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**Growth and Productivity Performance of Account Managed Companies**

***Final Report***

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# Executive Summary

***Introduction***

This study by the Enterprise Research Centre (ERC) for Scottish Enterprise (SE) examines whether Account Managed (AM) firms outperform comparator groups of non-assisted companies in terms of employment, turnover and productivity growth and provides an assessment of the extent that any additional growth can be attributed to AM support.

A secondary objective was to examine the drivers that have influenced growth, particularly productivity growth, by considering firm-level activities such as investment, innovation, skills, internationalisation, ownership, competition and public sector support.

Both sets of analyses will help SE understand better the implications for future operational considerations as they develop their business support offer.

***How we went about the project***

SE and HIE client data was linked to the ONS Business Structure Database (BSD) and other ONS business surveys available in the UK Data Service secure data lab.

The methodology to assess the impact of support included the use of control groups to provide the counterfactual position for AM supported firms. Here two separate control groups were constructed (and the analysis run separately for each) using ONS business population data; one drawn from a pool of non-assisted firms in Scotland and a second, drawn from a pool of non-assisted firms in Northern England; the latter used as a robustness test.

***Results***

The econometric results are consistent across both control groups and show that, due to a strong performance at the start of the decade and a slowing of growth towards 2014, the difference in growth for AM supported firms (between the earlier and latter periods) tends to be lower than that for the comparable difference for non-assisted firms for both turnover and employment, although in absolute terms growth is faster for AM supported firms in both periods. **However, the productivity growth differential is higher for AM supported firms and this holds irrespective of the periods examined between 2000 and 2014** (i.e., 2000-02 compared to 2012-14 or 2000-07 compared to 2008-14)[[1]](#footnote-1); this productivity differential arises due to a better performance by AM supported firms in the period up to 2014 in contrast to a declining productivity growth at the start of the decade.

**Overall, the results support the conclusion that there is a positive effect on the productivity growth for supported firms.** It would seem to support the actions of SE who, in 2008 redirected support towards achieving this aim and that of HIE who adopted the AM system in 2008; the similar results across both control groups imply the robustness of the results.

Using an alternative approach to explore the drivers of productivity by which controls for selection into the AM group of clients, the econometric analysis of **productivity levels** indicate that being SE/HIE supported has a positive effect on productivity – but in the **productivity growth** models the effect of support is negative. Aside from the effect of support, having a higher net capital expenditure and higher employment costs, which acts as a proxy for higher skill levels, is also associated with higher productivity levels.

These results for productivity growth differ from those above, but it is important to note why this is the case; these latter models employ a different methodology and focus on growth over different time periods (annual observations rather than the Difference-in-Difference methodology of growth over specific periods) and also involve a much reduced sample of firms due to the incorporation of variables from a number of sample-based business surveys; the latter, in particular, is very likely to impact on the representativeness of the results.

***Conclusion***

The analysis in this report provides some evidence that the SE/HIE interventions to business through the AM system are working but the lack of time series data prevents us from developing an explanation about what aspects of the support are driving the performance of the assisted pool of firms. However, it is essential that a more robust time series dataset be constructed in order to fully validate the role of the AM system in the uplift of productivity for SE/HIE clients. As the data-linking exercise, based on administrative data, resulted in an unbalanced dataset with a relatively low number of observations such a dataset could be achieved through the annual collection and validation of key performance metrics via the client CRM system. This could then be added to with external data, such as that from the Global Connections Survey.

# Introduction

The aim of the Scottish Enterprise (SE) and Highlands and Islands (HIE) Account Management (AM) service is to generate additional economic impact in Scotland by supporting companies with high levels of growth ambition achieve their growth aspirations. To this end SE commissioned the Enterprise Research Centre (ERC) to undertake an analysis of the growth and productivity performance of AM clients since 1998 and identify the added value of the account management approach by comparing AM companies’ performance to a sample of non-AM companies with similar characteristics in terms of size and sector. There is also a need to understand where the value comes from in the AM service to business.

This study examines whether AM firms outperform comparator groups of non-assisted companies in terms of employment, turnover and productivity growth; and gauge the extent of any additional growth deriving directly from AM support. The analysis will also consider the range and extent of the factors influencing AM and non-AM companies’ growth and productivity performance to provide SE with an understanding of the components and drivers of growth and productivity performance in these companies. Furthermore, the analysis seeks to examine the drivers that have influenced growth, particularly productivity growth, by considering firm-level activities such as investment, innovation, skills, internationalisation, ownership, competition and public sector support. This is of operational importance to SE.

The approach developed for this data analysis draws on Office of National Statistics (ONS) micro-data held within the UK Data Service (UKDS) Secure Lab and comprises elements of data-linking and best practice econometric techniques. To understand AM firms’ growth in context, a counterfactual position is provided using control groups of non-assisted firms which closely resemble the AM firms in terms of background characteristics. This has the effect of eliminating potentially misleading results based on comparisons with the wider business population who may be considerably different to assisted firms in terms of characteristics and growth performance. In order to provide a fully robust analysis two separate control groups are generated; one from a sample of Scottish non-assisted firms; and the second from a sample of non-assisted firms located in the Northern regions of England who would not have received AM support. The consistency of the results across the models for these two control groups serve as a robustness check on the results.

Focusing then on the two key aspects of growth and the drivers of growth, the report is divided into three main chapters:

1. The first chapter assesses the effect of AM on turnover growth, employment growth and productivity growth of clients against the two comparator control groups of non-assisted firms.
2. The second chapter adopts the same approach but focusses on the effect of AM in different time periods: for example, in the 2012-14 period as well prior to- and post- the recent recession period.
3. The third chapter reports on an exploratory analysis of the drivers of productivity, examining the impact of AM firms.

# The Effect of Account Management on Firm Growth

## 1.1 Introduction

The first stage of the analysis is to examine the impact that Account Management (AM) has had on the growth of firms. In answering this question one cannot simply examine the post-assistance growth of supported firms as any growth may have been achieved regardless of such AM support. Rather, in order to attribute any growth explicitly to AM support, one must consider what would have happened in the absence of the intervention – a counterfactual position examining their growth had they not been account managed. Obviously as this latter position is unobservable steps must be taken to provide a proxy for this. Generally this can be done through the use of control groups; that is making comparisons with firms which closely resemble those that are in receipt of support.

The approach adopted involves two stages. First, constructing control groups of non-assisted firms with similar background characteristics and growth profiles as the AM clients; and second, using a Difference-in-Difference model which compares the impact of AM over two periods.

The use of control groups and a Difference-in-Difference model ensures that we are comparing growth over time and between similar subjects (account managed and non-account managed). This method is superior to simply measuring the difference in outcomes between the supported and non-supported after the intervention has taken place as the supported firms may have been better performing to begin with; removing this source of bias enables us to better isolate the true impact of the support. In this way we measure growth for both groups of firms over a period at both the start and the end of the observation period and subtract one from the other; we then compare this difference in growth between the AM and non-assisted firms. The technique enables us to identify whether growth has been higher for the AM firms, and if so, by how much and whether statistically significantly[[2]](#footnote-2).

Firm growth was analysed in terms of employment growth, turnover growth and productivity growth. Productivity growth is measured here as turnover per employee, and reflects the available variables, as discussed in the methodology section. At the firm level, there are a number of ways in which productivity can be measured, either through single factor productivity measures, such as labour productivity, in which a measure of output is related to a single measure of input; or through multi-factor productivity measures, such as total factor productivity, in which a measure of output is related to a group of inputs. Within each of these measures is also the choice of inputs and outputs; output typically measured through either a gross output measure, or through a measure of value added, the latter attempting to capture the movement of output (Schreyer, 2001). Inputs are generally measured as labour or capital, or in the case of multi-factor measurements, include intermediate inputs such as energy, materials and services.

The choice of productivity measure is reliant on data availability which, at the firm level, typically restricts the measure to single factor measures such as labour productivity, and quite often turnover per employee (Gal, 2013)[[3]](#footnote-3). It has been suggested that value added is the preferred output measure (Kathuria et al., 2011)[[4]](#footnote-4), rather than turnover, as the latter fails to take account of intermediate inputs in the production process which can differ markedly across sectors in terms of quantity, quality and cost. This is a particular problem in sectors where re-selling is a key feature, such as in Wholesale and Retail. However, in its absence the use of turnover (per employee) provides a sufficient proxy in that it reflects, in its broadest form, the definition of labour productivity[[5]](#footnote-5), that is, the quantity of goods and services produced per unit of labour input[[6]](#footnote-6). Given that the issue we are concerned with here is the impact SE/HIE support has on productivity, rather than a specific productivity analysis, then we can be confident that the measure used here is adequate.

The analysis adopts a Difference-in-Difference approach which this requires two observation periods to be chosen and compared (see Appendix 1). We have selected the 2000-02 period, and the 2012-14 period[[7]](#footnote-7). The former provides an indication of growth early in the decade, during which the economy was generally buoyant. The latter reflects a period of recovery, following the ‘Great Recession’, in which the economy was starting to return to pre-recession levels. Taking the difference in growth between these periods allows us to control for wider economic conditions and thus comparing this difference to similar non-assisted firms enables the impact of support to be isolated (in that we have controlled for other observable contributing factors).

Subsequent to the main analysis a second timeframe is considered to assess the impact of the recession, and a re-orientation in terms of the focus of AM[[8]](#footnote-8). The two sub-periods considered are 2000-07 and 2008-14.

The methodology included the use of control groups to provide the counterfactual position for AM supported firms. Here two separate control groups were constructed (and the analysis run separately for each); one drawn from a pool of non-assisted firms in Scotland and a second, drawn from a pool of non-assisted firms in Northern England; the latter used as a robustness test. Where possible we have sought to ensure that those classified as non-assisted were not in receipt of any form of Government support[[9]](#footnote-9); however, in the absence of a comprehensive history of each firm in terms of any public assistance it may be the case that some firms were in receipt of some form of support from previous initiative provided by the now abolished English RDAs.

##  1.2 Methodology

The client dataset of SE and HIE Account Managed firms was imported to the Secure Lab area of the UK Data Service[[10]](#footnote-10). The SE dataset contained 4,217 records[[11]](#footnote-11), with firms categorised into their segmentation groups, to include Account Managed Growth; Early Stage Growth; Corporate Scotland; Important to the Economy; and Non-Relationship Managed. From this initial dataset it was advised that those firms classified as ‘Corporate Scotland’ be excluded from the analysis to avoid skewing the results. Removal of these records left 4,197, of which 3,398 had Enterprise Reference Numbers (ERN)[[12]](#footnote-12); this equated to 2,977 unique firms[[13]](#footnote-13).

Likewise the HIE dataset contained 833 records once again categorised into segmentation groups to include: AM relationship dormant; AM relationship active; actuals complete; growth plan agreed; and growth plan concluded. Of the total number of records 666 had ERNs which equated to 591 unique firms.

For both the SE and HIE firms the ERNs were attached to the dataset by the Scottish Government. Those for whom ERNS could not be found are typically firms which are not registered for VAT and/or PAYE and thus are not included on the IDBR (or who were not on the Register at the time of the matching). As each of the ONS Business Surveys are sampled from the IDBR these unique reference numbers appear on each of the business survey datasets and thus enable firms to be identified on each dataset and matched together so that their respective variables, from across these datasets, can be collated together.[[14]](#footnote-14) In order to assess the extent to which the SE and HIE firms appeared on the other ONS business datasets, to which we had access, a matching exercise was undertaken. Each business survey dataset contains an annual file relating to that year’s results from that particular survey; these were firstly linked together to construct a longitudinal version of each dataset; the SE and HIE firms’ ERNs were then matched to each of these longitudinal datasets to ascertain the number of firms that appeared on the longitudinal dataset. The match rates were as follows for the 2,977 SE firms and 591 HIE firms:

Business Structure Database (BSD) (1997-2014) = 92% match to SE / 84% match to HIE

UK Innovation Survey (UKIS) (1998-2012)

(Waves 3-8) = 21% match to SE / 13% match to HIE

Annual Respondents Database (ARD) (1997-2011) = 52% match to SE / 43% match to HIE

Annual Business Survey (ABS) (2008-2013) = 43% match to SE / 33% match to HIE

Business Expenditure on R&D (1997 -2013) = 35% match to SE / 21% match to HIE

Therefore, there were relatively low matching results for several of the datasets, which is perhaps not surprising given that these are sample-based surveys. In addition, it must be noted that where a firm is matched to a longitudinal dataset the match may be to only one year over the whole period. For example, where an SE firm appears as a match on the ABS it may have only been surveyed in 2010 and thus only have ABS data for 2010. For illustration, 328 SE/HIE firms have ABS data for 1997, 406 have data for 2013 but overall just 114 firms are on both 1998 and 2013.

Given this latter point, that not all firms that matched had data every year over the period, it was decided to undertake the subsequent growth performance analysis using just the BSD. This dataset differs from the others in that it is not a survey, and in fact represents an annual snapshot of the IDBR, hence the higher matching rates. This dataset covers all firms in the UK that are registered for VAT and/or PAYE and whilst it covers around 99% of UK economic activity (in terms of turnover) it contains relatively few variables, namely employment, turnover, business demography (i.e., birth and death), geography and sector. Obviously this reduced number of variables impacts on the scope of the analysis that can be undertaken and, in particular, the productivity metric that can be utilised. As discussed in the introduction, only a partial productivity measure can be constructed, that of labour productivity, using turnover per employee rather than the preferred metric of value-added per employee. However given its breadth of coverage in terms of the number of firms and the ability to observe the key variables of turnover and employment from the firm’s birth to 2014 means that any disadvantages associated with using turnover per employee are outweighed by the fact that the analysis can be conducted over time, enabling growth to be observed over a sufficient period, and the impact of support to be assessed.

The generation of the control groups is undertaken using the BSD, basing the selection of similar firms on the limited number of variables available. Size is generally considered to be one of the key variables with regards to the generation of a control sample, as it is highly correlated with growth[[15]](#footnote-15), thus we would want to ensure that the control sample is of a similar size distribution to the supported firms. A size-band analysis was thus undertaken first to gauge the distribution of the SE and HIE supported firms compared to the non-assisted to include non-assisted firms in Scotland and also non-assisted firms in the northern region of England (North East, North West and Yorkshire and the Humber Government Office Regions)[[16]](#footnote-16). The latter were included due to their proximity to Scotland, and the potential likelihood of their being too few Scottish non-assisted firms in the larger size-bands.

Table 1.1 shows the size-band distribution for each group of firms using the 2014 BSD dataset (the same analysis was carried out on other years for comparison purposes)[[17]](#footnote-17). It indicates that the SE and HIE supported firms are skewed towards larger size-bands compared to the non-assisted firms, with 28% having 50 or more employees compared to less than 2% of non-assisted firms. The actual numbers in these larger size-bands suggest a relatively small pool of firms, particularly in the Scottish sample, from which to draw a control group. The results provide support for the inclusion of the second control group, based on the northern England sample, firstly to allow for a larger pool of firms from which to draw a similar group of control firms, and secondly to provide a robustness test in the event that the relatively small Scottish sample would skew the results.

**Table 1.1: Size-band Distribution of SE/HIE Supported Firms and Non-assisted firms 2014**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **SE/HIE firms** | **Scottish non-assisted** | **Northern England non-assisted** |
| **Size** | **Freq.** | ***Percent*** | **Freq.** | ***Percent*** | **Freq.** | ***Percent*** |
|  |  |  |  |  |  |  |
| 1-9 | 970 | *32.9* | 128,935 | *89.1* | 509,876 | *88.6* |
| 10-49 | 1,154 | *39.1* | 13,633 | *9.4* | 55,352 | *9.6* |
| 50-249 | 591 | *20.0* | 1,791 | *1.2* | 8,703 | *1.5* |
| 250+ | 234 | *7.9* | 317 | *0.2* | 1,640 | *0.3* |
|  |  |  |  |  |  |  |
| **Total** | **2,949** | ***100.0*** | **144,676** | ***100.0*** | **575,571** | ***100.0*** |

With the pool of firms in each control group agreed, the next step was to generate a more closely matched sample of non-assisted firms that would resemble the SE & HIE supported firms in terms of their background firm characteristics and their previous employment growth. This matching process can be undertaken in a number of ways; the idea being to generate such a close match that the control group acts as a proxy for what would have happened to the supported firms, in terms of their growth, had they not received the support. As we are using the ONS BSD for this analysis we are limited with respect to the number of variables that can be used to generate control groups, in this case it is limited to variables measuring prior growth; size; age; sector; prior productivity levels; UK ownership and whether they export[[18]](#footnote-18).Whilst these variables are limited in number, they do enable comparisons of firms on a like-for-like basis in the subsequent analysis, thus removing the effects of larger, higher productivity, or faster growing firms being selected into receipt of AM support. Obviously had the matching to the other ONS datasets been more comprehensive we could have included a range of other variables. However, the case remains that there would still be other unobserved variables and would include metrics such as characteristics of the owner/manager; skill levels of the employees and growth ambitions of the firm. Without access to survey data collecting such information there is no way of ensuring that the control group of firms will be similar to the SE/HIE supported with regards to such variables. However, recent research, summarising the results of a range of international studies, has shown that the growth ambitions of SMEs matter to productivity growth[[19]](#footnote-19).

