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IMPACT ASSESSMENT OF BPIFRANCE'S FINANCIAL SUPPORT TO SMES' INNOVATION PROJECTS

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ABSTRACT

This paper evaluates the economic impact of Bpifrance's financial programmes to support SMEs' Research, Development and Innovation (RDI), called individual aid for innovation (IA). It focuses on the analysis of subsidies and zero-interest loans granted to SMEs over three years old during the period 2005-2018 in order to foster their RDI activity (R&D expenses and spending related to the development of innovative products, processes or services) and economic growth (turnover, employment).

We use a difference-in-differences methodology combined with a propensity score matching procedure to compare supported SMEs with non-supported SMEs with same initial characteristics. This counterfactual analysis is based on a unique dataset containing both financial and non-financial information about millions of French companies. Up to 12,000 SMEs supported over the 2005-2016 period have thus been analysed, making this study the first to estimate the effect of Bpifrance's individual aid for innovation on such a scale and using such detailed information.

Econometric results suggest that the use of Bpifrance's aid enables SMEs to boost their investment in RDI over the three years following the aid being granted, in comparison with non-supported SMEs with the same initial characteristics (+€250k of additional total R&D expenditure in aggregate over three years). Results show that the impact of the aid is additional, meaning that the support given does not take the place of any RDI investment that would have been made by SMEs had the support not been received. This analysis was supplemented by an examination of skilled employment and R&D employment, which indicates that Bpifrance's support encourages SMEs' investment in R&D jobs, with 0.5 more engineer/technician jobs per SME within three years (10% growth relative to the year preceding the support) and 0.4 more high-skilled jobs (up 9%).

Beyond the extra spending on R&D and innovation, the financial performance of supported SMEs also improves at the end of the three years compared with the counterfactual, with +€284k in additional turnover (6% higher than the year preceding the support), +€99k in additional added value, and +€77k more in export revenue. These effects are not significant at a one-year horizon, suggesting that the additional RDI investments resulting from the programme need time to be reflected in business growth.

1 ASSESSMENT OBJECTIVES

FOREWORD

This article is a simplified version of a report published in 20201 which formed part of an evaluation plan aiming at assessing the impact of a wide set of French public programmes dedicated to supporting innovation2, implemented upon request from the European Commission. The study was produced under the supervision of the French State and independent researchers from various institutions.

AN OPPORTUNITY TO ASSESS A BROAD PUBLIC PROGRAMME DEDICATED TO SUPPORTING INNOVATION

Companies possibly invest less in innovation than may be desirable for the whole economy. The existence and causes of the difficulties faced by companies in this respect have been widely documented in the academic literature. As regards the financing of innovation, some theoretical and empirical studies suggest that RDI projects may be particularly exposed to financial constraints (see Hall, 2002), notably due to their riskier nature (e.g., uncertainty about the commercial success of the product or service associated with the innovation project), and because RDI investments cannot be used to secure loans granted by private banks (RDI spending comprising mostly salaries). The technicality of innovation projects makes it more difficult for banks to assess the risk of such projects. In addition, innovation projects may intrinsically yield higher returns for the wider economy than for the individual companies that develop them because of the existence of positive externalities for example, or because

1 See https://www.entreprises.gouv.fr/files/files/etudes-et-statistiques/rapport_final_ai_bpi.pdf.
2 See https://www.entreprises.gouv.fr/fr/etudes-et-statistiques/autres-etudes/evaluation-des-aides-d-etat-la-rd-et-l-innovation-rapport.

companies may have difficulties protecting their inventions (thus not being able to benefit fully from their innovation efforts). This suggests that encouraging corporate investment in innovation through public intervention may be justified, particularly by mitigating the financial constraints innovative companies may face (either through the distribution of innovation grants, or through R&D tax credits for example). In this case, assessment is needed to determine the extent to which public money given to supported companies may have substituted for private innovation expenditures those companies would have incurred anyway (crowding-out effect) or whether the programme has had a positive effect on private innovation investment (crowding-in effect).

The empirical literature contains numerous studies assessing the effectiveness of public programmes aimed at supporting innovative companies through grants and subsidies, but very few focus on France[3]. Duguet (2004), using propensity score techniques, observes that the R&D subsidies granted by French ministries between 1985 and 1997 did not have a crowding-out effect on private R&D spending. Huber et Masquin (2012) show that the innovation projects supported by Oséo (Bpifrance's forerunner) are of relatively good technical quality since they are associated with a significantly higher production of patents than observed in non-supported companies. Serrano and Velarde (2009) find that the financial support granted by Anvar (Oséo's forerunner) may have partly crowded out some of the supported companies' private R&D expenditure (especially that of bigger companies). The present study aims to assess one of France's main innovation support programmes using a new and broad database containing precise information on SMEs over three years old[4], allowing evaluation of this programme on a very large scale. It attempts to measure the impact of Bpifrance's individual aid on the RDI spending of beneficiary SMEs and the extent to which the aid affected their economic growth in the following years (activity and employment).

