

Can research and development (R&D) funding stimulate recovery growth?

We provide forecasts (ex-ante evaluation) of the effectiveness of Business Finland's R&D support including the new "Funding for business development in disruptive circumstances" -program to stimulate recovery GDP growth after the COVID-19 related economic drop in 2020.

Is R&D funding likely to affect regional development trends in Finland during the COVID-19 pandemic?

- The emergence of the COVID-19 pandemic and subsequent public health restrictions have led to a significant economic slump around the globe. National governments have met the crisis with various policy actions – such as Research and Development (R&D) funding – to alleviate the economic distress and to bring the economy back on track: in Finland, we observe a massive increase in R&D funding for firms in 2020 to stimulate recovery growth after the significant GDP decline during the COVID-19 crisis in 2020.

- We use data on regional economic indicators and the allocation of funding by Business Finland to estimate the structural link between R&D funding and economic growth in Finland prior to COVID-19. We then use these structural estimates to forecast regional recovery growth for 18 Finnish NUTS-3 regions in 2020 and 2021 when R&D funds have been significantly upscaled, both through traditional funding channels and the new "Funding for business development in disruptive circumstances"-program.

Our forecasts point to regional recovery GDP growth after economic slump in 2020

- We found that:

- Depending on the chosen forecast scenario our results point to a **mean regional recovery growth rate of GDP between 2–4%** in 2021
- The contribution of R&D funding to this recovery process in terms of proportionate GDP growth is estimated to be between 0.4–1.0%-points
- R&D funding constitutes a more significant pillar to regions outside the normal growth areas of Finland

R&D funding is a major pillar for the recovery process in 2021

- Fighting the detrimental socio-economic effects of the ongoing COVID-19 pandemic is a major challenge for policymakers. Scientifically grounded evidence on the likely effectiveness of different policy instruments can help policymakers to evaluate proper policy mixes to tackle the crisis.

- In terms of regional GDP recovery growth, traditional funding through Business Finland together with the new "Funding for business development in disruptive circumstances" program is predicted to result in positive outcomes. In the light of these forecasting results, governments are advised to increase their support for private sector R&D counter-cyclically, rather than decrease it pro-cyclically.

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The full working paper version underlying this policy brief can be downloaded from:
<https://arxiv.org/abs/2112.11562> (pre-print)

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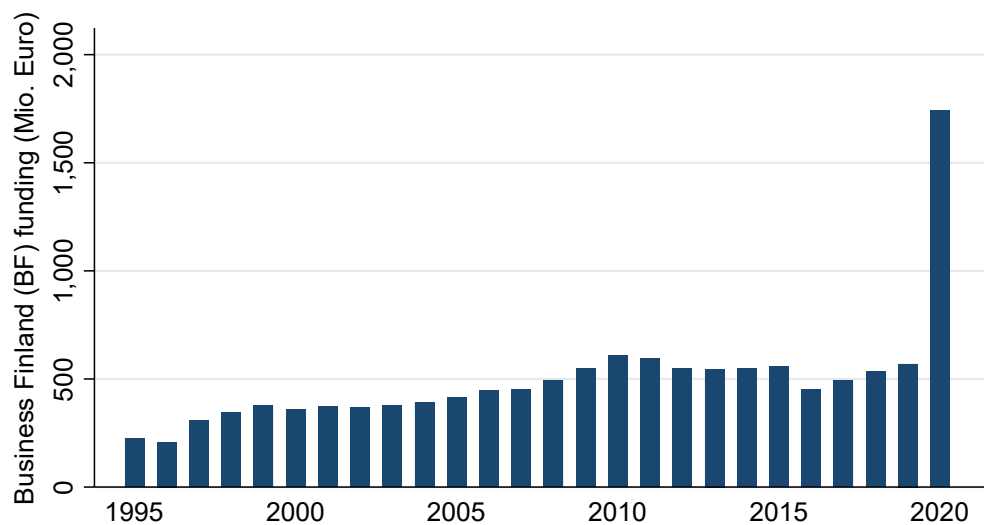
Introduction

