursue a longer terms research agenda and in many cases have close links with industry (examples would be Fraunhofer in Germany, or the national research councils in France or Italy). But only research funding institutions provide funding opportunities for new ideas and high-tech start-ups.

Eurostat figures show that Member States fund about 12 billion euro annually for R&D performed by the business sector. This can be compared to the close to 6 billion euro of Horizon funding that goes to companies (i.e. the private, for profit, sector). It follows that that Horizon provides almost half as much of the funding for new projects by companies in the EU, with shares well above 50 % in many poorer member states. This implies that EU funding through Horizon plays a key role in supporting research in companies outside government funded research labs.

Soete and Stierna (2018) document the wide differences between Member States in their own efforts to support R&D. The funding opportunities from Horizon programs are relatively much more important in Member States that spend themselves little to support R&D. In countries where the national R&D effort is much below the EU average, Horizon calls can represent the most important funding source for enterprises with an innovative project. In this sense, the Horizon programs contribute to leveling the playing field.

This consideration also provides a different view on the European Value Added that the Framework Programs are supposed to deliver. Creating collaboration across different Member States is the usual metric for European Value Added. Unfortunately, this has led to a preponderance of unwieldy consortia in Pillar II. But if the aim is to increase the competitiveness of the EU economy, consortium size, and in general the number of participants from different Member States, should not be the main criterium. The value added of European funding is that it levels the playing across the Union and that European calls for proposal address a much larger pool of potential applications. 27 national calls for innovative ideas on different topics are likely to lead inferior results than one call at the EU level. EU-wide calls for proposals have the advantage of addressing a wider pool of potential innovative ideas than any national call. This advantage cannot be achieved by coordination of national policies because ex ante one does not know where the best ideas or projects are likely to come from.

[2] The Joint Research Centre is the only part of HE that is performing research, but its share of HE is only 2 %.

5 EU Framework programs and competitiveness

Financing of R&D has been an increasing part of the EU budget. It has taken the form of framework programs running over the 7 years of the MFF cycle. Only a part of the current FP, Horizon Europe, has the aim of increasing competitiveness. Some parts are devoted to pure research. This can be seen in the three 'Pillars' of Horizon Europe:

— **Pillar I**: Excellent science

— **Pillar II**: Global Challenges and European Industrial Competitiveness

— **Pillar III**: Innovative Europe

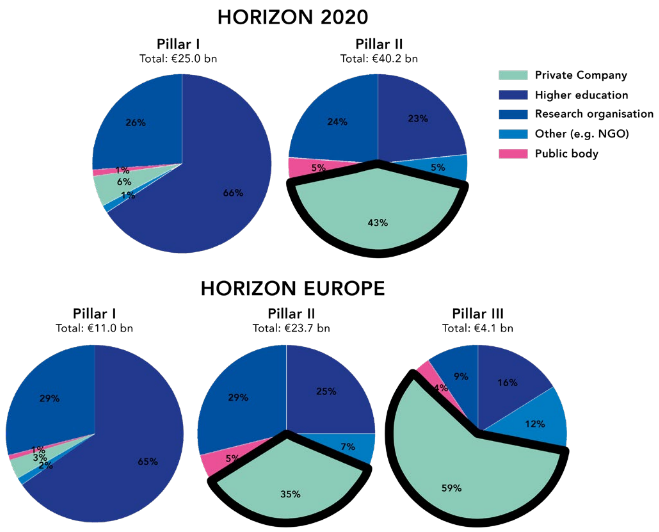
These three pillars have different aims and very different budgets.

Our focus here is on competitiveness. Spending on research can also have other aims, like contributing to scientific progress overall (as for Pillar I). But the focus here is to what extent EU support of R&D improves industrial competitiveness and fosters innovation led growth.

Measuring the overall impact of the Horizon programs on the competitiveness of the EU economy is inherently difficult. As the Draghi report, and many others, have found, Europe overall has clearly not become more competitive over the last two decades. The Horizon programs alone have thus clearly not been sufficient. However, a more limited issue can be addressed, namely to extent Horizon programs have improved the performance of those enterprises that received funding from it. This is the focus of the remainder of this contribution.