2 BPIFRANCE'S INDIVIDUAL AID FOR INNOVATION

Bpifrance's individual aid for innovation combines seven mechanisms designed to finance RDI projects run by businesses individually, meeting financing requirements typically ranging from €30k to €200k. These projects are generally at an early stage of the innovation process, i.e.,

Table 1: List of innovation schemes related to Bpifrance's individual aid

Scheme	Companies / projects targeted	RDI expenditure covered by aid
Individual aid for RDI distributed by the Bpifrance network	SMEs and midcaps from all trade sectors	Industrial research and/or experimental development activities (building and developing prototypes, pre-production, pilot and demonstration installations, expenditure on intellectual property and standards compliance, market research, tests…)
French Tech grant	Start-ups (less than one-year old) with strong growth potential developing a business underpinned by an innovation	Internal or external costs directly linked to research concerning the design, scoping and feasibility of the project to be run (spending on support & guidance, intellectual property, feasibility studies, legal and market research, design, seeking partners, special training, travel, trade fair registration fees...)
Global Innovation Competition and the Innovation Competition	Companies with a disruptive economic model with the potential to grow internationally, and operating in specific fields of innovation (energy storage, plant proteins and plant chemistry, individualised medicine, collective security…)	Industrial research and/or experimental development activities
Fund for the Digital Society	Companies operating in the digital sector (such as nano-electronics, embedded software and smart objects, digital security…)	Payroll costs, R&D costs, acquiring patents, equipment and instruments used within the RDI project
i-Lab	Researchers seeking to create companies using their own innovations	R&D programmes needed to finalise the innovative product, process or technological service
Regional Innovation Partnerships	Non-technological innovation projects located outside Paris and its suburbs	Expenditure related to innovation's feasibility, development or production
Social Innovation Fund	SMEs and structures in the social and solidarity economy (non-profits and cooperatives) running innovative projects addressing a social need currently met poorly or not at all	Internal costs (staff assigned to the project, overheads and investment allocated to the programme), external costs (accommodation, support and consultancy services, feasibility studies, intellectual or industrial property rights and design services or specific training)

3 For the US, see Howell (2017) who, using a very robust methodology, finds that the SBIR subsidy programme had a substantial positive effect on small innovative firms' growth.

4 Data related to young SMEs (less than 3 years) are very scarce, so such firms may be largely underrepresented in our results.

before an innovation is likely to generate a potential economic benefit for the company producing it. All programmes are intended to finance RDI projects bearing uncertainty in terms of potential economic return for the company (see table 1):

- The individual aid for RDI distributed by the Bpifrance network[5] covers the majority of individual aid deployed in terms of both the amounts granted and the number of recipients supported;
- The French Tech grant is a mechanism specifically targeting start-ups;
- The Global Innovation Competition and the Innovation Competition are programmes targeting disruptive companies operating in specific fields of innovation;
- France's national Fund for the Digital Society is a wide-ranging programme combining various waves of competitions, all focused on the digital sector;
- The i-Lab competition targets researchers seeking to create companies using their own innovations;
- The Regional Innovation Partnerships and the Social Innovation Fund support non-technological innovation and social innovation projects located outside Paris and its suburbs.

Figures 1 and 2 present the evolution of the seven individual aid schemes in terms of both amounts granted and numbers of companies supported. As shown, individual aid distributed by Bpifrance's network is the oldest support mechanism for innovation used by Bpifrance. It is also Bpifrance's single most significant innovation support mechanism in terms of amounts granted and numbers of recipients (€400m in commitment and 2,600 recipients per annum on average over the last ten years). Consequently, the results presented in this paper will essentially cover this particular scheme. This programme is aimed at a broad target of eligible businesses (SMEs or midcaps[6] with no age or trade-sector re-

Figure 1: Numbers of recipients supported by individual aid
By year and mechanism
Source: Bpifrance

