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An econometric evaluation of Scottish Enterprise grant support to businesses

Report prepared by the Fraser of Allander Institute

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Executive Summary

- Scottish Enterprise and Highland & Islands Enterprise are two of Scotland's economic development agencies. Together they offer a wide variety of support services for businesses across Scotland.

- This report evaluates the impact of Scottish Enterprise grant support over the period 2009/10-2017/18 on firms in Scotland, some of which are based in regions covered by Highlands and Islands Enterprise.

- The grants studied are:

    - Regional Selective Assistance (RSA), designed to support the creation or protection of employment, as well as capital expenditure;

    - SE R&D grants, and SMART: Scotland grants, aimed at promoting R&D activity;

    - Environmental Aid grants aimed at promoting environmental protections;

    - Proof of Concept grants, which support research commercialisation and creation of spin-out companies; and

    - Training Plus grants to encourage innovative workplace training.

- Using firm level data from UK business databases, alongside Scottish Enterprise data, we evaluate the impact of such grants on firm-level employment, turnover, and average turnover generated by each employee.

- Our methods take into account the characteristics of firms that are awarded grants so as to ensure that a robust set of results are obtained.

- There are, however, some limitations to this study which we discuss in more detail in the report, such as the availability of UK business data, the small number of recipients for some types of grants, and the varying purpose of support.

- Our findings provide new evidence on the relationship between grant support and business outcomes, and should be reviewed alongside the wider evidence base.

Key results

- The overall effects estimated using these methods are provided in Table E1 below. We find that -
    - employment levels in firms which receive grant support are – on average – higher than they otherwise would have been. This conclusion is *statistically significant*. For example, 5 years after receiving a grant firms, had, on average, employed 69 more staff than they would have in its absence;
    - there is less evidence to suggest that grants have had a statistically significant impact upon turnover, turnover per employee, or on the *growth* of any outcome (growth is not shown in the summary table);
    - for example, 5 years after receiving a grant, firms had, on average, increased turnover by £66,000,000 more than they would have in its absence. However, the variability in this estimate does not allow us to conclude the effect is statistically significant (i.e. different from zero);

Table E1 - Average effects of SE grants on all recipients 1-5 years after award

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Number of employees	+14.525*	+36.153**	+37.218**	+51.401**	+69.029**
Turnover (millions)	+38.104	+43.926	+25.353	+29.434	+66.273
Turnover per worker (thousands)	+16.053	-41.033 -	-32.236 -	-11.325 -	-36.733 -

Note: Numbers are the change in employment recipients experienced relative to that which otherwise would have occurred. Stars show the level of confidence with which we can conclude the effect is different from zero, with more stars indicating more confidence.

- Disaggregating these results, we find that the most significant employment impacts are for those in receipt of Regional Selective Assistance (RSA) grants.
- Table E2 provides the Average Treatment Effect of RSA grants on their recipients (ATT). It shows that -
    - 5 years after receiving a RSA grant, firms had on average employed roughly 92 more staff than they would have in its absence;

- there is no evidence of a statistically significant effect on turnover;
- as a result, we find some limited evidence of a small reduction in turnover per worker among RSA recipients (although the impact is generally only marginally statistically significant);

Table E2 – Average effects of RSA grants on all recipients 1-5 years after award

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Number of Employees	+19.061**	+46.720*	+49.439*	+66.967**	+91.905**
Turnover (millions)	+51.743	+59.890	+43.355	+49.285	+97.864
Turnover per worker (thousands)	-3.873 -	-57.212* -	-63.794* -	-52.398** -	-43.491* -

Note: Numbers are the change in employment recipients experienced relative to that which otherwise would have occurred. Stars show the level of confidence with which we can conclude the effect is different from zero, with more stars indicating more confidence.

- We find that the employment effects appear most significant for small and medium sized grants, but that there is no differential effect across grant sizes on turnover.
- Table E3 provides the ATT for grants valued between £100,000-£249,000, £250,000-£499,000, and £500,000-£999,999. Unsurprisingly, we find that the scale of the grant is positively correlated with the number of jobs supported. Table E3 shows that –
  - over the 5 years after a grant valued between £500,000-£1,000,000 is awarded, firms employ on average 88 more members of staff than they otherwise would have;
  - over the same horizon firms awarded a grant valued between £250,000-£500,000 employ on average 51 more members of staff (see Table E3);
  - as a result, there is some evidence of a small reduction on average turnover per worker of firms that receive grants in this range;
- Further, when considering firm attributes, we find evidence that the measured effect of grants varies according to firm size in terms of employment and turnover. In particular, the aggregate effects of grants on employment and turnover (Table E1 above) are estimated to be concentrated among small and medium sized firms.

Table E3 – Average effects of SE grants on recipients' employment 1-5 years after their award, by value

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
£100,000-£249,000	+12.16**	+14.95*	+17.21*	+21.14	+30.36
£250,000-£499,000	-2.36	+24.88***	+30.14**	+35.71**	+51.55**
£500,000-£999,999	+42.54**	+57.36**	+58.80**	+84.03**	+88.10***

Note: Numbers are the change in employment recipients experienced relative to that which otherwise would have occurred. Stars show the level of confidence with which we can conclude the effect is different from zero, with more stars indicating more confidence.

- Even when disaggregating by grant type and size we find less evidence that grants impacted on *growth* in recipients' turnover or turnover per worker.

What the results say and don't say

- Although we do not find consistent evidence of a statistically significant impact of grants on all outcomes, this does not mean that such grants have had no effect. Instead, the combination of data and methods used are unable or unsuitable to detect any impact either way.

- In the report, we discuss why this might be the case. This includes challenges with the methodology and data. The lack of statistically significant impact on certain outcomes could reflect a number of different factors.

- Unfortunately, we were only able to identify a subset of grant-supported enterprises in UK business data. This meant that we were unable to use the Annual Business Survey (ABS) to test for impacts upon GVA. We were able to identify less than 15% of SE supported firms in this database. Match rates were even smaller for other databases, such as those containing information on research and development activities.

- It should also be noted that the effects we estimate do not take into account any indirect economic impacts. Any externalities (through overemployment or indirect impacts on competing firms) or multiplier effects (for example from increased economic activity by firms or employees) are not included in our estimates.

- Going forward, we would recommend that this study is complemented with additional analysis focussed upon individual firms in receipt of grants and a consideration of how data is collected *prior* to grants being awarded or rolled-out.

1. Introduction

In spring 2019, the Fraser of Allander Institute (FAI) was tasked by Scottish Enterprise (SE) to undertake an evaluation of a range of different types of grant awards on recipient companies' outcomes. Given that some firms that received these grants are located in the highlands and islands of Scotland, this evaluation is also of interest to the economic development agency that covers these regions, Highlands and Islands Enterprise (HIE). Hereafter, we refer to SE as the body that awards the funding evaluated in this report.

The brief requested that we focus upon –

- turnover;
- employment;
- gross value added (GVA); and,
- turnover per worker (as a proxy for productivity).

This report presents the results from this analysis, concentrating on the impact of grants on turnover, employment, and turnover per worker. Unfortunately, a lack of detailed information on firms precluded robust analysis of GVA, as well as other aspects of firm performance such as R&D activity and exporting.

In order to understand the effect of grant support on these outcomes, we use administrative firm level data and an appropriate statistical methodology. Simply comparing the average performance of those firms which received support with firms who did not will give misleading comparisons. Firms accessing support from SE may be fundamentally different to those businesses which have not sought and/or received support. Economists refer to this challenge as a 'selection' effect. One way to address such issues is to use statistical matching methods. In doing so, we can hope to compare the performance of similar firms.

While this approach attempts to identify similar firms, there are a limited number of characteristics which can be controlled for. This means part of the variation in company performance between grant recipients and their matched controls could may be the result of those characteristics that remain unaccounted for. However, if there are consistent differences in the performance of the two groups it can be inferred that there is some relationship between grant support and company performance. This is in spite of our inability to estimate the precise contribution of grants to those differences.

To employ these matching methods, we use be-spoke data collected by SE on their grant recipients alongside the most comprehensive business data available. This allows us to match the recipients of grants to similar firms based on certain characteristics. Whilst such an approach is – in principle – transparent and statistically sound, it faces several challenges[1]. Despite these challenges we are able to undertake a quantitative analysis.

Using this approach, we find evidence of, on average, a boost to employment among grant recipients in the five years following a grant award. By comparing grant recipients to similar matched firms, we estimate that SE supported firms hired roughly 69 more staff over this period than would otherwise have been the case.

Given the grants considered serve a variety of purposes and are of varying value, we disaggregate these positive employment effects into contributions from individual grant types and values.

In doing so, we find that in the 5 years after Regional Selective Assistance (RSA) grants are awarded, firms hire, on average, 92 more employees than they otherwise would have. It is these RSA grants that drive the aggregate effects of grants on employment. We also find that in the year after receiving a R&D grant, firms increase employment by, on average, 31 more employees than they otherwise would have. This boost to employment relative to their matched counterparts fades after 3 years, however.

In analysing the impact of grants by size, we find evidence that those valued between £500,000-£1,000,000 have the largest, statistically significant effect on employment. In the 5 years after receiving a grant in this range, we estimate firms hire 88 more employees than they otherwise would have.

Over the same horizon firms that receive a grant valued between £250,000-£500,000 hire roughly 55 more employees than they would have.

We also examine the aggregate effect of grants across the distribution of firm size. This analysis suggests that the strongest and most consistent effects on employment are concentrated among the small and medium sized, supported firms. The effect of grants is more varied among the largest firms. Here, we define firm size within the sample, not according standard definitions of Small and Medium Sized firms (SMEs). As a result, “small and medium sized” firms are those with less than 100 employees. This is because the group of SE supported firms differs significantly from the wider population, and to focus discussion in this context.

[1] Most importantly, it relies upon an ability to identify a robust ‘control’ group. See below for a discussion

In addition, we analysed whether the impact of grants differs depending on the *type* of firm they awarded to. In the sample of SE supported firms, however, there is an extremely high correlation between the value and type of grant a firm receives, and characteristics of the firm such as their location (urban/rural), industry and account management status. For example, whilst information on location is incomplete, between 70-75% of supported firms are from large urban areas, and those that are rural predominantly receive RSA grants.

In cases such as this, examining whether the effect of grants varies depending on the type of firm (urban versus rural) is uninformative. Any difference in impact across characteristics that are highly correlated with the type or size of grant awarded would be driven by the features of the grant as opposed to the characteristics of the firm. We believe the effects of grants are driven by their size and purpose, as proxied by type, so we present results based on these characteristics[2].

Whether in aggregate or by grant type or value, we find less evidence of grants having a statistical impact upon other outcomes such as turnover or turnover per worker. This does not necessarily mean that such grants have had no impact on average (or on individual firms). Instead, it simply means that the methodology chosen for this study cannot identify any such effect either way.

This could of course be because the grants have had no impact relative to what would have otherwise been the case.

But there are also some important technical reasons why no impact may be being found – see Box 1. It should be noted that ex-post evaluations of this sort are not straightforward. Moreover, and contrary to some expectations, such evaluations may not always yield definitive conclusions (in either direction).

As a result, such econometric evaluations should be viewed as part of an overall package of mixed methods to test the effectiveness of different policy interventions. Effective use of survey work, descriptive statistics and effective appraisal and monitoring work should all be part of an overall assessment.

In our view, an area of future work for Scottish Enterprise would be to think carefully about the suite of information and data that is gathered before, during and after a grant has been awarded. Doing so, would allow a fuller assessment of a particular intervention than has perhaps been possible in the past. This is likely to include greater work at the outset to

[2] Sample size does not allow use to break down by grant type or size ***and*** location, or industry**.** It is not possible to provide a breakdown of impacts by ownership status as 65% of supported firms' foreign ownership status was recorded as unknown in the BSD.

collect data and information on the performance of firms receiving support (and crucially those that do not) and detailed monitoring of progress following receipt of the reward (ideally compared to firm-level benchmarking). Such work will not only be insightful in its own right, but will also help inform the design and focus of ex-post econometric and survey methods.

Box 1 – Barriers to ex-post policy evaluation

Firstly, by their very nature, interventions of the kind provided by SE and HIE are far from uniform. For example, certain grants might aim to minimise job losses at a plant; but elsewhere, the same grant may be used to stabilise or grow employment. Moreover, some firms might not be driven by growing turnover but some other objective. Measuring 'success' ex post – with no way of knowing what the original objective of a grant was – is almost impossible. For the same reasons, it is also difficult to find an appropriate firm with which to compare those who received support.

Secondly, the timing of any effect may vary greatly, both across firms and grants. For example, the effects of R&D grants on turnover might not be realised until many years following the start of a project. This also depends, however, on the project itself and the industry in which the firm operates.

Thirdly, there are challenges with the quality of the underlying data, the way in which grants are recorded and the limitations of examining a relatively small number of grants. In Scotland, there is also the issue of the *number* of firms available for comparison. This is particularly the case for R&D grants where there are few similar companies to compare against, and those that can be found, are also quite often in receipt of similar support.

