Research Proposal
Firm innovation in the Defense Industry, and Spill-over Effect

1. Introduction

These projects aim at understanding better the innovation system of the Defense industry in France, and its connection to the civilian industry.

2. Project A : Defense R&D and Private R&D : mechanisms of crowding-in

This first work has for objective to develop a clear analysis of the mechanisms of crowding-in of the defense R&D as identified in the literature (Pallante, Russo, and Roventini 2023; Moretti, Steinwender, and Van Reenen 2025).

A first step of this paper could be to measure impact on patenting activities and R&D activities of directly and indirectly targeted firms. The broad idea is just to obtain a measure of publicly funded R&D on crowding-in. Further, we propose to decompose the potentially observe effect into different channels :

- A first aspect would be to distinguish direct funding of publics labs vs private companies, in order to control for the "anticipated demand effect". We could follow Bergeaud et al. (2025) methodology to do so. It would also provide valuable results about the scientific content of patents in the military industry. Interestingly, patents might also be a way of identifying dual-uses goods/companies, indeed working under the assumption that finding scientific citations from a military institutions in civilian goods is an alternative measure of dual uses. Finally, we could measure the spill-over effect of public R&D with a measure of scientific citations based on the funding of a military project in different industries as a clear measure of public support to private research.
- A second channel is the **local spillover effect**. If firms evolving in close technological industries or local industries working for this companies then they can expect to benefit from other firms innovation they may invest to either secure their own position or integrate other firms innovation in their own product or processes. In that case, local spill-over effect due to technological clusters are to be expected. The transformative effect of defense R&D are well documented in the U.S. cases, noticeably their crucial role in building technological clusters and orienting American innovation toward initially military products — *spin-off* (Gross and Sampat 2023). Further run we could investigate more precisely the role between firms of innovation, especially the innovation network and the role of small firms and their inclusion into the innovation process. Do they participate, innovate and spend, if yes on what. Do they benefit from downstream innovation or does the surge in demand they can face push them to invest in their R&D.
- A third channel is **dual-uses goods** produced by firms. Most of the firms operating in the military industry also evolve in the civilian industry, and the high level of R&D they support in the military component of their business may translate into civilian goods (Ruttan 2006; Mazzucato and Penna 2015). In that case, crowding-in effect might be due to additional researches necessary to transfer military technology to marketable goods.

2.1. Valuable outputs

Academic outputs:

- Clean decomposition of different channels through which the public R&D in the defense industry might foster public investment

- Contribution to the debate on the optimal way of funding R&D

Professional outputs:

- Analysis on the respective roles of different institutions and private companies in the French Defense Innovation Network
- The impact of public funds on economic and scientific outputs

2.2. Data

1. Patents Data
2. Firm level data on contract with the army to build a defense expenditure shock & balance sheet.
3. MESRI : to recompose the innovation network.
3. Data on firm employment of scientist (complementary to MESRI data)

3. Project B : Credit Constraint, R&D, and firm's growth in the Defense Industry

An explanation for the R&D crowdin-in effect can be the access to credit. Credit constraints tends to limit investment capacities (Garicano and Steinwender 2016). Given that the **credit constraint** effect is stronger in the defense industry than in the civilian industries (Belin and Guille 2006) military funding might play a crucial role in alleviating the constraint.

A promising approach could be in the first time to identify credit constraint firms, the impact it has on their investment and growth strategy (R&D investment and firm dynamics) following Garicano and Steinwender (2016).

In a second time trying to understand on aspect of the credit constraint that might come from demand side effect. Indeed, the defense market is characterized by a monopsonistic behavior from the state. But the state demand design is itself regulated by European norms of public procurement, making that above a certain market size threshold (100K) the state must organize an open procurement. It creates an exogeneous entry cost to medium and large market size for SME and which may lead to break firms growth dynamic (no possibility to acquire more capital through credit borrowing given that they cannot access to larger market). This limits both their size, production and research capacity. We then propose to compare parallel access to credit such as DefInvest Funds from the BPI to see the economic trajectory of those firms compared to not selected projects, it would answer the question of how much alleviating the credit constraints plays in the defense case.

Access to credit would facilitate credit obtention by sending a positive signal of obtaining a grant — "certification effect". It might ease the access to classical banking credit. May also rise from a "funding" effect, being fund allows to develop prototypes of product, facilitating then further funding.

An alternative natural experiment to this credit relax could the Ukrainian war and surge in demand.

An interesting complement could be a dynamic model of firms growth, with credit constraint, exogeneous entry cost, access to market funding.

3.1. Data

1. Firm level data on balance sheets & military contracts
2. Patents

3. Level of R&D
4. Data on firm employment of scientist (complementary to MESRI data)

4. Project C : Anticipated Demand, Investment and Growth in the Military Industry

An important aspect of the question is **anticipated demand** that firm will face in their investment choice. If firms obtaining government grant consider it as a future signal of demand for a specific good from the MoD then winning government fund is the same as facing "guaranteed demand". They are incentivize to top-up government fund to secure future procurement contract (Belenzon and Cioaca 2024). Further research have showed that demand for experimental product is crucial so that new technology can grow to maturity and survive against more mature incumbant technology. Historically the MoD by their procurement in innovative equipments has played this "consumer in first resort" role to forster innovation (Malerba et al. 2007; Mowery 2010). Theoretical results from (Belenzon and Cioaca 2024) showed that larger firms with production capacities and upstream in the innovation channel are more likely to benefit from "guaranteed demand" mechanisms. Recent reforms of R&D funding that separate demand from R&D might lead to growth of SME.

Possibility to use *Fonds Innovation Défense* comme expérience naturelle d'allégement de la contrainte financière.

4.1. Data

1. Data on firm innovation expenditures : Enquête sur les dépenses de R&D des entreprises (MESRI)
2. Data on Credit constraints & firm financial situation : FARE
3. Data on workers of those firms to control for change in employment structure : BTS
4. Data on MoD procurement to control for potential demand : Chorus

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