Effectiveness of public support for R&D and entrepreneurship

Comment on the papers "The effect of R&D subsidies and tax incentives on employment: an evaluation for small firms in France"[i] by Vincent Dortet-Bernadet and Michaël Sicsic, and "Do public subsidies have an impact on start-ups survival rates? An assessment for four cohorts of firms set up by previously unemployed entrepreneurs in France"[ii] by Dominique Redor.

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Abstract - The papers by Dortet-Bernadet and Sicsic and by Redor in this issue examine respectively the success of R&D financial support programs in stimulating private R&D and the success of subsidized start-ups for the unemployed in creating long-lasting firms. Both papers focus on small French firms. Both programs are found to suffer from a deadweight loss. This comment discusses the results obtained and the policy conclusions that can be drawn from them. It is argued that the deadweight loss is in part unavoidable but that there are ways to limit it, for instance by using a policy mix of R&D tax incentives and subsidies, favoring tax incentives for small firms and subsidies for large firms. It is also recalled that a policy ought to be evaluated from various perspectives. Besides R&D additionality and firm survival a full cost benefit analysis would also consider R&D externalities, firm retention and decrease in unemployment.

The two excellent papers presented in this issue of *Economie et Statistique* provide some interesting and useful contributions to the discussion on the effectiveness of financial support towards R&D on the one hand and business start-ups for the unemployed on the other hand. Vincent Dortet-Bernadet and Michaël Sicsic examine the effectiveness of direct and indirect public support for investment in research and development by very small firms in France. Dominique Redor evaluates the success of another French policy aimed at small firms, namely the creation of start-ups by people who were previously unemployed.

Since the marginal productivity of capital is declining, a growth in GDP/capita can only be achieved by a more efficient utilization of resources, the introduction of new and more efficient technologies, or the production of new intermediate or final demand products that in the end achieve higher outputs (or consumer utility) with fewer resources. In this process of Schumpeterian creative destruction new products replace old products and newcomers replace incumbents. To some extent all this can happen endogenously by the mere forces of the market. However, irrespective of the social turmoil this process of creative destruction can cause, the market by itself might not reach the optimal growth and economic development because of market failures. Entrepreneurs following the invisible hand might not take externalities into account, for instance not spending sufficiently on R&D from a societal point of view or innovating in polluting technologies. Because of coordination failures, private entrepreneurs who fail to consult with each other may put unnecessary strains on some resources preventing other societal goals to be achieved, not speaking of moral hazard or intentional anticompetitive behavior. And finally, because of the public good nature of knowledge, innovators may be reluctant to provide fund providers with the required information to justify their lending, this being particularly the case for small firms and startups, which do not have the collateral or other guarantees to back up their financial requests.

A technical difficulty in the evaluation of the effectiveness of these policy interventions is the endogeneity of aid recipients and the self-selection into aid. Indeed, those firms that receive R&D subsidies or tax incentives as well as the unemployed who benefit from the ACCRE support might be inherently more hard-working, productive or efficient than those that receive no support. The former may also be more likely to

apply for such aid in the first place. The superior economic performance of aid recipients might therefore not only - if at all - be due to the support itself. The econometric difficulty is to filter out these two sources of bias. Besides addressing similar issues and focusing on a similar sub-population of firms, both papers are careful and skillful in properly handling the endogeneity of public support. They slightly differ in the way they handle the endogeneity problem.

The comment is organized as follows. First, we summarize the two papers regarding their method of analysis and the results obtained. We then proceed to critically discuss them and compare them with other studies in the literature. We conclude with some policy recommendations in light of the conclusions reached in the two studies.

