Regional Growth Fund Evaluation

Evidence from Econometric Analysis

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Executive Summary

The Regional Growth Fund has allocated £2.8 billion to programmes and projects since 2011 with the aim to create and safeguard jobs and, by 2020, the RGF monitoring data reports 345,863 years of new employment and 266,160 years of employment safeguarded across the interventions. A challenge has been to estimate additional economic impact, taking account of what would have happened without RGF support. This report looks at the approaches taken to evaluate the additional economic impacts for each of the Schemes. The results presented focus on estimates of the effects that are attributable to the Fund. The results focus on employment; however, the indicators of the quality of the additional jobs are also quantified as are turnover and other business performance measures.

Background to the Economic Impact Study

1. The Regional Growth Fund (RGF), launched in 2010 by the Department for Business, Energy and Industrial Strategy (BEIS)[1] and the Department for Levelling Up, Housing and Communities (DLUHC),[2] is aimed at promoting private sector led growth throughout England. It has two key objectives: The first is to stimulate enterprise by providing support for projects and programmes with significant potential for economic growth and to create additional sustainable private sector employment. The Fund's second objective is to support areas and communities dependent on the public sector make the transition to sustainable private sector-led growth and prosperity (HM Government, 2010, p.32).

2. The minimum direct application was for funding of £1m. RGF supported both Regional Projects (Scheme 1, where the money is spent directly by firms and business consortia, who tend to be large businesses) and National and Regional Programmes, Schemes 3 and 4 respectively, where typically small businesses receive funding via an intermediary (such as a bank or Local Enterprise Partnership). The RGF has also funded large-scale, place-based interventions under Scheme 2 and an Advanced Manufacturing Supply Chain Initiative (AMSCI), Scheme 5. Each successful bid is monitored for compliance and progress against targets, both intermediate outputs and longer-term outcomes. These relate to standard outputs (e.g. employment and turnover generated) and any additional outcomes (such as attracting additional companies, raising land values or increasing social cohesion).

[1] At the time, the Department for Business, Innovation and Skills.
[2] At the time, the Department for Communities and Local Government.

Evaluation Approach

3. This study uses econometric methods to understand the additional impacts of the Regional Growth Fund. It identifies comparable non-beneficiaries using statistical matching: a quasi-experimental approach called propensity score matching, a spatial differencing approach used for place-based support and also explores evidence from employment transitions.

4. A comprehensive dataset – compiled using the Office for National Statistics (ONS) business register, associated surveys, and external data regarding the RGF support – has been used for the analysis. The data has enabled tracking supported businesses and places, and also comparable unsupported businesses and places.

5. This is used to estimate the employment and turnover changes seen in supported businesses. Further, propensity score matching is used to identify a comparison group, which is then tracked in the same dataset to see what part of any growth seen in supported businesses does not take place in the comparator. This provides an estimate of the additional effects of RGF support.

6. To analyse the earnings effects of RGF support, the study draws on the Annual Survey of Hours and Earnings (ASHE). Each year, ONS surveys businesses about the pay, hours, occupation, age and gender of one percent of all employees. The ASHE design tracks individuals, as the same one percent are surveyed each year, with individuals that have moved jobs being surveyed in their new employer's return. This allows the quality of jobs to be assessed both in terms of levels of wages and the transitions as individuals move into and out of the supported businesses. This latter feature can proxy for the quality of jobs.

7. The main method to estimate the impact of the RGF place-based interventions is spatial and time-differencing as per the recent evaluation work on other place-based programmes. This compiles the ONS data, but on a local area basis. Impacts on the areas supported by Place-Based Programmes (Scheme 2) can then be estimated.

Employment Effects across the Fund

8. A key dataset used in the analysis is the monitoring data collected as RGF was delivered. Overall, £2.8 billion was distributed across 466 successful applicants, with the applicants including individual businesses or consortium of businesses (for Scheme 1) or organisations that then administered the funding on behalf of the BEIS and the DLUHC directing the support to eligible SMEs. In addition, the monitoring data tracked the

employment created and safeguarded by businesses, as those delivering programmes and projects reported their delivered jobs each quarter to BEIS and DLUHC.

9. The econometric analysis uses this monitoring data but then also draws in firm-level data, primarily the employment as recorded each year in the ONS based on annual payroll counts. For the evaluation, beneficiaries of the RGF – both directly funded by the Departments and through lists collected from programme intermediaries – have been compiled and then linked to the ONS Business Structure Database, an annual snapshot of the Inter-Departmental Business Register. The register covers almost all economically significant UK businesses, providing a second snapshot of employment in businesses supported by RGF.

10. Table 1 compiles the different estimates of the employment effects of the RGF by different schemes. Overall, 187,650 additional years of employment is estimated to have occurred across the five RGF Schemes, with 156,540 of those employment years occurring in the businesses directly supported and a further 31,110 additional years of employment through RGF investments in places benefitting businesses indirectly. These jobs are considered additional, in that 345,863 years of new employment was created in these businesses, with 54% of the employment identified as being over and above that seen in comparable, but unsupported, businesses or places.

11. The econometric analysis relies on ONS firm-level data, crucial in this analysis as it allows analysis of both supported and unsupported businesses and places (whereas monitoring necessarily only looked at RGF beneficiaries). However, Table 1 does indicate that the ONS data is consistent with that from monitoring information.

12. The RGF “Reported New Job Years” (column 2) should be compared with the years of employment on payrolls observed in ONS data. As RGF Regional Projects were monitored, 60,333 years of new employment were reported. These reflect the returns made each quarter to the RGF monitoring team about the new jobs resulting from RGF support. The third column has used the ONS data about employment in the establishments supported. This is a different source, where ONS has either surveyed the business about employment or used HMRC administrative data, and the years of employment in this measure is 57,653. Both measures add together the jobs created in supported businesses for the four years since the year before support and generates a measure of the years of employment, one as reported in management information and the second on payrolls as recorded in ONS data.

Table 1: Comparing Monitoring Payroll Data in Four Years after Programme/Project Start

	Reported New Jobs Years in MI **First four years after support**	Reported Safeguarded Job Years in MI **First four years after support**	Years of New Employment on Payrolls **First four years after support**	Additional Job Years **First four years after support**
Regional Projects	60,333	105,004	57,653	49,417
Place-Based Programmes	27,711	27,148	38,581	31,110
National Programmes	134,579	60,689	57,547	34,944
Regional Programmes	123,796	70,219	104,777	48,607
AMSCI*	n.a.	n.a	87,305	23,572
Total	**346,419**	**263,060**	**345,863**	**187,650**

Source: Regional Growth Fund Monitoring Data, which does not cover AMSCI completely*; Place-Based estimate is total new jobs.

13. The RGF monitoring information "Reported New Job Years" can be compared with the gross job years on payroll growth seen in ONS data scheme by scheme. For Scheme 1, Regional Projects, the coverage of both the econometric analysis of ONS data and the reporting of management information is high, so consistency here is high. There are fewer new years of employment reported in the monitoring data than ONS data about the areas for the first four years of support in Place-Based Programmes: this is because the econometric approach used to estimate effects uses an administrative geography, larger than the RGF monitoring. For National and Regional programmes, which supported thousands of small and medium-sized enterprises, the econometric analysis relied on collecting beneficiaries from individual programmes and coverage was partial. After business beneficiaries have been linked to ONS payroll data, the employment coverage is good for Regional Programmes, but somewhat lower for the National Programmes.

14. The Table also indicates how RGF has safeguarded employment, i.e. funded businesses to maintain jobs that otherwise would have been lost. Such jobs are harder to enumerate from ONS data. However, by setting up a robust comparator, the study has been able to consider what might have happened without support, the counterfactual. This was estimated for each Scheme using the linked data.

Impacts of Regional Projects

15. To understand the additional impact of Regional Project support on employment and other performance measures, the changes in beneficiary businesses was compared with a matched counterfactual. This was undertaken at a reporting unit level, a level ONS uses to conduct surveys that is below whole enterprises covering establishments in large,

multiple plant businesses.[3] Regional Projects supported businesses directly, with projects larger than £1m in value, so the focus was often on supported plants within the enterprises.

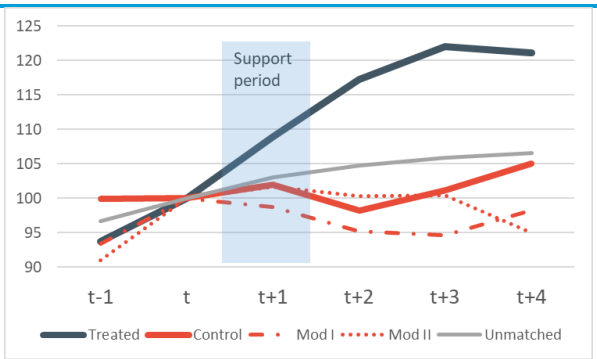
16. There was considerable growth seen in employment. Employment in the 185 supported establishments was 14.2% higher two years after projects had started and 23.3% higher four years after.

17. When comparable businesses are selected from the wider BSD using a model that uses firmographic characteristics such as size, industry, location, (Model I), the control group's employment grows somewhat slower with a 10.8% highly significant difference.

Figure 1: RGF Project supported businesses compared to comparators

Employment at enterprise level consider the change across whole businesses. Remembering that the matching is at reporting unit level, this then is an estimate for wider set of establishments linked to the plant supported with RGF projects.

One feature to highlight is that the pre-support growth in employment is found to be somewhat different between the control group and supported. This suggests the matching has provided comparator businesses that were on a somewhat different, around 5% growth trajectory difference to the supported before RGF support.



18. As indicated in Table 1, there were 57,653 years of employment seen in the supported reporting units and the differential growth rates suggests that 49,417 of these would be additional, with alternative models suggesting 16,472 to 45,299.

19. Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses and there is a large premium for changing jobs to a business unit that is supported by an RGF Regional Project. Individuals get an average of a 22% boost to their earnings when moving to a supported unit. At around 23%, the premium is even slightly higher when moving to a part of a business that has not been supported directly. In contrast, employees earn on average almost 7% less when moving away from a supported unit.

20. Other performance measures, such as GVA, turnover and investment are increasing faster in supported businesses than comparable businesses. However, sometimes estimates are insignificant statistically. Sample sizes are small and there is a high level of variance to contend with.

[3] So, a conglomerate may operate across many industries or many locations, and ONS would then define reporting units within the business in some economically meaningful way, such as the individual plants of the business, or groups of retail units owned by the conglomerate which operate and report at a the group level.

Impacts of the National and Regional Programmes

21. National Programmes and Regional Programmes are a diverse set of support measures made available to businesses through intermediaries, such as LEPs, banks, Local Authorities, or Higher Education Institutions. The individual incidences of support were collected from the 138 programmes. They were also asked about the applicants that did not meet the criteria for support and these businesses provided a pool from which the counterfactual could be selected.