Figure 1 below shows the distribution of the beneficiaries of the different 'pillars' under Horizon 2020 and Horizon Europe. For both programs (private) companies receive about 40 % of the total, with a very low share in Pillar (excellent science), and the highest share in HE's Pillar III, innovation. Pillar II is by far the largest part (over 60 % of the total) and will be the focus of this analysis.

Figure 1 Distribution of the beneficiaries of the different 'pillars' under Horizon 2020 and Horizon Europe



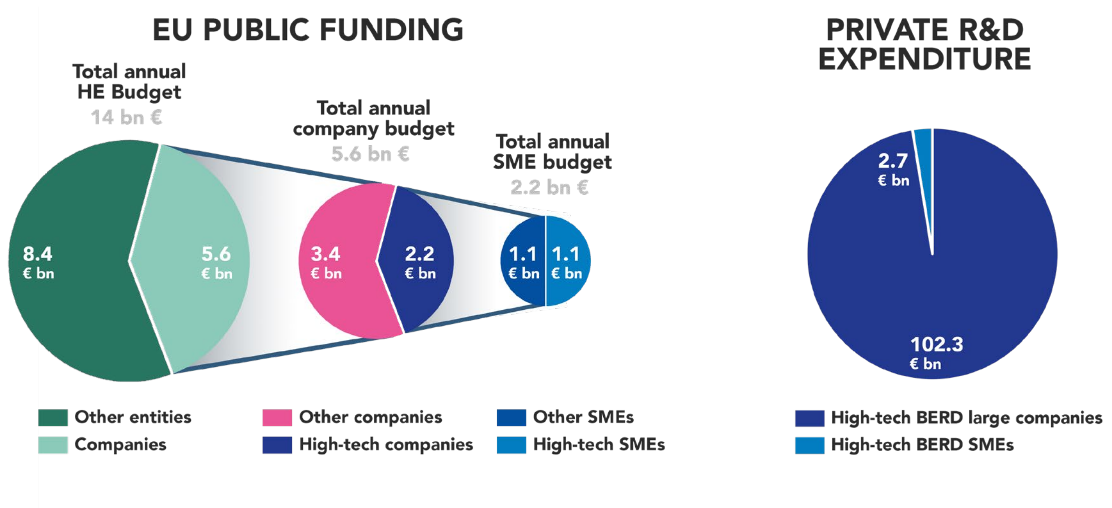
Source: European Commission

Pillar II is itself structured in different subparts, but for simplicity the differences between the different part of the pillar will be neglected here.

6 A brief anatomy of EU funding for competitiveness

Figure 2 below shows the distribution of Horizon funding, in terms of companies, high tech companies and the SMEs among them. The focus on high tech is motivated by the observation in Fuest et al. 2024 that this is where the EU economy is weakest.

Figure 2: Distribution of Horizon funding



Source: Own calculations based on Cordis and IRI Scoreboard data

High-tech SMEs receive only about 1 billion euro annually, a fraction of the Horizon total. If compared to overall private sector R&D spending the EU high-tech sector of over 100 billion euro, this appears small. However, only a small fraction of the R&D in the high-tech sector is performed by SMEs, about 2.7 billion. Horizon funding is thus a significant contributor to the needs of high-tech SMEs.

7 The Pareto world of Horizon

The Horizon Dashboard shows directly a list of the largest beneficiaries. If one restricts the search to H2020 and HE, one finds that the three biggest beneficiaries are (total grants received in parentheses, in million euro) Airbus (380 m€), Leonardo (150 m€) and Siemens (120 m€) [3]. These firms together received a total of 650 million euro under Horizon programs over the last ten years, about 5 % of the total of grants going to firms overall. This represents an extreme degree of concentration given that there are tens of thousands of other enterprises also competing for Horizon funds.

It is well known that the size distribution of firms tends to follow a power law or Pareto distribution in the upper tail, Axtell 2001. This can also be confirmed for the distribution of grants by firms [4]. Technically the finding of a Pareto distribution means that averages become meaningless, at least in the tail of the distribution. Practically, this means that one needs to consider the large firms that receive multiple projects separately from the smaller firms that participate only in one project.