Finally, in the UK, the quality of 'matching' that can be undertaken to find comparable 'controls' is not as good as it is in other countries. A lack of detailed information on, for example firm costs, value added, and exporting and R&D activity makes it difficult to find the most suitable comparison firms.

The remainder of this report is structured as follows: in Section 2 we provide some background and context for the award of business support grants by SE. In Section 3 we explain our methodology, before describing the data used in Section 4. In Section 5, we present a summary selection of our results. A suite of robustness checks is provided in the appendices. Section 6 concludes.

2. Background and context

SE and HIE are two of Scotland's economic development agencies, responsible for supporting business growth and development in their respective geographies.

Both institutions regularly test the impact of their support activities. The purpose of this study is to evaluate the impact of grant support provided by SE.

The enterprise support 'journey' for firms is complex, with a range of grants available and wider support often provided alongside. This approach is necessary given the varied make-up of Scotland's business base and the different stages of growth and/or development that businesses find themselves.

The specific format for each grant will vary depending upon its different purposes.

The longest running support package are Regional Selective Assistance (RSA) grants. RSA grants are designed to support the creation or protection of employment, as well as capital expenditure.

Other grants include those supporting R&D activity – for specific SE R&D grants, and SMART: Scotland grants which support Small and Medium Enterprises (SMEs) to undertake technical feasibility studies as well as R&D.

There are also grants for environmental protection projects (Environmental Aid), supporting research commercialisation and creation of spin-out companies (Proof of Concept), and for innovative workplace training (Training Plus).

Each of these six types of grant – RSA, R&D, SMART: Scotland, Environmental Aid, Proof of Concept, and Training Plus – cover a wide variety of activities and values[3]. During the period with which this study is concerned - 2009/10-2017/18 - over £500,000,000 of these grants were approved by SE[4].

Given their scale and coverage, there is keen interest in the efficacy of SE grant support. Key metrics of interest include possible impacts upon turnover, employment, productivity, engagement with overseas markets, and value added.

[3] Firms can also be in receipt of various external support measures, such as EU funding.

[4] Not all of the projects for which these grants were approved will have proceeded, and not all grants will have been used fully as of yet.

3. Methodology

The aim of this evaluation is to test and quantify the effect *on average* of being awarded a SE or HIE grant – what economists call a type of 'treatment' **–** on firm performance[5].

These *treatment effects* can tell us how grants affect firm performance along a number of dimensions.

Before presenting the methodology in more detail, we begin this section by briefly discussing:

- the nature of *selection effects* and why they prohibit comparison of the raw outcomes of treated and untreated firms; and,
- how we implemented our matching analysis to produce the results presented in the next section of this report.

Selection

A key challenge in attempting to test for the average effect of a grant is that we cannot observe the full characteristics of firms that are either given or not given grants.

Whilst it is possible to use information provided by SE to identify which firms in Scotland have received a grant, little is known about their underlying characteristics. This is even more of an issue for firms not in receipt of support.

This poses the risk that any differences in outcomes could be the result of firms **selecting** into the funding process: for example, it could be that certain types of firms are more likely to apply for grants (e.g. because they are more ambitious), or SE awards funding to certain types of firms.

Differences in the characteristics of firms receiving grant support can either be –

- Observable: for example, firm size, industry or age; or,
- Unobservable: for example, quality of governance, management, or working culture.

In the case of observable differences, average treatment effects can be estimated by adjusting for these observable differences in a number of ways. Here we focus on **matching,** a method that ensures that we compare firms with similar observable characteristics.

In the case of unobservable differences, selection is naturally more difficult to address.

[5] The nomenclature of "treatment", and later the complementary "control", stems from the experimental ideal of randomly assigned medical treatments to patients. It is now common in social sciences to use this term to describe any form of intervention, the impact of which on the "treated" is of interest.

A standard approach, however, is to make use of repeated observations on firms over time which enables us to use **differencing** methods to try and eliminate - or at least reduce - the effect of these unobservable factors. These methods compare the performance of different firms over time, and rely on the assumption that any differences in, for example, management or work culture, between the two groups would be constant in the absence of a grant.

Box 2 explains the method in a more detail. Appendix A provides a more technical description of difference-in-differences.

Box 2: Econometric methodology

The methodology employed attempts to isolate any changes arising from the award of a grant from all other factors that may explain differences in firm performance. Some of these are observable – e.g. size and sector. Others – such as the ambition of the management team – are not.

In the first stage, we attempt to account for observable differences through a matching exercise. It would make little sense to compare the performance of a manufacturing firm with more than 250 employees with a financial services firm with fewer than 50 employees. So we seek to identify similar firms. Of course, the larger the sample of untreated firms, and the more detailed the information available, the better the potential match.

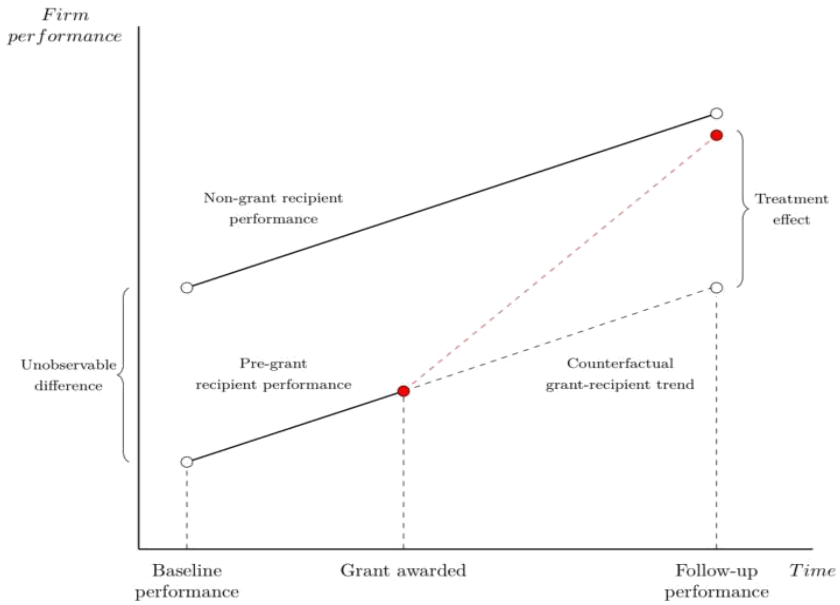
We identify each grant recipient's "nearest neighbour" in the population of non-recipients in Scotland – i.e. the firm based in Scotland that did not receive a grant to which they are most similar in terms of observable characteristics such as turnover, employment, and industry[6]. It should be noted that, unlike some other countries, we have a relatively limited number of firm level characteristics available from UK business databases.

In the second stage, we attempt to control for unobservable differences. In the case of our hypothetical 250+ employee manufacturing firm, it might be the case that it has unobservable characteristics – such as management quality – that improve its inherent ability to utilise a grant, and that this ability is not common to other firms of a similar size or industry.

If repeated observations on firms are available over time, the problem of unobservable selection can be addressed. This is achieved by differencing firm outcomes over time, and relies on the assumption that these unobservable characteristics would not change in the absence of treatment (see Figure 1). Figure 1 depicts a simple, two-period difference in differences comparison. On the y-axis is average firm performance. The x-axis indicates time.

[6] Traditionally, estimating treatment effects by nearest neighbour matching involves constructing a counterfactual outcome for both the treated and untreated that is the weighted average of their nearest 'neighbours'. The weights measure how "close" each observation's nearest neighbours are to sharing the exact same characteristics.

Figure 1: Difference–in–Difference analysis



Source: Fraser of Allander

The two left-most white dots represent the initial point of observing both the 'treated' and 'control' firms, their baseline performance. At this point, the vertical distance between two white dots represents the difference in performance due to unobservable characteristics. Moving along the x-axis, the middle red dot represents the time at which a grant is awarded to the treated firm.

The red dashed line from this point onwards then shows the trajectory of the treated firm's outcome post-treatment and the black dashed line its unobservable trajectory in the absence of treatment. The endpoint of this unobservable trajectory, the counterfactual follow-up performance shown by the right-most white dot, is what we hope to proxy with the control group.

Importantly this methodology assumes the award of a grant to one firm does not affect the outcomes of any other supported or matched control firm. This might be violated if firms compete closely for labour or sales. Matching is not carried out *within* regions of Scotland to minimise the likelihood a grant recipient is compared with a firm competing locally, however results must be viewed with this assumption in mind.

Effect estimates using this methodology do not consider any inefficiencies caused by grants or subsidies. In the example of employment, it identifies only the effect on the employment of treated firms relative to the matched controls and does not explicitly account for any aspects of labour supply of wider economic effects, such as generation of deadweight loss.

4. Database construction

With our methodology in place, we then constructed the relevant database. We used two main datasets:

1. Detailed information on firms awarded SE/HEI grants (provided by SE);
2. The Business Structures Database (BSD) from the Office National Statistics (ONS).

These data were cleaned and transformed into the format required to produce valid estimates of the impact of grants that were tailored to the way in which they were awarded. It also dictated which information provided by SE could be used in assessing the impact of grants.

For these reasons, the following sections provide detail on these data and a step-by-step guide on how they were prepared for use.

Identifying firms in receipt of grants

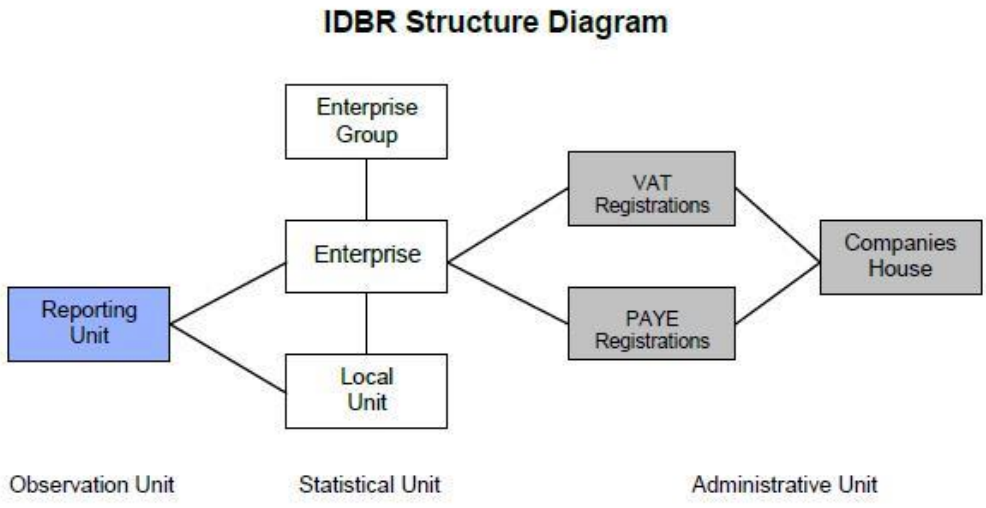
SE maintain a database containing the details of all grants awarded during the period 2009-2017, including the names, addresses and postcodes of the recipients. Using this information, statisticians at the Scottish Government sought to identify recipients in the Interdepartmental Business Register (IDBR) – an administrative record of all businesses registered for Value Added Tax (VAT) or operating a Pay As You Earn (PAYE) scheme.

The Scottish Government provided a database to the UK Data Service (UKDS) containing the *enterprise number* of each firm alongside details of the nature and timing of the grant(s) received. The ability to retrieve enterprise reference numbers from the IDBR determined the maximum number of supported firms that could be located within the business database.

Importantly, an enterprise can be comprised of more than one *local unit* (*plant*), and also be a part of a wider enterprise group – Figure 2 illustrates the structure of the IDBR.

For example, Smith Holdings, an enterprise group, might be comprised of three separate enterprises – Smith Shoe Repair, Smith Catering, and Smith Property. Each of these enterprises can further be comprised of local units. Smith Shoe Repair might have two local units, one in Edinburgh and another in Glasgow. Smith Catering could have several local units scattered between Stirling and Dundee.

Figure 2: IDBR structure



Source: BSD User guide

We focus our evaluation on the 'enterprise'. We choose not to focus on the enterprise groups due to their size and diversity. As a result of these attributes, it is unlikely grants are applied for or awarded to whole enterprise groups. Also, turnover is recorded at the enterprise and not the local unit level so we do not focus upon the local unit identifier.

The database provided by the Scottish Government to the UKDS contained 1,933 entries, 92% (1,780) of which contained a reference number as a result of matching[7]. This is a larger number of grants than SE reported to have awarded over the period in question.

These 1,780 entries, however, represented only 1,204 unique enterprises, indicating that a number of entries in the matched SE-IDBR data arose due to either an enterprise being awarded more than one grant in a year or over multiple years, or that there were features of the Scottish Government matching process that lead to duplicates being provided.

We therefore are required to make a number of assumptions.

Firstly, we assume that entries with the same enterprise number but report different years of award represent enterprises that receive multiple grants in multiple years. This was the case for 498 observations, representing 209 enterprises. Here we retain the value of the first grant that the enterprise was awarded and record the cumulative value of all support.