Summary presentation of the two papers

Vincent Dortet-Bernadet and Michaël Sicsic evaluate jointly the direct and indirect support for R&D employment in small and medium sized French enterprises (SMEs). Many papers have analyzed the effectiveness of R&D tax incentives and direct R&D subsidies in France and other countries (see the reviews by Ientile & Mairesse, 2009; Köhler et al., 2012; European Commission, 2014; Zuñiga-Vicente et al., 2014). This study has three particularities. First, it includes the very small enterprises, i.e. those with fewer than 10 employees and less than € 2 million of turnover and of assets, whereas most studies based on R&D survey data are biased towards large firms. The very small enterprises make up two thirds of the panel. Secondly, it merges many databases, namely those of the R&D tax credit (CRI), the young innovating enterprises program (JEI), the R&D survey, the list of accredited enterprises from the Ministry of Research, and various fiscal, social, financial and register data from the French Statistical Office. This data effort provides a unique, almost exhaustive, sample of SMEs and very small French firms. Thirdly, it examines at the same time direct and indirect R&D support measures, whereas most previous studies examined only one of the two types of support measures, thereby omitting a potential R&D determinant.

The authors carefully construct the estimation sample by first matching every firm that received financial support for R&D at least once between 2003 and 2010 with three firms

of the same age that did not receive financial support in the corresponding period and that had similar probabilities of receiving support in 2003 or in 2007. They then estimate by system GMM a dynamic R&D labor demand equation as a function of present and past levels of turnover and the relative cost of highly qualified labor compared to other types of labor. The latter is then instrumented by multiplying official changes in the R&D tax credit by the R&D labor share just before the change. Finally, first differences in R&D labor due to changes in the relative R&D labor cost and changes in turnover brought about by changes in the R&D tax credit are computed and subtracted from those of matched firms that did not benefit from R&D financial support. Knowing the amount spent on supporting R&D and the average cost of R&D labor, the change in R&D labor supported by the incentive measures can be calculated and the change in R&D labor not supported by government can be obtained residually.

The authors come to the conclusion that the R&D support increased R&D labor but with partial crowding out. In other words, the number of R&D workers that were financed by the private sector decreased. Part of the financial support received by private firms from government was used to decrease their own investment in R&D labor. The statistically significant decrease is especially visible after the 2008 reform in the R&D tax credit, which replaced the increment-based by a volume-based R&D tax credit system. For the firms that had existed since 2007, only 24% of the increase in financial support for R&D in its various forms was devoted to new hires of R&D workers.

Dominique Redor examines the effect of the French policy ACCRE, which aims to assist the unemployed to start or take over a business on their survival five years later. The econometric analysis is based on four cohorts of such enterprises (1994, 1998, 2002 and 2006) obtained from a stratified sample survey on newly created enterprises. The underlying model is based on a simultaneous bivariate probit model estimated by maximum likelihood: the first equation estimates the determinants of getting financial support to start a new business, the second one explains the survival 5 years later as a function of, among others, the fact of having benefitted or not from the subsidy. Two exclusion restrictions are used in the selection equation: the fact that the enterprise was created in the second quarter (implying that the request for aid was introduced in the first quarter, where funds are

typically more largely available than towards the end of the year), and the tension on the labor market (i.e. the ratio of job vacancies to the number of unemployed). Observable individual characteristics of the entrepreneur and the created enterprise are controlled for. Both exclusion restrictions are significant, although only at a 10% level of significance for the date of creation of the enterprise. When the two probits are estimated separately ACCRE has a positive effect on the probability of survival 5 years later; when they are estimated jointly the effect of ACCRE disappears. The endogeneity does not come from common unobservable determinants for the two endogenous variables as the correlation between the error terms of the bivariate normal distribution is not significant.

The conclusion is that ACCRE is not effective in creating enterprises that last at least 5 years. The result is found to be robust with respect to different definitions of financial means, different lengths of survival and different types of beneficiaries (inactive people, unemployed of less than one year and unemployed of more than one year). The only significant effect of ACCRE is for the year 1998 when all categories of unemployed are included in the sample. It is suggested that this exceptional result might be due to the smaller number of beneficiaries of ACCRE in 1998 due to less favorable terms of support offered in that year. The other cohorts benefitted from a more generous support. Maybe this could explain the different result for 1998, although on each subsample of beneficiaries the effect was insignificant even in that year.

Discussion of the results

Although Dortet-Bernadet and Sicsic's results contradict the findings of previous evaluations of the R&D tax credit system in France, the results are not entirely surprising.