The large amounts received by these three biggest beneficiaries (among enterprises) of Horizon are not due to their receiving a few very large projects, but the result of a large number of projects of the usual Horizon size (between a few hundred thousand a few millions of euro). Breschi 2006 has called this the 'oligarchic' structure of the Framework Programs. A large part of Horizon funding goes to a relatively small number of large beneficiaries that participate, often through different subsidiaries, in hundreds of projects. The canonical example of an SME in a corner of Europe that brings a new idea and participates in one project accounts only for a small proportion of the total.

The hundred of projects won by Leonardo or the various components of large conglomerates like Siemens or Airbus might all yield valuable research results. This is likely to be the case since these projects were won in a competitive tender process. But the question that remains is to what extent do these projects make the recipient firm stronger. Szücs 2020 does not find any crowding in of private R&D efforts for large enterprises, but a significant impact for small enterprises. This result is in line with the data on the relative importance of Horizon funding for SMEs shown above. It is thus probably not only a coincidence that the revenues and R&D expenditures of the three largest beneficiaries of Horizon mentioned above have not grown over the period considered here, namely the last ten years. Maybe one should at any rate not have expected a large impact of the Horizon grants these firms received. Even for Airbus, the 380 million euros received over the last ten years amounted only to a little over 1.3% of its own investment in R&D that was running at about 3 billion euro annually. But the least one can conclude is that Horizon grants did not have a measurable catalytic effect.

[3] For Airbus and Siemens, one needs to add different legal entities like Airbus France and Airbus Germany.

[4] A simple log-log plot of the 130 largest recipient firms shows a tight straight line with a slope of approximately -0.56, which indicates an even stronger degree of concentration than for firm size, for which one usually finds an exponent of about unity.

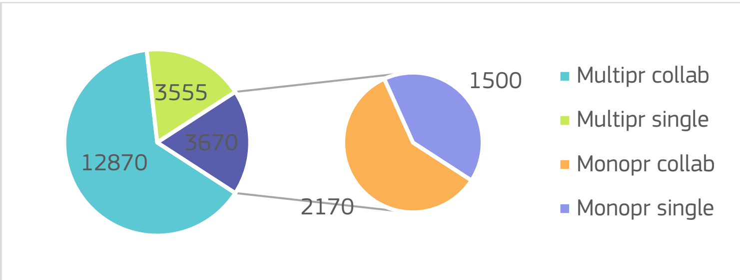
8 Measuring_impact

It becomes difficult to measure the impact of a single Horizon grant when the same firm receives several grants during the observation period. This implies that for any econometric evaluation one must restrict the sample to those firms that participate only in one project. Given the fat-tailed distribution mentioned above, this implies one must exclude a large part of the overall sample.

To measure the impact of Horizon funding on beneficiary companies the Institute for European Policymaking (IEP) at Bocconi University created a Dataset, COMPET. The starting point is a list of all projects financed under Horizon 2020 and Horizon Europe. All the companies from this list (i.e. all companies that participated in a Horizon project since 2014, the staring year of Horizon 2020) were matched the database ORBIS (and Crunchbase (in progress)). ORBIS provides financial performance indicators (revenue, employment), in principle from 1995 to 2024. The matching with ORBIS worked for over 90% of the companies from CORDIS and yielded a database with 50,000 projects over these almost 10 years with about 200,000 firm-funding instrument- year observations.

Figure 3 below is based on this dataset and shows the overall distribution of grants across firms that participated in only one project (Monopr) and those that participated in more than one project (denominated Multiplepr). Both types of firms can participate in either collaborative programs (like those under Pillar II) or singly entity programs (like the SME program, or the EIC accelerator). Mono-project firms receive only less than 4 bn euro, or about one fifth of the identified total funding (going to enterprises) of about 20 billion euro.