In order to generate the control groups, and at the same time estimate the impact of SE/HIE support, matched treatment effects models were run[[20]](#footnote-20) using the nearest neighbour approach. This is, in effect, a two-stage model which uses the observable characteristics of firms, as listed above, to select, from the non-assisted pool of firms those which closely resemble the SE and HIE supported firms[[21]](#footnote-21) in terms of these characteristics and identifies these as the control group (here we specified 4 matches per supported firm)[[22]](#footnote-22). With the control group constructed and identified through a binary (1/0) variable which indicates whether the firm is SE/HIE supported or not, the second stage of the model regresses growth on this binary variable, controlling for the observed characteristics. The end result is the production of an Average Treatment Effect (ATE) coefficient which essentially shows the impact of being supported on the growth metric (e.g., the impact of being supported on employment growth).

On the whole we are interested in the growth of firms since 1998. The BSD data is available from 1997 onwards, however, given that we would like to include variables to capture prior growth and prior productivity levels (to control for the fact that SE/HIE firms may have had higher levels of both to begin with) we have chosen to measure growth from 2000 onwards rather than 1998. This then allows for data from 1997 – 1999 to be used to capture underlying characteristics which are used in the generation of the control group[[23]](#footnote-23). As a result the observable variables included sector (2 digit SIC), size, age, ownership (all based on 2000), prior employment growth (1997-99) and prior productivity levels (1999). Variables were transformed to log form to reduce any skewness and the ownership variable was converted into a binary variable to indicate UK-ownership or not. An exporter variable was also included within the models for the Scottish control group based on data from 2009 onwards thus an exporter variable was created equal to 1 if the firm exported in any year, and 0 otherwise.

As specified above the model was run over two timeframes, with each estimating the difference in growth between a starting period and an ending period so in the first case the growth over 2012-14 minus the growth over 2000-02 and, separately the growth over 2008-14 minus the growth over 2000-07. By choosing this difference-in-difference approach one can control for the fact that growth may naturally be higher (or lower) for the supported firms in general[[24]](#footnote-24), and thus subtracting the earlier growth ensures that the comparison between the two groups of firms (supported and not) is made on a similar basis. It is important to note, however, that this method reports on the overall difference between the two groups of firms (based on their respective difference in growth over time) and the results must be seen within the context of the overall performance in each sub-period. This is particularly the case if growth slows down in the latter period; a lower overall difference (for supported firms compared to non-assisted) may not be a negative finding if their performance in each sub-period was actually better than the comparison group of non-assisted firms.

Table 1.2 shows the descriptive statistics for the supported firms (as a whole) versus the wider control group of non-assisted firms in Scotland[[25]](#footnote-25). Figures 1.1 – 1.3 display turnover growth, employment growth and productivity growth respectively for the sub-periods underlying the ‘growth difference’ metrics as shown in rows 1-3 of Table 1.2. In terms of the general characteristics the differences between the supported and non-assisted firms were all statistically significant[[26]](#footnote-26).

**Table 1.2: Descriptive Statistics for All SE/HIE Supported vs All Non-Assisted Scotland**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Non-assisted** |  | **SE/HIE supported** |  |  |
|  | No. of Firms | Mean % | sd |  | No. of Firms | Mean % | sd |  | ***t-stat (z)*** |
| Turnover growth difference (00/02 -12/14) | 14,551 | -0.16 | 0.84 |  | 1,334 | -0.11 | 0.97 |  | ***1.8907\**** |
| Employment growth difference (00/02 – 12/14) | 8,865 | 0.06 | 0.77 |  | 1,320 | -0.27 | 0.85 |  | ***14.0958\*\*\**** |
| Productivity growth difference (00/02 -12/14) | 88,06 | -0.16 | 0.92 |  | 1,306 | 0.16 | 0.98 |  | ***11.4122\*\*\**** |
| Size (log) 2000 | 23,260 | 2.25 | 1.41 |  | 1,406 | 3.12 | 1.90 |  | ***21.8133\*\*\**** |
| Prior employment growth (1997-99) | 19,423 | 0.07 | 0.52 |  | 1,165 | 0.16 | 0.59 |  | ***5.7447\*\*\**** |
| Prior productivity (log) (1999) | 23,866 | 3.93 | 1.06 |  | 1,311 | 4.41 | 0.98 |  | ***16.0257\*\*\**** |
| UK-owned 2000 | 37,503 | 0.99 | 0.08 |  | 1,438 | 0.97 | 0.16 |  | ***11.4565\*\*\**** |
| UK-owned 2014 | 15,315 | 0.95 | 0.22 |  | 970 | 0.62 | 0.49 |  | ***68.8119\*\*\**** |
| Exporter | 37,503 | 0.19 | 0.40 |  | 3,203 | 0.73 | 0.44 |  | ***68.5124\*\*\**** |

The supported firms grew faster in the years prior to the period of observation with a mean growth of 16% between 1997-99 compared to 7% for the non-assisted firms. The supported firms were also larger in employment size, and in terms of their prior productivity levels. In 2000 97% were UK-owned compared to 99% of non-assisted firms[[27]](#footnote-27) and almost three quarters were exporters compared to one-fifth of the non-assisted. Given that we cannot identify the date at which support was given it is difficult to conclude whether these firms were being selected for support based on prior superior performance, whether they self-selected for support to help achieve particular growth ambitions, or whether they had already been in receipt of some form of assistance. In other words, we cannot say definitively whether the performance of supported firms measured here is a cause or consequence of being in receipt of support[[28]](#footnote-28)

Table 1.2 shows that the overall difference in turnover growth between the two periods of 2000-02 and 2012-14 was -16% for non-assisted firms and -11% for the SE/HIE supported. Figure 1.1 expands on this, showing the growth in the two underlying periods behind this calculation. In both sub-periods supported firms had positive turnover growth, which was higher than that for the non-assisted firms. In 2000-02 growth was 22%, but, as a result of the downturn, this had slowed by 2012-14 to 11%; the resulting difference between the last and first period -11%. In contrast, turnover growth for the non-assisted firms was 11% during 2000-02 but by 2012-14 growth had fallen by around 4%; the net difference between the two periods was an overall decline of 16%.

**Figure 1.1: Average Turnover growth for SE/HIE supported firms versus Scottish non-assisted firms**



There was a stark contrast in employment growth over the two periods between the supported and non-assisted firms. Table 1.2 shows that employment growth fell by 27% overall for the supported firms between the two periods whilst for the non-assisted there was a 6% increase[[29]](#footnote-29). However, again, these results were due to mixed fortunes for the two groups of firms. Figure 1.2 shows that employment actually grew for supported firms in both periods, the 4% growth over 2012-14 dwarfed by the exceptional growth of 31% over 2000-02, resulting in the net decrease of -27% overall. Unlike their counterparts the non-assisted had a decline in employment over both periods; a 7% drop over 2000-02 and a decrease of just 1% over 2012-14, meaning that overall the difference was a positive growth of 6%.

**Figure 1.2: Average Employment growth for SE/HIE supported firms versus Scottish non-assisted firms**



There was also a notable difference in productivity growth between the two groups of firms. Table 1.1 indicates a 16% increase overall for the supported firms compared to a 16% decrease for the non-assisted. Again, the circumstances surrounding this differed for the two groups; Figure 1.3 shows that in fact productivity fell by 10% for supported firms between 2000-02 but grew by 6% over 2012-14; this resulted in the 16% growth overall between the last and first period. In direct contrast, productivity grew by 12% for the non-assisted over the earlier period but fell by 4% over 2012-14 – an overall decline of 16% between the two periods.

**Figure 1.3: Average Productivity growth for SE/HIE supported firms versus Scottish non-assisted firms**

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Therefore, the underlying growth performance of the two groups of firms differed remarkably both over time and across the three metrics. Notably, for both the turnover and employment metrics growth was stronger for the SE/HIE supported firms in each of the sub-periods. However, it was this strong growth in the earlier period, coupled with the slowing down, due largely to the effects of the recession and subsequent recovery in the latter period, that resulted in the negative growth overall. In fact, supported firms consistently outperformed their non-assisted counterparts with regards to employment and turnover, a scenario which is perhaps hidden when examining just the overall difference, and one which confirms the notion that supported firms are selected based on their growth potential. This latter point is illustrated perfectly by the fact that growth remained positive over 2012-14 for supported firms, whilst the non-assisted saw a decline. It is important to keep these underlying performance trends in mind when considering the results of the DID models, as the effect reported is that of the overall difference.

The differences between the Scottish supported firms and the non-assisted from the Northern England regions (Table 1.3) were of a similar magnitude to the above[[30]](#footnote-30), and as before, all the differences were statistically significant. Table 1.3 presents the descriptive statistics whilst Figures A2.1-A2.3 in Appendix 2 provide the accompanying charts for the underlying growth periods.

**Table 1.3: Descriptive Statistics for All SE/HIE Supported vs All Non-Assisted Northern England[[31]](#footnote-31)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | No. of Firms | mean | sd |  | No. of Firms | Mean | sd |  | ***t-stat (z)*** |
| Turnover diff (00/02 -12/14) | 40,446 | -0.18 | 0.86 |  | 1,334 | -0.11 | 0.97 |  | ***2.9474\*\*\**** |
| Emp diff (00/02 – 12/14) | 23,860 | -0.01 | 0.78 |  | 1,320 | -0.27 | 0.85 |  | ***11.4794\*\*\**** |
| Productivity diff (00/02 -12/14) | 23,692 | -0.11 | 0.96 |  | 1,306 | 0.16 | 0.98 |  | ***9.6476\*\*\**** |
| Size (log) 2000 | 67,135 | 2.25 | 1.45 |  | 1,406 | 3.12 | 1.90 |  | ***21.9573\*\*\**** |
| Emp growth (97-99) | 54,735 | 0.09 | 0.52 |  | 1,165 | 0.16 | 0.59 |  | ***4.3585\*\*\**** |
| Productivity (log) (1999) | 68,252 | 3.99 | 1.06 |  | 1,311 | 4.41 | 0.98 |  | ***14.0112\*\*\**** |
| UK-owned 2000 | 110,278 | 0.99 | 0.10 |  | 1,438 | 0.97 | 0.16 |  | ***9.7369\*\*\**** |
| UK-owned 2014 | 42,555 | 0.94 | 0.23 |  | 970 | 0.62 | 0.49 |  | ***73.3448\*\*\**** |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

Focussing more specifically on productivity, and in particular the differences between the two groups of firms, Tables 1.4 and 1.5 report productivity levels in 1998 by broad sector. Comparing the supported to the Scottish non-assisted, significantly higher average productivity levels are seen in the Construction; Wholesale and Retail and Transport, Storage and Communication sectors. In Construction average productivity was £351,000 for supported firms compared to £86,000 for the non-assisted; in Wholesale and Retail average productivity was £299,000 for the supported compared to £103,000 for the non-assisted; whilst in the Transport sector the respective figures were £131,000 and £91,000[[32]](#footnote-32). These figures do not control for firm size and given that previous descriptives showed that supported firms were on average larger, we would anticipate higher productivity levels, on average, for supported firms.

**Table 1.4: Descriptive Statistics for Productivity Levels 1998 All SE/HIE Supported vs All Non-Assisted Scotland[[33]](#footnote-33)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **No. of Firms** | **Mean £000** | **Sd** |  | **No. of Firms** | **Mean £000** | **sd** |  | ***t-stat (z)*** |
| Manufacturing | 2,924 | 90.7 | 412.6 |  | 580 | 103.7 | 137.5 |  | ***0.7499*** |
| Construction | 2,567 | 86.4 | 122.3 |  | 70 | 351.1 | 1887.4 |  | ***6.6534\*\*\**** |
| Wholesale & Retail | 9,409 | 103.1 | 476.2 |  | 224 | 298.7 | 1075.6 |  | ***5.8037\*\*\**** |
| Transport, Storage & Communication | 1,107 | 90.8 | 146.7 |  | 46 | 130.7 | 185.5 |  | ***1.7888\**** |
| Business Services | 4,502 | 98.4 | 959.9 |  | 210 | 95.7 | 132.7 |  | ***0.0408*** |
| Other  | 2,707 | 1152.5 | 15658.6 |  | 101 | 162.1 | 362.1 |  | ***0.6356*** |

When the same comparisons are made with the northern English non-assisted sample (Table 1.5) the only sector in which productivity levels are statistically significantly higher for supported firms is Construction. Here the supported firms have average productivity levels around three times higher than the non-assisted at £351,000 compared to £111,000.

**Table 1.5: Descriptive Statistics for Turnover per Employee 1998 All Assisted vs All Non-Assisted Northern England**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **No. of Firms** | **Mean £000** | **Sd** |  | **No. of Firms** | **Mean £000** | **sd** |  | ***t-stat (z)*** |
| Manufacturing | 12,050 | 84.6 | 340.0 |  | 580 | 103.7 | 137.5 |  | ***1.3471*** |
| Construction | 6,372 | 110.7 | 338.0 |  | 70 | 351.1 | 1887.4 |  | ***5.1452\*\*\**** |
| Wholesale & Retail | 24,161 | 126.9 | 1803.3 |  | 224 | 298.7 | 1075.6 |  | ***1.4236*** |
| Transport, Storage & Communication | 3,228 | 101.2 | 197.8 |  | 46 | 130.7 | 185.5 |  | ***1.0049*** |
| Business Services | 13,195 | 82.9 | 344.1 |  | 210 | 95.7 | 132.7 |  | ***0.5398*** |
| Other  | 6,925 | 416.1 | 9650.4 |  | 101 | 162.1 | 362.1 |  | ***0.2646*** |

## 1.3 Effect of SE/HIE Support on Growth

The Average Treatment Effect (ATE) provides an indication of the impact of SE and HIE support on the growth performance of firms; the coefficient providing an indication of the size, and significance, of the effect. In order to assess whether this impact differs according to different types of firm the analysis was run for different categories of clients (by segmentation group); for different size-bands (for the Account-Managed Growth firms) and, using the difference-in-difference approach, over two timeframes, the first covering the entire period (the difference between 2012-14 and 2000-02), the second covering the periods prior to and post-recession (the difference between 2008-14 and 2000-07).

Table 1.6 provides a summary table of the ATE effect for each of these categories showing the coefficient and its level of significance[[34]](#footnote-34). Results compared to the Scottish control group and the northern England control group are both shown. Statistical significance is indicated by the presence of \* with the sign on the coefficient indicating whether the impact is positive or negative.

Models 1 and 2 are run on the full sample of SE/HIE supported firms. The results are consistent across both control groups and show that, comparing growth in the earlier and latter periods, supported firms tend to have lower turnover growth and lower employment growth than non-assisted firms but higher productivity growth during this period. These results are slightly different than those shown in Figures 1.1 – 1.3, regarding turnover growth, and is due to the fact that these results are based on comparisons to the matched control group. However, as before, it is likely that the lower growth for the AM supported firms is due to a greater slowing down of growth in the latter period rather than an overall lower growth trend compared to the non-assisted. These results also hold when the timeframe for the analysis is switched to the 2000/07 – 2012/14 period.