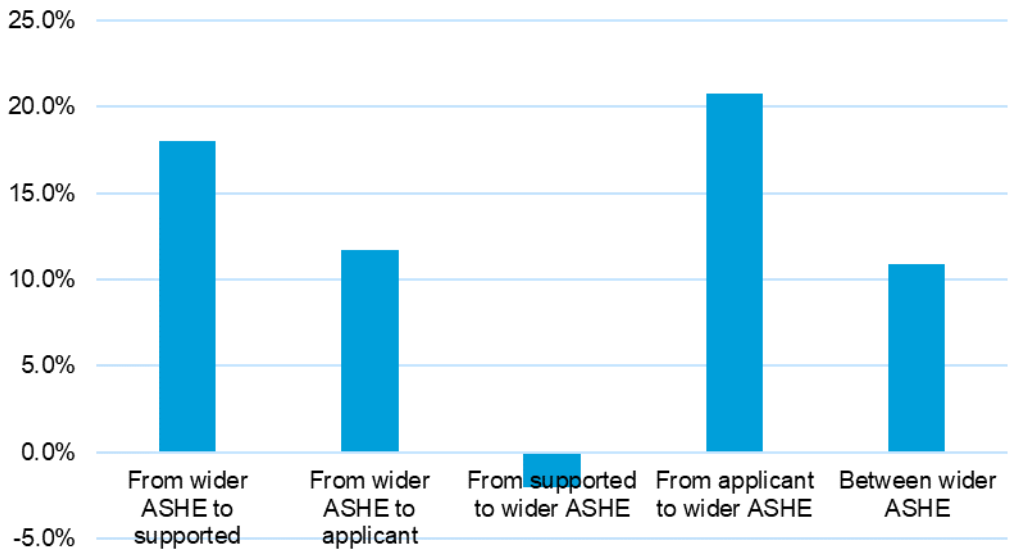
22. Overall, the growth in employment seen in the National Programmes was between 14.0% and 30.5%; for the Regional Programmes, the range was 18.9% to 31.9%. The comparator businesses also grew but there was a positive and generally significant difference, with this difference being between 8.1% and 15.7% for the National Programme and 6.9% to 18.5% for the Regional Programmes.

23. Employment in the businesses supported by National Programmes grew by 57,547 job years. Using the growth seen in supported businesses but not seen in the comparators, 34,944 years of employment are additional in the National Programmes. For the Regional Programmes, employment grew by 104,777 years of employment in the four years of support, of which 48,607 were years of additional employment (though the growth seen in the businesses did not differ as much with the counterfactual as was the case for the National Programmes).

24. The quality of employment has been analysed, using surveys of the earnings linked to the business of employees. Average earnings at National and Regional Programme supported businesses were much higher than both those in unsuccessful applicants and the wider ASHE population in the first programme cohorts (in 2012).

25. The analysis of employees that switched between supported, unsupported businesses and the businesses that applied but were unsuccessful reveal a premium of 18% when switching jobs to a supported business. In comparison, the premium is only 12% when moving to an unsuccessful applicant business. Employees who leave a supported business and join a business in the wider ASHE saw their earnings decline by 2% on average. In contrast, employees who left an unsuccessful applicant business to join a business in the wider ASHE experienced an earnings-increase of 20% on average. Employees changing jobs between businesses in the wider ASHE gained an earnings-increase of 11%.

Figure 2: Earnings growth of job changers for National Programme Support



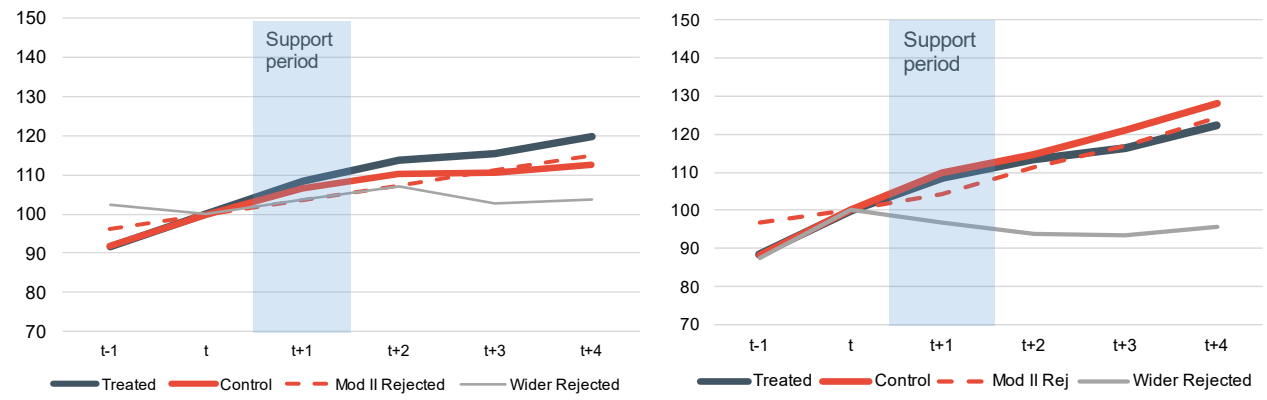
	Earnings growth	SD	Number of observations
From wider ASHE to supported	18.0%	0.59	184
From wider ASHE to applicant	11.7%	0.63	144
From supported to wider ASHE	-2.0%	0.51	133
From applicant to wider ASHE	20.8%	0.63	146
Between wider ASHE	10.9%	0.61	112,733

Impacts of the Advanced Manufacturing Supply Chain Initiative

26. The Advanced Manufacturing Supply Chain Initiative (AMSCI) is a large-scale programme that has supported UK advanced manufacturing supply chains to boost competitiveness. The programme has received RGF funding of £276m as grant and has exceeded its targets in terms of Private Sector Match funding and reported jobs. AMSCI beneficiary businesses were supported in financial years 2012 to 2017 and have benefitted from both additional employment and higher wages. Four years post support, 87,305 years of employment were generated through new jobs, of which, 23,572 were additional.

27. The analysis indicates that 26% of the employment growth is additional, in not being seen in the comparable businesses over the period. Figure 3 indicates that turnover growth tracks employment trends, suggesting that as businesses expand their workforce, their sales are growing as well. For the businesses supported by AMSCI, turnover growth is 22.4% in the four years post support.

Figure 3: Employment and Real Turnover Growth in AMSCI supported businesses



(a) Change in Employment (b) Change in real turnover

Analysis of Rejected Beneficiaries linked to AMSCI beneficiaries and other datasets; Turnover estimates with *t* before support then businesses are treated in a year-long financial year centring on *t+1*. Points *t* +2 and *t* +3, representing two and three years after the pre-support point; employment estimates centre on September in each year. Rejected enterprises in this modelling were used in matching all cohorts of the supported businesses, hence sample sizes higher and businesses could be used more than once in the counterfactual.

28. Furthermore, businesses that benefited from AMSCI support pay substantially higher wages than those that did not and therefore, employees who start a new job at a supported business can earn a substantial wage premium. Among supported businesses, primes pay the highest wages with wages at supply chain businesses significantly lower, but still above the wider ASHE sample.

Impacts of Place-Based Interventions

29. The RGF supported a wide array of area-based interventions from transport infrastructure to rail infrastructure to city redevelopments to flood defences.

30. The number of additional jobs created considering jobs from displaced businesses shows that net creation attributable to the area-based interventions is 10,370. The total cost of interventions is £389m, implying a cost per additional job of £37,512. This finding is similar to the estimate calculated by Gibbons et al. (2017) who calculate a cost per job of £39,675 for the Single Regeneration Budget. In terms of cost per year of employment, assuming that new employment last for three years so that there are 31,110 job years, this would mean a cost per year of employment of £12,504.

31. Areas within 1km of place-based RGF support experienced faster employment growth than comparable locations elsewhere in England. Analysis also suggests that employment growth mainly occurs within 1km and had no effect beyond 4km.

1 Introduction

The Regional Growth Fund has allocated £2.8 billion to programmes and projects since 2011 with the aim to create and safeguard jobs and the RGF monitoring data reports 345,863 years of new employment and 266,160 years of employment safeguarded across the interventions and many more years of employment. A challenge has been to estimate additional economic impact, taking account of what would have happened without RGF support. This report looks at the approaches taken to evaluate economic impacts for each of the Schemes. The results presented focus on estimates of the effects that are attributable to the Fund. The results focus on employment however the indicators of the quality of the additional jobs are also quantified.

Background to the Economic Impact Study

1. The Regional Growth Fund (RGF), launched in 2010 by the Department for Business, Energy and Industrial Strategy[4] and the Ministry of Housing, Communities and Local Government,[5] is aimed at promoting private sector led growth throughout England. It has two key objectives. The first is to stimulate enterprise by providing support for projects and programmes with significant potential for economic growth and to create additional sustainable private sector employment. The Fund's second objective is to support areas and communities dependent on the public sector make the transition to sustainable private sector-led growth and prosperity (HM Government, 2010, p.32).

2. The minimum direct application was for funding of £1m. RGF supported both Regional Projects (Scheme 1 where the money is spent directly by firms and business consortia, who tend to be large businesses) and National and Regional Programmes, Schemes 3 and 4 respectively, where typically small businesses receive funding via an intermediary (such as a bank or Local Enterprise Partnership). The RGF has also funded large-scale, place-based interventions under Scheme 2 and an Advanced Manufacturing Supply Chain Initiative (AMSCI), Scheme 5. Each successful bid is monitored for compliance and progress against targets, both intermediate outputs and longer-term outcomes. These relate to standard outputs (e.g. employment and turnover generated) and any additional outcomes (such as attracting additional companies, raising land values or increasing social cohesion).

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Evaluation Approach

3. This study uses econometric methods to understand the additional impacts of the Regional Growth Fund. It identifies comparable non-beneficiaries using statistical matching: a quasi-experimental approach called propensity score matching, a spatial differencing approach used for place-based support and also explores evidence from employment transitions. It follows an approach set out in a scoping study (BIS, 2015).

4. A rich, linked dataset at a business level has been used, based on the Office for National Statistics business register, associated surveys and data about the RGF support. The data has enabled tracking supported businesses and places, and also comparable unsupported businesses and places.

5. This is used to estimate the employment and turnover changes seen in supported businesses. Further, propensity score matching is used to identify a comparison group, which is then tracked in the same dataset to see what part of any growth seen in supported businesses does not take place in the comparator. This provides an estimate of the additional effects of RGF support.

6. To analyse earnings effects of RGF support, the study draws on the Annual Survey of Hours and Earnings (ASHE). Each year, ONS surveys businesses about the pay, hours, occupation, age and gender of one percent of all employees. The ASHE design tracks individuals, as the same one percent are surveyed each year, with individuals that have moved jobs being surveyed in their new employer's return. This allows the quality of jobs to be assessed both in terms of levels of wages and the transitions as individuals move into and out of the supported businesses. This latter feature can proxy for the quality of jobs.

7. The main method to estimate the impact of the RGF place-based interventions is spatial and time-differencing as per the recent evaluation work on other place-based programmes. This compiles the ONS data, but on a local area basis. Impacts on the areas supported by Place-Based Programmes (Scheme 2) can then be estimated.

Report Structure

8. The next chapter describes the data used in the econometric analysis for the RGF Evaluation and how different firm-level datasets were linked. At the core of the analysis are two datasets. The first is the ONS Business Structure Database (BSD) which provides employment and turnover estimates for all significant UK businesses. The second is the RGF management information (MI), covering businesses which benefited from RGF support and areas targeted for an area-based intervention. Also, various datasets have been linked into the BSD spine providing the characteristics of different areas and data for RGF business beneficiaries and non-beneficiaries.