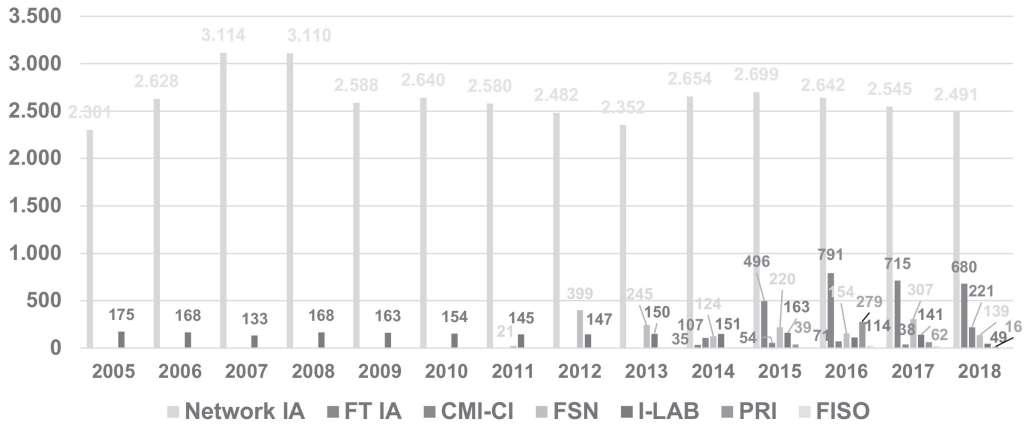
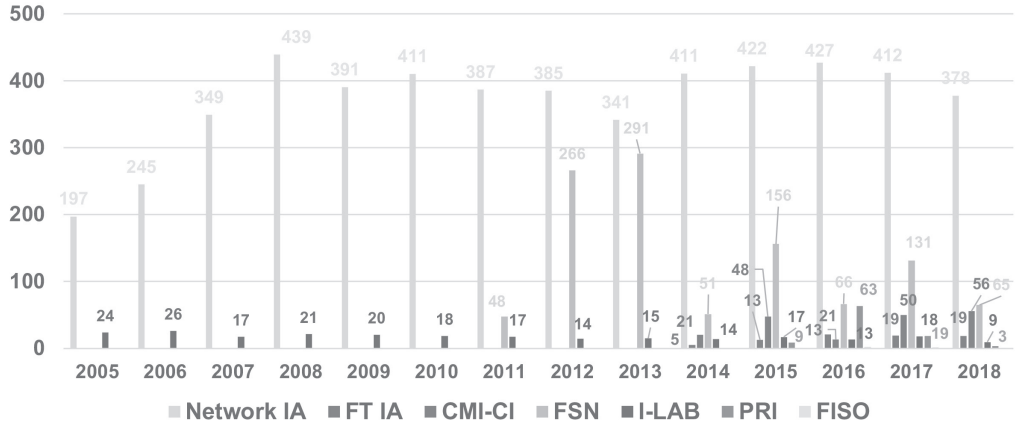


Figure 2: Amount of aid granted (€m)
By year and mechanism
Source: Bpifrance



5 This encompasses Bpifrance's network of regional branch offices, numbering around 50 in total in 2019, where the account managers specialising in examining innovation aid applications from local SMEs are based. Regional offices have decision-making authority up to a certain amount.

6 We define midcaps as companies between 250 and 4,999 employees at the group level.

strictions) and is intended to finance expenses directly linked to innovation development (industrial research and/or experimental development activities). Support takes the form of a subsidy, a repayable advance (subject to generating a certain turnover level) or an interest-free innovation loan (PTZI).

Network IA covers from 25% to 65% of the eligible expenditure basis, depending on the project and the size of the firm. The median amount for Network IA is €49k, and around 90% of the companies receiving Network IA are SMEs[7] (almost half with less than ten employees, see table 2). Over the 2005-2016 period, Network IA mainly covered manufacturing industry, information-telecommunications, and the scientific and technical activity sectors (see figure 3).

Figure 3: Breakdown of the number of recipients and amount of Network IA
By economic sector, period 2005-2016
Sources: Bpifrance, Ficus-Fare

Scope: Aid data for 2005-2016 where the French business registration number (Siren) and its trade sector are available.

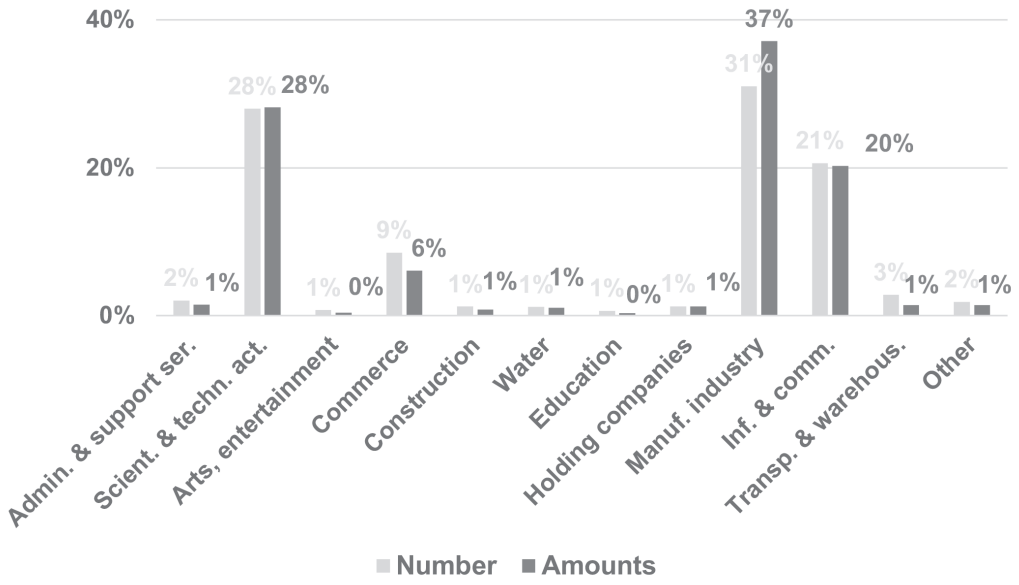


Table 2: Supported companies' financial statistics (Network IA)
Statistics computed the year the aid was granted, period 2005-2016

Network IA							
Indicator	**Observations** (number of firms x scheme x year)	**Of which, accounts available**	**Of which, data available** (share %)	**Mean**	**1st quartile**	**Median**	**3rd quartile**
Age	29.835	29.050	97%	13,7	2	6	16
Turnover	29.835	27.192	91%	6.651,0	132	843	4.060
Added value	29.835	27.192	91%	1.985,0	36	368	1.507
Headcount	29.835	26.894	90%	36,0	3	10	30
Capital expenditure	29.835	20.566	69%	215,0	1	17	100

Sources: Bpifrance, Ficus-Fare
Scope: Aid data for 2005-2016 where the French business registration number (Siren) is available.