Figure 3: Overall distribution of grants across collaborative and single entity programs (bn €)



Source: Own calculations based on the IEP COMPETE database

Most evaluations of Horizon programs focus on the results in terms of scientific output, like publications etc. The focus here is different. The question pursued here is whether Horizon funding has led to sustainable growth of the beneficiary firms.

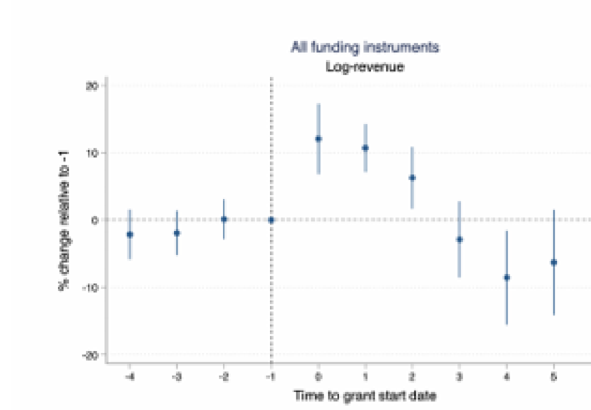
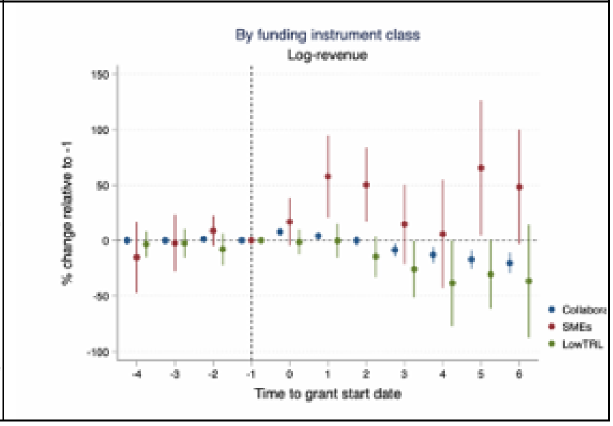
A key practical problem in the empirical work is that even if one restricts attention to firms that participate only in one project since 2014, the universe of recipient firms remains extremely diverse. For example, mean employment is above 1,200 but the median is only 31. This implies that one half of the firm had fewer than 31 employees. However, the size of the grant per company shows much less dispersion. The mean is close to €500k and the median still €250k. The average length is almost always between 3 and 4 years. A particularity of Pillar II is that the average size of the consortium is close to 20.

This difference in size is important for the empirical work since one cannot expect a measurable impact from a 500k € grant on an enterprise with billions of revenues. But the same grant should have a strong impact on an SME with only 10 employees. A grant of this size could finance up to 2 employees for the duration of the project. For an SME with 10 employees, this would mean an increase in employment of 20 % (about the size found in some previous studies).

In order to find out whether the grant had a permanent effect one has to follow the company for more than the duration of the project, i.e. for longer than 3-4 years. Our analysis uses data for up to 6 years after the start of the project.

A temporary impact would imply a hump-shaped pattern for employment and revenues (up during the project and then down again). This is indeed what we found when performing a standard event study [5] in which the number of employees in the firm is measured around the time the grant starts. Revenue and employment increase for three years and fall back down to the starting level .

Figure 4: Funding instruments Collaborative instruments versus single beneficiary (SME instrument)

A All Funding instruments	B Collaborative instruments versus single beneficiary (SME instrument)
	

Source: IEP report 2025, forthcoming

The hump shaped pattern in figure 4 was also observed for employment. The hump persisted through many robustness tests, with different control groups, different parts of Pillar II and different industrial sectors. Kim and Park 2021 also do not any long term impact of imposing collaboration in a Korean SME program.

The main exception to this finding of a hump shaped effect that returns to zero occurs when considering small consortia (results available upon request) and for a single beneficiary program, like the SME instrument for which one observes a permanent effect, albeit imprecisely estimated.

For more details see IEP report 2025, forthcoming.

[5] As typical for these event studies, year and industry fixed effects neutralise the impact of exceptional events, like the Covid recession.