First, the estimates combine the intensive margin (increase in R&D intensity for R&D performing firms) and the extensive margin (increase in the number of R&D performing firms). On the extensive margin more firms have decided to start doing R&D especially in the year of the 2008 reform of the R&D tax credit (Bozio et al., 2014). To enter the R&D game firms need to incur sunk costs in addition to the fixed and variable costs of R&D. Arqué-Castells and Mohnen (2015) estimate these sunk costs to be as large as 1% of total sales and to be higher for small firms than for large firms. The sample

here is mainly composed of very small firms, which were not captured in previous studies based on the R&D survey database. Small firms may not make enough profits to claim any R&D tax credit. It is only since 2010 that SMEs are able to receive immediate refunds for unutilized credits (EU Commission, 2014, Annex Country Fiches). Finally, we should not ignore the compliance costs of applying for R&D tax credits. The 2008 reform facilitated the application for R&D tax credits, yet for very small firms these compliance costs, which on average have been estimated at 7% in Canada and the Netherlands, may be at least twice to three times as high for very small firms. All this to argue that starting to engage in R&D and applying for the first time for R&D tax credits, which probably occurred at a higher rate in the year of the reform, carries with it additional costs that reduce the amount left over to hire R&D workers. The decline in privately financed R&D labor is the highest in 2008. It would have been nice to show the difference in effectiveness of R&D support at the intensive and the extensive margins.

Second, the partial crowding out may also be related to the gradual introduction of volume-based R&D tax credits in France after 2004 and the full substitution of increment-based by volume-based R&D tax credits after 2008. The deadweight loss, i.e. the funding for R&D that would have been done anyway, is a typical phenomenon of volume-based schemes. R&D has been shown to be persistent (Peters, 2009, Arqué-Castells & Mohnen, 2015). Hence once in the R&D game, firms tend to remain in the R&D game. In that case, a good deal of the financial support for R&D could be done without it. Firms would continue spending on R&D anyway. In increment-based R&D tax credit schemes only an increase in R&D is eligible for R&D tax credits and only part of the increase is financed by the policy. It is therefore not surprising that Mairesse-Mulkay (2004) and Duguet (2012) for France find a strong additionality for the period prior to 2003, where France had only incremental R&D tax credits, while Mulkay and Mairesse (2013) report a bang for the buck (BFTB) of 0.7 under the regime of level-based R&D tax credits after 2008. The BFTB found in most other studies where level-based tax credits dominate is below 1 (see Ientile & Mairesse, 2009 ; Caiumi, 2011 ; European Commission, 2014). The deadweight loss holds especially for large firms ; but even for small firms, like those in the present sample, the phenomenon may occur.

Third, as the authors admit, there may be partial crowding out in the short run, as firms incur sunk costs and adjustment costs, but in the long run there may be additionality. Given the high autoregressive coefficient in the estimated dynamic labor equation, the long-run elasticity of R&D labor to the relative wage of highly qualified labor could be pretty high. This reversal could also explain the insignificant decrease in privately financed R&D in 2010 as opposed to significant negative signs prior to 2010 for R&D support increases with respect to 2003 (table 4).

Dortet-Bernadet and Sicsic combine matching, difference in differences and structural modeling approaches, but in all stages they only control for observables. It may be that unobservables drive the firms to apply for R&D tax credits and that those same unobservables influence the demand for R&D labor. The post 2008 world financial crisis is one of those variables that may have affected both the application for government support and the amount of R&D expenditure. Redor in his paper allows for the presence of such unobservables through the correlation in the error terms of the selection and survival equations. In his case the correlations are not significant in any of the four cohorts of firms, implying that the survival is conditionally independent of selection into ACCRE support. Given the positive evaluation of the ACCRE program obtained in the study by Duhautois, Désiage and Redor (2015) for the year 1998 it would be interesting to redo the propensity score based matching analysis on the four cohorts, where no assumptions are made regarding the functional form of the specification nor the distribution of the error terms. True, no account would then be taken of the presence of unobservables, but they do not seem to matter anyway.