In general, these results are also relatively uniform across all the models. The only exceptions to this are among the Non-Relationship Managed group of firms (NRM)[[35]](#footnote-35), and, amongst the Account-Managed growth firms, for large firms with more than 250 employees over the 2000/07 – 2008/14 period; in both cases there is no statistically significant impact on productivity growth. The NRM finding is of interest as it suggests that it is the relationship management with firms provided by SE and HIE that makes the difference; this is ratified by the fact that all other segmentation categories report positive significant effects; with the Designated-Relationship Managed group (DRM) as a whole having around 20% higher productivity growth due to the support. This result controls for previous productivity levels, and also, given that we are considering the difference between two periods, controls for the growth in the earlier period. It indicates that when the difference in average productivity growth between 2000-02 and 2012-14 for non-assisted firms is subtracted from the difference in average growth for DRM firms, then the support is associated with higher productivity growth.

The effect of support on employment growth is quite mixed; generally it is negative but not always statistically significant. The exception to this is for large Account-Managed Growth firms, where a positive significant effect is found. This may reflect a particular strategy of SE/HIE as these firms may be strategically more important and thus helped to grow employment. Alternatively, it may be the case that these larger firms are in receipt of other forms of assistance, particularly if they are FDI, which is targeted towards growing their employment[[36]](#footnote-36). Further research is required to understand the particular ways support interacts with business dynamics and performance.

Overall, the results support the conclusion that there is a positive effect on the productivity growth for supported firms. It confirms the actions of SE who, in 2008 redirected support towards achieving this aim and that of HIE who adopted the Account Management system in 2008; the similar results across both control groups imply the robustness of the results.

**Table 1.6: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Sample** | **Control Group** | **Period** | **Turnover Growth**  | **Employment Growth** | **Productivity Growth** |
|  |  |  |  |  |  |  |
| 1 | Full Sample[[37]](#footnote-37) | Scotland | 00-02 – 12-14 | -0.0878\* | -0.232\*\*\* | 0.153\*\*\* |
| 2 | Full Sample | N. England | 00-02 – 12-14 | -0.0740 | -0.195\*\*\* | 0.136\*\*\* |
|  |  |  |  |  |  |  |
| 3 | Full Sample | Scotland | 00-07 – 08-14 | -0.216\*\*\* | -0.435\*\*\* | 0.227\*\*\* |
| 4 | Full Sample | N. England | 00-07 – 08-14 | -0.147\* | -0.362\*\*\* | 0.213\*\*\* |
|  |
| **Segmentation Groups 2000/02 – 2012/14** |
| 5 | DRM[[38]](#footnote-38) | Scotland | 00-02 – 12-14 | -0.0679 | -0.256\*\*\* | 0.199\*\*\* |
| 6 | DRM | N. England | 00-02 – 12-14 | -0.0578 | -0.225\*\*\* | 0.188\*\*\* |
|  |  |  |  |  |  |  |
| 7 | AMG[[39]](#footnote-39) | Scotland | 00-02 – 12-14 | -0.0646 | -0.254\*\*\* | 0.202\*\*\* |
| 8 | AMG | N. England | 00-02 – 12-14 | -0.0472 | -0.210\*\*\* | 0.184\*\*\* |
|  |  |  |  |  |  |  |
| 9 | ItE[[40]](#footnote-40) | Scotland | 00-02 – 12-14 | 0.0114 | -0.288\*\*\* | 0.303\*\*\* |
| 10 | ItE | N. England | 00-02 – 12-14 | -0.182 | -0.339\*\*\* | 0.157 |
|  |  |  |  |  |  |  |
| 11 | NRM[[41]](#footnote-41) | Scotland | 00-02 – 12-14 | -0.190\*\* | -0.135\* | -0.0523 |
| 12 | NRM | N. England | 00-02 – 12-14 | -0.0971 | -0.0612 | -0.0350 |
|  |
| **Segmentation Groups 2000/07 – 2008/14** |
| 13 | DRM | Scotland | 00-07 – 08-14 | -0.258\*\*\* | -0.456\*\*\* | 0.208\*\*\* |
| 14 | DRM | N. England | 00-07 – 08-14 | -0.186\*\* | -0.384\*\*\* | 0.191\*\*\* |
|  |  |  |  |  |  |  |
| 15 | AMG | Scotland | 00-07 – 08-14 | -0.264\*\*\* | -0.475\*\*\* | 0.213\*\*\* |
| 16 | AMG | N. England | 00-07 – 08-14 | -0.187\*\* | -0.379\*\*\* | 0.181\*\*\* |
|  |  |  |  |  |  |  |
| 17 | ItE | Scotland | 00-07 – 08-14 | -0.0191 | -0.327\*\* | 0.408\*\* |
| 18 | ItE | N. England | 00-07 – 08-14 | 0.0607 | -0.244 | 0.393\* |
|  |  |  |  |  |  |  |
| 19 | NRM | Scotland | 00-07 – 08-14 | -0.263\* | -0.407\*\*\* | 0.156 |
| 20 | NRM | N. England | 00-07 – 08-14 | -0.159 | -0.235\* | 0.0766 |
|  |
| **Account-Managed Growth 2000/02 – 2012/14** |
| 21 | Micro[[42]](#footnote-42) | Scotland | 00-02 – 12-14 | -0.0819 | -0.403\*\*\* | 0.336\*\*\* |
| 22 | Micro | N. England | 00-02 – 12-14 | -0.0705 | -0.267\* | 0.202 |
|  |  |  |  |  |  |  |
| 23 | Small | Scotland | 00-02 – 12-14 | -0.0646 | -0.284\*\*\* | 0.244\*\*\* |
| 24 | Small | N. England | 00-02 – 12-14 | -0.0774 | -0.254\*\* | 0.222\*\*\* |
|  |  |  |  |  |  |  |
| 25 | Large | Scotland | 00-02 – 12-14 | 0.162\* | 0.00355 | 0.158\*\* |
| 26 | Large | N. England | 00-02 – 12-14 | 0.191\*\*\* | 0.0209 | 0.164\*\* |
|  |
| **Account-Managed Growth 2000/07 – 2012/14** |
| 21 | Micro | Scotland | 00-07 – 08-14 | -0.144 | -0.643\*\*\* | 0.508\*\*\* |
| 22 | Micro | N. England | 00-07 – 08-14 | -0.0580 | -0.522\*\*\* | 0.478\*\*\* |
|  |  |  |  |  |  |  |
| 23 | Small | Scotland | 00-07 – 08-14 | -0.364\*\*\* | -0.613\*\*\* | 0.248\*\* |
| 24 | Small | N. England | 00-07 – 08-14 | -0.339\*\*\* | -0.528\*\*\* | 0.183\*\* |
|  |  |  |  |  |  |  |
| 25 | Large | Scotland | 00-07 – 08-14 | 0.0745 | 0.0389 | 0.0510 |
| 26 | Large | N. England | 00-07 – 08-14 | 0.190\* | 0.176 | 0.0128 |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

The same ATE analysis is performed for HIE supported firms as a separate category. Table 1.7 displays the results. The effect of support on productivity growth is positive but statistically significant only for the period covering 2000/07 – 2008/14. This means that the average difference in productivity growth between these sub-periods is higher for HIE firms than for the non-assisted and, in fact, HIE support increased productivity growth by at least 30%. The effect on employment and turnover growth is rather mixed; comparing the two separate timeframes we see that generally the signs on the coefficients are the same over both periods but only significant in the latter, and not consistently so across both control groups. Again the fact that support was found to have its greatest impact post-2008 ties in with the redirection of HIE’s aims around this time, during which the Account Management service was introduced.

**Table 1.7: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth HIE Firms**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Sample** | **Control Group** | **Period** | **Turnover Growth**  | **Employment Growth** | **Productivity Growth** |
|  |  |  |  |  |  |  |
| 1 | HIE | Scotland | 00-02 – 12-14 | 0.0305 | -0.0554 | 0.0857 |
| 2 | HIE | N. England | 00-02 – 12-14 | 0.0430 | -0.0212 | 0.0636 |
|  |  |  |  |  |  |  |
| 3 | HIE | Scotland | 00-07 – 08-14 | 0.134 | -0.224\*\* | 0.366\*\*\* |
| 4 | HIE | N. England | 00-07 – 08-14 | 0.193\* | -0.105 | 0.296\*\* |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

# Impacts over the Recession

## 2.1 Introduction

The previous chapter examined the growth performance of SE and HIE supported firms over the entire 2000-2014 period. However, the performance of the wider economy varied greatly during this time, with a period of growth until 2008, followed by a recession until 2012. The earlier analysis did examine growth prior to and post-2008 for evidence of a pre and post-recession effect, however, in an attempt to further understand the effects of support during this time, further sub-periods are considered.

The Average Treatment Effect (ATE) analysis, using the difference-in-difference approach, was re-run over three separate periods to capture the average difference in growth between 2012-14 and the periods immediately before, during and after the recent recession. The difference in growth was thus estimated for:

1. the ‘before’ period (2006/08 – 2012/14)
2. the ‘during’ period (2008/10 – 2012/14)
3. the ‘after’ period (2010/12 – 2012/14)

As before, this difference-in-difference approach captures the average difference in growth over time and between the SE/HIE supported and non-assisted firms. It works by subtracting growth in the first two-year period (e.g. 2006-08) from the latter two-year period (e.g. 2012-14) for both the supported and non-assisted firms, and then subtracts the figure for the non-assisted from that for the supported firms to provide the average effect from being supported. Following the previous methodology, control groups were used to provide the counterfactual; again these were drawn from the pool of Scottish non-assisted firms, with a second control group drawn from a pool of firms from northern England. The nearest neighbour approach was used to select, from this wider pool, the firms more closely resembling the supported firms, in terms of their characteristics as listed above.

## 2.2 Effect of SE/HIE Support on Growth

Table 2.1 reports the coefficients for the ATE models over each of the time periods for the full sample of DRM and NRM firms[[43]](#footnote-43). Looking firstly at the model which compares growth to the ‘before’ period (2006/08 – 2012/14) the results show that the average growth in employment for AM firms was significantly lower than the non-assisted in Scotland (but not significantly so compared to the northern England control group). There were also no significant differences between the supported and non-assisted with regards to turnover or productivity growth.

**Table 2.1: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth SE& HIE Firms**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Sample** | **Control Group** | **Period** | **Turnover Growth**  | **Employment Growth** | **Productivity Growth** |
|  |  |  |  |  |  |  |
| 1 | Full Sample | Scotland | 06-08 – 12-14 | -0.0129 | -0.0507\* | 0.0371 |
| 2 | Full Sample | N. England | 06-08 – 12-14 | -0.0271 | -0.0250 | 0.00210 |
|  |  |  |  |  |  |  |
| 3 | Full Sample | Scotland | 08-10 –12-14 | -0.00862 | -0.0674\*\* | 0.0612 |
| 4 | Full Sample | N. England | 08-10 – 12-14 | -0.0598 | -0.0322 | -0.0254 |
|  |  |  |  |  |  |  |
| 5 | Full Sample | Scotland | 10-12 –12-14 | 0.00712 | 0.0478\* | -0.0398 |
| 6 | Full Sample | N. England | 10-12 – 12-14 | 0.0374 | 0.0720\*\* | -0.0310 |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

The same results were observed for the model comparing growth to the ‘during’ period (2008/10 – 2012/14); again employment growth was significantly lower for AM firms only against the Scottish control group. It is only when compared to the ‘after’ period (i.e., 2010/12 – 2012/14) that consistent results were achieved against both control groups; here the results suggest that the difference in employment growth was higher for the AM supported firms compared to the non-assisted. But again no statistical difference in turnover or productivity growth was found.

The results are noteworthy in that, unlike the previous analysis, there are no significant productivity growth effects. In addition, the negative employment effects observed over the difference between 2012-14 and both the ‘before’ and ‘during’ periods, may suggest that AM support was directed towards achieving other aims during this period and perhaps firm survival took precedence, rather than sustaining high levels of growth.

If we look at the underlying growth periods relating to the overall 2006/08 – 2012/14 period it helps sheds some light on this hypothesis[[44]](#footnote-44). Figure 2.1 displays average growth in turnover for SE/HIE supported firms and non-assisted firms and Figure 2.3 shows average growth in productivity, and whilst growth was positive, in both metrics, for supported firms in both sub-periods the net difference was negative due to the much slower growth in the 2012-14 period. The Scottish non-assisted firms also experienced an overall net decline, albeit for different reasons, with relatively slow average growth in 2006-08 and negative growth over 2012-14.

**Figure 2.1: Average Turnover growth for SE/HIE supported firms versus Scottish non-assisted firms**

****

Average employment growth follows the same pattern with supported firms having positive employment growth in both 2006-08 and 2012-14 (Figure 2.2). However, the slower growth in the latter period results in the overall net decline between the two periods. In comparison, average employment growth for the non-assisted firms was relatively slow, growing by just 3% in 2006-08 and then 0% growth in 2012-14, also resulting in an overall net decline.

**Figure 2.2: Average Employment growth for SE/HIE supported firms versus Scottish non-assisted firms**

****

**Figure 2.3: Average Productivity growth for SE/HIE supported firms versus Scottish non-assisted firms**

****

In terms of these growth metrics, the underlying trends show that supported firms do outperform their non-assisted counterparts over both sub-periods, however, the slowing of their growth during 2012-14 does result in an overall net decrease. Obviously, as the economic climate over the former period was much more favourable to growth, a slowing down would be expected in the more recent 2012-14 period, and, in fact, looking at the non-assisted firms (i.e., the counterfactual position) suggests that without SE/HIE support then growth would have been much lower over 2006-08 and either negative or zero during 2012-14. The implication from this is, therefore, that support helped firms to grow over 2012-14, although at a slower rate than previously, in the face of a slowly recovering economy. The overall negative impact for SE/HIE supported firms is not, therefore, a reason for concern, unless the maintenance of growth at the previous level was a priority.

Performing the same ATE analysis on the Account Managed growth firms only (Table 2.2.) gives similar results with regards to both turnover growth and employment growth. There are negative significant impacts (compared to the Scottish control group), although as discussed above this is most likely due to a slowing down of growth over 2012-14. Here, employment and turnover growth are lower for the assisted group of firms.

However, a productivity impact is found for the average difference in growth between 2012-14 and the 2008-10 period, with the Account Managed Growth firms having 7% higher growth than the non-assisted. If productivity growth was being actively targeted over the 2012-14 period, and/or it was particularly negatively affected during the recession then the Account Management service provided a boost that would otherwise have not occurred.

**Table 2.2: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth SE& HIE Firms**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Sample** | **Control Group** | **Period** | **Turnover Growth**  | **Employment Growth** | **Productivity Growth** |
|  |  |  |  |  |  |  |
| 1 | AMG | Scotland | 06-08 – 12-14 | -0.0284 | -0.0696\* | 0.0384 |
| 2 | AMG | N. England | 06-08 – 12-14 | -0.0545 | -0.0503 | -0.00154 |
|  |  |  |  |  |  |  |
| 3 | AMG | Scotland | 08-10 –12-14 | -0.0110 | -0.0824\*\* | 0.0733\* |
| 4 | AMG | N. England | 08-10 – 12-14 | -0.0218 | -0.0341 | 0.0151 |
|  |  |  |  |  |  |  |
| 5 | AMG | Scotland | 10-12 –12-14 | -0.0247 | 0.0622 | -0.0865 |
| 6 | AMG | N. England | 10-12 – 12-14 | -0.00750 | 0.0644\* | -0.0701 |
|  |  |  |  |  |  |  |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

# **Analysis of the Drivers of Productivity**

##

## 3.1 Introduction

As a separate analysis to the effect of support on growth an exploratory study of the drivers of productivity was undertaken, again using the ONS datasets to understand the relationship. Obviously there are a range of measures which drive productivity at the firm level, such as investment, innovation activity and exporting, however there is no one dataset which collects all the required data. The intention for this analysis was to link available datasets together, drawing key variables from each (where numbers permitted), to generate a single dataset which would be used to explain the relationship between firm level activities and productivity levels and growth.

The analysis was exploratory as it was anticipated there would be difficulties in constructing a longitudinal dataset which had sufficient observations each year across a number of required variables. Each of the ONS datasets[[45]](#footnote-45), excluding the BSD, is a sample-based survey, and thus coverage of firms, particularly at the smaller end of the scale is quite sparse. Taking this alongside the fact that the same firms are purposely not surveyed over consecutive years (excluding the largest firms) to reduce their administrative burden means that it is difficult to obtain a run of information for the same firms over a number of years.

Ideally, we would need to have a time series of data to be able to include past business activities of the firm such as exporting and/or innovation as it would enable us to look at the causal impacts. As mentioned before, to do this properly a panel dataset would be required which tracked the same firms over time and had a range of relevant variables that would assist the modelling of the drivers of productivity.