9 Conclusion

Horizon Europe represents only a small share of total public R&D funding in the EU. Recognizing this the Commission proposes in its Competitiveness Compass to coordinate national R&D policies. This is unlikely to succeed given past experience and the absence of visible benefits from coordination.

The annual budget of Horizon Europe is about 14 billion euro, small compared to the over 100 billion euro spent by Member States. However, a closer look at the data shows that Horizon constitutes a significant source of R&D funding for companies, especially for SMEs.

The analysis presented here has found only very limited evidence of a durable impact of Horizon funding.

The three largest beneficiaries of Horizon funding have not grown over the last decade, despite participating in hundreds of projects and receiving hundreds of millions of euros.

Even if one restricts attention to the small part of Horizon that goes to firms that participate in only one project, the evidence remains mixed. The companies that received funding under the large collaborative projects of Pillar II show only a short-lived increase in employment and revenues that disappear when the project ends. The results are much more positive for smaller consortia and for the SME program that preceded Pillar III. Companies that received funding within smaller consortia show a permanent increase in employment and revenues.

The excessive size of consortia under Pillar II thus seems to be a key for its low performance in terms of competitiveness. This suggests two policy avenues: more funds should be shifted to Pillar III and/or the rules under Pillar could be tweaked to render the formal minimum requirement of 3 participants from three countries the effective limit by dropping or reinterpreting additional criteria like the European Added Value and inclusiveness.

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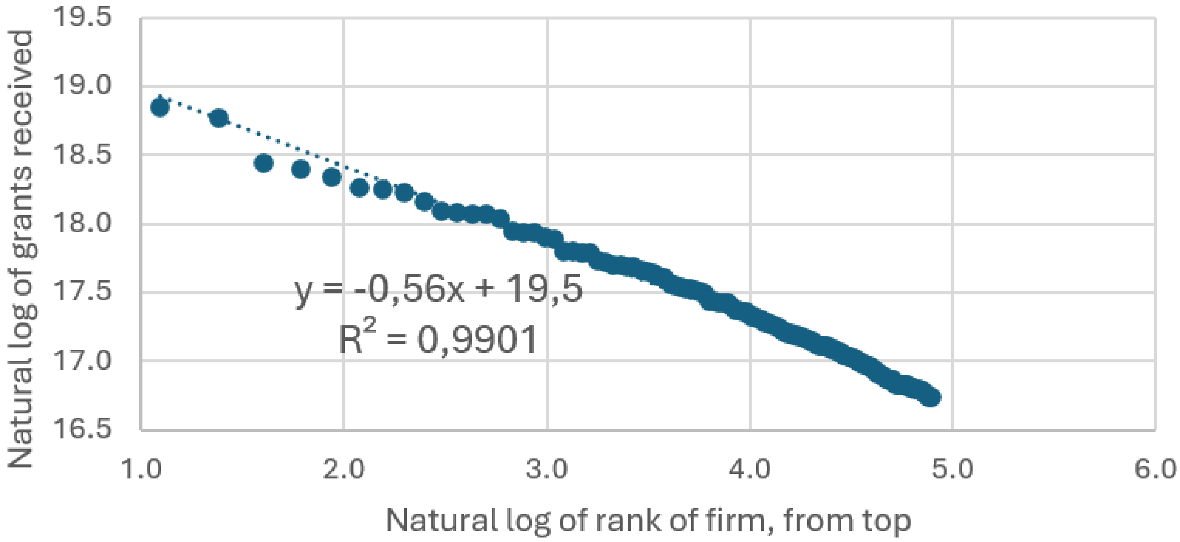
Evidence for a Pareto distribution in the right-hand tail of the distribution of Horizon grants by firms.

Figure 5: Evidence for a Pareto distribution of grants by firm



Source: own calculations based on Horizon Dashboard data.

N.B Each point represents one observation for each firm (ln rank and ln grants) starting from rank 3 down to rank 133.

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The portal data.europa.eu provides access to open datasets from the EU institutions, bodies and agencies. These can be downloaded and reused for free, for both commercial and non-commercial purposes. The portal also provides access to a wealth of datasets from European countries.

Science for policy

The Joint Research Centre (JRC) provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society

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