[7] The matches between the enterprises in the SE data and the IDBR were not perfect. For example, only 55% (979) of those in the former could be found in the latter based on their name, address and postcode. The remaining 45% (801) were matched based on only one or two of these.

Secondly, where entries that have the same enterprise number have identical years of grant award, we assume they received multiple grants in one year. In these cases, we use the total value of grants awarded in the year. 445 observations on 164 enterprises were captured in this way.

This approach ensures that no grants received are discarded from the analysis. It does however, have some limitations – for example, it is not possible to disentangle the effect of individual grants received by these enterprises.

The final database of SE supported firms contained 1,204 entries on enterprises that received at least one grant between 2009 and 2017.

Finding Enterprises in the Business Structures Database

With their enterprise identifiers retrieved, SE or HIE grant recipients were linked to the Business Structures Database (BSD) in the year ***before*** award***.*** This provides respective base years from which to evaluate the effect of support.

For example, if an enterprise was recorded as being awarded a grant in the 2016 financial year, it was linked to the BSD in 2015[8]. Doing so ensures any comparisons reflect pre-grant conditions.

Of the 1,204 enterprises that received at least one grant, data on 682, or 58%, were found in the BSD in the year prior[9].

There are several reasons why an enterprise may not be located in the BSD. For example, they may have not directly employed any PAYE registered workers or were not registered to pay VAT in the year prior to receiving a grant (e.g. if the firm was small).

Inward investors may also not appear in the BSD prior to receiving a grant since they may use some of the grant to *create* a new enterprise. Similarly, new enterprises that are created by indigenous companies will not be present for the same reason.

As an aside, the proportion of supported enterprises found in the BSD increased to 68% and 84% when linking the SE and BSD data in the year of and year after the award of a grant respectively. In addition, the proportion of SMART: Scotland and Proof of Concept (grants

[8] We were given the financial year of grant awards, whereas the BSD provides information over a calendar year. As such, the initial calendar year of the financial year in which an enterprise was awarded a grant was treated as its "grant year".

[9] 21 of these were located outside of Scotland.

aimed at small business R&D and commercialisation of products respectively) recipients is significantly smaller among those found in the BSD than those that were not.

Similarly, the number of RSA funded start-ups in the supported firms that are successfully matched to the BSD is far lower than in those that are not. The number of inward investors remains relatively unchanged across the two groups however, suggesting enterprise creation is not as pronounced among this group of grant recipients. As we do not use information on enterprises that cannot be found in the BSD in the year prior to receiving support, the inability to identify 42% of grant recipients has important implications for our analysis. Discarding these observations affects the conclusions that can be drawn from estimates of the impact of SE support, as well as the extent to which we can analyse them by grant type.

For example, as small companies are disproportionately affected by the criteria for inclusion in the BSD, the results of our analysis will not necessarily apply to them. Companies that are created as a result of SE funding are also excluded from our analysis, with the same consequence. Given that these enterprises are awarded distinct types of grant – for example small enterprises are far more likely to receive SMART: Scotland grants - their exclusion constrains any grant-specific evaluation.

We also sought to undertake an evaluation of the impact of these grants directly on the GVA generated by recipient firms. To do so required matching our grant data to the Annual Business Survey (ABS) data. Unfortunately, the low proportion of supported enterprises that we were able to find in the BSD meant that we were unable to extend our analysis in this way. Data on firm GVA is only available in the ABS, which contains information on a small sub-sample of firms in the BSD. As a result, we were able to identify less than 15% of SE supported firms in this database which is not large enough to carry out robust analyses on GVA. Match rates were even smaller for other databases, such as those containing information on R&D and exporting activities, meaning these could also not be used for analysis of the effect of grants on innovation and trade.

Matching grant recipients to comparable enterprises

Once grant recipients were identified in the BSD, a sample of comparable enterprises was constructed using the methods outlined in Section 3. More specifically, for each enterprise in receipt of SE funding a Scottish firm similar in terms of their employment, industry, turnover, and age in its base year were selected[10]. We ensure that all grant recipients are matched to

[10]We determine an enterprise to be "Scottish" on location as opposed to ownership. For robustness, matching was also carried out using firms in the North West of England. Matches were found using the statistical software package Stata's –*teffects*- command. See Appendix B1.

enterprises in their respective base years that do not receive a grant in any subsequent year. All un-supported enterprises that were not selected as a match for a grant recipient in its base year were not used in the analysis, the result being a sample consisting of 653 SE funded enterprises and their matched comparison enterprises in the year before they received a grant.

Table 1 shows a comparison of the SE supported firms (column 1) to all firms in the BSD in 2012 (column 2) and a comparable matched sample of Scottish firms not-in receipt of a grant (column 3). Panel A shows the average (mean) number of employees, turnover (in thousands of pounds), and turnover per worker (also in thousands of pounds). Numbers in parentheses are standard deviations.

Comparing standard deviations with their respective averages gives an indication of how varied outcomes are among the sample in question. For instance, if employment across firms in the sample is normally distributed, then the employment level of about 68% of firms will lie within one standard deviation of the mean (so between (average employment – standard deviation) and (average employment + standard deviation)). The first row of column 1 of Table 1 tells us that the average number of employees in a SE supported firm is roughly 100, but that the standard deviation is 540 employees. This suggests that the level of employment among these firms is extremely varied. This can be a result of the firms being extremely varied, or of there being small number of extremely small or large firms in the sample If, for example, the standard deviation was 10 employees, however, we would be able to say that the level of employment among SE supported firms does not vary a great deal.

Supported firms tend to have more employees and higher turnover on average than the wider population but are similar in terms of turnover per employee. They also have, on average, higher and less volatile annual growth in employment and turnover than the wider population of firms in Scotland. The matched firms similarly have higher average annual employment growth that the wider population, however they are much more volatile than both the SE supported and wider population of firms in terms of this measure. They do, however, have smaller and less volatile average annual turnover growth than both other groups.

By comparing columns 1 and 3, we can see that the matched sample of firms closely resembles the sample of grant recipients when considering all three outcomes. This suggests the matching has successfully minimised differences in the specified observable characteristics of the two groups of firms.

Panel B shows the proportion of firms in the sample by size (numbers in square brackets represent the *number* of firms in each category). Panel B again highlights the differences in terms of size distribution between supported firms and the wider population (columns 1 and 2), and that this distribution is much more similar in the matched sample (columns 1 and 3).

Panel C shows the proportion of firms by broad industry group. Again, the numbers in square brackets represent the *number* of firms in each category. Comparing columns 1 and 2, we see that SE supported firms are more likely to be in manufacturing. Column 3 shows that this industry distribution is well matched.

Panel D shows the proportion, and again number in square brackets, of firms that received a grant in each year between 2009-2017. Column 1 shows that grants were relatively equally spread out over the decade, but that slightly less firms received support in 2011, 2015 and, to a lesser extent, 2016.

Table 1 – Average (mean) characteristics in SE supported enterprises, Scottish enterprises in the 2012 BSD, and enterprises similar to the SE supported firms.

	(1) Treated Scottish Firms	(2) All Scottish firms 2012	(3) Matched Scottish Firms
Panel A: *Matching variables (numbers in brackets are standard deviations)*			
No. of employees (FT + PT)	99.45 (540.0)	12.35 (419.1)	94.77 (485.1)
Average annual % change in employment 09-18 (when present)	23.15 (238.41)	10.50 (307.54)	29.50 (1048.06)
Turnover (£000s)	30,705.9 (462,118.2)	2,264.6 (284,776.4)	28,037.7 (412,775.6)
Average annual % change in turnover 09-18 (when present)	70.89 (1,310.99)	65.61 (6,565.24)	42.95 (909.99)
Turnover per worker (£000s)	133.8 (302.0)	133.3 (2,803.5)	134.5 (255.3)
Panel B: *Proportion in employee number bands (numbers in square brackets)*			
0-9	0.405 [264]	0.882 [148,025]	0.406 [263]
10-49	0.363 [237]	0.0882 [14,621]	0.363 [235]
50-99	0.0934 [61]	0.00994 [1,648]	0.0926 [60]
100-249	0.0689 [45]	0.00525 [870]	0.0679 [44]
250+	0.0704 [46]	0.00373 [618]	0.0710 [46]

Table 1 (cont.)

	(1) Treated Firms	(2) Scottish firms 2012	(3) Matched Controls
Panel C: Proportion in growth *industry groups (numbers in square Brackets)*			
Business Services & Finance	0.263 [172]	0.275 [45,604]	0.265 [172]
Distribution, Accommodation & Food Services	0.0827 [54]	0.244 [40,516]	0.0833 [54]
Manufacturing	0.436 [284]	0.0505 [8,372]	0.438 [284]
Other Services (inc. Government)	0.0284 [18]	0.125 [20,775]	0.0185 [22]
Transport, Storage & Communication	0.150 [98]	0.0766 [12,696]	0.140 [91]
Panel D: *Proportion of firms awarded a grant in each year (numbers in square brackets)*			
2009	0.132 [86]		0.133 [86]
2010	0.112 [73]		0.113 [73]
2011	0.0965 [63]		0.0972 [63]
2012	0.135 [88]		0.136 [88]
2013	0.104 [68]		0.103 [67]
2014	0.127 [83]		0.125 [81]
2015	0.0781 [51]		0.0772 [50]
2016	0.103 [67]		0.102 [66]
2017	0.113 [74]		0.114 [74]
N	653	165,782	648

Note: All statistics are the mean value of their corresponding variable, noted in the left-most column. Standard deviations are in parentheses where applicable. For the banded employees and industries variables are binary and equal to 1 if an enterprise has the respective number of employees or is in the respective industry. As a result, the means are proportions of the Scottish enterprises in the BSD that fall in each category. The underlying *number* of enterprises that fall in each respective category are in square brackets. N represents the total number of firms in each sample. The "Matched Controls" column represents a sample of Scottish firms from the BSD that were reasonably similar to the SE supported firms. The "Year of Grant" panels shows the proportion of enterprises that received a grant in each year, or in the case of column (3) that have been matched to an enterprise that received a grant in that year. There are five less observations in column (3) than there ae in column (1) because 5 pairs of firms were matched to the same control as one another.

Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; *and* Scottish Enterprise.

In Table 1, we use all Scottish firms in 2012 (column 2) as the comparison year, whereas data on the treated (column 1) and matched (column 3) firms come from any year between 2008 and 2016. Using this middle year for comparison should minimise the extent to which our comparison misrepresents the population in each individual base year. Appendix Table A2 shows that the composition of the Scottish enterprises BSD changed little over the period 1998-2018.

Appendix B1 provides similar results but this time on a matching exercise with firms in the North West of England. We find that the matching process is more successful when using Scottish firms.

Once grant recipients were matched, data on all recipients and their matched firm were retrieved from all other years of the BSD. Thus, the final sample for analysis contained data on employment and turnover for the 653 SE funded enterprises and their matched comparisons over a maximum of twelve years[11].

Robustness – identifying and excluding volatile growth firms

Turnover and employment can be volatile. We find several instances of very high turnover and employment growth in the database.

For example, 30 enterprises in the matched sample are recorded to have employment growth of over 1,000% in a year, 10 of which are supported firms. Similarly, 100 enterprises in the matched sample are recorded as having turnover growth above the same threshold, 51 of which were in receipt of a SE grant.

These very high growth rates might significantly impact estimates of the effect of grants, skewing any 'average' result upwards. This could be of particular relevance when analysing the effects of specific grants – for example, all enterprises with growth over 1,000% in employment in a year are recipients of RSA funding.

One way to address this is to focus, as we do in this report, on the effect of grant awards on the level of employment, turnover and turnover per worker.

Another, is to repeat our central estimates using a smaller sample of enterprises excluding those firms with annual growth exceeding 1,000%, 500%, and 100%. Of course, these growth rates are consistent with very different increases in, for example, the number of employees a firm has depending on its initial level of employment – for a 1 employee firm to grow 1,000%

[11] Not all enterprises, whether a grant recipient or control, were present in the BSD in all twelve years, meaning this final dataset was an *unbalanced* panel of firms. 79.5% of se supported firms were in the data for all 12 years, only 4.8% were present for less than 8 years.

it only needs to hire 10 employees, whereas for a firm with 100 employees growth of this extent would require an additional 1000 employees. We bear this in mind in our analysis.

We are not advocating ignoring these firms and their impacts, but simply seeking ways to understand how sensitive the results are to particular observations. We also present estimates of the differences in the growth rates of those outcomes for firms receiving a grant in an appendix to this report.

5. Results

In this section, we present our results from estimating the ATT (Average Treatment Effect on the Treated) using the methodology outlined above.

We first show the overall ATT across grant recipients.

However, given that the seven different grant types considered have distinct purposes, targets and conditions, aggregating estimates of their effects will not give any indication of whether they achieved their aims. Therefore, we then provide results disaggregated by type of grant.

We next examine grants broken down by value, and finish by providing results of the overall ATT by firm size in terms of employment and turnover.

There are a number of important factors to consider when reviewing the results –

1. Given the different types of grants and characteristics, our analysis provides a large number of results. We present a set of headline results here, with robustness checks in the appendix.