9. The chapter then considers the methods used in the study. A focus is on approaches that develop robust counterfactuals to identify effects of RGF support that are additional. Methods have been developed to identify place-, firm- and employee-level comparisons and these are described. The study uses econometric methods to understand the additional impacts of the Regional Growth Fund. It identifies comparable non-beneficiaries using statistical matching.

10. Chapter 3 presents estimates of the employment created in the businesses that received RGF support. It first looks at the evidence from management information, primarily the returns made to BEIS and DLUHC as RGF delivery has been monitored. The steps taken to look at employment performance in administrative data is then described and this provides a second estimate of the jobs in businesses supported by the RGF.

11. The next chapters look at individual RGF Schemes. Chapter 4 describes the economic and wider impacts of Regional Projects. Projects were undertaken by large businesses generally and so the data sources used to look at economic impacts includes official surveys, as well as the administrative data. The chapter presents findings on employment and other impacts from analysis using firm-level data and establishes a counterfactual to compare performance. It considers the quality of the jobs in supported businesses using wage data.

12. Chapter 5 presents estimates of the impacts of the National and Regional Programmes, using results from an econometric analysis of ONS administrative data. Programmes involved RGF supporting intermediaries to then provide support to businesses, usually SMEs or start-ups. Lists of supported businesses and unsuccessful applicants have been collected from the Programmes. The chapter first assesses employment, growth and survival using firm-level data. It then presents the results from looking at wage rates in supported businesses.

13. Chapter 6 first assesses the employment, turnover and productivity effects of Scheme 5, the Advanced Manufacturing Supply Chain Initiative (AMSCI) programme. It then analyses the earnings impacts and quality of jobs at AMSCI supported businesses.

14. The final substantive chapter presents the econometric analysis of the economic impacts from the place-based interventions supported by the Regional Growth Fund. The RGF supported a wide array of area-based interventions from transport infrastructure to rail infrastructure to city redevelopments to flood defences.

2 Approach and Datasets

This chapter describes the data used in the econometric analysis for the RGF Evaluation and how different firm-level datasets were linked. At the core of the analysis are two datasets. The first is the ONS Business Structure Database (BSD) which provides employment and turnover estimates for all significant UK businesses. The second is the RGF management information (MI), covering businesses which benefited from RGF support and areas targeted for an area-based intervention. Also, various datasets have been linked into the BSD spine providing the characteristics of different areas and data for RGF beneficiaries and non-beneficiaries.

The chapter then considers the methods used in the study. A focus is on approaches that develop robust counterfactuals to identify effects of RGF support that are additional. Methods have been developed to identify place-, firm- and employee-level comparisons and these are described. Annexed are more details on the methods.

Summary

1. This study uses econometric methods to understand the additional impacts of the Regional Growth Fund. It identifies comparable non-beneficiaries using statistical matching: a quasi-experimental approach called propensity score matching, a spatial differencing approach used for place-based support and explores evidence from employment transitions. Propensity score matching matches two entities that are statistically similar, but where one received funding (treated) while the other did not (control). This produces a reliable comparison for computing the causal impact of policy. Propensity score matching works best, if unobservable traits can be controlled for (about which robustness checks offer confidence).

2. A rich, linked dataset at a business level has been used, based on the Office for National Statistics business register, associated surveys, and data about the RGF support. The data has enabled tracking supported businesses and places, and comparable unsupported businesses and places.

3. This is used to track the employment and turnover changes seen in supported businesses. Further propensity score matching is used to identify a comparison group, also then tracked in the same dataset to see what part of any growth seen in supported

business does not take place in the comparator. This provides an estimate of the additional effects of RGF support.

4. To analyse earnings effects of RGF support, the study draws on the Annual Survey of Hours and Earnings (ASHE). Each year, ONS surveys businesses about the pay, hours, occupation, age and gender of one percent of employees. The ASHE design tracks individuals, as the same one percent are surveyed, with individuals that have moved jobs being surveyed in their new employer's return.

Evaluation Approach

5. There may be selection bias in any support. Government support is provided to selected applicants and criteria used or on the drivers for application are likely to correlate with performance. This would be acceptable if the evaluator had measures of these criteria or drivers, but some aspects will be hard to measure (such as the motivation to grow of an applying business).

6. This would mean comparing supported businesses with unsupported businesses without taking account of this selection would bias results about whether impacts are additional, or due to the support. Improved relative performance may be the consequence of these underlying differences between those that sought and received support, rather than a consequence of the intervention: more motivated businesses seek support and were likely to grow faster anyway and data about this may be unavailable. A similar problem can be imagined for place-based interventions. Often the locations will already be experiencing weaker economic growth, a reason why an area is targeted with investment. As a result, evaluations of these types of initiatives typically suffer from policy endogeneity.

7. A “gold standard” for identifying comparable businesses or local areas is a randomised control trial (RCT), where random allocation follows the selection process for those that are accepted into support. This implies the beneficiaries and the control group on average share similar characteristics and any difference in impact observed between the two can be ascribed to the intervention.

8. All RGF applicants were accepted or rejected based on how well they met the Fund’s objectives and value for money criteria, and no randomisation was possible. So, an RCT is not possible for the RGF. This study identifies comparable non-beneficiaries using statistical matching; a quasi-experimental approach called propensity score matching, a spatial differencing approach used for place-based support and also explores evidence from employment transitions. These measures are relatively data intensive and this chapter both explains the methods used and the datasets linked together to implement the methods.

Firm level counterfactual impact analysis

9. It is possible to track the performance of businesses supported by the Regional Growth Fund over time. The Business Structure Database (BSD described in the box) provides a baseline employment and turnover level. Then, each year, the change in this measure as recorded in the BSD provides the changes in each of the businesses. These can be summed across all the supported businesses to give the gross change in the RGF beneficiaries, with an initial focus on the change in jobs.

10. However, gross job impacts do not give the additional jobs created due to the support. Gross employment measures need to be adjusted for those jobs that would have been generated anyway (BIS, 2009). In this study the focus is on accounting for deadweight (outcomes which would still have occurred even without the intervention) rather than displacement (the relocation of jobs or output from one business to another). For this, the study identifies comparable businesses that were not supported, the counterfactual.

11. The counterfactual is a sample of businesses that did not receive RGF support but are like the beneficiaries. There are statistical techniques to match the beneficiary businesses to unsupported businesses, but a constraint on statistical matching is that it can only be undertaken on measured or observable characteristics. Any control group derived may then differ from the beneficiary group due to characteristics missing from the statistical matching model.

Identifying the Counterfactual

12. There are several “quasi-experimental” methods to match unsupported firms to the supported businesses. The similarity between the two sets of firms is measured in terms of characteristics before the treatment, and – in circumstances variously referred to as exogeneity or selection on observables – this allows any difference in the outcome variable to be attributed to the support measure (Abadie and Imbens, 2006). This is at the heart of the propensity score matching (PSM) technique used in this study.

13. This evaluation has benefitted from including new variables about business behaviour, derived from data on the history of individual business’ use of other government support schemes. Firm-level data about any support received from non-RGF government policies has been added to the data. The fact a business has received support in the past may reveal motivational characteristics and selecting comparable businesses with a similar profile regarding past support can control for this. A matching strategy is developed to test the usefulness of this new data in identifying comparable businesses. Different counterfactual groups are constructed each using the new data in a different manner to test results for sensitivity. Figure 2.1 illustrates this strategy and the two levers used to optimise the matching: the match pool and the model specification.

14. The match pool is the population of businesses from which comparator businesses are selected. Three match pools have been used in this evaluation. All three use the

Business Structures Database (BSD). In fact, the first pool is effectively the entire database. The second pool is the subpopulation of the BSD that applied for RGF support but were unsuccessful or rejected. The second pool, linked to the BSD, may have some qualitative advantages. Unsuccessful businesses are similar to those receiving funding in the important aspects that they share the motivation to apply for funding. This may reflect otherwise unobservable characteristics that drive performance, such as managerial objectives for growth, knowledge etc.

ONS Business Structure Database, ASHE and the Annual Business Survey

Each year, the Business Structure Database (BSD) takes a snapshot of the industry, location, employment and turnover of the businesses recorded on the ONS Inter-Departmental Business Register (IDBR). IDBR is the live sampling frame used for ONS business surveys and the BSD – through its annual compilation – provides a longitudinal dataset of the UK's economically significant businesses. Using BSD, business births and deaths can also be identified. As IDBR records each workplace within a business, BSD can also be used to track relocations and the opening of new locations.

For this study, the business beneficiaries and rejected applicants of RGF support were collected, then matched to their Companies House number, and transferred to ONS SRS for matching to the BSD. As the BSD seeks to cover all significant businesses, the resulting dataset has performance evidence for both RGF businesses and all other businesses that is consistent and comparable. This then allows analysis to compare the performance of supported businesses with different groups of comparable and unsupported businesses drawn from the BSD. The largest businesses are more likely to have participated in the ONS Annual Business Survey, which is also stored in the ONS SRS and can be linked to the BSD. Where RGF beneficiaries are large, this has allowed analysis to use the ONS survey data, linked to the BSD, to analyse performance on other economic impacts, such as business investment.

A further data source used in this study has been the Annual Survey of Hours and Earnings (ASHE). Each year, ONS surveys businesses about the pay, hours, occupation, age and gender of one percent of employees. The ASHE design tracks individuals, as the same one percent are surveyed, with individuals that have moved jobs being surveyed in their new employer's return. This is because – working with HMRC – the ONS has sampled using National Insurance numbers and ensuring that the same numbers, and so individuals, are selected each year. ASHE is particularly valuable because of the scale of the survey meaning that samples are large, even when focusing on RGF supported businesses.