International comparison

Most, if not all, countries have some policies in place to support R&D, see OECD (2017) for a recent review of these measures. Although there is a huge heterogeneity across countries in the way tax incentives and subsidies are organized, a few stylized facts emerge. Most countries have found ways to let firms use their tax credits even in the absence of payable taxes. Most countries give higher R&D tax credits to small firms. More and more governments shift to the volume-based R&D tax incentives because they are easier to manage, they do not encourage a

see-saw behavior in R&D expenditure in order to capture the most out of the tax supports and they provide continuous support even in the absence of accelerating R&D investments. In principle, R&D tax incentives are neutral, although in many cases additional support is provided for collaborative research with universities. Some countries like Germany, Finland and Luxemburg have no expenditure-based R&D tax support, favoring subsidies to tax support. R&D subsidy programs are much more diversified and can to some extent be geared to projects with higher expected social returns.

The empirical studies on the effectiveness of R&D tax support (Ientile & Mairesse, 2009 ; European Commission, 2014) concur that R&D tax incentives are effective, i.e. they stimulate additional R&D. However, volume-based R&D tax incentives are rather inefficient in terms of cost-benefit analysis. The deadweight loss can be severe: under the assumption that firms will not cut their spending on R&D because of sunk costs, Lokshin and Mohnen (2012) evaluated the additional R&D originating from one Euro of R&D tax support in the Netherlands at 0.42 Euro. Mulkay and Mairesse (2013) for France found a long-run budget multiplier of 0.72. In their survey of the literature Zuñiga-Vicente et al. (2014) found mixed evidence regarding the crowding out versus additionality of direct R&D support, although the latest evidence seemed to be tilting more towards additionality.

Subsidized start-ups for the unemployed is a policy that has also been introduced in a number of other countries. As Caliendo (2016) reports in his survey of the literature, these policies have generally been effective in terms of job creation, but not so successful in creating long-lasting firms.

Policy recommendation

Direct and indirect R&D support might not be immediately successful in generating additional R&D employment because other costs need to be covered in the short run, and because support goes to R&D expenditure that would have been undertaken anyway. This deadweight loss is to some extent unavoidable, except if the subsidies are restricted to additional R&D. The increment-based R&D tax incentives have, however, proved to be costly to administer, for the firms and for the government, and limited

in their ability to generate a lot of new R&D. The question is whether these inefficiencies are outweighed by the externalities generated by the additional R&D. There are also ways to limit the inefficiencies. Large R&D performers need less help because they have other ways to generate money to finance their R&D projects: retained earnings, easier access to external financing and to venture capital markets. Another way would be to do a smart policy mix, giving easily obtainable tax credits to small firms and start-ups, and direct grants and subsidies to big projects, possibly collaborative projects involving big and small actors, private firms and universities, where a sound cost-benefit analysis has indicated the presence of social benefits in the long run. The idea is that small firms are the most affected by the asymmetric information problem and the lack of financial capital, whereas large firms are more likely to create R&D spillovers (Bloom et al., 2013). Finally, these financial support policies could be complemented by public procurement, protection of intellectual property rights, the creation of a venture capital market and a readiness to take risks and to accept failure.

The other thing to keep in mind is that a policy may have several effects and ought to be evaluated from various perspectives. The generous R&D tax credit policy after 2008 was also intended to keep R&D facilities in France instead of seeing R&D labs and personnel move to other countries. Hence even if the policy was not very effective in stimulating private R&D it may have been effective in retaining R&D in France. Likewise, subsidizing start-ups for the unemployed might not be very successful in creating long-lasting firms, but it may give the beneficiaries the chance to gain experience and then be in a better position to find a new job or to start a new business. If the aim is to create new firms that have a chance to survive a long period of time, it would make sense to be more selective in providing subsidies and to accompany the subsidies with training and mentoring. But, the start-up subsidies for the unemployed are also geared towards fighting unemployment, probably even more than towards creating new firms. Instead of examining the survival of newly created firms 5 years after, the employment record of the erstwhile unemployed five years after they received the ACCRE support plus and of the newly hired workers in the process, might be an alternative performance worth examining. □

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