Given this, it was decided to link across datasets one at a time with the expectation that there would be sufficient data points for a reduced number of firms. As a consequence any results may not be applicable to the wider population.

## 3.2 Methodology

The first step in the process was to merge key datasets together; as the ARD (ABS) is the only ONS dataset which collects the necessary financial information for analysing productivity, particularly Gross Value Added; it was used as the central dataset upon which to merge the remainder. The ARD dataset contains around 500,000 observations from 1997-2013; merging the UK Innovation Survey (UKIS) resulted in approximately 36,000 firms that appear on both datasets, of which 605 are SE/HIE supported firms (equating to 17% of the total SE/HIE firms with ERNs)[[46]](#footnote-46). Employment data from the BSD was added to this merged dataset, as was data from the BERD survey.

As there was a maximum of 605 supported firms that were on both the UKIS and ARD, these were categorised as either innovators or non-innovators. Those categorised as innovators had indicated in the survey that they had carried out innovation activities on any one of the UKIS surveys from waves 3-8[[47]](#footnote-47), equating to 1998-2012.

R&D and exporter variables were created in a similar manner; the BERD survey is regarded as a census of the R&D active firms in the UK (as identified from other survey sources) thus once it was merged to the dataset firms that had appeared on the BERD survey were categorised as R&D performers, and the remainder as non-RD performers.

Whether a firm was an exporter or not had been provided from the Global Connections Survey, which samples known and potential exporters in Scotland[[48]](#footnote-48). This was combined with data from the ABS (from 2009 onwards) which asks about exporting activities; thus firms were defined as exporters if they ever appeared as such on the Scottish data, or on the ABS.

This approach to classify a firm as an innovator, R&D active or an exporter if they had ever been engaged in these activities was the only feasible option as trying to identify such firms on an annual basis would have resulted in an unworkable sample size. Generally, to minimise the burden on firms, surveys such as the ABS are not sent to the same firms on a consecutive basis (the exception is to the largest firms, those with 250 + employees) thus making it difficult to construct a panel dataset containing a sufficient number of firms with annual information over a period of time.

The downside to this approach is that we cannot then truly analyse the causal links between such activities and productivity, rather we can only conclude whether there are statistical correlations. Given the inter-connected or endogenous relationships between productivity and conducting R&D; undertaking innovation and starting to export[[49]](#footnote-49) we would ideally want to include lagged variations of these variables so that we can determine whether current productivity (or productivity growth) is a function of past activity in any of these metrics. Categorising firms as being actively involved in these activities, if they had been involved at least once, does not allow such causal links to be established, and there may in fact be feedback or reverse causality effects. For example, higher productivity firms may self-select into exporting as they deem themselves sufficiently efficient to enter the wider competitive marketplace, but there may be no subsequent productivity effect from exporting (at least in the short term). In this scenario higher productivity associated with exporting firms would in fact be due to behaviour by the firm prior to exporting rather than the actual activity causing the improved productivity performance. We must, therefore, be careful in our interpretation of such results, and not falsely attribute causality where the direction of the relationship is unclear[[50]](#footnote-50).

Bearing these caveats in mind models estimating the impact of these activities, and SE/HIE support, were run on productivity and productivity growth using a two-step linear regression with endogenous treatment effects[[51]](#footnote-51). This model includes a first step probit which is run on the probability of being a supported firm, and a second stage OLS which then analyses the impact of support, and other variables, on productivity levels, and separately on productivity growth.

This type of model is chosen as it is suitable when the issue of selection, or omitted variable bias, arises. Selection is known to occur where firms have been chosen to receive support or assistance; in these cases the selection is generally non-random and thus there may be unobserved factors associated with these firms which may affect the outcome. For example, if firms were selected to receive support on the basis of superior performance then any assessment of their post-support performance must control for this, otherwise there is a risk of attributing any growth or improved performance solely to the support, when in fact their underlying characteristics are largely responsible. In this case failure to control for this would have resulted in an upward bias on the results (i.e. the coefficient for the SE/HIE variable would have been too big). If firms were selected based on initial poor performance, then similarly, failure to control for this could have a downward bias on the results.

The model thus controls for these endogenous treatment effects by firstly identifying those variables which increase the probability of being selected for support; the second stage then models the impact of support (and other variables) on productivity, controlling for this selection. A selection term is included in the model to indicate the extent of, sign, and significance, of any bias.

For the first stage of the model, predicting the probability of receiving SE/HIE support, variables were selected which represented likely characteristics of supported firms. Size was included as supported firms are quite often large firms as they are strategically important, particularly in areas of relatively high unemployment. Alternatively, small firms can be the focus of support as such firms find it difficult to access finance and other similar support from the private sector. We, therefore, anticipate either a positive (large firm) or negative (small firm) effect from size on the probability of being supported. In other words, if it is negative it means that small firms are more likely to be supported; if it is positive it means that large firms are more likely to be supported. As with size, the current level of productivity is included, again this can be positive or negative depending on whether the support is likely to be targeted towards better performing firms, to help them grow further, or whether it is focussed on those with lower productivity levels to help them improve. An exporter variable is included as we would generally expect supported firms to be engaged in exporting and thus we anticipate a positive sign on the exporter variable. Likewise we would also anticipate that supported firms are more likely to be involved in R&D activities.

The latter variable is also included here to ‘identify’ the second stage equation, whereby a variable is included in the probit which is not included in the second stage OLS[[52]](#footnote-52). R&D was selected as this identification variable as it is likely that supported firms are engaged in this activity, but, as R&D is an input into the innovation process rather than an output, it is not expected to directly have an impact on productivity or productivity growth. Rather, the resulting innovation, arising from the R&D process, is more likely to affect productivity as it represents an end result of the R&D process.

The second stage of the model, the OLS or linear regression, examines the impact on productivity. The ‘endogenous’ support variable is drawn from the probit and included at this stage, thus ensuring that the coefficient represents the true effect of support and is not biased (as we have just modelled which type of firms are more likely to be supported). We would anticipate that the support variable would be positively correlated with productivity and productivity growth, particularly given that one of the particular aims of AM support is to enhance productivity within firms.

Other variables included which are likely to have a positive correlation with productivity are net capital expenditure, which represents net investment in tangible assets by the firm. Firms making new investments, in particular, may be acquiring more up-to-date machinery which would result in improved productive performance. Firms with higher employment costs (per employee) would also be expected to have higher productivity in that higher employment costs or wages represent higher levels of human capital.

Binary variables[[53]](#footnote-53) included in the linear regression include exporter, product innovation, process innovation and subsidy variables[[54]](#footnote-54). Both the exporter and innovation variables would be expected to be positively related to productivity, whilst process innovation in particular would be expected to be positively related to productivity growth as such innovation is often aimed at streamlining the production process. The subsidy variable is included to take account of other non-SE/HIE support available to firms[[55]](#footnote-55), which it is expected could either be used to improve productivity, or alternatively it could be used for other performance measures, such as employment growth in which case there may be a negative or no effect on productivity[[56]](#footnote-56).

Other variables which are included as controls include size, age, ownership, sector and region. Variables to represent the previous productivity growth of the firm, and its existing level of capital stocks are also included to account for the underlying performance of the firm.

## 3.3 Drivers of Productivity

Table 3.1 (at the end of the section) presents the results of the model for **productivity levels** (in 2013) and **productivity growth** over the 2012-13 period[[57]](#footnote-57). Table 3.2 (at the end of the section) then presents the same models but pooled over all observations. The latter is run to allow for more observations than is included on the single year regression.

On the single year model the determinants of being supported (endogenous assistance regression) include being an exporter, undertaking R&D, and having higher productivity. These results are as expected *a priori*. The selection term is negative and highly significant suggesting that there was selection into receiving SE/HIE support. In other words, it was not a random allocation of support amongst the wider population of firms. The negative sign on the selection term means that in the model there are other factors (which we could not include due to lack of data) that make being supported more likely, and that these factors tend to be associated with lower productivity levels[[58]](#footnote-58). Failure to control for such bias, in a standard OLS regression, would have reduced the size of the coefficient on the SE/HIE support variable, and thus underestimated the impact of support.

The results on productivity levels indicate that after controlling for selection into assistance, being SE/HIE supported has a positive effect on productivity. This is consistent with the findings reported earlier that there is a positive effect on the productivity growth for supported firms see Section 1). It confirms the actions of SE who, in 2008 redirected support towards achieving this aim and that of HIE who adopted the Account Management system in 2008; the similar results across both control groups imply the robustness of the results. In addition, a productivity impact is found for the average difference in growth between 2012-14 and the 2008-10 period, with the Account Managed Growth firms having 7% higher growth than the non-assisted (see Table 2.2).

Having a higher net capital expenditure and higher employment costs, which acts as a proxy for higher skill levels, is also associated with higher **productivity levels**, as previously expected. Notably, exporting is found to be negatively correlated with productivity. This finding was not anticipated but as exporting can result in increased employee levels due to the additional demand for the goods/service provided, then productivity can fall particularly in the short term. Indeed, the wider literature reports inconsistent findings with regards to the impact of exporting on subsequent productivity, typically finding that firms are more productive prior to exporting rather than becoming more productive afterwards (see Wagner, 2007 for a summary).[[59]](#footnote-59)

The 2012-13 **productivity growth** model reports the same probit results, however, in this case the selection term is positive and significant. This suggests that unlike productivity levels, the unobserved factors associated with selection into SE & HIE support are correlated with higher productivity growth. These include such things as the intangible assets of the firms in terms of IP and the growth ambition and experience of the owner and/or senior management team. Failure to take account of which would have resulted in a larger coefficient on the support variable.

Again, unlike the model for productivity levels, the results indicate that being supported is associated with a negative impact on productivity growth. This finding is in contrast to prior expectations but this may be explained by the particular year under observation. As this was a period of recovery in the economy, it may reflect the fact that support was re-directed towards employment growth to allow firms to return to peak operational levels. Given the small sample sizes we must be careful, however, in drawing conclusions which may be affected by the relatively small proportion of supported firms in the sample. Indeed a similar model was run on productivity levels in 2008 and productivity growth over 2007-08 (See Appendix 4). The results were similar to those above, despite the very different economic conditions, thus reinforcing the caveats associated with the small, and likely skewed sample[[60]](#footnote-60).

The results for the pooled regression models are remarkably similar to the one year models. In both cases there is evidence for selection, with a negative selection effect for productivity levels and a positive effect for productivity growth[[61]](#footnote-61). Likewise the support variable suggests a positive correlation with productivity levels but a negative association with growth. It is noteworthy that the other significant variables associated with productivity growth, such as net capital expenditure and employee costs, are negative suggesting that firms with lower expenditure on both have higher productivity growth. These results hold even after controlling for lower prior productivity growth, and for sector, and run contrary to expectations. Again, given the caveats mentioned above, particularly in relation to sample size these unexpected results may be a reflection of the particular groups of firms for whom we have data and not applicable to the wider population. For example, we suspect that the firms that have data on each of the datasets, and hence have been merged, are more likely to be larger firms so the results represent only a subset of a group of larger firms.

Overall, we can conclude that this exploratory analysis has provided some evidence that SE/HIE AM supported clients have had some correlation with productivity gains. It is essential that a more robust time series dataset be constructed in order to fully assess the role of the AM system in the uplift of productivity.

**Table 3.1: Treatment Regression on Productivity and Productivity Growth 2013**

|  |  |  |
| --- | --- | --- |
|   | (1) | (2) |
| VARIABLES | Productivity 2013 | Productivity growth 2012-13 |
|   |   |   |
| **Supported by SE/HIE (dummy)** | **10.23\*\*\*** | **-1.739\*\*\*** |
|  | **(1.850)** | **(0.477)** |
| Net capital expenditure 2012 (log) | 0.120\*\*\* | 0.00164 |
|  | (0.0301) | (0.00775) |
| Subsidy 2012 (dummy) | -0.00859 | 0.0380 |
|  | (0.223) | (0.0575) |
| Product innovator (dummy) | -0.0491 | -0.0390 |
|  | (0.138) | (0.0357) |
| Process innovator (dummy) | -0.0278 | 0.0403 |
|  | (0.135) | (0.0349) |
| Exporter (dummy) | -0.540\* | -0.00229 |
|  | (0.305) | (0.0787) |
| Employment costs per employee 2012 (log) | 0.000746\*\* | 1.01e-05 |
|  | (0.000344) | (8.88e-05) |
| **Control Variables** |  |  |
|  |  |  |
| Productivity growth 2011-12 (log) | 0.00309 | -0.334\*\*\* |
|  | (0.107) | (0.0277) |
| Beginning year stocks 2012 (log) | 0.0949\*\*\* | 0.00729 |
|  | (0.0315) | (0.00812) |
| Size 2012(emp) (log) | -0.420\*\*\* | -0.0127 |
|  | (0.0581) | (0.0150) |
| Age | 0.00197 | 0.00310 |
|  | (0.0177) | (0.00457) |
| UK-owned 2012 (dummy) | -0.0423 | -0.0115 |
|  | (0.116) | (0.0299) |
| Sectoral dummies | Yes | Yes |
|  |  |  |
| Regional dummies | Yes | Yes |
|  |  |  |
| Constant | 5.936\*\*\* | 0.289 |
|  | (0.740) | (0.191) |
| **Endogenous Assistance Regression** |  |  |
|  |  |  |
| Exporter (dummy) | 0.639\* | 0.639\* |
|  | (0.378) | (0.378) |
| Size 2012 (emp) (log) | 0.0400 | 0.0400 |
|  | (0.0403) | (0.0403) |
| Undertake R&D (dummy) | 0.406\*\*\* | 0.406\*\*\* |
|  | (0.118) | (0.118) |
| Productivity 2012 (log) | 0.154\*\*\* | 0.154\*\*\* |
|  | (0.0497) | (0.0497) |
| Lambda (selection term) | -4.918\*\*\* | 0.840\*\*\* |
|  | (0.892) | (0.230) |
| Constant | -3.287\*\*\* | -3.287\*\*\* |
|  | (0.523) | (0.523) |
| Observations | 1,630 | 1,630 |
| N. Supported Firms Observations | 101 | 101 |
| Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |

**Table 3.2: Treatment Regression on Productivity and Productivity Growth (pooled observations)**

|  |  |  |
| --- | --- | --- |
|   | (1) | (2) |
| VARIABLES | Productivity | Productivity growth |
|   |   |  |
| **Supported by SE/HIE (dummy)** | **7.456\*\*\*** | **-1.675\*\*\*** |
|  | **(0.300)** | **(0.123)** |
| Lagged Net capital expenditure (log) | 0.139\*\*\* | -0.00621\*\*\* |
|  | (0.00486) | (0.00208) |
| Subsidy (dummy) | -0.0343 | 0.00879 |
|  | (0.0392) | (0.0161) |
| Product innovator (dummy) | 0.000324 | 0.0103 |
|  | (0.0214) | (0.00890) |
| Process innovator (dummy) | -0.0163 | 0.00870 |
|  | (0.0216) | (0.00892) |
| Exporter (dummy) | -0.181\*\*\* | 0.126\*\*\* |
|  | (0.0308) | (0.0132) |
| Lagged Employment costs per employee (log) | 0.00207\*\*\* | -0.000321\*\*\* |
|  | (0.000158) | (8.19e-05) |
| **Control Variables** |  |  |
| Lagged productivity growth (log) | 0.0992\*\*\* | -0.0565\*\*\* |
|  | (0.0148) | (0.00632) |
| Lagged Beginning year stocks (log) | 0.0821\*\*\* | 0.00448\*\* |
|  | (0.00464) | (0.00198) |
| Lag Size (emp) (log) | -0.323\*\*\* | -0.00253 |
|  | (0.00940) | (0.00407) |
| Age | -0.0226\*\*\* | 0.00207 |
|  | (0.00529) | (0.00240) |
| Sectoral dummies | Yes | Yes |
|  |  |  |
| Regional dummies | Yes | Yes |
|  |  |  |
| Constant | 3.638\*\*\* | -0.0447 |
|  | (0.115) | (0.0513) |
| **Endogenous Assistance Regression** |  |  |
|  |  |  |
| Exporter (dummy) | 0.771\*\*\* | 0.771\*\*\* |
|  | (0.0453) | (0.0542) |
| Size (emp) (log) | -0.0184\* | -0.0265\*\* |
|  | (0.00967) | (0.0113) |
| Undertake R&D (dummy) | 0.350\*\*\* | 0.355\*\*\* |
|  | (0.0270) | (0.0308) |
| Productivity (log) | 0.0772\*\*\* | 0.0921\*\*\* |
|  | (0.0134) | (0.0153) |
|  |  |  |
| Lambda (selection term) | -3.525\*\*\* | 0.801\*\*\* |
|  | (0.141) | (0.0582) |
| Constant | -2.681\*\*\* | -2.672\*\*\* |
|  | (0.0861) | (0.103) |
|  |  |  |
| Observations | 31,166 | 23,298 |
| N. groups | 7,454 | 5,324 |
| N. Assisted Groups | 280 | 224 |
| Standard errors in parentheses \*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |  |  |

# Appendix One

## Econometric Approaches

1. **Difference-in-Difference (DID) Approach with Nearest-Neighbour matching**

The DID approach is a method used for evaluation purposes when estimating the effects of a treatment or programme. The technique works by estimating a difference over time (before and after treatment) and a difference across subjects (between beneficiaries and non-beneficiaries) and produces an estimate of the impact of the treatment. Simply measuring the difference in outcomes between beneficiaries and non-beneficiaries after the intervention has taken place may leave it open to selection bias, in that the beneficiaries may have been better performing to begin with. However by incorporating data on the outcome variable for beneficiaries and non-beneficiaries observed before the intervention takes place the pre-intervention difference in outcomes can be subtracted from the post-intervention difference to eliminate selection bias related to time-invariant individual characteristics.