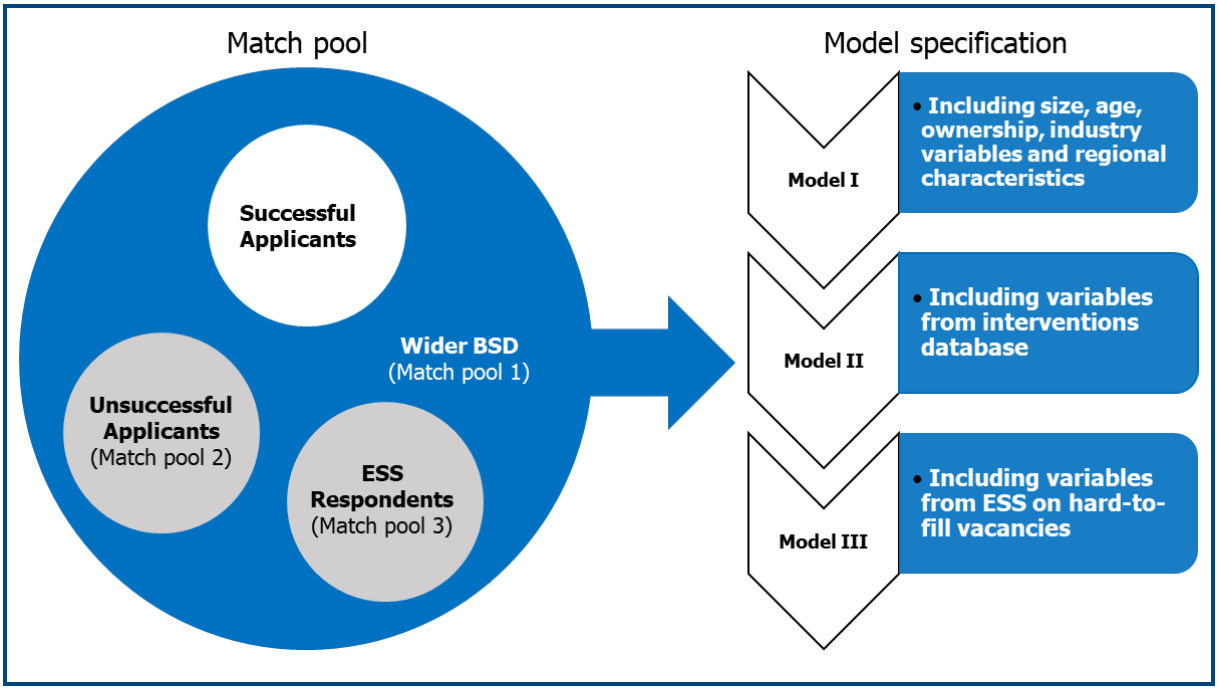
15. However, there may also be disadvantages to this second match pool. Firstly, it can be quite small. In the case of RGF Regional Projects – where beneficiaries are large businesses – later results indicate how an unsuccessful applicant can only be found to match some of the supported businesses. Further, the suitable rejected applicants are often matched to more than one beneficiary. A second issue with matching to the rejected applicants is that there may be an inherent selection bias: rejection may correlate with unsuitability to be in the control group. For example, in considering RGF project applications, BEIS considered the possibility of deadweight with funding being given after ensuring any proposed job creation would only happen with support. In such

circumstances, businesses that are expected to create jobs may be over-represented in the rejected applicant pool.

16. The third pool is another subset of firms of the business population in the BSD. It focuses on those businesses that were not beneficiaries but are respondents to a survey which collects data that is also known about the beneficiaries or characterises businesses more precisely. In responding to surveys, more is known about this subset of firms and the additional information can allow any statistical matching to be refined using this further data. A challenge is then to establish the same characteristics for the RGF beneficiaries.

17. For this third match pool, the study has taken some specific design steps. For RGF programme beneficiaries, a survey was conducted that contained questions used in the Employer Skills Survey. The respondents to the ESS linked to the BSD then provided a set of unsupported businesses where views about skills shortages is collected in a manner similar to the surveyed beneficiaries. For the Regional Projects, where the focus was relatively large businesses, ONS business surveys have been integrated into the analysis with these surveys often covering the businesses availing of Regional Project support.

Figure 2.1: Structure of econometric modelling



Propensity Score Matching

18. To select comparable businesses from the match pool, propensity score matching (PSM) is used. A first step is to model the selection process used by RGF, estimating the chance of receiving support using a probit model. The modelling provides a measure called the propensity score which is used to construct the counterfactual group. A business is selected from the untreated that has a propensity score closest to each of the supported

businesses (i.e. based on all observed characteristics they are as likely to have received RGF support). Table 2.1 indicates variables used in the modelling.

19. Figure 2.1 indicates two types of models, starting with a parsimonious Model I that includes characteristics such as size, age, ownership, industry variables and regional characteristics. These variables are found in the BSD. It provides a good baseline model using well-measured and well-understood business characteristics.

20. Model II builds on Model I by adding variables derived from firm-level data about each business linked into BSD. One set of variables come from a new interventions database made available to the study that identifies businesses provided business support from sources of public funding other than the RGF. Model II can also add variables from surveys, such as responses in the Employer Skills Survey (ESS) and the RGF beneficiary survey pertaining to the vacancies at the firm level and indicating whether they are hard-to-fill.

Table 2.1: Selection Modelling Variables

Variable	Definition	Source
RGF	Dummy variable indicating whether a firm received RGF support	RGF management information
No. of non-RGF interventions	Number of non-RGF public support business has received	Interventions Database
Real total amount of non-RGF support	The deflated value of non-RGF public support business has received	Interventions Database, ONS two-digit SIC (2007) GVA estimates
Real turnover	Deflated turnover	BSD and ONS two-digit SIC (2007) GVA estimates
Employees	Number of employees excluding proprietors	BSD
Age	Baseline Age of firm (years)	BSD
Age squared	Baseline Age of firm squared	BSD
No. of local units	Number of plants owned by the enterprise	BSD
UK ownership	Dummy variable indicating whether the firm is owned by a UK enterprise	BSD
Labour productivity	Real turnover per employee	BSD and ONS two-digit SIC (2007) GVA estimates
HH Index	Herfindahl Index of industry concentration (two-digit SIC)	BSD
Public sector employment (%)	Percentage of jobs that are public sector in each LEP area	LEP data
Population density	Number of people in an LEP area	LEP data
Industry-dummies included	Companies House SIC 2007 industries (see Annexes)	BSD
Incidence of Hard-to-fill vacancies	Dummy variable indicating whether the firm has any hard-to-fill vacancies in 2015	ESS

21. It is important to check the matching quality. Checks firstly look at the average characteristics of the supported businesses and the selected control businesses. There are statistical tests to confirm that the two groups are similar. The attention then turns to whether individual businesses are matched to appropriate unsupported businesses in terms of the propensity score. A focus is whether there is an overlap or 'common support' region. The intuition behind this is firms with the same characteristics should have a positive probability of being both a beneficiary and non-beneficiary. The matching is considered unsuccessful if this is not the case (Heckman, LaLonde, and Smith, 1999).

22. The most straightforward way to check this is a visual analysis of the distribution of the propensity score in both groups and whether the range of propensity scores seen in

the supported group is replicated in the counterfactual. A second test, also used in this work, is to check how sensitive the overall results are to the possibility some aspect of the selection process has been missed. These tests, described in annex B, model how much bias would be needed to make estimates insignificant.

Estimating Impact using Difference-in-Differences and Multivariate Estimation

23. Propensity score matching controls for observable characteristics which may also affect the performance outcomes analysed in this report (i.e. employment, turnover and productivity). However, on its own it is a cross-sectional estimator and thus only compares firms at one point in time. If unobservable characteristics such as intra-firm products/processes and skills of the workforce etc. are important determinants of firm performance outcomes, then the propensity score matching will erroneously attribute RGF support to all the growth witnessed in the performance outcomes of interest.

24. As a result, difference-in-differences is combined with propensity score matching, so that the time dimension of the BSD data is exploited. This allows unobservable variables which affect performance outcomes in a way constant over time to be cancelled out and thus controlled for. The key assumption for difference-in-differences is performance outcomes in supported and control businesses would follow the same time trend in the absence of the intervention. The benefit of combining propensity score matching with difference-in-differences is similar businesses, based on their propensity score, are more likely to exhibit similar trends. This assumption is difficult to verify but pre-treatment data is presented to check that the trends are broadly the same before support takes place.

25. The difference-in-difference for a number of outcome and impact variables can be estimated because of the data sources used in the study. As BSD is a panel, variables such as turnover, employment and business survival are available for each year both for the supported businesses and the wider business population. So, for these business performance indicators, the patterns seen in supported businesses can be compared with the changes seen in the counterfactual.

26. Employment may be analysed at the lower levels of reporting unit and local unit. The local unit is the ONS lowest level unit (for example a shop, workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. The reporting unit usually represents a large establishment or the smallest combination of local units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. This allows ONS to conduct surveys, so a reporting unit may be the R&D unit within a large business, so that the surveys about R&D expenditure can be conducted. Alternatively, an enterprise may have a structure of subsidiaries that lend themselves to being individually surveyed and these may then be the reporting units. For the sectors that RGF supported, the reporting units align to the individual plants within manufacturing businesses.

27. One of the other measures held within the BSD is turnover, taken from VAT returns in most cases. VAT turnover differs from accounting measures, such as that presented in annual accounts, but has the advantage of catching new companies as they register for VAT. For smaller firms, the VAT turnover estimate is used to estimate initial employment, so some care has to be taken when looking at the labour productivity measures for the new, small businesses. Whereas employment measures are available at local unit level, turnover is available at the enterprise level.

28. For larger businesses, the coverage of official surveys can be useful. This means that beyond the employment and turnover collected about businesses in administrative systems, other performance characteristics are collected. In this study, the ONS Annual Business Survey (ABS), which is compiled each year into a panel as the Annual Respondents Database (ARD) and the ONS Business Expenditure on Research and Development (BERD) has been used. The data are derived from random, stratified surveys. Both have low sampling ratios for SMEs but provide considerable evidence about the largest businesses.

29. The research also uses the FAME database, derived from firms' financial information obtained from company annual reports. The financial data include the usual items, such as sales, profits, wages and salaries, assets, standard industrial classification (SIC), and R&D expenditure. The accounts also include balance sheet details, such as the net capital stock of the businesses.

30. All financial data are deflated with using published price and deflator series. Some quality checks are required, such as the presence of high growth rates in the variables, due to firms merging or de-merging, or major adjustments in accounting procedures.

Understanding firm survival

31. For many incidences of support, the BSD holds many years of data after treatment allowing a more sophisticated modelling of any exit of businesses. It is a key area of investigation given the relationship between firm survival and the security of jobs, skills building up and the internalising of innovation. However, in terms of economic growth it is unclear whether a positive impact on firm survival is beneficial. Supporting plants that otherwise would have closed may hinder 'creative destruction' that creates growth in the economy by re-allocating productive inputs from low- to high-productivity firms. On the other hand, if the inputs become redundant and are not reallocated, then there is a positive contribution to growth in the economy through support reducing closures.

32. The economic theory concerning the impact of government subsidies on grants is relatively clear. A subsidy increases discounted expected profits so that plants that would otherwise close, choose to remain in operation (Moffat, 2013). However, as argued by Moffat, government grants are often conditional on meeting an activity target. Thus, a subsidised investment may necessitate a simultaneous increase in the use of other factor inputs leaving the discounted expected profits unchanged.

33. Survival analysis corresponds to a set of statistical approaches used to investigate the time it takes for an event of interest to occur. For the survival model, propensity score matching is combined with the Cox Proportional Hazards model. This is a similar approach to previous studies covering regional grant assistance (Moffat, 2013). The idea is that in creating the matched sample, the “treated” and “controls” have broadly similar values of important covariates.

34. Firm survival is then modelled. The key metric of interest is the hazard ratio, defined as the instantaneous risk that a firm will survive in the following period given it as survived up to just before that period. This is visualised in the Kapler-Meier plots that, on the horizontal axis, represents time, and on the vertical axis shows the probability of surviving, i.e. the proportion of businesses surviving, for both the supported businesses and the matched control. The plots provide a measure of how likely a supported business is to survive after support, but with a benchmark from a group of businesses assessed as comparable. Hazard ratios are estimated for the two groups – the supported businesses and comparable non-recipients. Two hazard ratios can be compared and, if equal, there is no difference in the hazard rate between the two groups, while a hazard ratio of less than one implies that the “treated” firms have a lower hazard relative to the “control” firms.

35. Hazard modelling yields survival curves presented in the findings later. Using these, the absolute reduction in the probability of firm closure within a timeframe of interest after receiving support can be estimated and the differential rate of exit between the matched groups of businesses multiplied by the economic activity of the survivors is the economic impact.