7 Companies with less than 250 employees at the group level.

It is important to note that, at some point, companies benefiting from individual aid often use alternative public programmes intended to support innovation, such as the French R&D tax credit (CIR, generating nearly €7bn of support in 2018). They may also use a second tax credit scheme specifically designed to support young innovative businesses ("JEI", generating around €150m a year), or other direct grants or subsidies (See table 3).

Table 3: Numbers of Bpifrance individual aid recipients and their propensity to make use of other public support schemes for RDI
Statistics computed the year the aid was granted, period 2005-2016

Year N	Number of recipients of Bpifrance IA in N	Of which having benefited from support between N-1 and N-3 (share %)				Of which having benefited from support in N (share %)			Of which having benefited from support between N+1 and N+3 (share %)*			
		Bpifrance IA	Other direct aid	Research tax credit	JEI	Other direct aid	Research tax credit	JEI	New Bpifrance IA between N+1 and N+3	Other direct aid	Research tax credit	JEI
2005	2.115					1%	na	19%	45%	2%	na	23%
2006	2.443					1%	na	21%	43%	2%	na	24%
2007	2.940					1%	na	19%	38%	4%	na	21%
2008	2.935	36%	1%	na	17%	1%	53%	20%	36%	5%	68%	22%
2009	2.481	33%	2%	na	17%	1%	59%	20%	36%	9%	71%	21%
2010	2.543	35%	2%	na	18%	3%	61%	23%	37%	10%	73%	24%
2011	2.513	35%	3%	57%	20%	4%	62%	24%	35%	12%	73%	26%
2012	2.817	31%	5%	60%	20%	6%	61%	24%	36%	14%	na	25%
2013	2.581	33%	5%	60%	21%	5%	64%	24%	35%	13%	na	28%
2014	2.823	30%	5%	55%	21%	5%	59%	26%				
2015	3.344	28%	5%	51%	20%	5%	na	24%				
2016	3.678	27%	4%	na	20%	4%	na	25%				
Total	33.213	32%	4%	57%	19%	3%	60%	22%	38%	8%	71%	24%

* Share in % among surviving firms 3 years after the aid being granted

Sources: Bpifrance, data from innovation support operators. "Other direct aid" covers Bpifrance aid to collective projects, and part of the aid from ANR (nuclear), ADEME (environment), CNES (space) and ONERA (aerospace) (source: France Stratégie).

Scope: All recipients of Bpifrance individual aid for innovation with a French business registration number.
Interpretation: In 2011, 2,513 beneficiaries received a Bpifrance IA, of which 35% had previously received at least one Bpifrance IA between 2008 and 2010.

3 IMPACT ASSESSMENT METHODOLOGY

DATA

Our first objective is to assess the individual aid's effect on supported companies' RDI spending, in comparison with the hypothetical situation of no support. A major obstacle in evaluating the aid's effect on RDI spending is the difficulty of reliably measuring such spending, which can cover wages (engineers, researchers…), prototyping and testing, market research and so on, none of which is easy to pinpoint in companies' financial statements as RDI spending. In this study, we measure RDI expenses in two ways:

- The GeCIR database (Research tax credit) is used to provide a first measure of the individual aid effect on companies' R&D spending. This database provides an annual list of companies that used the French Research tax credit scheme over the 2008-2014 period. It contains the amount of R&D expenditure such companies declared in order to benefit from the CIR tax credit, since this tax credit is computed as a proportion of their total yearly R&D expenditure. The GeCir database thus provides access to companies' R&D expenses, for companies that made use of CIR;
- DADS submissions (system for the automated reporting of employment data) are used to measure the effect of individual aid for innovation on R&D jobs, interpreting employment relating to technical roles within businesses as RDI labour. DADS provide accurate information on employment within any business that

employs staff, including data on the nature of the jobs, thereby making it possible to determine the numbers of engineers and technical staff employed and the high-skilled positions in a given legal unit, year by year. They are available for the period 1993-2016 and cover millions of businesses every year. This analysis supplements the examination of total R&D spending through the GeCIR database.

RDI investments are expected to affect the economic trajectory of the supported companies, through productivity gains, better market positioning, etc. If the individual aid has a positive impact on companies' total RDI spending, then its induced effects on recipients' economic growth should be isolated. We study supported companies' total turnover, export turnover and added value, as well as total recruitment, which are available in the Ficus-Fare tax statistics. This database contains complete economic and financial characteristics for almost all French businesses and covers the period 1994 to 2016.