2. With a dataset of over 30 million observations, undertaking matching is a computationally demanding exercise[12] and can never be an exact science. Point–estimates will change slightly depending upon the matching approach employed.

3. Most significantly, given the relatively small sample sizes involved for SE grant awards, generating results with enough precision to determine that results are statistically significantly is a challenge. This is particularly true for the case where a small number of

[12] As an illustration, the extension of our matching process to consider firms in the North West of England added, just to the time needed for the matching, around 8 hours of computation time.

grants have been awarded[13]. Unfortunately, there is limited corrective action that can be taken in the context of such an ex-post econometric evaluation.

We have done our best to maximise our chances of detecting statistically significant effects.

Of course, where we are not finding a result to be statistically significantly different from zero, we would caution that this does not necessarily mean that the support has not had an effect. Instead, it might simply mean that, given the sample and the methods available, our tests are underpowered and an alternative means of evaluation may be considered.

Finally, given interest in exploring multiple dimensions of grant awards, it is important to look across different sets of results to piece together a picture of the effect of different grant awards.

We conclude this section with a brief discussion of the barriers to further breakdowns by firm characteristics.

The average effect on the treated

Table 2 shows the ATT estimated using a matched sample where the control firm for each treated firm is the firm that is the nearest neighbour match within Scotland. We do this for three outcomes: the number of employees (Panel A), turnover in millions of pounds (Panel B), and turnover per employee in thousands of pounds (Panel C). Each column of Table 2 represents the effect estimates 1-5 years after receiving a grant respectively[14].

These ATTs can be interpreted as the difference in each outcome between treated and control enterprises. For example, the ATT on employment in column 3 of panel A represents the average difference between the change in employment of grant recipients and non-recipient 3 years after support. In this case, those in receipt of a grant appear to have 37 more employees – on average – three years after they are awarded a grant than the matched cohort of firms that did not receive a grant.

The numbers in parentheses are standard errors which indicate the statistical accuracy of the coefficient (point) estimate. It is the ratio of the ATT coefficient to the standard error which provides an indication of how precise the estimates are[15]. Stars above any numbers in Table 2 – and all other tables – indicate the degree of precision, with more stars meaning the ratio

13 There are ways to calculate the minimum sample size required and these are discussed in more detail here: http://www.stat.columbia.edu/~gelman/stuff_for_blog/chap20.pdf.

14 In Table 2 the sample size changes across panels in a column as there are less firms available to evaluate if the follow-up period is elongated – it is not possible to evaluate the impact of a grant awarded in 2016 five years later.

15 For example, a ratio of 1 between an ATT and its standard error would indicate the estimate is imprecise and that we cannot assume with any confidence that the effect is in fact zero i.e. the grants had no impact on recipients relative to their matched controls. The closer this ratio is to zero, the more imprecise is the estimated ATT.

is higher. At the bottom of each column/panel combination, 'N' indicates the number of *observations* used to estimate the respective ATT – this is the number of firms multiplied by the number of points in time from which data were used. For example, in column 1 of Panel A in Table 2, 1,130 firms were used to estimate the ATT presented, roughly half of which were supported by SE. Data from two points in time were used to estimate the effect (which is the difference in change in outcomes over time) so, in total, 2,260 data points (observations) were used[16]. The same rule applies to all tables that follow.

Focussing on panel A, the aggregate ATT on employment is positive and relatively precise in each year. In fact, the effect on employment is increasing over time, with grant recipients being estimated to have, on average, employed 15 more people one year after receiving support, and 69 five years after.

Panel B shows that there is estimated to be a positive impact on turnover in each year after firms are awarded grants, but that this effect is not statistically significant.

This means that in our sample we cannot reasonably conclude that between 1 and 5 years after being awarded a grant, turnover of grant recipients increased, on average, by a significantly greater amount than for non-recipients.

A similar conclusion is drawn from Panel C, which shows estimates of the ATT on turnover per worker.

In summary, Table 2 shows the average ATT of receiving a grant to be positive for employment, with firms in receipt of a grant having higher employment in each of the five years after a grant is awarded, but there is no statistically significant effect detected on the turnover or turnover per worker for those firms.

In Appendix C (Tables C1 and C2) we present results analogous to those in Table 2 but exclude firms with growth in turnover or employment greater than 1,000%, 500%, or 100%. Excluding firms with 1,000% annual growth and 500% annual growth does not qualitatively change the conclusions, albeit as we would expect the point estimates do change slightly.

However, when we exclude those firms with growth of 100% or more our estimate of the effect of grant award on employment drops significantly and become less precise. Similarly, the estimated ATTs for turnover area also greatly reduced. These results suggest that firms

[16] In column 1 of Panel A in Table 2, the number of supported firms used is 587. This is less than the number that were contained in the final dataset of matched SE supported firms (653) as data were not available for all firms in both the base and follow-up years.

experiencing between 100% and 500% growth are driving a substantial amount of what we found in Table 2.

Another way to look at the effect of grant awards on firms is by looking at whether there is an impact on the average annual growth of employment, turnover, and turnover per worker, of recipient firms. The corollary to Table 2 is Appendix Table D1. The comparison is made with average annual growth after 1-5 years[17]. The results show a positive but imprecise ATT on average annual employment growth in each year after grants are awarded.

The beginning of Appendix D outlines some issues that arise when using growth rates as outcomes. The estimated ATTs for average annual turnover and turnover per worker growth are also imprecise, meaning, again, we cannot conclude the aggregate, average effect of the grants on these outcomes was different from zero.

Table 2 - Average treatment effect on SE supported enterprises (ATT) 1-5 years after receiving a grant

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment (FT + PT) level change*					
ATT	14.525* (8.107)	36.153** (18.128)	37.218** (18.895)	51.401** (23.789)	69.029** (30.934)
N	2,260	2,100	1,976	1,859	1,694
Panel B: *Turnover level change (£000,000)*					
ATT	38.104 (26.335)	43.926 (30.536)	25.353 (36.151)	29.434 (40.975)	66.273 (52.880)
N	2,260	2,100	1,976	1,859	1,694
Panel C: *Turnover per worker level change (£000)*					
ATT	16.053 (20.764)	-41.033 (32.030)	-32.236 (41.600)	-11.325 (42.794)	-36.733 (23.025)
N	2,256	2,096	1,972	1,855	1,690

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. N denotes the number of observations – the number of firms multiplied by the number of time periods used (2) in each column. ATT is an interaction of two binary variables, one which indicates an enterprise received support and one which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; *and* Scottish Enterprise.

[17] Comparing using annual average growth 2-5 years before the award of a grant as opposed to 1 would require firms to be in the BSD between 1-5 years before they were funded by SE or HIE. This restricts the sample even further, so we choose to use their growth in the year prior.

ATT by type of grant

Having found a clear and persistent effect of grant awards on employment but not on turnover, we disaggregate these results by grant type.

Due to the small number of firms that received Environmental Aid, Proof of Concept, and Training Plus grants (henceforth "other" grants), firms receiving any of these supports have been grouped in to one category. These are distinct types of grants that serve different purposes and are awarded to firms in different industries, so this grouping will limit any inference that can be made from their estimated ATTs. We choose to include them in our analysis in this way rather than exclude them altogether. The number of firms in the sample that were in receipt of each type grant is given underneath their title in the left-most column of Table 3[18].

Table 3 shows the ATT of each grant on employment, turnover, and turnover per worker. Looking across Panel A it appears that the aggregate effects on employment shown in Table 2 are driven mainly by the positive and relatively precise effect of RSA grants on employment in each of the 5 years after receiving funding. As in Table 2, this positive effect is also increasing over time. RSA grant recipients are estimated to have, on average, **employed 19 more people employed one year after receiving support, and 70 five years after.**

R&D jobs appear to have a non-zero effect on employment in years 1 and 2, but, whilst increasing in magnitude, we cannot conclude it is different from zero thereafter. **Those that receive one of the "other" grants are estimated to increase employment on average by 130 employees relative to their matched counterparts 5 years after receiving support.** However, we cannot apportion any increases to the grants individually.

Panel B shows that, in addition to the aggregate effect, the grant specific ATTs are statistically indistinguishable from zero for turnover. **R&D and RSA grants do have consistently positive ATTs, however the effects are not significant.** Panel C shows that, while in the case of the aggregate ATT on turnover per worker we could not conclude the effect was different from zero, there is some evidence or more precise, grant-specific effects. **RSA grants are estimated, with some precision, to negatively affect the change in turnover per worker of recipients compared with the non-recipients 2-5 years after support is awarded.**

[18] These numbers are only shown in panel A of Table 3 as they are identical allacross Panels A, B, and C.

Table 3 - Average treatment effect on SE supported enterprises by type of grant

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level (FT + PT) change*					
Environment Aid/Proof of Concept/Training + *(No. supported firms =10)*	-257.471 (219.567)	12.172 (38.893)	16.989 (34.123)	50.368 (59.467)	130.429*** (26.285)
R&D *(No. supported firms =25)*	31.706** (14.803)	36.339* (18.655)	40.117 (36.855)	98.035 (83.065)	51.529 (55.733)
RSA *(No. supported firms =362)*	19.061** (9.263)	46.720* (26.937)	49.439* (26.979)	66.967** (32.554)	91.905** (42.257)
SMART *(No. supported firms =104)*	6.435 (5.788)	7.699 (8.210)	5.314 (9.210)	7.749 (13.812)	19.454 (19.137)
N	2,081081	1,933933	1,820820	1,710710	1,558558
Panel B: *Turnover level change (£000,000)*					
Environment Aid/Proof of Concept/Training +	68.062 (53.663)	-5.745 (36.527)	-56.316 (47.996)	-48.778 (44.087)	66.525* (36.060)
R&D	16.330 (15.453)	25.128 (20.515)	57.044 (52.368)	108.575 (101.399)	42.172 (70.495)
RSA	51.743 (39.323)	59.890 (44.584)	43.355 (54.110)	49.285 (60.676)	97.864 (81.449)
SMART	12.644 (13.069)	15.374 (16.071)	-14.134 (11.516)	-17.659 (13.958)	5.014 (9.686)
N	2,081	1,933	1,820	1,710	1,558
Panel C: *Turnover per worker level change (£000)*					
Environment Aid/Proof of Concept/Training +	-5.195 (30.703)	-141.324 (105.226)	-214.393 (154.030)	-169.551 (108.089)	19.331 (41.872)
R&D	-45.361* (23.768)	-73.702 (46.665)	751.559 (746.786)	1309.281 (1330.642)	-120.367 (100.119)
RSA	-3.873 (18.063)	-57.212* (31.978)	-63.794* (35.929)	-52.398** (26.647)	-43.491* (25.612)
SMART	-1.354 (13.641)	-34.105 (31.110)	-36.814 (36.756)	-36.492 (26.639)	-19.490 (23.815)
N	2,077	1,929	1,816	1,706	1,554

Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; *and* Scottish Enterprise.
Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. In each panel, post-treatment denotes a variable indicating whether or not an observation one an enterprise comes after the receipt of a grant; the four following categories represent the variables indicating whether or not an enterprise received a particular type of grant; and N denotes the number of observations used.

Appendix Tables C4-C6 present results analogous to those above but exclude firms with growth in turnover or employment greater than 1,000%, 500%, and 100%. These results portray a similar picture. Again, small firms who experience between 100%-500% growth after receiving support appear to be driving the impacts of individual grants. Appendix Table D3 shows analogous estimates to those above with average annual growth in employment, turnover, and turnover per work as outcomes. In terms of the ATT in average annual employment growth, the only evidence of a grant-specific effect is for R&D grants. This is despite there only being evidence for a non-zero effect on the level of employment 1 and 2 years after the award of a grant. There is some evidence that recipients of R&D and RSA grants experienced, on average, a larger change in average annual growth in turnover from 3 years after receiving support. There is no evidence, however, that there is any effect on turnover per worker.

ATT by grant value

Table 4 shows the ATT of grants by value on employment, turnover, and turnover per worker. As in Table 3, the number of firms in the sample that were in receipt of each type of grant is given underneath their value in the left-most column of Table 4[19].

Panel A shows that, when disaggregating by grant value, the overall ATT on employment shown Table 2 appears to be driven by the effect of grants valued between £100,000-£1,000,000. Given the key role of RSA in boosting employment, illustrated in Table 3, and that most RSA grants are within this value range, this is further evidence for this employment effect.

Table 4 also shows a pattern of an increasing effect on employment over time matched by the pattern in effect by size of grant. **For example, 2 years after the award of a grant between £500,000-£999,999 grant recipients are estimated to have, on average, employed roughly 42 employees more than non-recipients. By 5 years, this difference in change in employment is estimated to be 88 employees.** There is a similar pattern in the ATT on employment changes for grants valued between £250,000-£499,999, and a small relatively precisely estimated positive effect 1-3 years after the award of a grant valued at between £100,000-£249,000.

[19] These numbers are only shown in panel A of Table 4 as they are identical across Panels A, B, and C.