Earnings Effects and Employment Transitions

36. Aghion et al. (2018) use the Annual Survey of Hours and Earnings (ASHE) to estimate the wage premium of R&D intensity, focusing on businesses with more than 400 employees. They find a clear positive relationship between R&D intensity and average wages. When looking at different skill levels, the relationship becomes stronger when looking at the low-skilled. Moreover, these findings hold when controlling for an individual’s age, tenure, and full-time/part-time status, as well as firm size.

37. A similar methodology can be applied to estimate whether RGF supported businesses pay wage premiums after receiving support. Average wages per firm can be computed each year. Even if individual workers join and leave a company, average wages can be calculated in a pseudo-panel, and as far as possible, changes in workforce characteristics can be accounted for. Wage growth in supported firms can then be compared against wage growth in matched unsupported firms.

38. However, changes in the workforce may be an outcome of support itself. For example, a firm may hire more scientists or engineers to perform the R&D they have been awarded funding for. In that instance, the causal effect of the support may be less clear.

The support may have an independent effect on productivity, it may only be a consequence of the new hires. Without support, those workers may have never been hired in the first place, so this would just be another channel through which support may have an effect.

39. Another possibility is to compare only wages of those who stay with one firm during the whole period, before and after support. This makes it possible to measure the effect of innovation support on the productivity of individual workers. Worker fixed effects can be used to control for individual characteristics that are stable over time, and comparison against the matched control group controls for general wage growth, e.g. due to experience and seniority. This can then establish a proxy for increasing productivity.

40. Lastly, a treatment effect can be identified from job switchers. Those are employees joining the RGF-supported firms around the time of the treatment. Wage growth of switchers to treated firms, higher than that of switchers to non-treated firms, would indicate that treatment has a positive effect on earnings, even controlling for the fact that some workers may have been specifically hired in response to the support.

41. To analyse earnings effects of RGF support, the study draws on the Annual Survey of Hours and Earnings (ASHE). Each year, ONS surveys businesses about the pay, hours, occupation, age and gender of one percent of employees. The ASHE design tracks individuals, as the same one percent are surveyed, with individuals that have moved jobs being surveyed in their new employer's return. This is because - working with HMRC - the ONS has sampled using National Insurance numbers and ensuring that the same numbers, and so individuals, are selected each year. ASHE is particularly valuable because of the scale of the survey meaning that samples are large, even when focusing on RGF supported businesses. The main variable of interest is gross weekly earnings. This has been adjusted for inflation using the GDP deflator.

42. Given that surveys are completed by employers from payroll information, the data are deemed to be of high quality. Crucially, this makes them also linkable to enterprise reference numbers and the specific workplace. Linking RGF supported businesses to ASHE by enterprise reference and postcode yields a sample of employees that were employed at RGF supported plants. As corporate ownership of plants may change over time, care was taken to track the same plants over time. As it is possible to identify supported plants, we compare supported plants or units to other units within an enterprise that were not directly supported.

43. To understand the earnings effect of RGF support, the data is analysed in several different ways. Earnings growth at supported and unsupported businesses around the time of support start is reviewed, tracking the same employees that stayed with the business over time. Any positive effect on productivity due to support may result in higher wages for employees at supported plants. Tracking the same employees over time ensures that the estimates are not affected by employees that were newly hired as a result of the support.

44. On the other hand, earnings of newly hired employees at supported firms are also reviewed. This part of the analysis aims at determining the value of jobs created by the RGF. Of course, some of those moves may also be related to replacing previous employees who left an organising, so are not direct results of the RGF. Still by comparing earnings of employees before and after starting employment at an RGF supported businesses, it is possible to estimate the effect on earnings while controlling for employee-specific unobservable factors such as specialist skills and experience.

45. Job changes are identified by changes in the enterprise reference of an employee, or, where workers stay with the same employer, changes in the postcode. The focus is on employees who moved from unsupported to supported firms and units and vice versa, any time after the start of support. A job change is not the only reason why the enterprise reference for an employee might change. This would also occur in the event of a merger or takeover. To exclude these cases, all instances where more than 10 employees moved from one specific enterprise reference to another in a given year, or, where more than half of ASHE employees moved to another specific enterprise reference, are excluded from this part of the analysis.

Place-based Impact Analysis

46. The main method to estimate the impact of the RGF place-based interventions is spatial and time-differencing as per the recent evaluation work on other place-based programmes.

47. With any ex-post evaluation of an economic policy, the important economic concepts of additionality and displacement need to be investigated. Additionality refers to whether the policy could generate positive outcomes beyond what would have occurred without government intervention. It is impossible to know what would have happened in any of the chosen locales had they not been allocated RGF resources for critical infrastructure. In the literature on causal inference (see Heckman et al., 1999), a way of solving this additionality problem is by comparing treated sites with nearby suitable control groups.

48. In addition, businesses might decide to relocate close to a treated site where their product demand is higher due to the intervention or to fill a place in a commercial development, pulling up employment in nearby areas and down in areas further away (displacement effect). Therefore, evaluating the extent of additionality, and displacement are the key issues examined in this research.

49. The main methodological issue is that some of the area-based interventions under study have a geographical spread that is not known at the start because each project is only given a postcode in the monitoring information. As a result, the use of spatial differencing using strict boundaries. (i.e., measuring the difference between an area and its neighbour) cannot be used to estimate impact because the stable unit treatment value

assumption[6] cannot be met. In other words, identification relies on the assumption that spillovers of these policies are limited geographically with certain boundaries.

50. A way to overcome these problems, is to understand that the treatment effect varies with intensity at different distances from an RGF sponsored intervention. The standard difference-in-differences approach is altered to allow the control group to change in size by varying geographical distances of comparison firms (the control group will increase in size when more geographically distant firms are included in the analysis). This approach assumes all firms within a given distance of an intervention are treated with areas close to an intervention "treated" more intensively than areas further afield.

Concluding remarks

51. This chapter considers the methods used in the study. A focus is on approaches that develop robust counterfactuals to identify effects of RGF support that are additional. Methods have been developed to identify place-, firm- and employee-level comparisons and these are described. Annexed are more details on the methods.

[6] The stable unit treatment value assumption requires that the observation on one unit should be unaffected by the particular assignment of treatments to the other units (Cox, 1958).

3 Employment Effects across the Fund

The Regional Growth Fund seeks to create additional sustainable private sector employment and – through the five schemes – employment change in supported businesses has been significant. It has been tracked in management information as RGF was delivered and administrative data.

This chapter presents estimates of the employment created in the businesses that received RGF support. It first looks at the evidence from management information, primarily the returns made to BEIS and DLUHC as RGF delivery has been monitored. The steps taken to look at employment performance in administrative data is then described and this provides a second estimate of the jobs in businesses supported by the RGF.

Summary

- A key dataset used in the econometric analysis is the monitoring data collected as RGF was delivered. Overall, £2.8 billion was distributed across 434 successful applicants, with the applicants including individual businesses or consortium of businesses (for Scheme 1) or organisations that then administered the funding on BEIS and DLUHC's behalf directing the support to eligible SMEs (Schemes 3, 4 and 5). Scheme 2 were investments in place rather than individual firms.

- The econometric analysis uses firm-level data, primarily the employment as recorded each year in the ONS based on annual payroll counts. For the evaluation, beneficiaries of the RGF – both directly funded by the Departments and through lists collected from programme intermediaries – have been compiled. These are linked to the ONS register.

- The RGF monitoring data and ONS data can be compared scheme by scheme. RGF monitoring data reported 346,419 new years of employment for the first four years of support for the schemes 1-4. After business beneficiaries have been linked to ONS payroll data, 345,863 years of new employment are seen in the supported businesses for the five schemes including AMSCI, again calculated for the four years after support. This suggests a consistency between the two sources.

Monitoring the Regional Growth Fund

1. A key dataset used in the econometric analysis is the monitoring data collected as RGF was delivered. Monitoring started as projects and programmes were set up.

Applications made for RGF funding were logged within a data system and then tracked as the bids were appraised against economic criteria. The monitoring data then records contracting, including the final grant offer letters, the final set of terms agreed with the successful bidders including timetables for funding and the delivery expected of jobs and private investment.

2. In terms of the financial commitment, Table 3.1 indicates the grant values across the five schemes of the Fund. Overall, £2.8bn were distributed across 434 successful applicants, with the applicants including individual businesses or consortium of businesses (for Scheme 1) or organisations that then administered the funding on BEIS and DLUHC's behalf directing the support to eligible SMEs.

Table 3.1: RGF Funding by Scheme

Scheme	Successful applicants	
	Count	Value (£m)
Scheme 1: Regional Projects	258	752
Scheme 2: Place-Based Projects	38	389
Scheme 3: National Programmes	31	554
Scheme 4: Regional Programmes	104	824
Scheme 5: AMSCI	3	276
Total	**434**	**2,795**

Source: Regional Growth Fund Monitoring Data

3. The minimum funding for Scheme applicants was a million pounds and Table 3.1 indicates that there is variation in the average level of funding per project or programme. Unsurprisingly, the Scheme 1 direct business support for projects has an average closest to the minimum funding. However, where support has been administered through intermediaries RGF funding exceed the minimum amounts by a greater amount (though this funding would then go on to split this support across many businesses). So, the three AMSCI applications would then have distributed to numerous businesses, collaborations and other organisations applying to the administering organisation, Finance Birmingham.

4. The funding was allocated through rounds of competitions, with six rounds implemented. The progress through each round involved some applicants withdrawing and many were rejected. There were also exceptional applications to the Fund. This was a means by which money from withdrawn projects and programmes could be recycled and was used to support companies which needed RGF support in urgent and exceptional circumstances, such as responding to economic shocks.

Monitoring the Jobs Created and Safeguarded

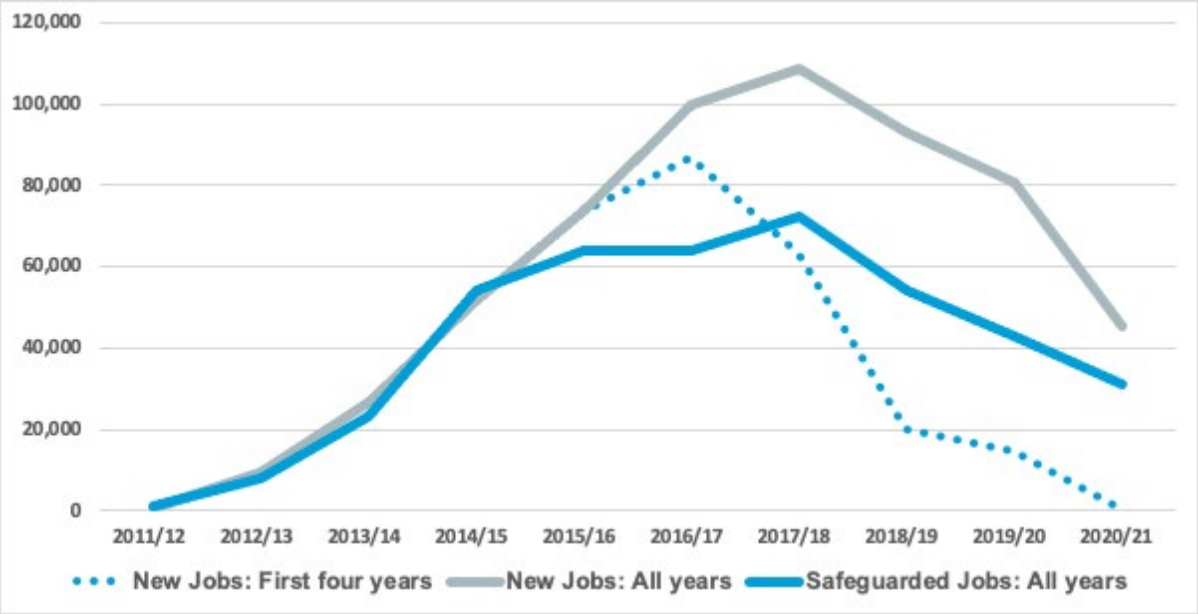
5. Jobs that businesses had agreed to safeguard or create as a direct result of RGF funding were "monitored jobs". Quarterly returns were made to RGF Monitoring Officers about the progress being made by the funded projects and programmes in meeting these

commitments. The monitoring data compiles for each successful applicant the original planned job creation or safeguarding, any changes to these plans and the actual jobs (updated at the end of quarters).