Lastly, several databases enable companies' use of public innovation schemes to be tracked:

- The Bpifrance database enables companies using individual aid for RDI, the subject of this assessment, to be identified. These data cover the period 2005-2018 and around 25,000 distinct businesses;
- Companies' use of alternative RDI public aid programmes is identified through the following databases:
  - The GeCIR database described above enables companies using the tax credit scheme to be identified. As explained above, these data enable the performance variable to be built for measuring R&D spending, but they can also help to build the counterfactual sample used in the econometric analysis;
  - The JEI innovative start-up scheme database provides an annual list of businesses benefiting from this second tax scheme. Tracking this programme may be necessary since it is used a lot by companies that benefited from individual aid. Over the period 2004-2016, the GeCIR and JEI databases list approximately 50,000 distinct businesses;
  - France Stratégie gathered data related to various innovation aid operators in France, making it possible to build an aggregate variable identifying businesses receiving innovation grants other than the Bpifrance individual aid[8]. These data cover around 5,000 distinct businesses for all the operators combined.

In the longer term, the expected effect of RDI support policies also encompasses benefits for the community at large, benefits that are not necessarily monetisable by businesses (the spread of innovations into the rest of the economy, access to new healthcare methods, the reduction of pollution, etc.). These are positive externalities generated by innovation. It is difficult to measure the contribution made by an RDI aid programme to such collective benefits because they are influenced by many factors and are observed in the economy over a longer term. Such impacts are not studied in this assessment.

IDENTIFICATION STRATEGY

Our methodology relies on a difference-in-differences (DiD) approach combined with a propensity score matching procedure. The general idea of the DiD approach is to compare economic outputs of businesses that did and did not receive aid, on the assumption that in the absence of aid, their trajectories would have been similar or "parallel". The difference in the changes in performance metrics seen over time between supported and non-supported businesses is then attributed to the aid. To improve comparability between supported and non-supported eligible companies, we reduce the set of non-supported eligible companies to a subset of non-supported companies close to the supported businesses regarding different observable attributes in the past (counterfactual sample). These attributes need to influence both companies' likelihood of receiving an individual aid and their future performance. Counterfactual companies are chosen based on the following indicators:

- Use made of various innovation support mechanisms in the past is a factor expected to have a marked effect on the likelihood that aid will be used in the current year (see Duguet 2004): IA, other direct aid such as ADEME (environmental sector), ANR (nuclear), CNES (space), ONERA (aerospace), fiscal aid CIR and JEI;
- Ratios used to quantify companies' past innovation intensity level: the ratio between R&D spending and turnover in the year preceding receipt of aid[9], the ratio between the number of engineers and technical staff and the total headcount. The matching procedure also makes sure that the total amount of public-sector aid received by supported firms and non-supported firms over the last three years is similar;
- Qualitative factors (age, size, business sector, geographical location) and financial characteristics (past performance indicator level, growth in turnover and past capital expenditure, net profit margin, liquidity, added value over payroll costs, equity-to-assets ratio, debt coverage ratio, past gross operating profit margin) are also included in the propensity score matching.

Each supported company is matched with its closest non-supported counterpart based on the propensity score within a given individual aid cohort[10]. Econometric tests are run to ensure that the distribution of the above ex ante characteristics of both supported and non-supported companies are the same (balance tests). Additional econometric tests are run in order to check that the dynamics of the performance indicators of both supported and non-supported firms are similar before receipt of aid (falsification tests).

8 France Stratégie is a French think-tank that was a partner in this research work. The data supplied by France Stratégie have been gathered from ADEME (environmental sector), ANR (nuclear), CNES (space), ONERA (aerospace) and Bpifrance aid programmes for collective projects. They cannot be used here to pinpoint directly which type of direct aid a business used or the operator from which it was requested.

9 Such a ratio is available only for companies present in the GeCIR database.

10 The method used here is nearest neighbour with replacement. Supported and non-supported companies are matched only if sufficiently close in terms of propensity score, i.e., if the absolute difference in scores is less than a given limit. Various values for this threshold were tested with no significant impact on the results.

Once supported and non-supported companies are matched, we estimate the following model:

$$Y_{it}=T_{it}\,\delta+c_i+e_t+u_{it} \qquad (1)$$

Where:
The index i means a company (supported with an IA or not)
The index t means the period
Y_{it} is the performance indicator
T_{it} =1 if the company i receives an IA in year t
c_i is an individual fixed effect
e_t is a time fixed effect

The coefficient δ measures the impact of aid on the performance indicator[11]. Performance indicators may not be available for very young businesses (less than three years old), which are then under-represented in the analysis. Moreover, impact estimates are made only on the SME population because the quality of matching for the midcap segment is very poor (see table 4). Results are therefore only valid for relatively mature SMEs[12].