COVID-19 has had severe negative impacts on the Finnish economy

Due to spread of the COVID-19 pandemic and subsequent public health measures to restrict mobility and social contacts, the Finnish GDP sunk in 2020 along with the rest of the world. Thanks to the rapid availability of vaccinations, which facilitated the re-opening of public life, the Finnish economy has already started to show signs of economic recovery in 2021. Another important factor in this recovery process is arguably the massive financial support for the private sector in the form of standard, undirected business cost subsidies and also targeted R&D funding. An example of the latter measure is the "Funding for business development in disruptive circumstances" (hereafter COVID-19 instrument) allocated through Business Finland to firms with innovative ideas to tackle the detrimental effects of the COVID-19 crisis to their businesses. Overall Business Finland funding volumes grew from 570M EURO in 2019 to 1 740M Euro in 2020 (Figure 1). Out of the total of 1 740M Euro around 990M were allocated through the new COVID-19 instrument.

The volume of Business Finland funding increased significantly in 2020 as a response to the economic crisis caused by the COVID-19 pandemic

Figure 1. Business Finland funding volumes 1995–2020.



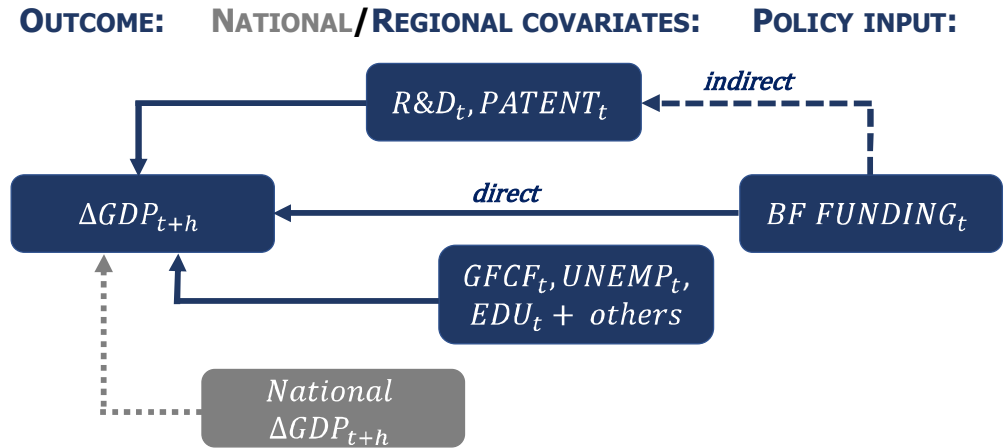
The program has been criticized for its hasty implementation and due to observations pointing to a conclusion that it has not been targeted to the 'right' firms, i.e. to the ones that have been most affected by the crisis (Valtiontalouden tarkastusvirasto, 2021). In this evaluation, however, we take another stance and instead of investigating firm-level allocational issues we focus on the links between R&D funding and regional growth to evaluate the essential question: Is the significant increase in R&D funding in Finland likely to affect regional development and crisis recovery growth?

Data/methods

For our empirical estimations we utilize regional NUTS-3 level (*maakunnat*) data from 1995–2018 for Mainland Finland (excluding Åland due to missing data on some of the included variables). While 2018 is the latest year with full data coverage at the time of the analysis, for some variables, especially Business Finland funding, we have data ranging until 2020. This facilitates the conduct of short-run forecasts of regional GDP growth after the COVID-related economic slump in 2020. Regional economic indicators were gathered from the Stat.Fin -database and patent data from OECD RegPat database. R&D funding data was partially provided by Business Finland.

Since regional data for conducting ex-post evaluations are naturally not yet available, we provide an ex-ante estimation of the likely effectiveness of Business Finland's COVID-19 instrument to stimulate recovery growth.

Figure 2. Overview of economic model for estimation and forecasting.



Variable	Description
<i>ΔGDP</i>	Regional and national GDP growth rate (in %, based on GDP per employee)
<i>GFCF</i>	Regional gross fixed capital formation (in 1,000 Euro per employed person)
<i>R&D</i>	Regional private and public R&D expenditures (in % of GDP) and R&D personnel (in % of total employment)
<i>PATENT</i>	Regional patent applications (number per 1,000 employed persons)
<i>UNEMP</i>	Regional unemployment rate (in %)
<i>EDU</i>	Regional stock of highly educated employees (in % of total employment)
<i>BF Funding</i>	Regional Business Finland funding (in Euro per employed person)
<i>Index</i>	t = time period (1995-2018 for in-sample estimations), $t+h$ = forecast horizon (with $h=1$ for out-of-sample period 2019-2021)

An ex-ante estimation of Business Finland’s COVID-19 instrument is provided

We do this in two stages. We first estimate a structural economic growth model to capture the main transmission channels of R&D funding (direct and indirect as shown in Figure 2) based on existing data prior the outbreak of the COVID-19 pandemic until 2018 (in-sample period). Second, we then use these structural parameters to forecast regional GDP growth levels for the out-of-sample period up to 2021 and compute the contribution of Business Finland R&D funding, most notably the COVID-19 instrument, to crisis recovery growth.