6. These data provide a measure of the employment effects of RGF. Businesses use the support provided by the Fund either to create new jobs or maintain jobs that were identified at risk.

7. Figure 3.1 indicates the total number jobs that projects and programmes reported as delivered. At its peak, the RGF was supporting over 108,000 new jobs and over 72,000 were being safeguarded.

Figure 3.1: Jobs created and safeguarded



8. Much of the econometric analysis uses ONS data about businesses' employment level, usually the number of jobs that are on a business' payroll. Also, the analysis focuses in on the period after the business receives support using the timing of the support start to then assess changes before and after support. The four years after support is analysed, with this period being long enough to assess effects but also a period that means even the latest RGF support has sufficient data. With final RGF disbursements occurring in financial year 2016, the four years after support will align with the latest data.

9. The figure also indicates the total number jobs that Schemes reported as delivered, focusing on the first four years of each funded project and programme (dashed blue line). The dip after 2016/17 indicates that many projects and programmes that started in the early phases of the RGF expected that the jobs created will be maintained into year five, six and beyond. However, it also indicates that about 60% of the contracted new employment is within the first four years of projects and programmes.

Comparing Monitoring and Firm-level Data on Employment

10. The econometric analysis uses firm-level data, primarily the employment as recorded each year in the ONS business register. Firms that have been supported have to be linked to the ONS data, and the next sections explain how this has been achieved. For Scheme 1, the Regional Projects, the supported businesses were listed in the RGF monitoring information, with the project application process being overseen by BEIS and DLUHC including the details of the businesses supported. For the other schemes, the detail about which businesses have been supported is more complex. Further management information was collected directly from the intermediaries that delivered projects and programmes and then compiled for linking to ONS data.

11. Table 3.2 presents the overall findings. The focus is years of employment that has occurred in the four years after support. Monitoring focuses on the jobs created or safeguarded as reported by the RGF beneficiaries in terms of their contracted requirements. For Schemes 1-4, monitoring was undertaken through a centralised RGF system used by projects and programmes from application, but this did not cover AMSCI.

12. Comparing these with jobs recorded in statistical sources, primarily the number of jobs on payrolls, is difficult. Payrolls will include other, non-RGF employment generated in the businesses. Secondly, using the employment data in the BSD, it is not possible to distinguish where a job has been safeguarded: the change in employment as seen in the ONS data – the Business Structure Database described in Chapter 2 – can be a proxy for new jobs (if positive) and say less about the jobs not lost (i.e. safeguarded).

13. To some extent, this latter issue does not prove too problematic when looking at impacts using a counterfactual. As long as the counterfactual is robustly defined, the employment that would have been safeguarded had support been provided would – for the counterfactual – be lost. Then, as the analysis compares the supported businesses to the counterfactual, any difference observed will include the employment that would not be safeguarded.

14. The next sections explore the new jobs, considering the evidence of new jobs seen in supported businesses through their payroll data, and then compares this to the reported new jobs in management information.

Table 3.2: Jobs Created and Safeguarded in Four Years after Programme/Project Start

	Reported New Jobs Years **First four years after support**	Reported Safeguarded Jobs **First four years after support**
Regional Projects	60,333	105,004
Place-Based Programmes	27,711	27,148
National Programmes	134,579	60,689
Regional Programmes	123,796	70,219
AMSCI*	n.a.	n.a.

Total	**346,419**	**263,060**

Source: Regional Growth Fund Monitoring Data, which does not cover AMSCI completely*

Schemes 1 and 5: RGF Regional Projects and the Advanced Manufacturing Supply Chain Initiative

15. In Scheme 1, the Regional Projects, firms and business consortia have received money directly from BEIS and DLUHC. These tend to be grants received by large businesses. Such projects typically involve capital investment by a business (e.g. upgrade/ expansion of premises or the installation of new plant and machinery).

16. There are 258 RGF Regional Projects supported, across several cohorts of support. The cohorts have been grouped by financial years, from 2011/12 to 2016/17. As a small number were supported in the final two financial years these have to be grouped together sometimes to avoid results being disclosive.

17. The number of businesses supported through the RGF Scheme 1 support is somewhat fewer than the number of projects as some businesses successfully applied for more than one support. Also, some businesses staged their overall programme of investments and job creation over a number of projects. Overall, there were 219 businesses that were supported through RGF Scheme 1 funding.

18. As the project funding is relatively substantial, the businesses supported are large. Further, as there is no intermediary between the supported businesses and BEIS or DLUHC, the records provided to the evaluation included good contact details, such as the Companies House registration number (CRN) and address of the location of the project. This means that linking the businesses to administrative sources is relatively straightforward.

19. One complication is that many of the Regional Projects provided funding to businesses having multiple plants and operating at a global scale. The analysis has therefore identified which ONS reporting unit contains the plants within the large businesses that are being supported and differentiated these units from the enterprise's other plants and establishments. Measures of employment and performance are available at this plant level in the ONS BSD.

20. Table 3.2 presents the level of employment for each of the first four years after support by five cohorts of supported businesses. Using BSD's plant level employment data – known as a reporting unit – there were 12,829 jobs in 2011 in the 36 plants that benefitted from RGF projects that year. The table then records the employment for each year after this and finds that there were 423 more jobs four years after the projects started.

Table 3.3: Employment in Plants supported by RGF Projects after Support

First support		Reporting unit employment				
Year	Units	t	t+1	t+2	t+3	t+4
2011	36	12,829	11,255	12,457	13,644	13,252
2012	68	56,345	57,940	60,583	63,657	62,314
2013	68	56,378	54,519	55,253	56,942	58,357
2014	24	28,799	34,766	37,735	38,750	38,587
2015/16	23	5,874	6,345	7,328	7,923	7,461
		Change in jobs from year before support				
Year	Units	Total	t+1	t+2	t+3	t+4
2011	36	-708	-1,574	-372	815	423
2012	68	19,114	1,595	4,238	7,312	5,969
2013	68	-441	-1,859	-1,125	564	1,979
2014	24	34,642	5,967	8,936	9,951	9,788
2015/16	23	5,046	983	1578	898	1587
Job years		57,653				

21. Adding together the annual jobs created for each year after support and grouping businesses by the year of support provides the years of employment (job years) that have been created in the reporting units. This figure is comparable to the estimates made in the last section using monitoring data for the individual projects about the new jobs created. That estimate of 60,333 job years is similar to the 57,653 years of employment in the BSD data.

22. Similar to Scheme 1, the data collected about the beneficiaries of Scheme 5, the Advanced Manufacturing Supply Chain Initiative (AMSCI), is largely held centrally by BEIS as the department administered the initiative centrally. However, there was some collection directly from programmes also. There were 686 incidences of support often collaborative projects funded by AMSCI. Consortiums included universities, Catapults and other organisations that were not businesses, and this led to 645 businesses being identified and 473 unique businesses. Many businesses did appear in more than one consortium, unsurprising given the Scheme focused on a single sector where an overlap across consortiums may be expected. The support measure is spread over several years, with the first year of support being 2012 and the final year projects being initiated being 2015. Around three quarters of the projects began in the first half of that period.

23. Table 3.4 presents the employment generated in the businesses but excludes the largest supported businesses, with employment over 500. There are 391 unique businesses identified in the ONS register, having linked to the register using CRNs, of which 336 have employment less than the cut-off. Businesses in Table 3.4 are tracked from the year before the start of the first project they are involved in and then employment change observed for the next four years.

Table 3.4: Employment in businesses supported by AMSCI after Support

		Enterprise unit employment				
Year after Support		t	t+1	t+2	t+3	t+4
Obs	336	96,080	105,209	121,033	119,007	126,376
		Change in jobs from year before support				
Year after Support		T	t+1	t+2	t+3	t+4
Obs	336	0	9,128	24,953	22,927	30,295
Change in Job years		87,305				

24. Unlike the Regional Projects, many beneficiary businesses are identified only in terms of the company participating. There is often no information about the establishment or production unit involved in the project for the large businesses. This means that the employment estimation has to be undertaken using whole enterprise data, which would certainly overstate the economic activity in a business associated with each project.

25. Different approaches were taken to estimate the employment change after support. The focus on SMEs in Table 3.4 provides a higher estimate than some alternatives, such as using the geometric mean of employment or the median. These would provide estimates less affected by large enterprises. However, using businesses below 500 employees did remove outliers and allow estimates of change to focus in on the smaller, single plant businesses so reducing any multi-plant upward bias.

Schemes 3 and 4: RGF Programmes with Intermediaries

26. For the programmes, unlike the projects and AMSCI, a centralised database of all beneficiaries was not available. The individual programme intermediaries hold such data and, to collect it from each programme, a template was designed and sent to programme managers for completion on four occasions (in 2014, 2015, 2017 and 2019). It asked the intermediaries to list the beneficiaries of their grant and loan schemes as well as unsuccessful applicants. The template included several fields to identify the businesses, including name, address, Companies House number, PAYE number and VAT registration.

Table 3.5: Linking Programme applicants to ONS data

	Scheme 3: National Programmes		Scheme 4: Regional Programmes	
	Programmes	Grant value (£m)	Programmes	Grant value
Count of Programmes	31	554	104	824
Of which applicants collected	25	445	87	715
Coverage	81%	80%	84%	87%
Matching to CRNs and ONS register				
Support applications	17,586		15,334	
Matched to CRNs	14,706		14,393	
Unique CRNs	8,859		7,883	
Matched to ONS data	7,547		6,537	
Supported businesses	**6,305**		**3,075**	

Source: Compiled returns from RGF Programme intermediaries linked to the Companies House Register and then to the ONS business register

27. Table 3.5 indicates the number of programmes that made returns listing the businesses that applied for support. There were a few large Scheme 3 programmes while the Regional Programmes tended to be smaller in scale. The table indicates that over 80% of the programmes, both in terms of the number of programmes and their grant value were captured during at least one of the four phases of data collection. Whether the lists reflected all the businesses that benefitted from a programme was somewhat uncertain, as not all programmes could participate in all the rounds of beneficiary collection.