The DID estimator thus works on the principle that if what differentiates beneficiaries and non-beneficiaries is fixed in time, subtracting the pre-intervention differences eliminates selection bias and produces a plausible estimate of the impact of the intervention.

The purpose of the estimation in this analysis is to identify the effects of Account Management (AM) on the growth performance of firms. In order to undertake this using the DID model the change in employment (or turnover or productivity) for supported firms is estimated across two periods and compared to the change in the same periods for the non-assisted. Typically the periods of interest would include a pre-assistance period and a post-assistance period, however given that the dataset does not identify the start and end points of support, we select periods representing those towards the start and end periods of the available data.

Using this method the resulting DID estimator provides an unbiased estimate of the effect of the support if, without it, the average change in growth would have been the same for the assisted and non-assisted. Obviously the key element of DID estimation is this latter assumption, known as the ‘parallel trend’, that is, that the counterfactual trend is the same for treated and non-treated units. To ensure this situation arises the non-assisted must closely resemble the supported firms in terms of background firm-level characteristics. This necessitates the use of control groups, drawn from the wider pool of non-assisted firms that are similar to the supported firms. There are a number of techniques available to generate control groups; here they have been created using the nearest-neighbour matching technique.

The nearest-neighbour matching technique is performed within the overall Treatment Effects model. In order to identify non-assisted firms that are similar to the supported firms, variables describing background characteristics are added to the model (e.g. size, sector, age etc.) A process is then undertaken whereby the nearest-neighbour of treated firms is identified, from the pool of non-assisted firms, based on a weighted function of the background variables for each firm. By default, the Mahalanobis distance is used, in which the weights are based on the inverse of the background variables’ variance–covariance matrix.

Those firms selected as the nearest-neighbours are retained in the model to act as the control group; the model imputes the missing potential outcome for each firm by using an average of the outcomes of the similar firms that receive the other treatment level i.e. for the treated firms the potential outcome had they not been treated is imputed based on an average outcomes of their identified nearest-neighbour non-treated firms, and vice versa. The Average Treatment Effect, which provides the impact of the support, is then estimated as the average difference in outcomes between the observed and the potential outcomes for each firm.

1. **Linear Regression with Endogenous Treatment Effects**

The model used to estimate the drivers of productivity is a second type of treatment model typically used in programme evaluation to counteract the effects of selection, or omitted variable bias. Selection is known to occur in such scenarios where there are non-random components and/or incomplete information. The problem that potentially arises here is that in estimating the impact of AM support on productivity the sample of firms that are supported are likely to be non-random, drawn from a subpopulation of a wider population, thus potentially skewing any results. Any inferences drawn about the impact of being supported on productivity must thus take account of this to avoid biasing the results upwards (if the supported firms are typically better performing than the wider population to begin with) or downwards (if they are typically poorer performing to begin with).

The treatment model used here alleviates this selection bias problem through the use of a two-stage model. In the first stage a probit model is run to estimate the characteristics which make it more likely that the firm will be AM supported. This binary variable to indicate whether AM supported or not is then directly entered into the second stage linear regression equation which estimates the impact on the outcome variable e.g. productivity levels. The model thus directly controls for the underlying observed traits of AM supported firms, when estimating the impact on productivity, whilst it further controls for other unobserved traits, by generating a ‘selection’ term which identifies whether bias is likely to have been present in the model (if it had been run as a standard linear regression). The significance of the selection term suggests that bias is an issue, whilst the sign on the selection term indicates whether this bias would have caused the estimated effect of the AM support variable on productivity to be higher than it should be (positive sign) or lower than it should be (negative sign) due to other unobserved variables associated with being AM supported.

# Appendix Two

## Sub-Period Growth Metrics

**Figure A2.1: Average Turnover growth for SE/HIE supported firms versus Northern England non-assisted firms**

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**Figure A2.2: Average Employment growth for SE/HIE supported firms versus Northern England non-assisted firms**

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**Figure A2.3: Average Employment growth for SE/HIE supported firms versus Northern England non-assisted firms**

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|  |
| --- |
| **Table A2.1: Descriptive Statistics for All (SE/HIE supported vs non-assisted Scotland) 2006/08 – 2012/14** |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (06/08 - 12/14) | 14,669 | -0.12 | 0.82 |  | 2,043 | -0.18 | 1.12 |  | ***3.1539\*\*\**** |
| Avg Turnover growth 2006-08 | 14,669 | 0.07 | 0.58 |  | 2,043 | 0.29 | 0.87 |  | ***-14.848\*\*\**** |
| Avg Turnover growth 2012-14 | 14,669 | -0.04 | 0.58 |  | 2,043 | 0.11 | 0.69 |  | ***-11.0477\*\*\**** |
| Avg Employment diff (06/08 - 12/14) | 11,902 | -0.03 | 0.66 |  | 2,040 | -0.13 | 0.79 |  | ***5.9147\*\*\**** |
| Avg Employment growth 2006-08 | 11,902 | 0.03 | 0.48 |  | 2,040 | 0.20 | 0.58 |  | ***-14.5764\*\*\**** |
| Avg Employment growth 2012-14 | 11,902 | 0.00 | 0.44 |  | 2,040 | 0.08 | 0.53 |  | ***-7.1057\*\*\**** |
| Avg Productivity diff (06/08 - 12/14) | 11,876 | -0.08 | 0.90 |  | 2,029 | -0.06 | 1.12 |  | ***-1.0611*** |
| Avg Productivity growth 2006-08 | 11,876 | 0.04 | 0.67 |  | 2,029 | 0.09 | 0.87 |  |  ***-3.1657\*\*\**** |
| Avg Productivity growth 2012-14 | 11,876 | -0.04 | 0.59 |  | 2,029 | 0.04 | 0.67 |  | ***-5.3783\*\*\**** |

|  |  |  |
| --- | --- | --- |
| **Table A2.2: Descriptive Statistics for All (SE/HIE supported vs non-assisted N. England) 2006/08 – 2012/14** |  |  |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (06/08 - 12/14) | 40,781 | -0.09 | 0.83 |  | 2,043 | -0.18 | 1.12 |  | ***4.5487\*\*\**** |
| Avg Turnover growth 2006-08 | 40,781 | 0.04 | 0.57 |  | 2,043 | 0.29 | 0.87 |  | ***-19.0683\*\*\**** |
| Avg Turnover growth 2012-14 | 40,781 | -0.06 | 0.60 |  | 2,043 | 0.11 | 0.69 |  |  ***-12.3327\*\*\**** |
| Avg Employment diff (06/08 - 12/14) | 32,492 | -0.04 | 0.65 |  | 2,040 | -0.13 | 0.79 |  | ***5.4648\*\*\**** |
| Avg Employment growth 2006-08 | 32,492 | 0.02 | 0.45 |  | 2,040 | 0.20 | 0.58 |  | ***-17.3572\*\*\**** |
| Avg Employment growth 2012-14 | 32,492 | -0.02 | 0.46 |  | 2,040 | 0.08 | 0.53 |  | ***-9.5152\*\*\**** |
| Avg Productivity diff (06/08 - 12/14) | 32,401 | -0.04 | 0.89 |  | 2,029 | -0.06 | 1.12 |  | ***0.7466*** |
| Avg Productivity growth 2006-08 | 32,401 | 0.01 | 0.64 |  | 2,029 | 0.09 | 0.87 |  |  ***-5.2667\*\*\**** |
| Avg Productivity growth 2012-14 | 32,401 | -0.03 | 0.60 |  | 2,029 | 0.04 | 0.67 |  |  ***-4.5761\*\*\**** |

|  |
| --- |
| **Table A2.3: Descriptive Statistics for All (SE/HIE supported vs non-assisted Scotland) 2008/10 – 2012/14** |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (08/10 - 12/14) | 14,761 | -0.06 | 0.86 |  | 2,303 | -0.13 | 1.18 |  | ***3.5218\*\*\**** |
| Avg Turnover growth 2008-10 | 14,761 | 0.02 | 0.64 |  | 2,303 | 0.26 | 0.89 |  | ***-15.6365\*\*\**** |
| Avg Turnover growth 2012-14 | 14,761 | -0.04 | 0.58 |  | 2,303 | 0.12 | 0.74 |  | ***-12.1682\*\*\**** |
| Avg Employment diff (08/10 - 12/14) | 12,597 | 0.01 | 0.68 |  | 2,297 | -0.13 | 0.83 |  | ***8.9141\*\*\**** |
| Avg Employment growth 2008-10 | 12,597 | -0.01 | 0.50 |  | 2,297 | 0.22 | 0.65 |  | ***-19.0534\*\*\**** |
| Avg Employment growth 2012-14 | 12,597 | 0.00 | 0.43 |  | 2,297 | 0.09 | 0.55 |  |  ***-8.3688\*\*\**** |
| Avg Productivity diff (08/10 - 12/14) | 12,581 | -0.07 | 0.89 |  | 2,288 | 0.00 | 1.17 |  | ***-3.1285\*\*\**** |
| Avg Productivity growth 2008-10 | 12,581 | 0.02 | 0.66 |  | 2,288 | 0.04 | 0.89 |  | ***-0.8322*** |
| Avg Productivity growth 2012-14 | 12,581 | -0.04 | 0.59 |  | 2,288 | 0.04 | 0.70 |  | ***-5.7867\*\*\**** |

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| **Table A2.4: Descriptive Statistics for All (SE/HIE supported vs non-assisted N. England) 2008/10 – 2012/14** |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (08/10 - 12/14) | 40,943 | -0.04 | 0.87 |  | 2,303 | -0.13 | 1.18 |  | ***4.6708\*\*\**** |
| Avg Turnover growth 2008-10 | 40,943 | -0.01 | 0.64 |  | 2,303 | 0.26 | 0.89 |  | ***-19.1136\*\*\**** |
| Avg Turnover growth 2012-14 | 40,943 | -0.06 | 0.60 |  | 2,303 | 0.12 | 0.74 |  |  ***-13.7323\*\*\**** |
| Avg Employment diff (08/10 - 12/14) | 34,196 | -0.01 | 0.69 |  | 2,297 | -0.13 | 0.83 |  | ***8.4425\*\*\**** |
| Avg Employment growth 2008-10 | 34,196 | -0.02 | 0.50 |  | 2,297 | 0.22 | 0.65 |  | ***-21.5980\*\*\**** |
| Avg Employment growth 2012-14 | 34,196 | -0.02 | 0.45 |  | 2,297 | 0.09 | 0.55 |  | ***-11.1175\*\*\**** |
| Avg Productivity diff (08/10 - 12/14) | 34,115 | -0.03 | 0.89 |  | 2,288 | 0.00 | 1.17 |  | ***-1.3120*** |
| Avg Productivity growth 2008-10 | 34,115 | 0.00 | 0.63 |  | 2,288 | 0.04 | 0.89 |  | ***-2.6412\*\**** |
| Avg Productivity growth 2012-14 | 34,115 | -0.03 | 0.60 |  | 2,288 | 0.04 | 0.70 |  | ***-4.8172\*\*\**** |

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| **Table A2.5: Descriptive Statistics for All (SE/HIE supported vs non-assisted Scotland) 2010/12 – 2012/14** |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (10/12 - 12/14) | 14,872 | 0.07 | 0.95 |  | 2,522 | 0.06 | 1.42 |  | ***0.3777*** |
| Avg Turnover growth 2010-12 | 14,872 | -0.12 | 0.64 |  | 2,522 | 0.09 | 0.99 |  | ***-13.359\*\*\**** |
| Avg Turnover growth 2012-14 | 14,872 | -0.04 | 0.58 |  | 2,522 | 0.15 | 0.86 |  | ***-14.3126\*\*\**** |
| Avg Employment diff (10/12 - 12/14) | 13,069 | 0.03 | 0.67 |  | 2,516 | -0.01 | 0.79 |  | ***2.1958\*\**** |
| Avg Employment growth 2010-12 | 13,069 | -0.02 | 0.47 |  | 2,516 | 0.11 | 0.59 |  |  ***-12.8473\*\*\**** |
| Avg Employment growth 2012-14 | 13,069 | 0.00 | 0.43 |  | 2,516 | 0.11 | 0.57 |  |  ***-10.5572\*\*\**** |
| Avg Productivity diff (10/12 - 12/14) | 13,053 | 0.05 | 0.99 |  | 2,507 | 0.07 | 1.42 |  | ***-1.0486*** |
| Avg Productivity growth 2010-12 | 13,053 | -0.09 | 0.67 |  | 2,507 | -0.03 | 0.95 |  | ***-3.9708\*\*\**** |
| Avg Productivity growth 2012-14 | 13,053 | -0.04 | 0.59 |  | 2,507 | 0.04 | 0.79 |  | ***-6.3198\*\*\**** |

|  |
| --- |
| **Table A2.6: Descriptive Statistics for All (SE/HIE supported vs non-assisted N. England) 2010/12 – 2012/14** |
|  | **non-assisted** |  | **SE/HIE supported** |  |  |
|  | **N** | **mean** | **sd** |  | **N** | **mean** | **sd** |  | ***t-stat (z)*** |
| Avg Turnover diff (10/12 - 12/14) | 41,230 | 0.06 | 0.94 |  | 2,522 | 0.06 | 1.42 |  | ***-0.2377*** |
| Avg Turnover growth 2010-12 | 41,230 | -0.12 | 0.64 |  | 2,522 | 0.09 | 0.99 |  | ***-14.8495\*\*\**** |
| Avg Turnover growth 2012-14 | 41,230 | -0.06 | 0.60 |  | 2,522 | 0.15 | 0.86 |  | ***-16.4585\*\*\**** |
| Avg Employment diff (10/12 - 12/14) | 35,502 | 0.01 | 0.67 |  | 2,516 | -0.01 | 0.79 |  |  ***1.4189*** |
| Avg Employment growth 2010-12 | 35,502 | -0.03 | 0.46 |  | 2,516 | 0.11 | 0.59 |  | ***-15.4012\*\*\**** |
| Avg Employment growth 2012-14 | 35,502 | -0.02 | 0.45 |  | 2,516 | 0.11 | 0.57 |  | ***-13.5838\*\*\**** |
| Avg Productivity diff (10/12 - 12/14) | 35,436 | 0.05 | 0.98 |  | 2,507 | 0.07 | 1.42 |  |  ***-0.9139*** |
| Avg Productivity growth 2010-12 | 35,436 | -0.08 | 0.65 |  | 2,507 | -0.03 | 0.95 |  | ***-3.7471\*\*\**** |
| Avg Productivity growth 2012-14 | 35,436 | -0.03 | 0.60 |  | 2,507 | 0.04 | 0.79 |  | ***-5.5930\*\*\**** |