Table 4 - Average treatment effect of SE supported enterprises by banded value of grant

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level (FT + PT) change*					
< £50,000	-1.61	5.22	1.86	6.03	19.61
(No. supported firms = 46)	(8.47)	(8.30)	(9.39)	(14.15)	(19.44)
£50,000-£99,000	10.55*	16.19*	14.50	12.87	21.41
(No. supported firms = 138)	(6.10)	(8.85)	(9.86)	(14.10)	(19.18)
£100,000-£249,000	12.16**	14.95*	17.21*	21.14	30.36
(No. supported firms = 221)	(5.90)	(8.38)	(9.55)	(14.16)	(19.40)
£250,000-£499,000	-2.36	24.88***	30.14**	35.71**	51.55**
(No. supported firms = 84)	(21.16)	(9.54)	(12.14)	(16.11)	(21.24)
£500,000-£999,999	42.54**	57.36**	58.80**	84.03**	88.10***
(No. supported firms = 53)	(21.51)	(24.56)	(26.18)	(40.81)	(33.70)
£1,000,000-£1,999,999	9.80	5.93	-1.73	53.98	82.50
(No. supported firms = 26)	(18.39)	(24.45)	(37.36)	(59.13)	(60.11)
> £2,000,0000	104.89	459.49	469.18	589.86	661.53
(No. supported firms = 20)	(125.94)	(420.46)	(422.78)	(430.79)	(485.37)
N	2,258	2,098	1,975	1,858	1,693
Panel B: Turnover level change *(£000,000)*					
< £50,000	12.44	15.07	-14.38	-18.13	5.12
	(13.08)	(16.08)	(11.53)	(13.97)	(9.69)
£50,000-£99,000	12.61	14.51	-15.13	-18.48	5.33
	(13.08)	(16.14)	(11.62)	(14.05)	(9.70)
£100,000-£249,000	14.23	17.86	-10.09	-12.23	12.33
	(13.15)	(16.23)	(11.84)	(14.29)	(10.58)
£250,000-£499,000	19.34	18.64	-8.67	-12.00	10.34
	(13.88)	(16.13)	(11.67)	(14.03)	(9.79)
£500,000-£999,999	16.85	17.87	-10.35	-4.38	25.65
	(13.16)	(16.49)	(12.27)	(15.21)	(23.36)
£1,000,000-£1,999,999	18.28	23.76	41.68	77.24	48.48
	(13.98)	(17.52)	(38.60)	(62.83)	(30.91)
> £2,000,0000	693.63	740.29	923.12	920.28	1142.57
	(651.37)	(684.12)	(894.03)	(894.19)	(1,068.08)
N	2,258	2,098	1,975	1,858	1,693

Table 4 (cont.)

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel C: Turnover per worker level change *(£000)*					
< £50,000	-16.060	-45.400	-37.616	-48.476*	-21.837
	(15.158)	(30.893)	(36.107)	(25.675)	(25.240)
£50,000-£99,000	-2.659	-55.768	-74.872**	-61.033**	-52.596*
	(16.787)	(34.247)	(37.907)	(28.722)	(29.298)
£100,000-£249,000	-27.296*	-58.998*	-62.315*	-65.296**	-52.614*
	(14.75)	(32.953)	(37.304)	(28.724)	(29.114)
£250,000-£499,000	3.347	-20.412	-7.261	17.490	17.140
	(17.172)	(35.253)	(40.957)	(40.573)	(30.156)
£500,000-£999,999	81.706	-61.867	-67.524	-20.017	-50.856
	(85.068)	(40.692)	(46.271)	(38.574)	(32.907)
£1,000,000-£1,999,999	336.115	-17.869	543.671	803.468	3.044
	(343.446)	(38.981)	(544.447)	(794.482)	(25.397)
> £2,000,0000	191.359	189.615	-75.241	-79.996	-25.419
	(188.061)	(200.994)	(56.733)	(59.036)	(57.201)
N	2,254	2,094	1,971	1,854	1,689

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. In each panel, post-treatment denotes a variable indicating whether or not an observation one an enterprise comes after the receipt of a grant; the seven following categories represent the variables indicating whether or not an enterprise received a particular value of grant; and N denotes the number of firms multiplied by the number of time periods used (2) in each case.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Panel B finds no evidence of turnover effects. This is similarly sparse evidence of any effect on turnover per worker, except in the case of grants value between £100,000-£249,000 where there is a small, negative effect on turnover per worker. From 3 years after their award, there is a similar pattern for grants valued between £50,000-£99,000. These negative effects are driven by increases in employment that are not matched by increases in turnover.

Appendix Tables C7-C9 present results analogous to those in Table 4 but excluding the large growth in certain firm outcomes. These results portray a similar picture to the aggregate ATT estimates and the ATT estimates disaggregated by grant type when excluding outliers – the broad results change little until excluding firms with at least 100% growth in any year. This, again, suggests, that it is those small firms that experience growth of between 100%-500% in growth after receiving a grant that are driving the results in Table 4.

Appendix Table D3 shows analogous estimates to those in Table 4 with average annual *growth* in employment, turnover, and turnover per worker as the outcomes represented in

Panels A, C, and C respectively. Panel A shows that the ATTs growth of between £50,000-£99,000 and £100,000-£249,000 on average annual employment are consistently positive. They are also estimated precisely, each ATT to standard error ratio being above 1.96.

For example, 5 years after being awarded, grants between £100,000-£249,000 result in a change in average annual employment growth in their recipients that is roughly 23 percentage points higher than in the group of non-recipients. This suggests some evidence that grants of these sizes increased average annual employment growth in their recipients.

ATT across the distribution of firm outcomes

Tables 5-7 provide estimates of the aggregate ATT of grants across the distribution of employment, turnover and turnover per worker respectively. The quartiles divide the firms in to four groups. In the case of employment, for example, these four groups are:

1. The first (i.e the lowest) quartile - Those with less employees than 75% of firms.
2. The second quartile - Those with less employees than 50% of firms, but more than the bottom 25% (those in the first quartile).
3. The third quartile - Those with less employees than 75% of firms, but more than the bottom 50% (those in the second quartile).
4. The fourth (i.e the highest) quartile - Those with more employees than 75% of firms.

In doing so we can analyse in which firms the overall effect of grants is most pronounced.

For example, the ATTs in Panel A of Table 5 show the difference, on average, in change in employment between grant recipients and non-recipients who have less employees than 75% of firms (i.e are in the lowest quartile of the employment distribution).

Table 5 provides strong evidence of non-zero effects of grants on employment in the bottom two quartiles of the employment distribution, and some evidence of early effects in years 1-3 in the third quartile. These effects, however, are much smaller in magnitude than the estimated aggregate ATT on employment shown in Table 2 using the whole distribution.

Panel D suggests that this discrepancy is driven by large, imprecise estimates of the ATT in the upper end of the employment distribution. In years 2, 4 and 5 after grants are awarded, there is some weak evidence of positive effects on employment in this quartile, however, overall, we cannot conclude with a great deal of confidence that they are statistically different from zero. This suggests large variation in the impacts of grants in this quartile, the result being uncertainty as to whether they in fact had a consistent impact on employment.

The results in Table 6, which show ATTs across the quartiles of the turnover distribution, show similar patterns. Despite their being no evidence for grants having a non-zero effect on

turnover in Table 2, Table 6 suggests a small, precisely estimated effect in every follow-up year for those firms in the second quartile of the turnover distribution.

For example, the ATT in column 5 of Panel B in Table 6 suggests that in the 5 years following the award of a grant, turnover increased by, on average £351,000 more for recipient firms than for non-recipients. Again, however, the estimated ATTs in the upper quartile of the distribution are imprecise. This suggests that the aggregate ATTs on turnover, and their imprecision, shown in Table 2 are driven by variability in the estimated impact of the grants in this quartile.

Table 5 - Average effect on employment for all SE supported (ATT) enterprises in each quartile of the employment distribution

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Quartile 1*					
ATT	0.499***	0.732***	0.775***	0.766***	0.462
	(0.131)	(0.179)	(0.241)	(0.243)	(0.283)
N	635	553	503	469	435
Panel B: *Quartile 2*					
ATT	1.393***	1.251***	1.439***	2.477***	2.256**
	(0.312)	(0.396)	(0.552)	(0.765)	(0.931)
N	596	539	481	445	410
Panel C: *Quartile 3*					
ATT	2.140**	2.868**	2.906**	0.297	1.032
	(0.867)	(1.132)	(1.380)	(1.649)	(2.066)
N	569	547	522	491	436
Panel D: *Quartile 4*					
ATT	52.526	127.423*	122.209	194.942*	260.759*
	(38.152)	(76.416)	(81.168)	(105.823)	(152.266)
N	559	532	517	486	430

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, C, and D provide estimates of the ATT within each quartile of the employment distribution, with columns (1)-(5) representing the number of years after the grant employment is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and on which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). Business Structures Database, 1997-2018: Secure Access. [data collection]. 10th Edition. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table 7 shows no strong evidence of non-zero effects of grants on turnover per worker across the distribution. In the lowest quartile, there is estimated to be a small, positive, and relatively precise effect 4 and 5 years after grants are awarded: turnover per worker in firms in receipt of a grant is estimated to have changed by £2,141 per worker more than among non-recipients in the 5 years following the award of support (Column 5, Panel A of table 7). The ATT to standard error ratio means that we can conclude with a reasonable degree of confidence that this effect is statistically different from zero.

Table 6 - Average effect on turnover (in millions of pounds) of all SE supported (ATT) enterprises in each quartile of the turnover distribution

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Quartile 1*					
ATT	0.028***	0.038***	0.028	0.019	0.017
	(0.010)	(0.014)	(0.017)	(0.019)	(0.023)
N	592	518	480	436	413
Panel B: *Quartile 2*					
ATT	0.173***	0.186***	0.242***	0.217***	0.351***
	(0.033)	(0.043)	(0.057)	(0.072)	(0.078)
N	617	555	514	473	424
Panel C: *Quartile 3*					
ATT	0.202**	0.463***	0.317**	0.128	0.046
	(0.099)	(0.130)	(0.151)	(0.175)	(0.221)
N	582	556	507	485	428
Panel D: *Quartile 4*					
ATT	169.615	186.018	93.468	111.512	283.606
	(115.479)	(130.375)	(151.939)	(177.912)	(228.553)
N	568	542	522	497	446

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, C, and D provide estimates of the ATT within each quartile of the turnover distribution, with columns (1)-(5) representing the number of years after the grant turnover is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates, and enterprise received support, and on which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table 7 - Average effect on level of turnover per worker (in thousands of pounds of all SE supported (ATT) enterprises in each quartile of the turnover per worker distribution

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Quartile 1*					
ATT	1.619 (1.801)	0.941 (1.979)	4.211 (2.204)	5.541* (2.699)	2.141 (2.977)
N	616	563	534	509	463
Panel B: *Quartile 2*					
ATT	-0.655 (1.934)	4.945 (2.159)	1.732 (2.423)	2.243 (2.821)	3.642 (3.676)
N	529	505	476	443	385
Panel C: *Quartile 3*					
ATT	-4.199 (2.770)	0.419 (3.293)	-3.927 (3.380)	-9.205 (3.956)	3.379 (5.356)
N	553	518	481	449	429
Panel D: *Quartile 4*					
ATT	83.328 (105.526)	-189.222 (190.819)	-125.395 (242.026)	-10.252 (252.143)	-52.373 (52.737)
N	549	497	434	490	408

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, C, and D provide estimates of the ATT within each quartile of the turnover per worker distribution, with columns (1)-(5) representing the number of years after the grant turnover per worker is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and on which indicates if an observation on an enterprise comes after the award of a grant. **Source:** Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

ATT by other firm characteristics

Part of our analysis involved examining how the impact of grants might vary across firm attributes such as foreign ownership status, industry, urban/rural classification and whether or not firms were in receipt of Account Management support from Scottish Enterprise. Our analysis uncovered several features of the data, and the relationship between firm and grant characteristics, which mean such breakdowns would either be uninformative or were not possible to produce robust results.

For example, in the case of foreign ownership, and its relationship with the effectiveness of grant support, when we looked at the data in the BSD, foreign ownership data were only available for about 86% of matched SE supported firms and, of these, 65% had a foreign ownership status of “unknown”. This further reduced the sample of firms, and meant we were unable to provide a breakdown along this dimension.

We also sought to produce breakdowns of the effect of grants by location using an urban/rural classification of the main business location. Setting aside challenges around whether the firm is headquartered in the same place as the grant impact might be realised, in the data we found substantial incomplete reporting on the urban/rural classification. However, where it was available only 17% of those supported firms that were successfully matched were classified as being in rural areas, and these firms predominantly received RSA funding. As a result, breaking down the effect of grants by this characteristic would conflate the effect of the grant attributable to location and grant type.

