

The Impact of Public Support for Innovation on Firm Level Outcomes

Introduction

BEIS (Department for Business, Energy & Industrial Strategy) commissioned Frontier Economics to perform an econometric analysis of the impact generated by agencies and institutions that support innovation. This study is focussed on assessing the economic impact of direct support for business innovation delivered through:

- Grants from Innovate UK (government innovation agency)
- Paid NMS services from NPL, LGC and NEL

The study assesses the effect on survival and employment up to four years after receipt of these forms of support. Moreover, it has been possible to estimate separate effects for grants from Innovate UK and NMS services provided by the National Measurement Institutes. However, this note will only discuss the part of Frontier's analysis that relates to the NMS labs.

There is clear evidence that that companies who use NMS services have higher survival rates than a control group of non-customers. Moreover, support from the NMS can boost employment by 10%-15% within 2 to 4 years; with an average cost to the state of £18k to £23k per job.

Data Sources

Frontier's analysis is based on administrative data over a 5 year period (2008 to 2012) on income for paid NMS services. The NMS services for which invoicing records were available include:

- Knowledge transfer: instrumentation, contract R&D; consultancy; and training.
- Measurement services: calibration; reference materials; and testing.

Next, this administrative data on 'treatment' was matched to Business Structure Database (BSD) which includes basic annual information on most firms in the UK and can be used to monitor survival and employment. The primary outcomes of interest were:

- 'Survival' as proxied by remaining in the BSD.
- Employment growth as measured by changes in headcount.

The BSD provides no information on a firm's previous innovation activities or whether it has used public support in the past. This problem was overcome by linking the BSD to two other datasets, namely, the BERD (Business Enterprise Research and Development) and the Business Support Database (maintained by officials at BIS).

- Appearance in the sample frame used for the BERD survey was used as a proxy for having had R&D activity in the past.
- Previous appearances in the Business Support Database was used to control for firms' varying propensities to make use of public support.

Rubin Causal Model

Rubin (1973) established what has become the dominant approach to assessing causal effects in the field of programme evaluation when using observational data (rather than experimental data). Firstly, Rubin adopted the language of 'treated' and 'untreated' units, as found in medical control

trials, and extended its domain so as to cover any type of intervention or programme. Secondly, Rubin argued that we should interpret causal statements as comparisons of potential outcomes: the outcome that occurs for a specific unit (e.g. firm) if it is treated versus the outcome that occurs for the same unit if it is not treated. Within this conceptual framework, the causal impact of an intervention is the difference between the observed outcome for a 'treated' unit and the outcome that would have occurred had the same unit been left 'untreated'. As we can't observe what would have happened had this unit been denied support, evaluations are essentially about finding a proxy for this 'counterfactual'.

Methodology

Frontier's analysis was based on Propensity Score Matching (PSM):

1. Estimate the likelihood (propensity score) that a firm with a certain set of characteristics will opt into a particular treatment. That is, use NMS services.
2. Match treated firms to similar untreated firms on the basis of these propensity scores; where the matched untreated firms constitute the control group.
3. Differences between outcomes for treated firms and their matched controls are observed up to four years after treatment occurs.
 - a. The survival effect t-years after treatment, is found by subtracting the probability (in percentage points) that a treated firm is still active from the probability that its matched controls are still active.
 - b. Frontier net off any difference in the initial number of employees (pre-treatment) between the treated firms and their matched controls. This yields a difference-in-differences estimate for the impact of treatment on employment. Hence, the counterfactual is baseline employment for treated firms plus the observed growth amongst the matched controls.
 - c. Frontier net off any difference in the initial turnover between the treated firms and their matched controls. As with employment, this yields a difference-in-differences estimate for the impact of treatment.

For the NMS it was possible to find controls for 966 out of the 2,329 firms that paid for services over a five year period. Hence, the analysis is assessing around 190 of the 470 firms using paid NMS services each year.

Main Results

Survival Effects: There is compelling evidence of positive survival effects. Survival effects grow from 5 percentage points one year after treatment to 11 percentage points after three years. Among the matched control firms, the survival rates are around 94% after one year and 84% after three years. Together, these results suggest that nearly all treated firms survive for at least four years. Finally, survival effects are noticeably larger for younger firms (2 to 5 years old) than for older firms.

Employment Effects: Generally, there are positive impacts on employment – the use of NMS services results in around 20 extra employees.¹ For the use of NMS services, the employment effects equate to an increase in employment of around 10-15% against the corresponding counterfactual outcome.

¹ Unsurprisingly, when expressed in terms of additional headcount, the effects are much smaller for younger firms.

The scale of the employment effects can be found by multiplying the annual number of (matched) treated firms by the typical effect on employment. The results suggests that NMS services generate around 3,000 to 4,000 additional jobs among the population of users who feature in this analysis. Since the NMS budget was around £54m pa with an additional £16m pa from grants, this equates to a cost to the Exchequer of around £18k to £23k per job created.²

The cost per additional job appears low relative to other interventions. Previous analysis suggests this may be due to the ‘leveraging in’ impacts public investment has on private investment. For example, the Homes and Communities Agency (2015) found that programmes focused on job creation have an indicative cost per additional job of nearly £30,000.

Assumptions

The validity of this approach rests on the following assumptions.

- On average the counterfactual outcome for the treated firms is the same as the observed outcome for the untreated firms once you control for observable pre-treatment differences between the two groups. In short, there are no unobservable elements that effect both the likelihood of being treated and potential outcomes.
- The general trend in employment - the number of new employees taken on per year - is the same for treated firms and their matched controls; which is known as the ‘common trends’ assumption and is really a special case of our first assumption.
- There is no subset of treated firms for whom opting into treatment was a total certainty. More technically, the distribution of propensity scores for treated and untreated firms fully overlap.

If the common trends assumption holds, then we would expect the average pre-treatment trajectory of employment to be the same for a treated group and its control group. In most cases, the change in employment between year t-3 and year t-1 (with treatment in year t) is similar for treated firms and their controls. That is, for the two years prior to treatment, the average number of employees taken on per year was about the same for the treated firms and their matched controls.³

² The matched treated are only about half the full number of treated firms. If the employment effects were the same among the lost firms, then this would mean £7k to £9k per job created but such claims go beyond the evidence.

³ The common trends assumption has been examined for all firms except those in the youngest age group where the approach isn’t really viable due to data constraints.