For the out-of-sample forecasts of regional GDP growth we take advantage of already published national GDP data and/or available forecasts until 2021 (see Figure 2). Specifically, we use national GDP growth as an essential scaling factor at the regional level and, for instance in 2021, assume an equally strong national rebound growth rate as the observed decline in 2020 (about -1.8%). The interested reader is advised to read the full version of the working paper underlying this policy brief for full details on our data, estimation and forecasting approaches.

Results

Business Finland’s COVID-19 instrument was channeled through two types of grants: 1) Preliminary funding (maximum of 10 000 €) and 2) Development funding (maximum of 100 000 €). The funding amounts can be considered as modest compared to the usual Business Finland funding instruments: the mean granted sums in 2020 were 30 000 € lower than in 2019. Business Finland received almost 30 000 applications out of which circa 20 000 were funded. The instrument has, thus far, been the largest of the individual support measures implemented by the Finnish government under COVID-19.

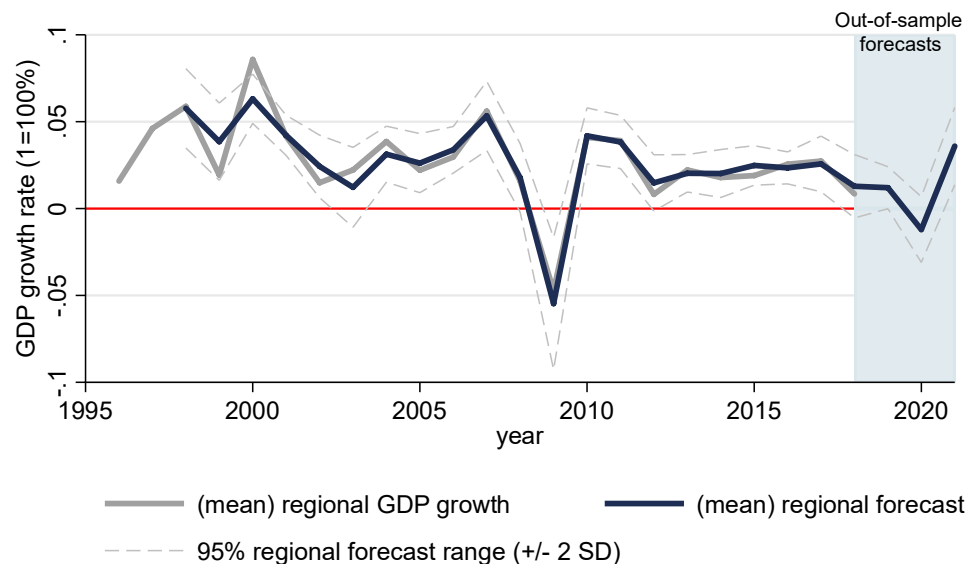
Business Finland’s COVID-19 instrument is, at least, currently the largest individual support measure implemented by the Finnish Government

The regional distribution of Business Finland funding from 1995 to 2020 indicates that firms located in the most economically developed and populous regions of Finland (centered around the largest cities of Helsinki, Tampere, Oulu and Turku) have done consistently well in attracting R&D funding. However, in terms of the Business Finland's new COVID-19 grant scheme, firms in regions such as Kainuu, South Savo and Päijät-Häme, which have historically attracted low levels of traditional Business Finland funding, have significantly increased funding volumes (measured as regional aggregates) in relation to the pre-crisis period. In fact, the above-mentioned regions exhibit the highest growth rates of attracted Business Finland R&D funding between 2019 and 2020.