28. Matching business beneficiaries to ONS data required several strategies. Whereas the linking for RGF projects was straightforward because of the completeness of the management information held, the programme intermediaries' individual management information systems are of varying comprehensiveness on identifiers. This is exacerbated by supported businesses being smaller and often relatively new. For example, many businesses would not have registered as companies at the time of application. Programme intermediaries were also asked details of rejected applicants to their programme. For the unsuccessful applicants, the quality and consistency of data was generally poorer than for the beneficiaries.

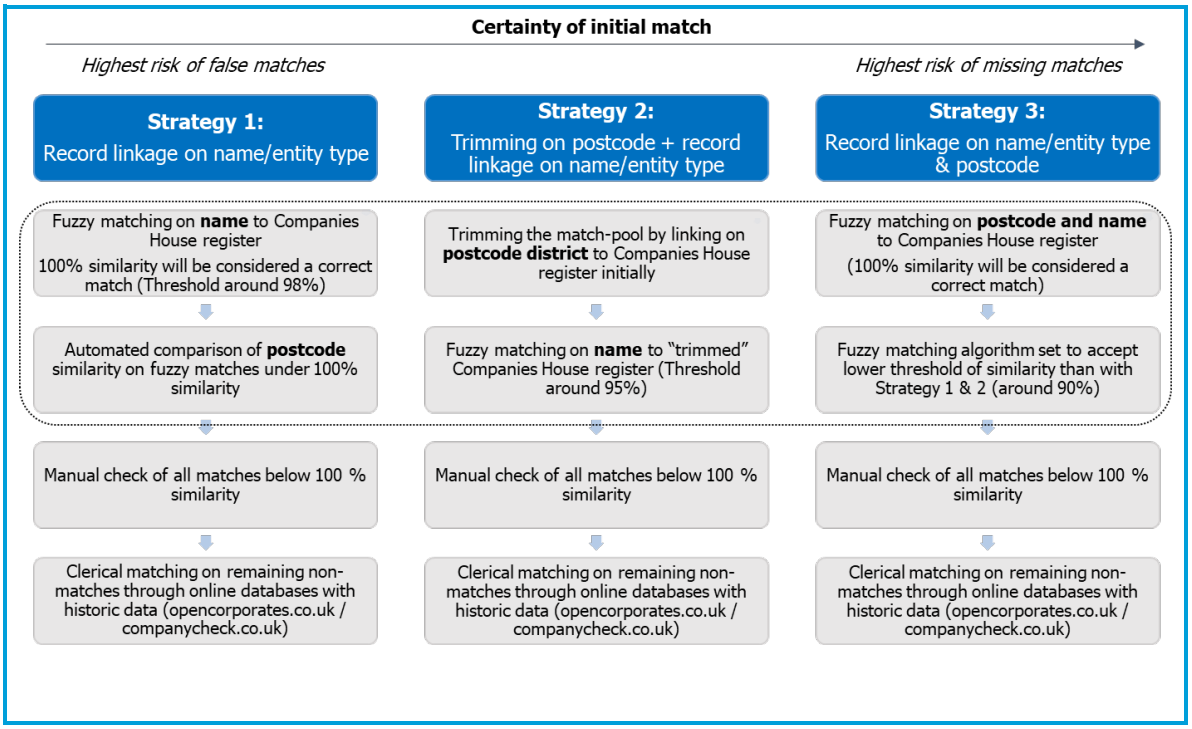
29. A first aspect about the dataset was that – as the collection was repeated over three phases – the incidences of support were likely to be counted more than once. The returns made by programmes usually sent all applicants duplicating their previous lists. Sometimes programmes updated the previous data, for example including identifiers as an applicant registers as a company for example. Therefore, there is significant fall in the number of businesses as they are identified to a Companies House number.

30. Where a beneficiary name and address are available but not the CRN, identifying the CRN greatly increases the potential for linking between the management information and the BSD. A fuzzy matching exercise to the full Companies House register was

undertaken as data was compiled. Such matching tolerates some inexactness in identifiers when matching, and therefore finds both exact matches and those that potentially match. Matching to the Companies House register was pursued using three strategies, illustrated in Figure 3.2 below.

31. A first strategy initially matched beneficiary name[7] to the Companies House register. The algorithm identifies businesses providing a score on the quality of the match. A high threshold of similarity filtered out those poorly matched. There was then a further check on postcode to confirm the match.

Figure 3.2: Fuzzy matching strategies



32. In the second approach, the matching first used geography. The business's postcode was used to filter the matching by name only to those businesses located near to the business's location. This began to restrict the name matching considerably, ruling out businesses with similar names but clearly in a different locale.

33. The final approach was similar to this second approach matching on geography and name, with the difference being it simultaneously used the full postcode and the name. This approach relies on the address given by the applicant being the one used by Companies House business register. This may not be the case where there are multiple locations or where a business when registering, uses the address of a business services provider or a residential address. All three approaches ended with a clerical match on a

[7] Adjusting for differences in punctuation (such as spacing and use of full stops), case sensitivity and common spelling (e.g., Ltd, Plc, LLP and Co).

sample of those that remain unidentified. Then any systematic matching issues identified were used to provide improvements to the automated matching.

34. Tables 3.6 and 3.7 indicate the employment recorded in ONS data for the cohorts of RGF programme support. Table 3.6 focuses on Scheme 3, where over the five years of programme support, a total of 3,810 separate businesses were identified. The Scheme did support some businesses through more than one programme and then the first incidence of support was identified, and the business recorded only once in the table. Further a correction was applied so that any business supported in both Schemes 3 and 4 were tracked in both tables but their employment was apportioned across the two schemes to avoid double counting any employment.

Table 3.6: Scheme 3 National Programmes Employment

First support		Employment				
Year	Firms	t	t+1	t+2	t+3	t+4
2012	901	27,696	30,784	33,462	35,506	39,012
2013	648	20,974	21,961	23,290	24,882	31,105
2014	752	15,905	17,378	17,426	17,308	17,546
2015	698	8,466	9,137	9,188	9,425	8,850
2016	811	14,736	15,015	15,130	15,936	16,311
		Change in jobs from year before support				
Year	Firms	Total	t+1	t+2	t+3	t+4
2012	901	27,981	3,088	5,767	7,810	11,316
2013	648	17,342	987	2,316	3,908	10,131
2014	752	6,040	1,474	1,522	1,403	1,642
2015	698	2,737	672	723	959	384
2016	811	3,448	279	394	1,200	1,575
Job years		57,547				

Note: Beneficiary SMEs tracked in Business Structure Databases with table indicating levels and changes in employment from year of support by year of support.

35. The lower half of Table 3.6 indicates the change in employment one, two, three and four years after the support started. The totals for each cohort of support indicate a stronger employment growth in the first two cohorts of the support. The years of employment recorded in the firm-level data is lower than that reported in the monitoring data. There, 134,579 years of employment has been created, suggesting that there are coverage issues (businesses that were not matched to ONS data inevitably will lead to missing employment).

36. Table 3.7 presents employment for the businesses supported by Scheme 4, the Regional Programmes. Here, the employment observed in the monitoring data for new jobs is closer to the estimated years of employment in the ONS linked data.

Table 3.7: Scheme 4 Regional Programmes Employment

First support		Reporting unit employment				
Year	Firms	t	t+1	t+2	t+3	t+4
2012	275	59,532	60,141	59,912	60,966	61,379
2013	1055	78,661	83,775	86,668	91,084	92,596
2014	1197	72,442	77,373	85,930	86,846	91,024
2015	466	37,650	38,664	40,386	40,574	39,005
2016	243	8,046	8,262	8,373	8,615	8,525
		Change in jobs from year before support				
Year	Firms	Total	t+1	t+2	t+3	t+4
2012	275	4,272	610	381	1,435	1,847
2013	1055	39,481	5,115	8,008	12,424	13,936
2014	1197	51,406	4,931	13,488	14,405	18,582
2015	466	8,028	1,014	2,736	2,924	1,355
2016	243	1,591	216	327	569	479
Job years		104,777				

Note: Beneficiary SMEs tracked in Business Structure Databases with table indicating levels and changes in employment from year of support by year of support.

37. Monitoring data records 123,796 years of new jobs, not dissimilar to the employment seen as businesses are tracked in the ONS register.

Concluding remarks

38. Table 3.8 compiles the different estimates of the employment effects of the RGF by different schemes. It indicates that the analysis of ONS data is consistent with monitoring information. The RGF “Reported New Job Years” should be compared with the gross job years on payroll growth seen in ONS data.

Table 3.8: Comparing Monitoring Payroll Data in Four Years after Programme/Project Start

	Reported New Jobs Years in MI **First four years after support**	Reported Safeguarded Jobs in MI **First four years after support**	Years of New Employment on Payrolls **First four years after support**
Regional Projects	60,333	105,004	57,653
Place-Based Programmes	27,711	27,148	38,581
National Programmes	134,579	60,689	57,547
Regional Programmes	123,796	70,219	104,777
AMSCI*	n.a.	n.a	87,305
Total	**346,419**	**263,060**	**345,863**

Source: Regional Growth Fund Monitoring Data, which does not cover AMSCI completely*; Place-based Programmes estimate for jobs rather than job years.

39. The table presents the RGF monitoring data and ONS data scheme by scheme. There are 347,255 new years of employment reported in the monitoring data for the first four years of support. After business beneficiaries have been linked to ONS payroll data, 345,863 years of new employment are seen in the supported businesses and places, calculated for the four years after support for businesses. This suggests a consistency between the two sources.

40. RGF Regional Projects started in 2011 and, by 2015, contracted jobs had passed its peak. The job years estimated in monitoring data is somewhat higher than the new jobs found in the ONS data, reflecting the payrolls of the business.

41. For the National Programmes, lists of beneficiaries had to be obtained and matched to the ONS registers. Collating lists of beneficiaries is complex, and some coverage issues are likely. A significant portion of the jobs reported in monitoring data have not been found in the linked datasets, probably due to coverage issues. This collation was also required for the Regional Programmes, but the businesses linked to the ONS data have created a level of jobs quite close to the reported new jobs in RGF monitoring systems. This could be because the businesses are filling jobs over and above the contracted RGF jobs.

42. For economic impact evaluation, these gross impacts are adjusted to take account of what would have happened without support. Each scheme has been evaluated using econometric analysis adapted to the type of beneficiary and integrating spatial and case study evidence for place-based programmes.

4 Impacts of Regional Projects

This chapter describes the economic and wider impacts of Regional Projects. Projects were undertaken by large businesses generally and so the data sources used to look at economic impacts includes official surveys, as well as the administrative data. It presents findings on employment and other impacts from analysis using firm-level data and establishes a counterfactual to compare performance.

Findings

- To understand the additional impact of Regional Projects support on employment and other performance measures, the changes in beneficiary businesses was compared with a matched counterfactual. This was undertaken at a reporting unit level, i.e. taking account of the fact that beneficiaries were often large, multiple plant businesses, so that analysis could focus on supported plants within the enterprises. There was considerable growth seen in the employment. Employment in the 185 supported establishments was 14.2% higher two years after projects had started and 23.3% higher four years after.

- When comparable businesses are selected from the wider BSD using a model that only uses firmographic characteristics such as size, industry, location, (Model I), the control group's employment grows somewhat slower with a 10.8% highly significant difference.