Table 4: Analysis of matching quality: SMEs vs midcaps
Characteristics of companies on the matched sample

Sub-population	Average headcount N-1 (Nb)		Average total public aid granted between N-3 and N-1 (€k)	
	Non-supported	Supported	Non-supported	Supported
SMEs	17	17	79	80
Midcaps	253	1118	524	2412

18,344 observations used (N=year of receipt of aid)
Sources: Bpifrance, Ficus-Fare tax statistics, DADS employment data, data from innovation support operators

Scope: All businesses eligible for Bpifrance individual aid for which financial statements are available

4 RESULTS

MATCHING PROCEDURE

Estimation of the probability that a SME receives Bpifrance individual aid in a given year is in line with results previously found in the literature:

- Consistent with the work of Duguet (2004), the likelihood of using Bpifrance IA in a given year is strongly influenced by having previously received support for innovation in the last eight years:
  - This holds particularly true for Bpifrance individual aid received in the past, where the positive influence on using aid in the current year is substantial;
  - Likewise, use of research tax credits and having been part of the JEI innovative start-up scheme both have a strong positive influence on the likelihood of obtaining Bpifrance individual aid in a given year;
  - The proportion of engineers and technical staff in the total workforce in the year preceding receipt of aid is higher for supported companies than for non-supported ones;
  - The likelihood of using aid increases significantly with the intensity of R&D activities as measured by the past ratio of the total R&D spending as a percentage of turnover;
  - Other factors may also explain the probability of using an individual aid, notably:
    - Companies requesting Bpifrance individual aid have more frequently been exporters (in the past) than the rest of the companies eligible for aid;
    - They are significantly younger;
    - They are better-capitalised.

The latter results suggest that for our counterfactual analysis to be valid, supported SMEs need to be compared with innovative non-supported SMEs, which was expected[13].

11 When estimating the model, the distribution of the performance indicators is trimmed (1% to both the right and the left of the distribution) in order to remove the effect of outliers.

12 The analysis also excludes some trade sectors and forms of legal entity: limited partnerships, non-profits, the public sector, property development businesses, holding companies and the agricultural and financial sectors.

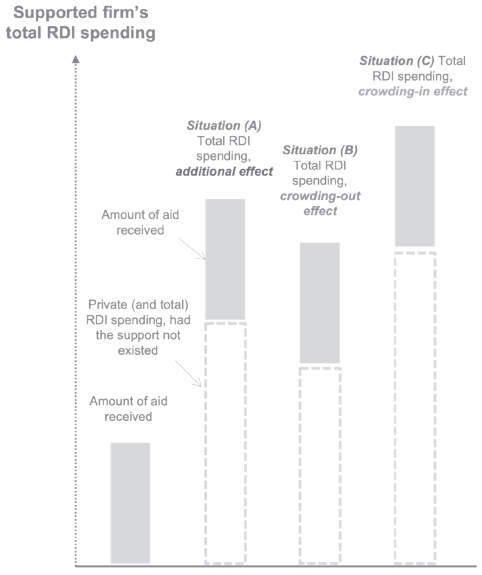
13 Econometric tests suggest that the hypotheses underlying the validity of the approach are verified. Eventually, supported and counterfactual non-supported SMEs are indeed very similar before receiving aid in terms of the characteristics mentioned above.

DISCUSSION OF THE METHODOLOGY AND ITS LIMITS

The validity of our methodology relies on the assumption that the performance of supported SMEs and their non-supported counterparts would have been close, had the aid not existed. This hypothesis raises the question of why the non-supported firms did not request access to the aid, since it would have helped them achieve better economic performance. In other words, our methodology may be valid if there are good reasons to believe that non-supported firms did not benefit from the aid because of specific factors unrelated to their future performance. A possible explanation may be that not all firms were aware of the existence of Bpifrance's programme or knew how to gain access to it (for example because such businesses were located far from Bpifrance's agencies or because the public schemes to support companies' innovation in France is known to be complex[14]), but this would need further investigation.

Moreover, our approach implies that at some point, we may compare currently supported SMEs with currently non-supported SMEs that received some Bpifrance aid in the past. Recent progress in the econometric literature show that under certain circumstances (typically when the effect of the programme varies with time or from company to company), estimations obtained using our method may be biased. Thus, further developments would be needed in order to assess the robustness of our results (see Baker, 2021).

Figure 4: Illustration of how the aid can interact with SMEs' private R&D expenditure
Additional effect vs crowding-out effect vs crowding-in effect



IMPACT OF BPIFRANCE'S INDIVIDUAL AID ON R&D SPENDING

We study the impact of Bpifrance individual aid on the total R&D expenditure reported by SMEs benefiting from the R&D tax credit. We also analyse the effect of aid on total R&D expenditure after deduction of any public support received by SMEs (private R&D spending). Figure 4 illustrates how to interpret the results of impact estimation, depending on how supported SMEs' private R&D expenditure evolves compared with the counterfactual situation. The impact of aid on private R&D spending can be negative, zero or positive: a negative impact means that at least part of the public aid granted to the SMEs was used as a substitute for private R&D spending (that would have been spent in R&D had the programme not existed). A zero-impact means that the public aid was entirely spent on R&D (in addition to SMEs' private spending). A positive impact means that the public aid encouraged SMEs to spend even more private funds in R&D than they would have invested if the programme had not existed.