Business Finland R&D funding is positively correlated with regional GDP growth

The estimation results concerning the structural growth parameters of Finnish NUTS-3 regions show that in all the specifications we ran, there is a robust statistically significant and positive conditional correlation between the Business Finland R&D funding intensity and regional GDP growth. This already indicates that Business Finland's COVID-19 instrument should also have a significant positive impact on regional recovery growth – if constant returns to R&D funding apply and no structural break occurs (robustness tests did not indicate any in-sample parameter instability).

Figure 3. In- and out-of-sample forecasts of regional GDP growth rates in Finland.



The forecast model is relatively accurate in depicting in-sample development of Finnish regions

As it can be seen from Figure 3, our baseline scenario forecast, which assume constant returns to Business Finland funding, matches the de facto mean GDP growth development in 1995–2018 accurately (only in 2000–2004 there is a slight tendency to over- or underpredict the actual growth rates). Most importantly, the in-sample prediction model identifies economic turning points correctly. For example, the model does particularly well in matching the economic slump and recovery resulting from the financial crisis of 2008.

Mean regional GDP recovery rate is estimated at 4%

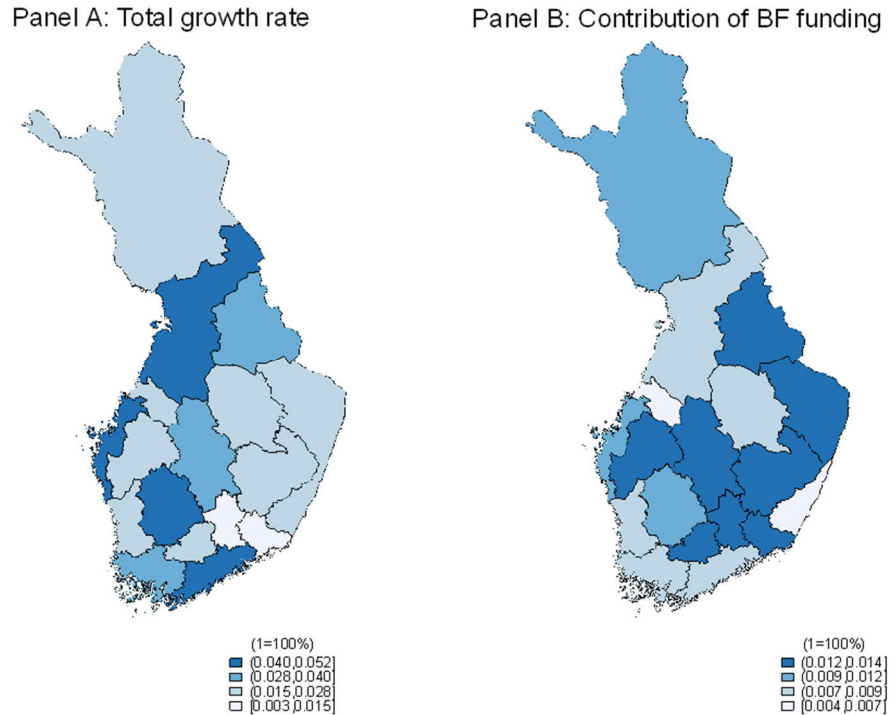
For the baseline scenario we estimate a mean regional recovery rate (GDP growth) in 2021 of between 3 and 4%. One should note though, that these forecasts are not weighted according to the regions' share in national GDP and should thus not be taken straightforwardly as an indicator for overall recovery growth in Finland. As Figure 4 further shows, the region-specific forecasts of the GDP growth rate vary approximately between 1 and 5% (as indicated by the 95% regional forecast range).

The mean Business Finland R&D funding contribution to regional GDP recovery is estimated at 1%

Based on this forecast scenario, and as visualized in Panel A of Figure 4, regions that showed the largest GDP growth rates before the outbreak of the COVID-19 pandemic are also predicted to return to their growth paths, while regions that had been struggling before the crisis are likely to recover at a more sluggish rate (cf. European Commission 2020). Therefore, the COVID-19 pandemic seems to have relatively small impact on the overall picture of regional development in Finland. The contribution of

Business Finland R&D funding to the recovery growth is expected to have a mean growth contribution of 1%-point measured in terms of the proportionate regional GDP growth rate (see Panel B of Figure 4). In general, we, thus, find that the significant increase in Business Finland R&D funding (mainly through the COVID-19 instrument) constitutes a major pillar of the recovery process of Finnish NUTS-3 regions.

Figure 4. Regional GDP growth and the contribution of Business Finland funding in the recovery growth (baseline scenario).