These kinds of challenges emerged in considering other desired breakdowns of the data. For example, the vast majority of firms that were account managed were in receipt of RSA or SMART grants. They are also more likely to have grants less the £500,000. Again, any disaggregation of the effect of grants by account management status would therefore include the differential effects of grant type and size. In terms of industry, there are only a substantial number of firms in two industries – 44% of supported firms successfully matched to the BSD are in the Manufacturing industry, and 21% are categorised as being in the Professional & Scientific industry. Again, firms in these industries are far more likely to receive particular types of grants: over half of manufacturing firms receive RSA grants.

The relatively small sample size across grant types and sizes means that it is was not possible to disaggregate by, for example, urban/rural or industry and grant type or size. We believe, and our analysis suggests, that the driver of grants’ impact is their size and purpose, as proxied by grant type. As a result, they are the breakdowns that are least likely to be driven by other aspects of the firms of the grants themselves.

6. Conclusions

This report presents the results from undertaking an evaluation of SE's grant support to businesses in Scotland. It does so with the best available statistical methods, given the structure of the programme of support and the available data.

Compared with matched comparison firms, we find evidence of a positive effect of grants on recipient-firm performance in terms of their change in employment over the five years after receiving support. We find no consistent evidence, however, that turnover or turnover per worker are impacted similarly, or that, in aggregate, growth in any outcome is impacted relative to the same sample.

Unpicking these aggregate results by grant type, we find evidence that RSA grants account for the majority of the difference in change in employment between recipient and non-recipients. We also find some evidence that R&D grants had a positive impact on the change in employment (and rate of employment growth) in recipient firms relative to non-recipients over the 2 years following their award.

To further explore these aggregate findings we explored the results by banded value of grant. In doing so, we find some evidence for grant awards valued at £100,000 – £250,000 and strong evidence for grants valued between £250,000 – £1,000,000, that these are the main drivers of the increase in change in employment among supported firms.

When looking at the impact of grants across the distribution of firm outcomes, there is also evidence that the aggregate impact of grants is strongest for small and medium sized firms in terms of employment and turnover. This analysis also shows that when accounting for the fact aggregate effect sizes might differ across firm size, there is evidence of small effects on turnover for those in the lower end of the turnover distribution.

Overall, we find consistent evidence of grants' impact on employment, whether in aggregate terms or when grants are considered by type and value, but not on turnover or turnover per employee. Given that our grant type results show that most of the effect of SE grant awards appears to be stemming from RSA grants.

While we do not find a statistically significant effect of SE or HIE grants on turnover or turnover per worker, this is not to say that these are necessarily not being impacted. There are a couple of things that are worth bearing in mind. Firstly, as highlighted throughout this report, finding that there is a statistically significant effect requires two things, a large enough effect and a large enough sample to detect it. It is the balance of these things that determines whether we can safely conclude that there is an effect. In this case the inability of our analysis to find any

effects might be the result of features of the grant award process, the available sample of grant recipients, or shortcomings of the feasible evaluation methodology.

Secondly, it is also the case that turnover per worker is a poor proxy for productivity, but that no alternative exists in the data that we can readily and widely match our sample to. Finally, it is also worth bearing in mind that the underlying data in the Business Structures Database are not fully designed to support evaluation of this kind. For example, while data on employment is obtained from a survey and is deemed relatively reliable, data on turnover can and often is estimated rather than taken from a direct measurement. This introduces an element of error and noise into such analysis.

Our analysis was also constrained by the low number of grant recipients that could be linked to UK business data. Business outcome data could only be recovered for 58% of SE supported firms, reducing the sample available for evaluation. This makes our results less generalizable than if the whole sample of SE supported firms had been used in their estimation. It also precluded any investigation of the grant-specific effects of Environmental Aid, Proof of concept, and Training Plus funding.

Similarly, very few SE supported firms could linked to data on R&D, investment, and exporting activities. This meant it was not possible to carry out an evaluation of the impact of grants across a broad range out outcomes and focused our analysis on employment and turnover.

Appendix A: Difference in Difference estimation

With A being the control group and B the treated group, we can think of the Difference-in-Difference approach as estimating a model of the following form:

$$= 0 + 1 \quad + 2 \quad + \quad 3(\quad * \ ) +$$

Where the difference-in-difference estimate is:

$$= \\ 3 = (\ 2 - \ ,1) - (\ 2 - \ ,1)$$

In this case the firms in group **A** are those that we have selected using matching methods outlined earlier. This model can be straightforwardly extended to consider more than two time periods (i.e. a panel (or longitudinal) model in which firms are observed over time) and varying time of treatment, as well as including control variables. To estimate the average effect of a grant on those awarded funding by SE, we use those in the matched control group as counterfactuals for the treated firms and compare changes in average outcomes in the two groups over time.

Using this approach, we obtain an estimate of the **average treatment effect on the treated** (ATT) – the average change in outcome for those firms that received a grant.

More formally, the **average treatment effect** (ATE) is:

$$1 = (\quad =1 - \quad =0)$$

And the ATT is:

$$1 = (\quad =1 - \quad =0 | \quad = 1)$$

The ATT is less generalizable relative to the overall ATE - which gives the expected effect of a grant on a randomly selected firm from the population – however, given the directed nature of SE grant funding estimating the ATT is the appropriate metric.

It is straightforward to disaggregate both the ATE and ATT by sub-category of treatment. In our analysis we break down the ATT by grant type and value.

Appendix B - Additional tables

Table B1 – Average characteristics in SE supported enterprises, NWE enterprises in 2012 BSD, and enterprises in NWE similar to the SE supported firms respectively.

	(1) Treated Scottish firms	(2) All North West English firms 2012	(3) Matched North West English firms
Panel A: *Matching variables*			
Enterprise employees (FT + PT)	99.45 (540.0)	11.31 (310.4)	227.5 (3367.5)
Turnover (£000)	30705.9 (462118.2)	1242.1 (49403.4)	29011.3 (405336.4)
Turnover per worker (£000)	133.8 (302.0)	115.1 (793.0)	144.8 (283.9)
Panel B: *Employees banded*			
0-9	0.405 [264]	0.888 [200705]	0.402 [264]
10-49	0.363 [237]	0.0910 [20557]	0.364 [239]
50-99	0.0934 [61]	0.0106 [2397]	0.0915 [60]
100-249	0.0689 [45]	0.00588 [1329]	0.0716 [47]
250+	0.0704 [46]	0.00383 [865]	0.0701 [46]
Panel C: *Industry (grouped)*			
Business Services & Finance	0.263 [172]	0.302 [68174]	0.259 [170]
Construction	0.0199 [13]	0.115 [26078]	0.0229 [15]
Distribution, Accommodation & Food Services	0.0827 [54]	0.248 [55970]	0.0854 [56]
Other Services (inc. Government & Non-manufacturing Production)	0.0483 [31]	0.0125 [28238]	0.0503 [33]
Transport, Storage & Communication	0.150 [98]	0.1564 [35322]	0.148 [97]

Panel D: *Year of Grant*			
2009	0.132 [86]		0.131 [86]
2010	0.112 [73]		0.113 [74]
2011	0.0965 [63]		0.0991 [65]
2012	0.135 [88]		0.137 [90]
2013	0.104 [68]		0.102 [67]
2014	0.127 [83]		0.127 [83]
2015	0.0781 [51]		0.0762 [50]
2016	0.103 [67]		0.102 [67]
2017	0.113 [74]		0.113 [74]
N	653	225853	656

Note: All statistics are the mean value of their corresponding variable, noted in the left-most column. Standard deviations are in parentheses where applicable. For the banded employees and industries variables are binary and equal to 1 if an enterprise has the respective number of employees or is in the respective industry. As a result, the means are proportions of the Scottish enterprises in the BSD that fall in each category. The underlying *number* of enterprises that fall in each respective category are in square brackets. The "Matched Controls" column represents a sample of Scottish firms from the BSD that were reasonably similar to the SE supported firms. The "Year of Grant" panels shows the proportion of enterprises that received a grant in each year, or in the case of column (3) that have been matched to an enterprise that received a grant in that year.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table B2 – Average characteristics among all Scottish enterprises in the BSD, 2008-2018

	(1) 2008	(2) 2010	(3) 2012	(4) 2014	(5) 2016	(6) 2018
Panel A: Matching variables						
Enterprise employees (FT + PT)	12.73 (407.7)	12.86 (401.1)	12.35 (419.1)	11.83 (374.0)	9.874 (315.7)	10.85 (302.4)
Turnover (£000)	1683.1 (133316.8)	2097.4 (207484.3)	2264.6 (284776.4)	1663.0 (145228.3)	1398.1 (140374.8)	1486.0 (94360.2)
Turnover per worker (£000)	155.0 (5512.6)	151.4 (3848.1)	133.3 (2803.5)	147.2 (5868.5)	132.3 (2932.0)	155.8 (8810.7)
Panel B: Employees (banded)						
None	0.219 [35307]	0.207 [33030]	0.189 [31412]	0.185 [32161]	0.186 [41370]	0.207 [40241]
1-9	0.672 [108488]	0.682 [109051]	0.703 [116613]	0.705 [122830]	0.717 [159570]	0.688 [133485]
10-49	0.0891 [14382]	0.0908 [14505]	0.0882 [14621]	0.0920 [16038]	0.0810 [18027]	0.0873 [16955]
50-99	0.0105 [1703]	0.0107 [1718]	0.00994 [1648]	0.00978 [1705]	0.00850 [1892]	0.00930 [1806]

Table B2 (cont.)

	(1) 2008	(2) 2010	(3) 2012	(4) 2014	(5) 2016	(6) 2018
100-249	0.00573 [925]	0.00563 [900]	0.00525 [870]	0.00509 [887]	0.00434 [966]	0.00500 [970]
250+	0.00385 [621]	0.00387 [618]	0.00373 [618]	0.00361 [629]	0.00296 [658]	0.00347 [673]
Panel C: Industry (grouped)						
Business Services & Finance	0.245 [39492]	0.259 [41449]	0.275 [45604]	0.294 [51296]	0.303 [67493]	0.288 [55974]
Construction	0.125 [20162]	0.123 [19695]	0.116 [19270]	0.109 [19061]	0.111 [24801]	0.110 [21271]
Distribution, Accommodation & Food Services	0.251 [40579]	0.249 [39826]	0.244 [40516]	0.239 [41702]	0.236 [52616]	0.256 [49726]
Government Services	0.0479 [7738]	0.0478 [7642]	0.0480 [7959]	0.0476 [8300]	0.0440 [9789]	0.0453 [8786]
Manufacturing	0.0535 [8639]	0.0532 [8499]	0.0505 [8372]	0.0503 [8764]	0.0513 [11413]	0.0535 [10394]
Non-manufacturing Production	0.118 [19049]	0.114 [18240]	0.112 [18548]	0.108 [18890]	0.0951 [21162]	0.0988 [19178]

Table B2 (cont.)

	(1) 2008	(2) 2010	(3) 2012	(4) 2014	(5) 2016	(6) 2018
Other Services	0.0809 [13055]	0.0782 [12497]	0.0773 [12816]	0.0726 [12651]	0.0749 [16669]	0.0653 [12669]
Transport, Storage & Communication	0.0787 [12710]	0.0749 [11973]	0.0766 [12696]	0.0780 [13585]	0.0833 [18537]	0.0831 [16132]
N	161426	159822	165782	174250	222483	194130

Note: All statistics are the mean value of their corresponding variable, noted in the left-most column. Standard deviations are in parentheses where applicable. For the banded employees and industries variables are binary and equal to 1 if an enterprise has the respective number of employees or is in the respective industry. As a result, the means are proportions of the Scottish enterprises in the BSD that fall in each category. The underlying *number* of enterprises that fall in each respective category are in square brackets.

Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Appendix C – additional results excluding outliers

Table C1 - Estimates of the average treatment effect on SE supported (ATT) enterprises 1-5 years after receiving a grant respectively, excluding enterprises with annual growth exceeding 1000%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
***Panel A:** Employment change*					
ATT	14.929* (8.704)	38.591** (19.537)	39.214* (20.084)	54.384** (25.345)	72.609** (32.563)
N	2182	2032	1929	1816	1667
***Panel A:** Turnover change (£000,000)*					
ATT	40.742 (28.308)	47.618 (32.895)	27.769 (38.524)	31.722 (43.805)	70.621 (56.172)
N	2182	2032	1929	1816	1667
***Panel A:** Turnover per worker change (£000,000)*					
ATT	-0.010 (0.014)	-0.022 (0.016)	-0.003 (0.029)	0.003 (0.041)	-0.041* (0.023)
N	2178	2028	1925	1812	1663

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and one which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C2 - Estimates of the average treatment effect on SE supported enterprises (ATT) 1-5 years after receiving a grant respectively, excluding enterprises with annual growth exceeding 500%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment change*					
ATT	14.994*	39.195*	40.013*	55.656**	74.948**
	(9.021)	(20.115)	(20.712)	(26.159)	(33.934)
N	2145	2007	1905	1795	1646
Panel A: *Turnover change (£000,000)*					
ATT	42.237	49.198	28.640	32.801	73.770
	(29.347)	(33.866)	(39.732)	(45.228)	(58.697)
N	2145	2007	1905	1795	1646
Panel A: *Turnover per worker change (£000,000)*					
ATT	0.002	-0.013	-0.000	0.010	-0.040*
	(0.011)	(0.015)	(0.030)	(0.042)	(0.023)
N	2141	2003	1901	1791	1642

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and one which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C3 - Estimates of the average treatment effect on SE supported enterprises (ATT) 1-5 years after receiving a grant respectively, excluding enterprises with annual growth exceeding 100%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
***Panel A:** Employment change*					
ATT	4.662 (7.265)	14.092** (7.114)	10.824 (8.235)	18.211 (14.587)	30.682 (20.375)
N	1809	1711	1641	1564	1467
***Panel A:** Turnover change (£000,000)*					
ATT	3.406** (1.545)	3.610** (1.736)	4.407 (3.638)	5.666 (6.087)	1.752 (5.451)
N	1809	1711	1641	1564	1467
***Panel A:** Turnover per worker change (£000,000)*					
ATT	0.005 (0.015)	0.001 (0.011)	0.036 (0.039)	0.057 (0.062)	-0.026* (0.016)
N	1805	1707	1637	1560	1463

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and one which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C4 - Estimates of the average treatment effect on SE supported enterprises by type of grant received, 1-5 years after receiving a grant respectively, excluding enterprises with annual growth exceeding 1000%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level change*					
Environment Aid/ Proof of Concept/Training +	-257.438 (219.588)	12.370 (39.021)	16.989 (34.246)	50.435 (59.649)	130.939*** (26.788)
R&D	32.919** (15.444)	36.537* (18.918)	40.117 (36.969)	98.102 (83.197)	52.039 (55.973)
RSA	19.219* (9.836)	48.790* (28.393)	51.514* (28.308)	69.828** (34.244)	95.005** (43.743)
SMART	6.407 (6.212)	7.490 (8.792)	4.717 (9.655)	7.654 (14.576)	19.478 (19.822)
N	2008	1869	1775	1669	1534
Panel B: *Turnover level change (£000,000)*					
Environment Aid/ Proof of Concept /Training +	68.993 (53.907)	-4.496 (37.043)	-56.830 (48.134)	-49.524 (44.337)	66.693* (36.156)
R&D	17.337 (16.449)	26.377 (21.418)	56.529 (52.494)	107.829 (101.511)	42.340 (70.546)
RSA	54.703 (41.591)	63.855 (47.025)	46.101 (56.786)	51.535 (63.812)	101.774 (84.317)
SMART	13.533 (14.028)	16.581 (17.210)	-14.736 (12.070)	-18.474 (14.724)	5.140 (10.035)
N	2008	1869	1775	1669	1534
Panel C*: Turnover per worker level change (£000,000)*					
Environment Aid/ Proof of Concept /Training +	-0.008 (0.031)	-0.116 (0.102)	-0.186 (0.151)	-0.154 (0.107)	0.014 (0.042)
R&D	-0.051** (0.024)	-0.049 (0.038)	0.780 (0.746)	1.325 (1.331)	-0.125 (0.100)
RSA	-0.008 (0.019)	-0.028* (0.017)	-0.033* (0.018)	-0.040* (0.020)	-0.048* (0.025)
SMART	-0.013 (0.011)	-0.014 (0.016)	-0.028 (0.017)	-0.034** (0.017)	-0.024 (0.024)
N	2004	1865	1771	1665	1530

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C5 - Estimates of the average treatment effect on SE supported enterprises by type of grant received, 1-5 years after receiving a grant respectively excluding enterprises with growth exceeding 500%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level change*					
Environment Aid/Training +	-257.304 (219.600)	12.531 (39.076)	17.195 (34.334)	50.783 (59.765)	131.772*** (27.336)
R&D	33.053** (15.540)	36.698* (19.031)	40.323 (37.052)	98.450 (83.280)	52.872 (56.238)
RSA	19.164* (10.150)	49.046* (28.979)	52.003* (28.952)	70.799** (35.119)	96.855** (45.156)
SMART	6.380 (6.448)	7.488 (9.034)	4.927 (9.965)	7.987 (15.044)	20.272 (20.564)
N	1974	1847	1753	1650	1515
Panel B: *Turnover level change (£000,000)*					
Environment Aid/Training +	69.555 (54.049)	-3.790 (37.266)	-57.209 (48.233)	-49.983 (44.496)	67.056* (36.263)
R&D	17.900 (16.907)	27.083 (21.801)	56.151 (52.586)	107.370 (101.581)	42.703 (70.601)
RSA	56.427 (42.884)	65.408 (48.015)	46.926 (58.046)	52.640 (65.391)	104.913 (86.953)
SMART	14.089 (14.563)	17.294 (17.683)	-15.107 (12.458)	-18.931 (15.193)	5.443 (10.408)
N	1974	1847	1753	1650	1515
Panel C: *Turnover per worker level change (£000,000)*					
Environment Aid/Training +	0.008 (0.030)	-0.106 (0.102)	-0.185 (0.151)	-0.148 (0.107)	0.016 (0.042)
R&D	-0.035 (0.023)	-0.039 (0.038)	0.781 (0.746)	1.330 (1.331)	-0.123 (0.100)
RSA	0.002 (0.016)	-0.019 (0.015)	-0.029 (0.018)	-0.032 (0.020)	-0.044* (0.026)
SMART	0.002 (0.008)	-0.004 (0.015)	-0.026 (0.018)	-0.030* (0.018)	-0.024 (0.025)
N	1970	1843	1749	1646	1511

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C6 - Estimates of the average treatment effect on SE supported enterprises by type of grant received, 1-5 years after receiving a grant respectively excluding enterprises with growth exceeding 100%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
***Panel A:** Employment level change*					
Environment Aid /Proof of Concept/ Training +	-365.908 (294.746)	-24.515 (58.417)	-22.665 (36.585)	100.685*** (20.205)	108.613*** (19.455)
R&D	26.967* (15.138)	34.651* (19.869)	48.460 (52.266)	129.019 (128.472)	8.113 (7.200)
RSA	6.267 (4.801)	12.719* (7.446)	11.744 (9.386)	17.929 (17.161)	37.232 (26.348)
SMART	2.092 (3.932)	-2.109 (4.706)	-6.785 (5.956)	-8.577 (9.520)	-0.299 (8.098)
N	1665	1574	1509	1438	1350
***Panel B:** Turnover level change (£000,000)*					
Environment Aid/ Proof of Concept/ Training +	89.080 (67.016)	22.474 (18.095)	11.459 (8.577)	14.904 (9.115)	55.916 (35.002)
R&D	5.878** (2.902)	14.654** (6.990)	104.282 (73.082)	195.281 (154.286)	6.101 (4.242)
RSA	1.921 (1.461)	3.222 (2.283)	1.975 (3.266)	1.707 (4.587)	2.497 (6.029)
SMART	-0.369 (0.385)	-0.624 (0.532)	-2.897 (1.802)	-4.471 (3.454)	-5.736 (4.245)
N	1665	1574	1509	1438	1350
***Panel C:** Turnover per worker level change (£000,000)*					
Environment Aid/ Proof of Concept/ Training +	0.046*** (0.018)	0.035 (0.038)	0.014 (0.018)	-0.003 (0.012)	0.031 (0.037)
R&D	-0.009 (0.012)	0.024* (0.014)	1.347 (1.170)	2.312 (2.127)	-0.213*** (0.007)
RSA	0.004 (0.022)	-0.009 (0.012)	-0.010 (0.013)	-0.011 (0.016)	-0.027 (0.020)
SMART	-0.005 (0.011)	-0.010 (0.007)	-0.023*** (0.008)	-0.023** (0.011)	-0.037*** (0.011)
N	1661	1570	1505	1434	1346

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C7 - Estimates of the average treatment effect on the level performance of SE supported enterprises by banded value of grant received, 1-5 years after receiving a grant respectively excluding enterprises with growth exceeding 1000%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
***Panel A:** Employment level change*					
< £50,000	-2.27 (9.06)	5.14 (8.90)	2.88 (9.82)	7.28 (14.86)	18.29 (20.07)
£50,000-£99,000	10.89* (6.56)	16.98* (9.51)	14.90 (10.37)	13.26 (14.89)	21.82 (19.88)
£100,000-£249,000	12.07* (6.32)	15.21* (8.96)	17.40* (10.01)	21.76 (14.95)	31.29 (20.11)
£250,000-£499,000	-2.33 (21.28)	25.40** (10.07)	30.61** (12.55)	36.36** (16.83)	52.06** (21.86)
£500,000-£999,999	47.40* (25.03)	66.66** (28.22)	67.71** (29.91)	94.47** (46.29)	99.47*** (36.51)
£1,000,000-£1,999,999	10.28 (20.03)	6.07 (25.73)	-1.73 (37.47)	54.04 (59.31)	83.01 (60.34)
> £2,000,0000	113.52 (132.28)	488.43 (442.87)	469.19 (422.81)	589.93 (430.84)	662.04 (485.42)
N	2180	2030	1928	1815	1666
***Panel B:** Turnover level change (£000,000)*					
< £50,000	13.40 (14.04)	16.33 (17.22)	-14.78 (12.08)	-18.53 (14.74)	5.26 (10.04)
£50,000-£99,000	13.54 (14.04)	15.67 (17.28)	-15.74 (12.18)	-19.28 (14.82)	5.53 (10.05)
£100,000-£249,000	15.12 (14.11)	19.20 (17.38)	-10.46 (12.42)	-12.70 (15.09)	12.74 (11.00)
£250,000-£499,000	20.27 (14.79)	19.94 (17.27)	-9.12 (12.22)	-12.70 (14.80)	10.51 (10.13)
£1,000,000-£1,999,999	18.41 (15.01)	25.29 (18.70)	41.17 (38.77)	76.49 (63.00)	48.64 (31.03)
> £2,000,0000	728.66 (684.80)	779.98 (721.09)	922.60 (894.08)	919.53 (894.24)	1142.74 (1068.12)
N	2180	2030	1928	1815	1666
***Panel C:** Turnover per worker level change (£000,000)*					
< £50,000	-0.02 (0.02)	-0.02 (0.02)	-0.02 (0.02)	-0.03 (0.02)	-0.03 (0.03)
£50,000-£99,000	-0.01 (0.02)	-0.03 (0.02)	-0.05** (0.02)	-0.05** (0.02)	-0.06** (0.03)

£100,000-£249,000	-0.03**	-0.04*	-0.04	-0.05**	-0.06**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
£250,000-£499,000	0.00	0.00	0.01	0.02	0.01
	(0.02)	(0.02)	(0.03)	(0.04)	(0.03)
£500,000-£999,999	0.08	-0.02	-0.01	-0.02	-0.04
	(0.10)	(0.02)	(0.03)	(0.04)	(0.03)
£1,000,000-£1,999,999	-0.02	-0.01	0.57	0.82	-0.00
	(0.02)	(0.02)	(0.54)	(0.80)	(0.03)
> £2,000,0000	0.01	0.02	-0.05	-0.06	-0.03
	(0.06)	(0.07)	(0.05)	(0.06)	(0.06)
N	2176	2026	1924	1811	1662

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C8 - Estimates of the average treatment effect on the level performance of SE supported enterprises by banded value of grant received, 1-5 years after receiving a grant respectively excluding enterprises with growth exceeding 500%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level change*					
< £50,000	-3.18 (9.72)	5.15 (9.14)	2.86 (10.13)	7.36 (15.34)	18.69 (20.82)
£50,000-£99,000	11.25* (6.81)	17.54* (9.80)	15.59 (10.73)	13.97 (15.38)	22.93 (20.63)
£100,000-£249,000	12.38* (6.57)	15.55* (9.21)	17.93* (10.33)	22.35 (15.42)	32.39 (20.85)
£250,000-£499,000	-2.28 (21.59)	25.80** (10.32)	31.54** (12.84)	37.63** (17.28)	52.98** (22.62)
£500,000-£999,999	44.17* (25.39)	63.88** (28.78)	64.63** (30.60)	91.98* (47.65)	100.10*** (38.50)
£1,000,000-£1,999,999	10.42 (20.10)	6.23 (25.82)	-1.53 (37.56)	54.39 (59.43)	83.84 (60.59)
> £2,000,0000	113.66 (132.30)	514.77 (468.15)	496.17 (448.39)	623.20 (456.50)	704.84 (518.25)
N	2143	2005	1904	1794	1645
Panel B: *Turnover level change (£000,000)*					
< £50,000	13.94 (14.57)	17.02 (17.69)	-15.18 (12.47)	-19.02 (15.21)	5.60 (10.42)
£50,000-£99,000	14.07 (14.58)	16.29 (17.76)	-16.21 (12.58)	-19.84 (15.30)	5.86 (10.42)
£100,000-£249,000	15.74 (14.65)	19.98 (17.86)	-10.73 (12.82)	-13.04 (15.56)	13.30 (11.39)
£250,000-£499,000	20.85 (15.32)	20.60 (17.75)	-9.52 (12.61)	-13.18 (15.27)	10.73 (10.51)
£1,000,000-£1,999,999	18.97 (15.51)	25.99 (19.14)	40.79 (38.90)	76.03 (63.12)	49.01 (31.15)
> £2,000,0000	729.22 (684.83)	825.49 (762.11)	980.61 (948.07)	977.37 (948.24)	1223.71 (1141.39)
N	2143	2005	1904	1794	1645
Panel C: *Turnover per worker level change (£000,000)*					
< £50,000	0.00 (0.01)	-0.01 (0.01)	-0.01 (0.02)	-0.02 (0.02)	-0.02 (0.03)
£50,000-£99,000	-0.01 (0.01)	-0.02 (0.02)	-0.05** (0.02)	-0.04* (0.02)	-0.06** (0.03)