Table 5 summarises the results of the econometric analyses: individual aid leads to an average additional increase of €36k in total R&D spending per firm in the year of the aid, and €250k in cumulative spending after three years, compared with the counterfactual situation. Access to Bpifrance aid permits SMEs to increase their total R&D spending compared with the counterfactual situation. Results also show a significant decrease (€74k) in privately sourced R&D spending in the year of aid, suggesting a crowding-out effect in the very short term. However, cumulatively over the three years following the support, individual aid has no impact on privately sourced spending (down €18k, result statistically not significant). Bpifrance IA finances projects spread over several years (typically up to three years), and it is possible that a time-lag effect exists between the payment of the aid and when it is actually spent on innovation projects, which might explain the negative impact on privately sourced spending in the very short term. Nonetheless, when the three-year assessment of this impact on total privately sourced R&D cumulative spending is produced, the effect of aid is additional, meaning that all aid disbursed was spent on R&D and privately sourced spending was unaffected.

14 See for example "Fifteen years of innovation policies in France" report from the National Commission on Innovation Policy Evaluation, France Stratégie, January 2016.

Table 5: Estimated additional impact of Bpifrance individual aid on R&D spending
Impact measured in €000s

Indicator	Supported SMEs studied	Indic. av. N-1 recipient	Estimated mean impact	95% CI low. limit	95% CI upp. limit	P-value	Relative mean impact
Cumulative R&D spending in the year of the aid (GeCIR)	3.889	387	36,1	28,2	43,9	0,000%	9%
Cumulative R&D spending over 3 years (GeCIR)	2.024	387	249,9	131,2	368,5	0,004%	65%
Cumulative R&D spending net of public-sector aid in the year of the aid (GeCIR)	4.116	209	-74,1	-81,2	-67,0	0,000%	-35%
Cumulative R&D spending net of public-sector aid over 3 years (GeCIR)	1.987	213	-18,2	-88,4	52,1	61,258%	-9%

Source: Bpifrance calculations
Scope: SMEs supported in 2009-2014with records in the GeCIR database for at least one year.

Note: Column 2 shows the number of supported SMEs analysed over the period, after matching and trimming of the performance indicator distribution. The mean impact and the limits of its 95% confidence interval are shown in columns 4 to 6. The relative mean impact is the mean estimated impact (column 4) relative to the mean of the performance indicator in the year preceding receipt of aid (column 3).

Table 6 offers a better understanding of the changes in privately sourced spending because the analysis focuses on a balanced panel of SMEs (those for which observation was possible for each of the three years following the support): the negative effect of aid on cumulative privately sourced spending declines over time, becoming not significant within two years. Such a result confirms that the crowding-out effect is only temporary.

Table 6: Estimated additional impact of Bpifrance individual aid on private R&D spending
Impact measured in €000s on a balanced panel, by year

Timeframe	Supported SMEs studied	Estimated mean impact	Standard deviation	T	P-value
Year of the aid	1.987	-52,2	7,1	-7,4	<0,01%
1 year after the aid	1.987	-40,2	14,0	-2,9	0,400%
2 years after the aid	1.987	-19,0	23,9	-0,8	45,620%
3 years after the aid	1.987	-18,2	35,8	-0,5	61,260%

Source: Bpifrance calculations
Scope: SMEs supported in 2009-2014 with records in the GeCIR database for at least one year.

IMPACT OF BPIFRANCE'S INDIVIDUAL AID ON R&D LABOUR

Table 7 suggests that use of Bpifrance individual aid results in a significant increase in the number of engineers and technical staff in recipient SMEs in comparison with the counterfactual situation, with an extra 0.4 jobs per SME in the year of the aid and 0.5 extra jobs after three years. For SMEs already employing people in these positions in the year preceding receipt of aid, no associated salary increase is observed, suggesting that aid is used to recruit new engineers and technicians, rather than to increase the pay of existing staff. It is interesting to note that the increase in R&D employment measured in this way is partly driven by SMEs employing engineers and technicians for the first time. The proportion of supported SMEs employing staff in this category before receiving aid climbs from 77% the year preceding aid (77% for similar but unsupported businesses) to 84% within the three-year timeframe (78% for the unsupported businesses). This suggests that Bpifrance IA encourages SMEs to invest in R&D jobs for the first time.

These results are corroborated by the analyses of highly skilled labour employment, which increases in similar proportions to that of engineers and technical staff in comparison with the counterfactual.

Table 7: Estimated additional impact of Bpifrance individual aid on R&D employment
Impact measured in headcount or €000s