# Appendix Three

## Average Treatment Effect Tables

**Table A3.1: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Full Sample* Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 1 | ATE – Scotland | 9,014 | 1,095 | -0.0878\* | (0.0482) | -1.821 | (0.0686) | -0.182 | (0.00671) |
| 2 | ATE – N. England | 22,185 | 1,095 | -0.0740 | (0.0460) | -1.611 | (0.107) | -0.164 | (0.0160) |
|  |  | **Employment Growth** |
| 3 | ATE – Scotland | 8,922 | 1,099 | -0.232\*\*\* | (0.0433) | -5.370 | (0.0000) | -0.317 | (-0.148) |
| 4 | ATE – N. England | 21,963 | 1,099 | -0.195\*\*\* | (0.0434) | -4.481 | (0.0000) | -0.280 | (-0.109) |
|  |  | **Turnover per Employee Growth** |
| 5 | ATE – Scotland | 8,873 | 1,094 | 0.153\*\*\* | (0.0483) | 3.171 | (0.00152) | 0.0584 | (0.248) |
| 6 | ATE – N. England | 21,857 | 1,094 | 0.136\*\*\* | (0.0436) | 3.111 | (0.00186) | 0.0502 | (0.221) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.2: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Full Sample* Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 7 | ATE – Scotland | 9,101 | 1,100 | -0.216\*\*\* | (0.0723) | -2.994 | (0.00275) | -0.358 | (-0.0748) |
| 8 | ATE – N. England | 22,372 | 1,100 | -0.147\* | (0.0841) | -1.753 | (0.0796) | -0.312 | (0.0174) |
|  |  | **Employment Growth** |
| 9 | ATE – Scotland | 8,998 | 1,103 | -0.435\*\*\* | (0.0639) | -6.807 | (0) | -0.560 | (-0.310) |
| 10 | ATE – N. England | 22,142 | 1,103 | -0.362\*\*\* | (0.0670) | -5.413 | 0.0000 | -0.494 | (-0.231) |
|  |  | **Turnover per Employee Growth** |
| 11 | ATE – Scotland | 8,970 | 1,099 | 0.227\*\*\* | (0.0677) | 3.357 | (0.000787) | 0.0946 | (0.360) |
| 12 | ATE – N. England | 22,046 | 1,099 | 0.213\*\*\* | (0.0639) | 3.337 | (0.000845) | 0.0881 | (0.339) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Segmentation 2000-02 – 2012-14**

**Table A3.3: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Direct Relationship Managed (DRM)* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 13 | ATE – Scotland | 8,813 | 894 | -0.0679 | (0.0498) | -1.363 | (0.173) | -0.165 | (0.0297) |
| 14 | ATE – N. England | 21,984 | 894 | -0.0578 | (0.0494) | -1.170 | (0.242) | -0.155 | (0.0390) |
|  |  | **Employment Growth** |
| 15 | ATE – Scotland | 8,720 | 897 | -0.256\*\*\* | (0.0508) | -5.034 | (4.81e-07) | -0.355 | (-0.156) |
| 16 | ATE – N. England | 21,761 | 897 | -0.225\*\*\* | (0.0535) | -4.210 | (2.55e-05) | -0.330 | (-0.120) |
|  |  | **Turnover per Employee Growth** |
| 17 | ATE – Scotland | 8,672 | 893 | 0.199\*\*\* | (0.0491) | 4.065 | (4.81e-05) | 0.103 | (0.296) |
| 18 | ATE – N. England | 21,656 | 893 | 0.188\*\*\* | (0.0444) | 4.235 | (2.28e-05) | 0.101 | (0.275) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.4: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Account Managed Growth* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 19 | ATE – Scotland | 8,688 | 769 | -0.0646 | (0.0537) | -1.203 | (0.229) | -0.170 | (0.0407) |
| 20 | ATE – N. England | 21,859 | 769 | -0.0472 | (0.0536) | -0.881 | (0.378) | -0.152 | (0.0578) |
|  |  | **Employment Growth** |
| 21 | ATE – Scotland | 8,593 | 770 | -0.254\*\*\* | (0.0570) | -4.453 | (8.46e-06) | -0.366 | (-0.142) |
| 22 | ATE – N. England | 21,634 | 770 | -0.210\*\*\* | (0.0619) | -3.389 | (0.000702) | -0.331 | (-0.0885) |
|  |  | **Turnover per Employee Growth** |
| 23 | ATE – Scotland | 8,547 | 768 | 0.202\*\*\* | (0.0532) | 3.791 | (0.000150) | 0.0974 | (0.306) |
| 24 | ATE – N. England | 21,531 | 768 | 0.184\*\*\* | (0.0452) | 4.077 | (4.56e-05) | 0.0956 | (0.273) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.5: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Important to Economy* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 25 | ATE – Scotland | 8,044 | 125 | 0.0114 | (0.115) | 0.0987 | (0.921) | -0.215 | (0.238) |
| 26 | ATE – N. England | 21,215 | 125 | -0.182 | (0.268) | -0.681 | (0.496) | -0.707 | (0.343) |
|  |  | **Employment Growth** |
| 27 | ATE – Scotland | 7,950 | 127 | -0.288\*\*\* | (0.0616) | -4.679 | (0.000) | -0.409 | (-0.168) |
| 28 | ATE – N. England | 20,991 | 127 | -0.339\*\*\* | (0.120) | -2.824 | (0.00474) | -0.575 | (-0.104) |
|  |  | **Turnover per Employee Growth** |
| 29 | ATE – Scotland | 7,904 | 125 | 0.303\*\*\* | (0.0896) | 3.380 | (0.000724) | 0.127 | (0.479) |
| 30 | ATE – N. England | 20,888 | 125 | 0.157 | (0.177) | 0.890 | (0.374) | -0.189 | (0.504) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.6: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *NRM* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 31 | ATE – Scotland | 8,120 | 201 | -0.190\*\* | (0.0788) | -2.414 | (0.0158) | -0.344 | (-0.0358) |
| 32 | ATE – N. England | 21,291 | 201 | -0.0971 | (0.0646) | -1.502 | (0.133) | -0.224 | (0.0296) |
|  |  | **Employment Growth** |
| 33 | ATE – Scotland | 8,025 | 202 | -0.135\* | (0.0756) | -1.786 | (0.0742) | -0.283 | (0.0132) |
| 34 | ATE – N. England | 21,066 | 202 | -0.0612 | (0.0908) | -0.675 | (0.500) | -0.239 | (0.117) |
|  |  | **Turnover per Employee Growth** |
| 35 | ATE – Scotland | 7,980 | 201 | -0.0523 | (0.0863) | -0.606 | (0.545) | -0.221 | (0.117) |
| 36 | ATE – N. England | 20,964 | 201 | -0.0350 | (0.0950) | -0.368 | (0.713) | -0.221 | (0.151) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Segmentation 2000-07 – 2008-14**

**Table A3.7: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Direct Relationship Managed (DRM)* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 37 | ATE – Scotland | 8,900 | 899 | -0.258\*\*\* | (0.0767) | -3.369 | (0.000755) | -0.409 | (-0.108) |
| 38 | ATE – N. England | 22,171 | 899 | -0.186\*\* | (0.0754) | -2.468 | (0.0136) | -0.334 | (-0.0383) |
|  |  | **Employment Growth** |
| 39 | ATE – Scotland | 8,796 | 901 | -0.456\*\*\* | (0.0692) | -6.585 | (0) | -0.591 | (-0.320) |
| 40 | ATE – N. England | 21,940 | 901 | -0.384\*\*\* | (0.0661) | -5.810 | (6.24e-09) | -0.514 | (-0.255) |
|  |  | **Turnover per Employee Growth** |
| 41 | ATE – Scotland | 8,769 | 898 | 0.208\*\*\* | (0.0709) | 2.937 | (0.00331) | 0.0692 | (0.347) |
| 42 | ATE – N. England | 21,845 | 898 | 0.191\*\*\* | (0.0627) | 3.044 | (0.00234) | 0.0680 | (0.314) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.8: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Account Managed Growth* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 43 | ATE – Scotland | 8,772 | 771 | -0.264\*\*\* | (0.0784) | -3.366 | (0.000764) | -0.417 | (-0.110) |
| 44 | ATE – N. England | 22,043 | 771 | -0.187\*\* | (0.0745) | -2.508 | (0.0121) | -0.333 | (-0.0409) |
|  |  | **Employment Growth** |
| 45 | ATE – Scotland | 8,667 | 772 | -0.475\*\*\* | (0.0752) | -6.312 | (2.76e-10) | -0.622 | (-0.327) |
| 46 | ATE – N. England | 21,811 | 772 | -0.379\*\*\* | (0.0710) | -5.329 | (9.89e-08) | -0.518 | (-0.239) |
|  |  | **Turnover per Employee Growth** |
| 47 | ATE – Scotland | 8,641 | 770 | 0.213\*\*\* | (0.0759) | 2.811 | (0.00493) | 0.0646 | (0.362) |
| 48 | ATE – N. England | 21,717 | 770 | 0.181\*\*\* | (0.0670) | 2.700 | (0.00694) | 0.0496 | (0.312) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.9: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Important to Economy* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 49 | ATE – Scotland | 8,129 | 128 | -0.0191 | (0.140) | -0.136 | (0.891) | -0.294 | (0.255) |
| 50 | ATE – N. England | 21,400 | 128 | 0.0607 | (0.143) | 0.424 | (0.671) | -0.220 | (0.341) |
|  |  | **Employment Growth** |
| 51 | ATE – Scotland | 8,024 | 129 | -0.327\*\* | (0.152) | -2.157 | (0.0310) | -0.624 | (-0.0298) |
| 52 | ATE – N. England | 21,168 | 129 | -0.244 | (0.175) | -1.399 | (0.162) | -0.586 | (0.0980) |
|  |  | **Turnover per Employee Growth** |
| 53 | ATE – Scotland | 7,999 | 128 | 0.408\*\* | (0.160) | 2.556 | (0.0106) | 0.0952 | (0.722) |
| 54 | ATE – N. England | 21,075 | 128 | 0.393\* | (0.209) | 1.875 | (0.0607) | -0.0177 | (0.803) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.10: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *NRM* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 55 | ATE – Scotland | 8,202 | 201 | -0.263\* | (0.135) | -1.950 | (0.0511) | -0.527 | (0.00131) |
| 56 | ATE – N. England | 21,473 | 201 | -0.159 | (0.120) | -1.321 | (0.186) | -0.395 | (0.0768) |
|  |  | **Employment Growth** |
| 57 | ATE – Scotland | 8,097 | 202 | -0.407\*\*\* | (0.130) | -3.141 | (0.00168) | -0.661 | (-0.153) |
| 58 | ATE – N. England | 21,241 | 202 | -0.235\* | (0.121) | -1.939 | (0.0525) | -0.473 | (0.00252) |
|  |  | **Turnover per Employee Growth** |
| 59 | ATE – Scotland | 8,072 | 201 | 0.156 | (0.129) | 1.206 | (0.228) | -0.0973 | (0.409) |
| 60 | ATE – N. England | 21,148 | 201 | 0.0766 | (0.149) | 0.516 | (0.606) | -0.215 | (0.368) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Size 2000-02 – 2012-14**

**Table A3.11: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Micro Firms (1-9 emp)* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 61 | ATE – Scotland | 2,013 | 224 | -0.0819 | (0.117) | -0.702 | (0.483) | -0.311 | (0.147) |
| 62 | ATE – N. England | 4,913 | 224 | -0.0705 | (0.0875) | -0.806 | (0.420) | -0.242 | (0.101) |
|  |  | **Employment Growth** |
| 63 | ATE – Scotland | 1,937 | 224 | -0.403\*\*\* | (0.123) | -3.273 | (0.00106) | -0.644 | (-0.162) |
| 64 | ATE – N. England | 4,744 | 224 | -0.267\* | (0.157) | -1.698 | (0.0895) | -0.575 | (0.0412) |
|  |  | **Turnover per Employee Growth** |
| 65 | ATE – Scotland | 1,924 | 224 | 0.336\*\*\* | (0.115) | 2.923 | (0.00347) | 0.111 | (0.562) |
| 66 | ATE – N. England | 4,714 | 224 | 0.202 | (0.134) | 1.511 | (0.131) | -0.0601 | (0.465) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.12: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Small Firms (10-49 emp)* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 67 | ATE – Scotland | 5,635 | 313 | -0.0646 | (0.0597) | -1.081 | (0.280) | -0.182 | (0.0525) |
| 68 | ATE – N. England | 14,245 | 313 | -0.0774 | (0.0848) | -0.913 | (0.361) | -0.244 | (0.0888) |
|  |  | **Employment Growth** |
| 69 | ATE – Scotland | 5,617 | 314 | -0.284\*\*\* | (0.0928) | -3.064 | (0.00219) | -0.466 | (-0.102) |
| 70 | ATE – N. England | 14,178 | 314 | -0.254\*\* | (0.101) | -2.518 | (0.0118) | -0.452 | (-0.0563) |
|  |  | **Turnover per Employee Growth** |
| 71 | ATE – Scotland | 5,590 | 312 | 0.244\*\*\* | (0.0777) | 3.141 | (0.00168) | 0.0917 | (0.396) |
| 72 | ATE – N. England | 14,120 | 312 | 0.222\*\*\* | (0.0569) | 3.899 | (9.64e-05) | 0.110 | (0.334) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.13: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Larger Firms (50+ emp)* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 73 | ATE – Scotland | 1,040 | 232 | 0.162\* | (0.0842) | 1.930 | (0.0536) | -0.00252 | (0.327) |
| 74 | ATE – N. England | 2,701 | 232 | 0.191\*\*\* | (0.0696) | 2.743 | (0.00608) | 0.0545 | (0.327) |
|  |  | **Employment Growth** |
| 75 | ATE – Scotland | 1,039 | 232 | 0.00355 | (0.0515) | 0.0690 | (0.945) | -0.0974 | (0.105) |
| 76 | ATE – N. England | 2,712 | 232 | 0.0209 | (0.0395) | 0.530 | (0.596) | -0.0565 | (0.0984) |
|  |  | **Turnover per Employee Growth** |
| 77 | ATE – Scotland | 1,033 | 232 | 0.158\*\* | (0.0717) | 2.207 | (0.0273) | 0.0177 | (0.299) |
| 78 | ATE – N. England | 2,697 | 232 | 0.164\*\* | (0.0647) | 2.535 | (0.0112) | 0.0372 | (0.291) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Size 2000-07 – 2008-14**

**Table A3.14: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Micro Firms (1-9 emp)* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **Z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 79 | ATE – Scotland | 2,040 | 224 | -0.144 | (0.174) | -0.827 | (0.408) | -0.486 | (0.197) |
| 80 | ATE – N. England | 4,966 | 224 | -0.0580 | (0.145) | -0.401 | (0.689) | -0.342 | (0.226) |
|  |  | **Employment Growth** |
| 81 | ATE – Scotland | 1,966 | 224 | -0.643\*\*\* | (0.135) | -4.751 | (2.03e-06) | -0.908 | (-0.378) |
| 82 | ATE – N. England | 4,789 | 224 | -0.522\*\*\* | (0.137) | -3.800 | (0.000145) | -0.791 | (-0.253) |
|  |  | **Turnover per Employee Growth** |
| 83 | ATE – Scotland | 1,962 | 224 | 0.508\*\*\* | (0.111) | 4.571 | (4.86e-06) | 0.290 | (0.726) |
| 84 | ATE – N. England | 4,768 | 224 | 0.478\*\*\* | (0.105) | 4.540 | (5.62e-06) | 0.271 | (0.684) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.15: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Small Firms (10-49 emp)* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 85 | ATE – Scotland | 5,690 | 316 | -0.364\*\*\* | (0.101) | -3.589 | (0.000332) | -0.562 | (-0.165) |
| 86 | ATE – N. England | 14,350 | 316 | -0.339\*\*\* | (0.114) | -2.973 | (0.00295) | -0.562 | (-0.115) |
|  |  | **Employment Growth** |
| 87 | ATE – Scotland | 5,658 | 316 | -0.613\*\*\* | (0.111) | -5.524 | (3.30e-08) | -0.830 | (-0.395) |
| 88 | ATE – N. England | 14,278 | 316 | -0.528\*\*\* | (0.124) | -4.268 | (1.97e-05) | -0.770 | (-0.285) |
|  |  | **Turnover per Employee Growth** |
| 89 | ATE – Scotland | 5,640 | 315 | 0.248\*\* | (0.105) | 2.366 | (0.0180) | 0.0425 | (0.453) |
| 90 | ATE – N. England | 14,225 | 315 | 0.183\*\* | (0.0811) | 2.251 | (0.0244) | 0.0236 | (0.342) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.16: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *Larger Firms (50+ emp)* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 91 | ATE – Scotland | 1,042 | 231 | 0.0745 | (0.122) | 0.610 | (0.542) | -0.165 | (0.314) |
| 92 | ATE – N. England | 2,727 | 231 | 0.190\* | (0.110) | 1.726 | (0.0843) | -0.0258 | (0.406) |
|  |  | **Employment Growth** |
| 93 | ATE – Scotland | 1,043 | 232 | 0.0389 | (0.119) | 0.328 | (0.743) | -0.194 | (0.271) |
| 94 | ATE – N. England | 2,744 | 232 | 0.176 | (0.118) | 1.484 | (0.138) | -0.0563 | (0.407) |
|  |  | **Turnover per Employee Growth** |
| 95 | ATE – Scotland | 1,039 | 231 | 0.0510 | (0.105) | 0.487 | (0.626) | -0.154 | (0.256) |
| 96 | ATE – N. England | 2,724 | 231 | 0.0128 | (0.112) | 0.114 | (0.909) | -0.207 | (0.233) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**HIE Analysis**