It is important to acknowledge three confounding issues. First, the COVID-19 instrument does deviate from normal Business Finland funding. Second, the Finnish national economy might not recover as fast as predicted in our baseline scenario. Third, there is ample evidence pointing towards decreasing rather than constant returns to public R&D funding after a certain threshold is reached (Mitze et al. 2015). Therefore, we also ran forecasting scenarios based on discount factors considering 1) that the COVID-19 instrument might not be as effective in driving regional GDP growth as the traditional funding provided by Business Finland and 2) that we might have overestimated the capacity of the Finnish national economy to bounce back from the slump of 2020.

Conservative forecasts indicate slower regional GDP recovery and a more modest Business Finland R&D funding contribution

These more conservative estimation strategies naturally lead to lower proportionate regional GDP growth contributions of Business Finland funding, estimated to range, on average, between 0.4 and 0.7%-points depending on the chosen scenario. We observe significantly smaller growth contributions particularly for those regions, where the new COVID-19 instrument has substituted normal Business Finland funding. Similarly, the more conservative estimates surmount to a lower overall mean regional GDP growth rate of approximately 2%.

Business Finland R&D funding has regionally varied outcomes

As shown in Figure 4, our results also show that the recovery growth has a distinct spatial pattern. The recovery growth follows the commonly identified differences in Finland between fast recovery in the most developed regions (for example, Uusimaa) and weaker recovery in the less developed regions. Our estimations also point out that the significance of Business Finland's COVID-19 instrument is higher for regions outside the typical growth cores. As such, the impact of R&D funding during the COVID-19 crisis seems to be more important for regions with less endogenous growth factors. Thus, while Business Finland R&D funding is in principle spatially 'blind' (i.e.,

the funding is not directed through any regional quotas but is directed to firms with the best ideas irrespective of their home location in Finland), it does result in spatially varied outcomes.

One economic question that finally needs to be answered is whether the estimated additional GDP growth contribution of Business Finland R&D funding, ranging between 0.4 and 1%-points, appears to be plausible or not. To answer this question, we can make use of a simple back-of-the-envelope calculation: If we compute the percentage share of Business Finland R&D funding in 2020 (in Euro) in regional GDP levels for 2018 (in Euro; last in-sample observation available), we find that, on average, the annual Business Finland funding volume is equivalent to 0.6% of a region's GDP (maximum 0.94%). Hence, we can expect that – even without any additionally private investments induced – the additional monetary inflow of public R&D funding into the region during the COVID-19 crisis should raise regional GDP levels by a rate that is, by and large, within the dimension our model predictions. We take this back-of-the-envelope calculation as supportive evidence for the plausibility of our predicted growth contribution of Business Finland R&D funding.

Implications for innovation policy and proposals for action

Governments are advised to support private sector R&D in times of crisis

Innovation is generally considered as the key for economic development. The need for public R&D funding arises from the risk averseness of the private sector in cases where the expected returns do not amount to profit even though the goal of the innovation might be socially desirable. As such, government efforts to facilitate innovation through R&D funding can be considered as attempts to achieve long-term economic goals, such as growth and employment, but also as a means to induce solutions for environmental and social problems. Evidence suggests that public-sector R&D is linked to high share of Finnish innovations and that it heightens regional employment, firm patenting and private R&D spending (Haapanen et al. 2017; Torregrosa-Hetland et al. 2019; Fornaro et al. 2020).

Business Finland's COVID-19 funding seems to be an effective policy instrument for stimulating regional growth recovery

Against this backdrop a major threat to innovation and subsequent economic growth during a crisis is the slowdown of R&D activities: firms postpone their future-oriented R&D investments due to cash-flow problems caused by the crisis (Deschryvere et al. 2020). While governments are also struggling with lowered tax returns and increased need for spending in other government areas (Makkonen 2013), they are nevertheless advised to support R&D counter- rather than pro-cyclically. That is, R&D funding is an important means for crisis recovery, in addition to standard business cost support, particularly if the crisis lingers (cf. Vihriälä et al. 2020). Therefore, surviving a crisis requires governments to design policies that encourage innovation. The Business Finland administered "Funding for business development in disruptive circumstances"-program seems to be a successful example of such policy implemented as it gives weight to the innovative aspects of the proposed projects rather than just mere firm survival.

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