Indicator	Supported SMEs studied	Indic. av. N-1 recipient	Estimated mean impact	95% CI low. limit	95% CI upp. limit	P-value	Relative mean impact
Engineers and technical staff, year of the aid	7.839	4	0,4	0,3	0,4	0,000%	9%
Payroll costs for engineers and technical staff, year of the aid	7.855	143	10,3	8,0	12,5	0,000%	7%
Engineers and technical staff after 3 years	3.718	5	0,5	0,3	0,6	0,000%	10%
Payroll costs for engineers and technical staff after 3 years	3.720	164	17,8	10,1	25,4	0,001%	11%
Average salary of engineers and technical staff, year of the aid	2.751	33	0,0	0,0	0,1	72,354%	0%
Average salary of engineers and technical staff after 3 years	1.576	35	0,0	0,0	0,1	51,186%	0%
Highly-skilled jobs, year of the aid	7.823	4	0,3	0,2	0,3	0,000%	7%
Payroll costs for highly-skilled jobs, year of the aid	7.823	190	11,5	9,0	14,1	0,000%	6%
Highly-skilled jobs after 3 years	3.724	4	0,4	0,2	0,6	0,002%	9%
Payroll costs for highly-skilled jobs after 3 years	3.729	212	18,4	9,1	27,7	0,010%	9%
Average salary of highly-skilled jobs, year of the aid	3.057	45	0,0	0,0	0,1	39,372%	0%
Average salary of highly-skilled jobs after 3 years	1.649	48	0,0	-0,1	0,0	43,722%	0%

Source: Bpifrance calculations
Scope: SMEs supported in 2009-2014 with records in the DADS database for at least one year.

IMPACT OF BPIFRANCE'S INDIVIDUAL AID ON EMPLOYMENT AND BUSINESS

From the point when aid is likely to affect SMEs' RDI investment favourably, it might be expected that such investment would result in a tangible effect on the economic trajectories of businesses in the short term. The estimated impact of aid on total employment supports the result obtained for R&D employment, so use of Bpifrance individual aid by SMEs results in the creation of an additional 0.7 jobs per SME in the year of receipt of the aid, and 1.6 jobs in three years, according to Ficus-Fare tax statistical data (Table 8). The results obtained using DADS employment data are qualitatively similar.

Table 8: Estimated additional impact of Bpifrance individual aid on total employment
Impact measured in headcount

Indicator	Supported SMEs studied	Indic. av. N-1 recipient	Estimated mean impact	95% CI low. limit	95% CI upp. limit	P-value	Relative mean impact
FARE total workforce, year of the aid	12.124	14	0,7	0,6	0,7	0,000%	5%
FARE total workforce after 3 years	7.908	16	1,6	1,4	1,9	0,000%	10%
DADS total workforce, year of the aid	7.000	13	0,6	0,5	0,7	0,000%	4%
DADS total workforce after 3 years	3.303	17	0,9	0,5	1,3	0,000%	5%

Source: Bpifrance calculations
Scope: SMEs supported in 2005-2016 (Ficus-Fare tax data) or 2010-2016 (DADS employment data).

Table 9 shows that the impact of aid on total turnover and added value is almost nil and barely significant in the year it is granted, but it is positive and significant over the three-year timeframe (€284k additional turnover in comparison with the counterfactual, making an average impact of +6%). These results suggest that RDI investment funded through aid needs time before its effects can be seen in economic terms.
Aid's impact on export turnover is also both positive and significant in the medium term (€77k over the three-year timeframe). In practice, the proportion of total turnover generated by exports for SMEs with a non-zero export turnover in the year preceding receipt of aid shows little difference between supported businesses and the counterfactual (remaining the same at three years for both populations, at a level close to 30%). However, the proportion of SMEs generating export turnover grows significantly among supported SMEs (from 55% in the year preceding aid to 64% in the three-year timeframe), whereas the change is slight for the counterfactual (55% to 57%). In this respect, individual aid appears to help trigger the international expansion of supported SMEs.

Table 9: Estimated additional impact of Bpifrance individual aid on recipients' turnover and added value
Impact measured in €000s

Indicator	Supported SMEs studied	Indic. av. N-1 recipient	Estimated mean impact	95% CI low. limit	95% CI upp. limit	P-value	Relative mean impact
Total turnover, year of the aid	9.814	4839	51,3	19,7	83,0	0,149%	1%
Total turnover after 3 years	6.592	5125	284,2	193,7	374,7	0,000%	6%
Added value, year of the aid	8.499	1933	-13,3	-27,7	1,1	6,973%	-1%
Added value after 3 years	6.101	1953	98,7	62,7	134,8	0,000%	5%
Export turnover, year of the aid	11.992	878	18,4	6,1	30,8	0,331%	2%
Export turnover after 3 years	7.464	1009	77,0	40,7	113,2	0,003%	8%

Source: Bpifrance calculations
Scope: SMEs supported in 2005-2016 with records in the Ficus-Fare tax data.

CONCLUSIONS

This paper uses a very rich database to conduct an unprecedented impact assessment of Bpifrance's individual aid for innovation. Econometric results suggest that such aid has a positive effect on SMEs' RDI investment, whether in terms of R&D expenditure or spending on R&D labour. Analysing SMEs that had used research tax credits before accessing the aid suggests that Bpifrance's individual aid lowers privately sourced R&D spending in the year of receipt of the aid, showing a very short-term crowding-out effect on these SMEs. However, cumulatively over the three-year timeframe, the individual aid has no impact on privately sourced R&D expenditure, suggesting that the aid received is allotted entirely to medium-term R&D expenditure (additional effect).

RDI investment made using aid results, within the three-year timeframe, in increased total employment and turnover for recipient SMEs. Their total and export turnovers also rise significantly, with aid contributing in particular to triggering international expansion for SMEs previously operating exclusively domestically.

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