**Table A3.17: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *HIE only* - Growth Difference 2000-02 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 97 | ATE – Scotland | 8,087 | 168 | 0.0305 | (0.0795) | 0.383 | (0.701) | -0.125 | (0.186) |
| 98 | ATE – N. England | 21,258 | 168 | 0.0430 | (0.0654) | 0.658 | (0.510) | -0.0851 | (0.171) |
|  |  | **Employment Growth** |
| 99 | ATE – Scotland | 7,991 | 168 | -0.0554 | (0.0892) | -0.621 | (0.535) | -0.230 | (0.119) |
| 100 | ATE – N. England | 21,032 | 168 | -0.0212 | (0.0947) | -0.224 | (0.823) | -0.207 | (0.164) |
|  |  | **Turnover per Employee Growth** |
| 101 | ATE – Scotland | 7,947 | 168 | 0.0857 | (0.0993) | 0.863 | (0.388) | -0.109 | (0.280) |
| 102 | ATE – N. England | 20,931 | 168 | 0.0636 | (0.0964) | 0.660 | (0.510) | -0.125 | (0.252) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.18: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth – *HIE only* - Growth Difference 2000-07 – 2008-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 103 | ATE – Scotland | 8,169 | 168 | 0.134 | (0.108) | 1.239 | (0.215) | -0.0781 | (0.347) |
| 104 | ATE – N. England | 21,440 | 168 | 0.193\* | (0.106) | 1.811 | (0.0702) | -0.0159 | (0.401) |
|  |  | **Employment Growth** |
| 105 | ATE – Scotland | 8,063 | 168 | -0.224\*\* | (0.101) | -2.226 | (0.0260) | -0.421 | (-0.0268) |
| 106 | ATE – N. England | 21,207 | 168 | -0.105 | (0.110) | -0.959 | (0.338) | -0.320 | (0.110) |
|  |  | **Turnover per Employee Growth** |
| 107 | ATE – Scotland | 8,039 | 168 | 0.366\*\*\* | (0.114) | 3.211 | (0.00132) | 0.142 | (0.589) |
| 108 | ATE – N. England | 21,115 | 168 | 0.296\*\* | (0.119) | 2.491 | (0.0127) | 0.0631 | (0.529) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Recession Period**

**Table A3.19: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Full Sample* Growth Difference 2006-08 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 109 | ATE – Scotland | 13,076 | 1,765 | -0.0129 | (0.0427) | -0.302 | (0.762) | -0.0965 | (0.0707) |
| 110 | ATE – N. England | 32,941 | 1,765 | -0.0271 | (0.0389) | -0.698 | (0.485) | -0.103 | (0.0491) |
|  |  | **Employment Growth** |
| 111 | ATE – Scotland | 12,876 | 1,771 | -0.0507\* | (0.0271) | -1.870 | (0.0615) | -0.104 | (0.00245) |
| 112 | ATE – N. England | 32,205 | 1,771 | -0.0250 | (0.0279) | -0.896 | (0.370) | -0.0796 | (0.0297) |
|  |  | **Turnover per Employee Growth** |
| 113 | ATE – Scotland | 12,851 | 1,764 | 0.0371 | (0.0430) | 0.864 | (0.388) | -0.0471 | (0.121) |
| 114 | ATE – N. England | 32,123 | 1,764 | 0.00210 | (0.0416) | 0.0505 | (0.960) | -0.0794 | (0.0836) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.20: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Full Sample* Growth Difference 2008-10 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 115 | ATE – Scotland | 14,115 | 2,029 | -0.00862 | (0.0447) | -0.193 | (0.847) | -0.0962 | (0.0789) |
| 116 | ATE – N. England | 35,181 | 2,029 | -0.0598 | (0.0367) | -1.632 | (0.103) | -0.132 | (0.0120) |
|  |  | **Employment Growth** |
| 117 | ATE – Scotland | 13,877 | 2,031 | -0.0674\*\* | (0.0292) | -2.310 | (0.0209) | -0.125 | (-0.0102) |
| 118 | ATE – N. England | 34,316 | 2,031 | -0.0322 | (0.0280) | -1.150 | (0.250) | -0.0870 | (0.0227) |
|  |  | **Turnover per Employee Growth** |
| 119 | ATE – Scotland | 13,867 | 2,029 | 0.0612 | (0.0476) | 1.287 | (0.198) | -0.0321 | (0.155) |
| 120 | ATE – N. England | 34,294 | 2,029 | -0.0254 | (0.0370) | -0.685 | (0.493) | -0.0979 | (0.0472) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.21: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Full Sample* Growth Difference 2010-12 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 121 | ATE – Scotland | 15,013 | 2,288 | 0.00712 | (0.0337) | 0.211 | (0.833) | -0.0590 | (0.0732) |
| 122 | ATE – N. England | 37,017 | 2,288 | 0.0374 | (0.0388) | 0.964 | (0.335) | -0.0386 | (0.113) |
|  |  | **Employment Growth** |
| 123 | ATE – Scotland | 14,850 | 2,289 | 0.0478\* | (0.0284) | 1.684 | (0.0922) | -0.00785 | (0.104) |
| 124 | ATE – N. England | 36,353 | 2,289 | 0.0720\*\* | (0.0294) | 2.447 | (0.0144) | 0.0143 | (0.130) |
|  |  | **Turnover per Employee Growth** |
| 125 | ATE – Scotland | 14,842 | 2,288 | -0.0398 | (0.0404) | -0.986 | (0.324) | -0.119 | (0.0393) |
| 126 | ATE – N. England | 36,340 | 2,288 | -0.0310 | (0.0431) | -0.719 | (0.472) | -0.116 | (0.0535) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level

**Table A3.22: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Account Managed Growth* Difference 2006-08 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 127 | ATE – Scotland | 12,547 | 1,236 | -0.0284 | (0.0416) | -0.684 | (0.494) | -0.110 | (0.0531) |
| 128 | ATE – N. England | 32,412 | 1,236 | -0.0545 | (0.0404) | -1.351 | (0.177) | -0.134 | (0.0246) |
|  |  | **Employment Growth** |
| 129 | ATE – Scotland | 12,343 | 1,238 | -0.0696\* | (0.0360) | -1.935 | (0.0530) | -0.140 | (0.000899) |
| 130 | ATE – N. England | 31,672 | 1,238 | -0.0503 | (0.0371) | -1.357 | (0.175) | -0.123 | (0.0223) |
|  |  | **Turnover per Employee Growth** |
| 131 | ATE – Scotland | 12,322 | 1,235 | 0.0384 | (0.0470) | 0.816 | (0.415) | -0.0538 | (0.130) |
| 132 | ATE – N. England | 31,594 | 1,235 | -0.00154 | (0.0429) | -0.0359 | (0.971) | -0.0857 | (0.0826) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

**Table A3.23: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Account Managed Growth Sample* Growth Difference 2008-10 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 133 | ATE – Scotland | 13,521 | 1,435 | -0.0110 | (0.0423) | -0.260 | (0.795) | -0.0938 | (0.0718) |
| 134 | ATE – N. England | 34,587 | 1,435 | -0.0218 | (0.0422) | -0.517 | (0.605) | -0.105 | (0.0609) |
|  |  | **Employment Growth** |
| 135 | ATE – Scotland | 13,283 | 1,437 | -0.0824\*\* | (0.0355) | -2.322 | (0.0202) | -0.152 | (-0.0128) |
| 136 | ATE – N. England | 33,722 | 1,437 | -0.0341 | (0.0348) | -0.979 | (0.328) | -0.102 | (0.0342) |
|  |  | **Turnover per Employee Growth** |
| 137 | ATE – Scotland | 13,273 | 1,435 | 0.0733\* | (0.0426) | 1.721 | (0.0852) | -0.0102 | (0.157) |
| 138 | ATE – N. England | 33,700 | 1,435 | 0.0151 | (0.0440) | 0.344 | (0.731) | -0.0711 | (0.101) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

**Table A3.24: Average Treatment Effect on Turnover, Employment and Turnover per Employee Growth *– Account Managed Growth Sample*  Growth Difference 2010-12 – 2012-14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **No. Obs** | **N. Assisted Firms** | **Coeff.** | **Std Error** | **z** | **P>(z)** | **95% confid int -lower** | **95% confid int - upper** |
|  |  | **Turnover Growth** |
| 139 | ATE – Scotland | 14,343 | 1,618 | -0.0247 | (0.0412) | -0.600 | (0.549) | -0.105 | (0.0560) |
| 140 | ATE – N. England | 36,347 | 1,618 | -0.00750 | (0.0418) | -0.179 | (0.858) | -0.0895 | (0.0745) |
|  |  | **Employment Growth** |
| 141 | ATE – Scotland | 14,180 | 1,619 | 0.0622 | (0.0443) | 1.405 | (0.160) | -0.0246 | (0.149) |
| 142 | ATE – N. England | 35,683 | 1,619 | 0.0644\* | (0.0379) | 1.700 | (0.0891) | -0.00984 | (0.139) |
|  |  | **Turnover per Employee Growth** |
| 143 | ATE – Scotland | 14,172 | 1,618 | -0.0865 | (0.0583) | -1.485 | (0.138) | -0.201 | (0.0277) |
| 144 | ATE – N. England | 35,670 | 1,618 | -0.0701 | (0.0476) | -1.472 | (0.141) | -0.163 | (0.0232) |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

# Appendix Four

## Regression Models for Productivity Drivers 2008

**Table A4.1: Treatment Regression on Productivity and Productivity Growth 2008**

|  |  |  |
| --- | --- | --- |
|   | (1) | (2) |
|  VARIABLES | Productivity 2008 | Productivity growth 2007-08 |
|  |  |  |
| Supported by SE/HIE (dummy) | 13.31\*\*\* | -2.478\*\*\* |
|  | (3.770) | (0.886) |
| Net capital expenditure 2007 (log) | 0.0820\*\* | 4.74e-05 |
|  | (0.0413) | (0.00971) |
| Subsidy 2007 (dummy) | -0.0435 | -0.000420 |
|  | (0.404) | (0.0949) |
| Product innovator | -0.0540 | 0.0550 |
|  | (0.193) | (0.0453) |
| Process Innovator | -0.00607 | 0.00667 |
|  | (0.190) | (0.0446) |
| Employment costs per employee 2007 (log) | 0.00988\*\*\* | -0.00167\* |
|  | (0.00377) | (0.000887) |
| **Control Variables** |  |  |
|  |  |  |
| Productivity Growth 2006-07 | 0.0770 | -0.183\*\*\* |
|  | (0.144) | (0.0339) |
| Beginning year stocks 2007 (log) | 0.0759 | 0.0236\*\* |
|  | (0.0505) | (0.0119) |
| Size 2007 (emp) (log) | -0.345\*\*\* | -0.0206 |
|  | (0.0878) | (0.0206) |
| Age | -0.00731 | 0.00762 |
|  | (0.0432) | (0.0102) |
| UK-owned 2007 (dummy) | -0.0846 | -0.00769 |
|  | (0.164) | (0.0385) |
| Sectoral dummies | Yes | Yes |
|  |  |  |
| Regional dummies | Yes | Yes |
|  |  |  |
| Constant | 4.271\*\*\* | 0.544\*\* |
|  | (1.141) | (0.268) |
| **Endogenous Assistance Regression** |  |  |
|  |  |  |
| Size 2007 (emp) (log) | 0.0433 | 0.0433 |
|  | (0.0374) | (0.0374) |
| Undertake R&D (dummy) | 0.243\*\* | 0.243\*\* |
|  | (0.111) | (0.111) |
| Productivity 2007 (log) | 0.113\*\* | 0.113\*\* |
|  | (0.0526) | (0.0526) |
| Lambda (selection term) | -6.506\*\*\* | 1.181\*\*\* |
|  | (1.844) | (0.433) |
| Constant | -2.314\*\*\* | -2.314\*\*\* |
|  | (0.354) | (0.354) |
|  |  |  |
| Observations | 1,469 | 1,469 |
| N. Supported Firms Observations | 106 | 106 |

\*\*\* = significant at 1% level, \*\*=significant at 5% level, \*=significant at 10% level

# Appendix Five

## ONS Dataset Descriptions

**The Business Structure Database (BSD)**

The *Business Structure Database* (BSD) is a 'snapshot' in time of the *Inter-Departmental Business Register* (IDBR), which is a live register of firms registered for VAT and/or Pay As You Earn (PAYE) in the UK. The IDBR is estimated to cover approximately 99% of UK economic activity.

The 'snapshot' of the IDBR used for the BSD is taken around April annually; the reporting period for the firm is generally the financial year although the IDBR data are complimented with data from ONS business surveys and hence reporting periods can vary by firm depending on whether the record has been updated by survey data. The BSD snapshots contain approximately 2 million observations annually.

The BSD is divided into two datasets, one covering ‘enterprises’ and the other ‘local units'. An enterprise is the overall business organisation. A local unit is a 'plant', such as a factory, shop, branch, etc. In some cases, an enterprise will only have one local unit, and in other cases (such as a bank or supermarket), an enterprise will own many local units.

For each company on the BSD dataset, data are available on employment, turnover, foreign ownership, and industrial activity based on Standard Industrial Classification (SIC)92, SIC 2003 or SIC 2007. Year of 'birth' (company start-up date) and 'death' (termination date) are also included, as well as postcodes for both enterprises and their local units.

A longitudinal version of the BSD can be created by linking together the annual snapshots, which are available from 2007 onwards. As a snapshot of the IDBR the BSD contains unique reference numbers for each firm which can be used to link the data to other ONS business survey datasets that are sampled from the IDBR.

**The UK Innovation Survey**

The *UK Innovation Survey* (UKIS) is the main source of information on business innovation and represents the UK's contribution to the Europe-wide *Community Innovation Survey* (CIS). The survey is based on a core questionnaire developed by Eurostat and EU Member States and covers a range of innovation-related concepts, including:

* Details of any innovation-related activities such as R&D, acquisition of equipment, training, design etc.
* Information on innovations in business strategies and practices
* Product innovation
* Process innovation
* Abandoned and incomplete innovation activities
* The context for innovation e.g. increase range of goods or services, entering new markets
* Cooperation agreements
* The factors constraining innovation.

The UKIS is a sample based survey (sampled from the IDBR) and covers UK businesses with 10 or more employees in sections B-N of the Standard Industrial Classification (SIC) 2007 (prior to 2008-2010, sections C-K of SIC 2003) that are registered for VAT and/or PAYE. Sampling stratification is based on region, SIC and business size. Responses to each wave vary but include up to 16,000 respondent firms, representing a typical response rate of 51 per cent. The responses are weighted back to the total business population as identified by the IDBR. On average each respondent represents 12 enterprises in the population.

Data is currently available from UKIS waves 2 – 8 which covers the period 1994-2012. The survey was originally conducted every four years but moved to every two years in 2007. The survey period covered by the questionnaire is the two year period prior to the survey year, so for example UKIS wave 8 was conducted in 2013 covering the period 2010-12.