£100,000-£249,000	-0.02 (0.01)	-0.03 (0.02)	-0.03 (0.02)	-0.05* (0.02)	-0.06** (0.03)
£250,000-£499,000	0.02 (0.02)	0.01 (0.02)	0.01 (0.03)	0.03 (0.04)	0.01 (0.03)
£500,000-£999,999	0.10 (0.10)	-0.01 (0.02)	-0.02 (0.03)	-0.02 (0.04)	-0.04 (0.03)
£1,000,000-£1,999,999	-0.00 (0.02)	0.00 (0.02)	0.57 (0.54)	0.82 (0.80)	0.00 (0.03)
> £2,000,0000	0.02 (0.06)	0.04 (0.08)	-0.05 (0.05)	-0.06 (0.06)	-0.03 (0.06)
N	2139	2001	1900	1790	1641

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table C9 - Estimates of the average treatment effect on the level performance of SE supported enterprises by banded value of grant received, 1-5 years after receiving a grant respectively excluding enterprises with growth exceeding 100%.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Employment level change*					
< £50,000	-0.01 (4.08)	-4.55 (4.79)	-10.12* (6.07)	-15.00 (9.83)	-6.89 (8.38)
£50,000-£99,000	7.62 (4.95)	8.76 (7.41)	4.66 (8.38)	-3.33 (10.27)	-1.75 (7.33)
£100,000-£249,000	6.33 (4.10)	4.40 (4.88)	4.22 (6.40)	0.72 (9.66)	6.87 (8.11)
£250,000-£499,000	-15.73 (33.65)	21.91** (9.36)	28.04** (14.05)	31.87* (16.31)	44.11** (17.43)
£500,000-£999,999	45.09 (32.62)	65.42* (34.16)	42.34 (30.35)	44.85 (34.32)	63.43* (33.99)
£1,000,000-£1,999,999	-1.05 (26.46)	2.56 (36.15)	-7.21 (58.02)	13.19 (76.58)	33.11 (76.12)
> £2,000,0000	-38.22 (39.25)	18.39 (88.43)	24.84 (99.09)	231.09 (219.34)	309.86 (395.15)
N	1807	1709	1640	1563	1466
Panel B: *Turnover level change (£000,000)*					
< £50,000	-0.55 (0.43)	-0.97* (0.57)	-3.10* (1.82)	-4.95 (3.47)	-5.69 (4.25)
£50,000-£99,000	0.05 (0.41)	0.09 (0.58)	-2.10 (1.83)	-3.56 (3.48)	-5.52 (4.25)
£100,000-£249,000	1.88 (2.26)	2.86 (3.63)	1.71 (4.63)	1.42 (5.73)	2.26 (7.41)
£250,000-£499,000	9.42 (7.58)	3.25 (1.98)	2.48 (3.24)	0.79 (3.76)	-0.19 (4.46)
£500,000-£999,999	3.17* (1.63)	5.87* (3.53)	2.09 (2.59)	1.84 (4.38)	-3.92 (5.02)
£1,000,000-£1,999,999	9.89 (7.41)	11.70 (10.68)	81.16 (58.35)	105.12 (84.16)	29.39 (36.92)
> £2,000,0000	17.85* (9.50)	27.42** (13.94)	13.25 (15.84)	9.58 (19.12)	27.40 (28.44)
N	1807	1709	1640	1563	1466
Panel C: *Turnover per worker level change (£000,000)*					
< £50,000	-0.00 (0.01)	0.00 (0.01)	0.01 (0.01)	0.01 (0.01)	-0.00 (0.01)
£50,000-£99,000	-0.01* (0.01)	-0.01 (0.01)	-0.02** (0.01)	-0.01 (0.02)	-0.04** (0.02)

£100,000-£249,000	-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.03 (0.03)	-0.05 (0.03)
£250,000-£499,000	0.02 (0.02)	0.03 (0.03)	0.03 (0.03)	0.06 (0.06)	0.02 (0.04)
£500,000-£999,999	0.13 (0.13)	-0.01 (0.01)	0.00 (0.01)	0.01 (0.01)	-0.01 (0.01)
£1,000,000-£1,999,999	0.01 (0.02)	0.02** (0.01)	0.94 (0.87)	1.17 (1.11)	0.01 (0.02)
> £2,000,0000	0.01 (0.02)	0.14 (0.10)	0.02 (0.03)	-0.00 (0.03)	0.02 (0.03)
N	1803	1705	1636	1559	1462

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Appendix D – additional results in growth rates

The following tables provide analogous estimates to those in Tables 2-7 of the report, with **growth** in employment, turnover and turnover per work as outcomes.

We focus on the change in the level of the outcomes in the body of the report as regressions using growth rates can be very sensitive to outlying values. This is a particularly relevant problem in the case of firm level data where the size of firms differs greatly.

If a small firm increases employment from 1 employee to 11, its employment growth is 1000%. However, if a large company increases its employment by 10, from 300 to 310, its growth is only 3%.

Creating growth rates then "spreads" the values of outcomes extremely widely, creating large outlying values that can have two effects. Firstly, they can bias results by dominating the ATTs, skewing estimates in their direction. Secondly, and as a result of the increased spread in the data once growth rates are used as outcomes, they can cause estimates to become extremely imprecisely estimated.

Table D1 - Estimates of the average treatment effect on growth of SE supported (ATT) enterprises 1-5 years after receiving a grant respectively.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Average annual employment growth*					
ATT	13.052 (10.117)	12.544 (10.799)	10.999 (11.607)	12.361 (13.278)	7.766 (16.694)
N	2255	2095	1971	1854	1689
Panel B: *Average annual Turnover growth*					
ATT	-27.202 (105.248)	4.624 (63.546)	89.379 (56.657)	112.347 (84.705)	112.145 (97.654)
N	2255	2095	1971	1854	1689
Panel C: *Average annual Turnover per worker growth*					
ATT	-67.726 (99.289)	-42.494 (60.350)	13.427 (24.084)	22.916 (25.238)	9.353 (20.448)
N	2253	2093	1969	1852	1687

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively. Panels A, B, and C represent the outcome in each column, with columns (1)-(5) representing the number of years after the grant this outcome is measured. N denotes the number of observations used in each case. ATT is an interaction of two binary variables, one which indicates an enterprise received support and one which indicates if an observation on an enterprise comes after the award of a grant.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table D2 - Estimates of the average treatment effect on growth of SE supported enterprises by type of grant received, 1-5 years after receiving a grant respectively

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Average annual employment growth*					
Environment Aid/ Proof of Concept/ Training +	10.535 (16.000)	6.871 (16.195)	-2.871 (22.046)	-4.652 (17.460)	-20.032 (20.121)
R&D	48.697** (22.527)	48.291** (22.116)	48.531** (20.422)	56.611*** (19.191)	78.777*** (24.982)
RSA	14.055 (15.157)	13.998 (16.129)	11.857 (16.698)	13.697 (19.112)	9.822 (24.421)
SMART	1.250 (12.482)	-3.171 (12.762)	-6.819 (14.430)	-3.522 (15.861)	-7.021 (17.697)
N	2076	1928	1815	1705	1553
Panel B: *Average annual Turnover* growth					
Environment Aid/ Proof of Concept/ Training +	-5.169 (124.488)	-49.590 (60.543)	-10.510 (15.081)	2.574 (14.739)	14.964* (7.669)
R&D	-79.949 (95.967)	-27.407 (60.525)	42.286* (25.201)	61.399* (35.349)	65.337 (61.981)
RSA	-5.341 (118.443)	-16.703 (60.101)	39.056** (17.932)	44.459** (18.448)	44.429** (18.188)
SMART	-58.483 (113.823)	102.411 (143.831)	352.437 (315.804)	459.160 (482.194)	422.042 (503.045)
N	2076	1928	1815	1705	1553
Panel C: *Average annual Turnover per worker growth*					
Environment Aid/ Proof of Concept/ Training +	4.468 (152.881)	-64.453 (61.623)	-18.095 (24.818)	-6.828 (21.576)	25.076* (13.407)
R&D	-120.139 (96.513)	-83.270 (61.761)	46.105 (79.265)	69.400 (105.498)	-50.796 (58.623)
RSA	-58.575 (105.162)	-50.930 (61.038)	1.615 (19.820)	3.813 (17.683)	8.590 (17.898)
SMART	-58.155 (103.243)	14.982 (80.785)	88.889 (105.705)	129.456 (119.486)	42.054 (77.348)
N	2074	1926	1813	1703	1551

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.

Table D3 - Estimates of the average treatment effect on growth of SE supported enterprises by banded value of grant received, 1-5 years after receiving a grant respectively.

	(1) 1 year	(2) 2 years	(3) 3 years	(4) 4 years	(5) 5 years
Panel A: *Average annual employment growth*					
< £50,000	-4.137 (12.288)	-1.481 (14.853)	-0.885 (16.119)	21.124 (31.969)	30.510 (48.826)
£50,000-£99,000	32.330** (15.165)	27.924*** (8.553)	29.096*** (8.451)	26.528*** (9.203)	26.428** (11.070)
£100,000-£249,000	20.594*** (7.467)	23.228*** (6.262)	23.809*** (6.478)	23.233*** (6.749)	23.206*** (7.848)
£250,000-£499,000	7.298 (11.530)	3.540 (13.638)	5.595 (15.548)	3.616 (17.609)	-10.241 (21.351)
£500,000-£999,999	-70.308 (84.613)	-75.701 (93.577)	-89.905 (105.600)	-91.531 (117.679)	-100.164 (128.377)
£1,000,000-£1,999,999	22.409*** (6.538)	19.398*** (6.731)	16.988*** (6.274)	22.824*** (6.813)	24.696*** (7.237)
> £2,000,0000	70.252 (86.739)	87.742 (105.087)	58.355 (84.703)	73.666 (95.743)	56.564 (91.739)
N	2253	2093	1970	1853	1688
Panel B: *Average annual Turnover growth*					
< £50,000	-83.656 (101.965)	-71.866 (64.473)	-12.658 (33.118)	-19.471 (42.326)	-20.682 (50.135)
£50,000-£99,000	-65.508 (97.959)	52.738 (81.789)	135.997 (99.852)	70.105 (43.611)	28.185 (26.863)
£250,000-£499,000	-30.561 (108.306)	91.901 (142.538)	353.655 (330.050)	592.076 (565.283)	693.312 (674.508)
£500,000-£999,999	-119.055 (113.109)	3.989 (126.730)	38.116 (115.185)	62.933 (112.449)	29.003 (106.442)
£1,000,000-£1,999,999	-119.409 (115.210)	-110.855 (81.065)	-37.894 (67.637)	-20.016 (63.824)	-54.511 (80.865)
> £2,000,0000	-55.184 (100.342)	32.034 (74.319)	51.874 (45.605)	65.324 (57.066)	94.345 (85.267)
N	2253	2093	1970	1853	1688
Panel C: *Average annual Turnover per worker growth*					
< £50,000	-107.753 (103.690)	-104.901 (69.683)	-51.595 (44.334)	-66.825 (56.004)	-25.839 (51.244)
£50,000-£99,000	-78.417 (97.486)	-17.236 (65.380)	20.480 (30.157)	18.961 (26.860)	3.397 (23.951)
£100,000-£249,000	-21.961 (120.027)	-57.554 (60.631)	-21.272 (16.104)	-17.783 (15.946)	-15.798 (16.961)

£250,000-£499,000	-75.931 (97.491)	-14.047 (73.324)	110.698 (111.685)	119.265 (114.909)	97.888 (86.884)
£500,000-£999,999	-110.538 (102.004)	25.717 (132.037)	58.528 (108.968)	150.244 (138.688)	61.148 (89.326)
£1,000,000-£1,999,999	-193.934* (114.137)	-197.262* (101.717)	-10.436 (81.438)	-7.934 (89.620)	-80.562 (80.607)
> £2,000,0000	-108.377 (96.693)	-26.419 (74.494)	-20.248 (20.417)	-15.779 (19.368)	-8.623 (21.126)
N	2251	2091	1968	1851	1686

Notes: Standard errors in parentheses. *, **, and *** denote statistical significance at 10%, 5%, and 1% respectively.
Source: Office for National Statistics (2019). *Business Structures Database, 1997-2018: Secure Access*. [data collection]. *10th Edition*. UK Data Service. SN: 6697, http://doi.org/10.5255/UKDA-SN-6697-10; and Scottish Enterprise.