**The Annual Business Survey**

The *Annual Business Survey* (ABS) is the largest business survey conducted by the ONS in terms of the number of respondents and variables it covers. It is the key resource for understanding the detailed structure and performance of businesses across the UK, and is a large contributor of business information to the UK National Accounts.

There are 51 different questionnaires for the ABS, made up of 34 ‘short’ and 17 ‘long’ versions with the short requesting totals, and the corresponding long questionnaire asking for more detailed breakdowns. As a result the ABS contains variables relating to around 600 questions and provides a number of high-level indicators of economic activity such as the total value of sales and work completed by businesses, the value of purchases of goods, materials and services; stocks; capital expenditure, and total employment costs. The contribution of different industries to the overall value of economic activity can also be assessed through a measure of value added.

The ABS is a sample-based annual survey of businesses in the UK covering the Production, Construction, Distribution and Service industries. Every year, ABS questionnaires are sent by the ONS to around 62,000 businesses in Great Britain, and by the Department for Finance and Personnel Northern Ireland (DFPNI) to around 9,000 businesses in Northern Ireland. Sampling stratification is based on SIC (2007), employment and country;  all large businesses are surveyed along with subsets of medium and small businesses. As a compulsory survey response rates of 74% are anticipated by the end of the survey year; responses are weighted to the full population of firms on the IDBR.

The ABS replaced the Annual Business Inquiry, Part 2 (ABI/2) in 2009. The historical annual ABI datasets are available under the Annual Respondents Database.

The ABS data include 3 files for each year of the survey:

* Data files, which contain the responses on a reporting unit basis from the businesses selected for the survey who provided returns to the ONS;
* 'reporting unit universe' files, which are sampling files that include records on a reporting unit basis for all businesses, including those not selected by the ONS for the survey; to include variables covering employment, turnover, Standard Industrial Classification codes, legal status, foreign ownership codes
* 'local unit universe' files, which are sampling files that include records on a local unit basis for all businesses, including those not selected by the ONS for the survey; to include variables covering geography, employment, Standard Industrial Classification codes, legal status, foreign ownership codes.

**The Business Expenditure on R&D Survey**

The *Business Expenditure on Research and Development* is an annual survey providing information on total Research and Development expenditure in the UK by business enterprises; total Research and Development employment, and sources of funds.

The BERD is a sample-based survey, drawn from the IDBR. Since 1995, the BERD survey has used a stratified random sample, stratified by Product Group and employment sizeband. In the first stage of the sampling procedure the largest 400 firms are chosen; these companies have either been identified as R&D active from previous returns or from another data source. There are a number of sources that contribute towards the sampling frame for the BERD. The ABI business survey asks a filter question about whether or not a firm engages in R&D. The Department of Business, Trade and Investment and the Scottish executive provide ONS with R&D information on companies. These 400 firms are then sent a long form.

The sampling frame covers all industries. For those firms not receiving a long form, they are broken down in to the remaining two employment sizebands. Enterprises are then selected randomly from each size band using the sampling fractions applicable to that band. Those identified are then sent a short form. For non-selected firms, data is imputed on the basis that these enterprises have the same R&D to employment ratio as selected reporting units in their class.

The Reporting Units surveyed receive either a 'long form' or 'short form'. The long form asks for information on:

* in-house expenditure on Research and Development:
* current expenditure broken down by basic research; applied research; and experimental research
* capital expenditure broken down by land and buildings; and plant and machinery
* Research and Development commissioned outside the company
* number of employees working on Research and Development broken down by scientists and engineers; technicians; others.

Smaller firms receive a short form. This only asks for a breakdown of Research and Development by civil and defence for three questions. It requests aggregate figures for Intramural Research and Development (including both current and capital expenditure), purchasing of Research and Development (work conducted outside the company, funded by the business) and average employment on Research and Development (number of full time equivalents).

The BERD survey has been conducted since 1994 and is an annual survey covering approximately 3,500 - 26,000 businesses.

1. We did not have access to the date at which firms became AM supported so could not distinguish a prior or post-AM support period. [↑](#footnote-ref-1)
2. The difficulty we have faced is that generally a D-i-D model is used to compare the before and after periods of an intervention. In this case we have not had the start dates for the support so it was difficult to pinpoint a before and after. It happens to be the case that the periods we have used to proxy this have been very different i.e. 00-02 was a boom period and 12-14 a recovery period. [↑](#footnote-ref-2)
3. Gal, P. N. (2013) ‘Measuring total factor productivity at the firm level using OECD-ORBIS. OECD Economics Department Working Paper No. 1049. OECD [↑](#footnote-ref-3)
4. Kathuria, V., Raj, R., and Sen, K. (2011) Productivity measurement in Indian manufacturing: A comparison of alternative methods. Development Economics and Public Policy Working Paper Series WP No. 31/2011, University of Manchester [↑](#footnote-ref-4)
5. We have not attempted to compare the turnover and GVA data as they are from different sources and are not based on the same level e.g. turnover from the BSD is at the enterprise level, whilst GVA is collected as the Reporting Unit and Local Unit level. [↑](#footnote-ref-5)
6. Looking at the match rates to the ABS and ARD we get a 52% maximum match rate to our SE firms. As these are sample based surveys we will not have annual data points for the 52% that match, so although we will have GVA per worker from these surveys we cannot look at time series trends, or use D-i-D, as there are simply not enough continuous observations. [↑](#footnote-ref-6)
7. On the whole we are interested in the growth of firms since 1998. The BSD data is available from 1997 onwards, however, given that we would like to include variables to capture prior growth and prior productivity levels (to control for the fact that SE/HIE firms may have had higher levels of both to begin with) we have chosen to measure growth from 2000 onwards rather than 1998. This then allows for data from 1997 – 1999 to be used to capture underlying growth characteristics. [↑](#footnote-ref-7)
8. SE commissioned the first major review of Account Management in 2008. A number of recommendations were adopted as a result, with the most significant internal change involving a move from autonomous LEC structures to a single centralised structure with a focus on company and sector growth. The aim was to adopt and embed a more consistent approach to delivery of account management, with more companies from the key industry sectors becoming account managed (Upper Quartile; Additional Research; Research Resource, (2013) “Evaluation of Scottish Enterprise Engagement with Account Managed Companies”, September 2013). [↑](#footnote-ref-8)
9. We have undertaken a matching exercise to link firms to a dataset of those in receipt of 9 BIS Schemes, and excluded any firm which appeared on this aggregated dataset. [↑](#footnote-ref-9)
10. This enables analysis to be undertaken in a secure setting using anonymised datasets to prevent disclosure of any individual firm data. [↑](#footnote-ref-10)
11. The dataset contained firms that were both current and no-longer AM companies, however there were no dates to indicate start and end of the AM relationship. [↑](#footnote-ref-11)
12. ERNs are the firms’ unique identifiers; they are allocated to each firm that appears on the ONS Inter-Departmental Business Register (IDBR). [↑](#footnote-ref-12)
13. Some firms appeared on the dataset more than once due to the fact that the matching, to append ERNs, was undertaken at site level using the local unit reference number (luref). This luref can change over time, thus resulting in multiple entries for individual firms. [↑](#footnote-ref-13)
14. The datasets available in the Secure Lab have all been anonymised, with any business name or address details removed, thus in order to match firms across datasets one can only use the unique identifier (ERN). [↑](#footnote-ref-14)
15. Size is usually negatively correlated with growth in that smaller firms tend to have higher rates of growth. [↑](#footnote-ref-15)
16. We were able to identify assisted firms in the UK that had received support through nine schemes run by the Department of Business, Innovation and Skills, as we had the ERNs of these firms in the Secure Lab. These were removed from the sample to reduce contamination of the ‘non-assisted by assisted firms in the potential pool. [↑](#footnote-ref-16)
17. The numbers in Table 1.1 refer to those firms with BSD data in 2014 and are a subset of the total sample of SE and HIE firms. This is the reason why there are only 2,949 and not 2,977 firms in the analysis – 28 firms were no longer in existence in 2014. [↑](#footnote-ref-17)
18. The export variable is drawn from the Global Connections Survey and thus can only be used for the Scottish firms, hence it is not included in the construction of the Northern England control group. [↑](#footnote-ref-18)
19. Levie, J and Autio, E (2013) “Growth and growth intentions: A meta-analysis of existing evidence”, ERC White Paper No.1, April 2013. [↑](#footnote-ref-19)
20. Using the teffects command in Stata. [↑](#footnote-ref-20)
21. Alongside running the model for all SE and HIE firms combined (excluding Corporate Scotland) we also run separate models for the various segmentation groups to capture the individual effects of the specific type of support e.g. Account Managed Growth; Important to Economy; Direct Relationship Managed and Non-Direct Relationship Managed. [↑](#footnote-ref-21)
22. This is the recommended number of matches on the basis of a trade-off between one-to-one match and the complexity of more matches. [↑](#footnote-ref-22)
23. Ideally one would have data indicating the year the firm first received support and thus the variables capturing underlying characteristics would reflect activity prior to receipt of support. Unfortunately the data here did not indicate start or end year for receipt of support, thus the 1997-99 data was used as a proxy for prior behaviour. [↑](#footnote-ref-23)
24. Firms are likely to have been selected for support based on certain criteria rather than being randomly selected. In such a scenario their growth may not resemble the average firm which can be a source of bias. [↑](#footnote-ref-24)
25. The non-assisted group here represents the full set of firms in Scotland that were not AM/HIE supported. At this stage comparisons are not being made with the matched control group and so the descriptive statistics, for example on the growth difference, do not control for the differing characteristics between the two sets of firms. Any outliers have been removed. [↑](#footnote-ref-25)
26. This is indicated by the t-statistic and the accompanying \* signs to show significance level. [↑](#footnote-ref-26)
27. It is worth noting that in 2014 62% of supported firms were UK-owned, the proportion of non-assisted firms that were UK-owned remained at over 90%. [↑](#footnote-ref-27)
28. We can control for this selection issue in the regression model through the generation of the control group of firms with similar background characteristics. [↑](#footnote-ref-28)
29. It is important to remember that the control groups were matched in characteristics to the treated firms so it would not be the case that this difference is the result of a different sectoral mix in the two groups. [↑](#footnote-ref-29)
30. The only exception to this was that employment growth also fell for the non-assisted between the two periods, although at a lower rate than the decrease for the supported firms. [↑](#footnote-ref-30)
31. Note that the exporter variable is not included as the GCS data covers Scotland only. [↑](#footnote-ref-31)
32. Within these sectors there are a number of supported firms with extremely high productivity levels which skew the mean values upward. The ‘Other’ sector includes Financial Services, amongst others, and values here for non-assisted firms are particularly high. The previous caveat that turnover per employee would be higher than a standard productivity measure, such as GVA per employee, also holds. [↑](#footnote-ref-32)
33. Again, the number of firms in the analysis in reduced due to the fact that it refers to 1998 so not all the firms in the dataset will have been alive. [↑](#footnote-ref-33)
34. Tables showing full results including sample size, coefficients, standard errors and confidence intervals are provided in Appendix 3. [↑](#footnote-ref-34)
35. These firms are a segmentation category of the AM/HIE supported firms. [↑](#footnote-ref-35)
36. Regional Selective Assistance is given to firms for employment and/or capital growth which may also be reflected in the findings here. [↑](#footnote-ref-36)
37. The full sample of firms relates to all SE and HIE firms that are Designated Relationship Managed and Non- Relationship Managed. [↑](#footnote-ref-37)
38. DRM firms relate to those that are Direct Relationship Managed and include all those categorised as Account Managed Growth and Important to the Economy. [↑](#footnote-ref-38)
39. AMG firms relate to Account Managed Growth and include all those SE firms categorised as so and those HIE firms that are categorised as AM relationship dormant; AM relationship active; actuals complete; growth plan agreed and growth plan concluded. [↑](#footnote-ref-39)
40. ITE firms relate to those categorised as Important to the Economy. [↑](#footnote-ref-40)
41. NRM firms relate to those categorised as Non-Relationship Managed and include all those SE firms categorised as so and those HIE firms categorised as AM discontinued. [↑](#footnote-ref-41)
42. Micro firms relate to those with 1-9 employees; small firms relate to those with 10-249 employees and large firms relate to those with 250 or more employees. [↑](#footnote-ref-42)
43. Tables reporting the full regression results are included in Appendix 3 [↑](#footnote-ref-43)
44. Tables reporting these figures and those for the 2008/10-2012/14 and 2010/12-2012/14 periods are given in Appendix 2. [↑](#footnote-ref-44)
45. See Appendix 5 for a brief overview of all the datasets used in this analysis. [↑](#footnote-ref-45)
46. In total 2,089 of the SE/HIE firms merge onto the combined ARD and ABS from 1997-2013. However the matches for individual years range from a min of 328 in 1997 to a max of 718 in 2007. If we were to run the analysis on 2013 data, using previous data points as explanatory variables then the number reduces again. For example, just 210 SE/HIE firms have data for 2011, 2012, and 2013. We could run a regression on these but we would be missing the key variables relating to R&D and innovation so the resulting regression would not be any more useful than the ones we have produced, and in fact the R-squared would be lower due to these missing variables. [↑](#footnote-ref-46)
47. That is, CIS3 – CIS8. [↑](#footnote-ref-47)
48. There are approximately 5,500 firms sampled for the survey, with a response rate of between 34-39%. [↑](#footnote-ref-48)
49. For example, internationally active SMEs are three times more likely to introduce products or services that are new to their sector than those which are entirely domestic in orientation (ERC/GS/BBB (2015) “Unlocking UK Productivity: Internationalisation and Innovation in SMEs”, November 2015. [↑](#footnote-ref-49)
50. The only way to attribute causality is through the use of lagged variables (i.e. past values). We could not generate these due to having to code firms as exporters, innovators and R&D active if they had ever done this – we need to be able to separate the timing of these activities from that of the outcome measure, otherwise all we can say are that they are correlated. [↑](#footnote-ref-50)
51. Using the etregress command in Stata. [↑](#footnote-ref-51)
52. The identifying variable has to be one which is correlated with the likelihood of receiving support but not correlated with the outcome, that is, growth. We have a limited number of variables to work with from which we could choose such variables, and it is also difficult to find a variable that would be related to being supported but not related to growth. R&D was chosen as it represents an input into the innovation process so we could argue that R&D itself is not correlated with growth (rather it is the output from R&D that affects growth e.g. the innovation) but R&D could be correlated with gaining support. [↑](#footnote-ref-52)
53. Binary variables are 1/0 variables indicating that yes they do this activity (1) or no they do not (0) [↑](#footnote-ref-53)
54. This variable is drawn from the Annual Business Survey (previously ABI) and is defined as ‘Total amounts received in subsidies from UK government sources and the EU’. [↑](#footnote-ref-54)
55. This is a subsidy variable taken from the ABS – see footnote 52. [↑](#footnote-ref-55)
56. The 2013 evaluation of the impact of Regional Selective Assistance found there to be positive significant effects on employment and turnover growth but no effects on productivity growth (Bonner, K. and Hart, M.,2013, Regional Selective Assistance in Scotland: Econometric Analysis 2004/05 – 2010/11) [↑](#footnote-ref-56)
57. The latest ARD (ABS) data available is for 2013 so the model can only be run up to 2013. [↑](#footnote-ref-57)
58. An example of this would be a variable such as the prior business experience of the owner; if we imagine a scenario whereby a support programme is provided to new start-up firms (and as a result the majority are owned by those with no prior experience) then we would expect that zero prior experience would be correlated with the receipt of support but the productivity levels of those firms would be lower than those firms who have owners with extensive previous experience. [↑](#footnote-ref-58)
59. Wagner, J. (2007) Exports and productivity: A survey of the evidence from ﬁrm-level data. The World Economy 30(1): 60–82 [↑](#footnote-ref-59)
60. Given that the underlying surveys are sample-based and typically stratified by size (amongst other factors) there is a greater chance that the firms which are linked consistently across surveys are the largest in size (smaller firms either being sparsely sampled and/or surveyed sporadically). This means that the sample used here is skewed towards larger firms whose results may not be replicable to the wider population of firms. [↑](#footnote-ref-60)
61. The positive sign on the selection term in the productivity growth model means that there are other factors, which we haven’t been able to include in the model, that are associated with higher productivity growth. Failure to control for this source of bias in a normal OLS regression would have resulted in an inflated impact of support on growth. [↑](#footnote-ref-61)