- There were 57,653 years of employment seen in the supported reporting units and the differential growth rates suggests that 49,417 of these would be additional, with alternative models suggesting 16,472 to 45,299.

- Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses and there is a large premium for changing jobs to a business unit that is supported by an RGF Regional Project. Individuals get on average a 22% boost to their earnings when moving to a supported unit. Tracking individuals as they move jobs is suggestive of a productivity increase at whole economy level, as people move to more remunerative jobs. At around 23%, the premium is even slightly higher when moving to a part of a business that has not been supported directly. In contrast, employees earn on average almost 7% less when moving away from a supported unit.

- Other performance measures, such as GVA, turnover and investment are increasing in supported businesses faster than comparable businesses. However, sometimes estimates are insignificant statistically. Sample sizes are small and there is a high level of variance to contend with.

1. To understand the additional impact of Regional Project support on employment and other performance measures, the change in beneficiary businesses was compared with a matched counterfactual. A difference-in-difference estimation was used to compare the change observed in a treated group with that seen in the control group. Comparing across models and matched groups also allows some initial analysis of the sensitivity of employment outcomes to the control group used. Different control groups are used to estimate this, using counterfactuals derived from combinations of different match pools and model specifications.

2. For the evaluation, careful consideration of alternative matching pools led to the decision not to use the rejected RGF project applicants. Using this pool, the matching often did not find businesses similar enough to qualify as a useful counterfactual. In using the rejected project applicant pool, matching the whole range of supported businesses proved impossible, with several beneficiaries having to be dropped as no comparable rejected applicant was available. The preferred control group for the RGF projects was instead drawn from the wider BSD, which improved the analysis by providing a wider range of businesses from which to draw comparable businesses.

3. The analysis has focused on business units below the whole enterprise. This is because supported businesses were large, often multinational, and complex entities, and often had multiple plants. Working at an establishment level – with the unit identified in terms of the location the project was sited in – has the advantage of tracking performance in an entity likely to be the target of support, rather than the wider organisation.

4. In addition to the creation and safeguarding of jobs, the evaluation has analysed the quality of created jobs. This assesses the wage premium associated with the jobs created using the Annual Survey of Hours and Earnings (ASHE). Workers earn a “wage premium” if their wage is higher than it would have been in a different business or occupation given their ability, skills and experience. A premium may arise if the worker is more productive, and the higher wage is considered as reflecting this. The evaluation has therefore estimated wage premiums to assess the impact of RGF support and the full methodology is annexed.

Impacts of the Regional Projects

5. The econometric analysis presents estimates of the additional employment and other performance measures in businesses benefiting from the Regional Projects. In the Regional Projects, firms and business consortia have received money directly from BEIS. These tend to be grants received by large businesses. Such projects typically involve capital investment by a business (e.g. upgrade/ expansion of premises or the installation of new plant and machinery).

6. There are 258 RGF Regional Projects supported and there have now been several cohorts of businesses supported by the projects, with the cohorts being grouped by

financial years, from 2011/12 to 2016/17. As a small number were supported in the final two financial years these have to be grouped together sometimes to avoid results being disclosive. Also, because the number of businesses is quite small, a richer dataset has been compiled linking together ONS administrative data, business surveys and data from business accounts.

Developing data about effects at plant level

7. RGF Projects targeted individual plants often within large multilocation businesses, encouraging employment in specific areas of England. Tracking employment growth and other business performance measures is complicated as it may be difficult to focus in on the supported plants and locations.

8. The ONS Business Structure Database (BSD) has a detailed local unit dataset, which lists every individual establishment within a business, the employment in the unit and its industry. For many businesses, this may be individual plants, shops or offices, indicating the geographical detail of a large business' presence.

9. ONS then also conducts an Annual Business Survey (ABS) which, like predecessor annual surveys, enumerates information about business value added, investment and is conducted for individual reporting units (groups of local units that form a distinct operational entity within large businesses). The ABS – especially in manufacturing – will collect data at plant level defining a large industrial establishment to a reporting unit. ONS then has compiled successive years of the survey and this plant-level panel in the Annual Respondents Database (ARD).

10. As it is based on a survey which samples from the business population, the coverage of individual reporting units will be partial. The box below indicates how the sampling for the ARD has been taken so coverage for the businesses supported by RGF projects has been maximised, through thorough steps. Broadly, the largest UK businesses are surveyed every year and many RGF Projects have a relatively complete annual picture for such businesses. However, for the medium sized businesses, while employment estimates are available, the reporting unit evidence beyond this is partial.

11. However, the ARD goes beyond the BSD's focus on turnover and employment. Each year, for the largest businesses, the value added is collected, collected data about their expenditures on staff, purchases of materials and services and investment in different assets. The dataset is at a detailed level asking large multi-establishment businesses about the economic activity within an individual plant or groups of establishments, with ONS judging an appropriate level of detail that is not overly burdensome.

Selection Modelling for the Regional Projects

12. This section focuses on the selection modelling for the Regional Projects, estimating the factors that correlated with a business receiving RGF Project support. The projects were large investments, usually in large businesses. This means differences between the successful applicants and the wider business population (which is dominated

by small businesses) are inevitable. There are, however, greater similarities between businesses receiving support and those that applied but were rejected. Accordingly, the section also considers this alternative pool of businesses from which to identify a counterfactual.

BOX: Using the Annual Respondents Database to Widen Impacts Evaluated

For this study, the core analysis has focused on modelling using the ONS Business Structure Database (BSD). To widen the analysis to impacts beyond employment and turnover, and to look at individual supported plants, RGF Regional Project beneficiaries were matched to the respondents to the ONS Annual Business Survey, ABS. The ABS is a large-scale, official survey conducted each year asking businesses about their expenditures on staff, purchases of materials and services and investment in different assets. The survey asks large multi-establishment businesses about the economic activity within an individual plant or groups of establishments. ONS then has compiled successive years of the survey and linked each at the reporting unit level into the Annual Respondents Database (ARD).

Whereas the BSD is a census of all significant businesses, the ARD is a sample and analysis has to focus on the beneficiaries that are included in the survey. The survey starts with BSD employment. Of the 185 businesses that could be linked to employment estimates, around 140 RGF Project beneficiaries appeared in at least three surveys in the 11 years 2009-20; 67 appear in each year. That is a reasonable level of coverage over time and reflects the fact that the RGF Project businesses were large and so likely to be surveyed. For 128 of the businesses, there is a survey covering periods both before and after the support.

Because there are gaps in data across years for many businesses, three approaches to addressing this have been used. Imputation on employment has been used for GVA and reporting unit turnover. This uses the data points that are available fitting a trend to the missing points in time but relating this to the reporting unit employment (which is known for all years and all businesses). These imputed values are then used in difference-in-difference estimates. These GVA and turnover estimates have a higher coverage but have to be treated with some caution as they will reflect employment changes for many of the supported businesses. For other measures, such as investment, the approach is to only use the sample where a survey was conducted before and after the start of an RGF project. Then, any trend change analysis is not possible. A third approach has been used for the capital stock estimation, described in the text, where essentially additional balance sheet data was used to fill gaps.

13. The counterfactual businesses are identified by comparing supported and unsupported businesses on a range of observable characteristics. These were chosen based on factors that went into the selection of projects for the RGF, such as the sector the business operates in and the share of public sector employment in the local area. Furthermore, factors that may influence the impact of the support, such as size and age,

were considered. Lastly, the propensity of businesses to apply for support was taken into account by including measures on non-RGF support received. The preferred specifications were then identified iteratively, comparing models on their overall fit and how closely the identified counterfactual resembles the supported group.

14. The selection modelling was more complex for the Regional Projects than the modelling for other schemes. Firstly, samples sizes are smaller than in RGF programmes. So, looking at individual cohorts of supported businesses was not possible. Rather, the sample has been pooled across all years of support. The data about businesses has been recast in terms of the years before or after the start of the RGF project and a dummy for the year of support then introduced to then ensure that the counterfactual businesses are spread across years in a similar way to the support.

15. The results of the estimation of selection models used on the BSD match pools are given in Table 4.1. The preferred model is chosen based pre-treatment employment growth and propensity scores (figure 4.2), but the table indicates a consistency in terms of the co-efficients on parameters. It includes the plant capital stock estimated using a perpetual inventory model for reporting units (a dummy variable marks businesses where the capital stock was not estimated due to data gaps). This constructed variable proves significant, as well as size variables, the businesses' R&D activity and past support received by a business. Results highlight a complex selection for the projects:

- Businesses receiving RGF support are large and R&D active. The estimates for whether these factors influence selection are positive and significant.
- The businesses operate outside of London and the South East and are more likely to be foreign owned than the wider set of businesses that ONS surveys in its annual surveys.
- Selected businesses are capital intensive, with a further positive effect for plant.

Table 4.1: Probit model of RGF Regional Project selection in 2012

	Scheme 1: National Programmes		
Match pool	ARD/BSD		
Model specification	**Control**	**Mod I**	**Mod II**
Plant stock	0.15 (6.00***)		
Cap Stock	1.08 (4.84***)		
2-5 years	0.04 (0.19)	2.99 (0.03)	3.38 (0.02)
6-10 years	0.00 (0.01)	2.96 (0.03)	3.48 (0.02)
11+ years	0.00 (-0.02)	2.98 (0.03)	3.67 (0.02)
Support before	0.34 (6.64***)	0.39 (7.44***)	0.32 (5.80***)
3-9 employees	0.39 (2.22**)	0.42 (2.12**)	0.39 (1.91)
10-49 employees	0.77 (5.42***)	0.75 (4.46***)	0.76 (4.39***)
50-249 employees	0.97 (7.06***)	1.01 (6.19***)	1.05 (6.19***)
250+ employees	1.14 (7.77***)	1.37 (8.29***)	1.46 (8.47***)
UK owned	-0.30 (-5.70***)	-0.31 (-5.94***)	-0.22 (-3.88***)
R&D active	0.34 (6.48***)	0.33 (6.27***)	0.20 (3.74***)
London/SE	-0.41 (-5.83***)		-0.34 (-4.54***)
2011 Cohort	0.07 (0.74)	0.07 (0.74)	0.01 (0.05)
2012 Cohort	0.31 (4.42***)	0.32 (4.61***)	0.30 (4.16***)
2013 Cohort	0.21 (2.97***)	0.22 (3.12***)	0.21 (2.89***)
2014 Cohort	-0.14 (-1.61)	-0.16 (-1.81)	-0.18 (-1.86)
Patentholder	0.32 (5.00***)	0.33 (5.23***)	0.21 (3.33***)
Log emp change (ent, t-1)		0.04 (0.71)	0.07 (1.07)
Value of support before		0.00 (-2.92***)	0.00 (-2.82***)
Low paid industry (=1)			-0.50 (-4.31***)
High technology industry (=1)			0.28 (4.25***)
Manufacturing industry (=1)			0.41 (7.02***)
Age			-0.04 (-1.93)
Age squared			0.00 (1.60)
Constant	-5.43 (-17.46***)	-7.42 (-0.08)	-7.71 (-0.05)
Adjusted R-Squared	0.28	0.27	0.31
Observations	1,307,492	1,248,302	1,248,302

16. The capital stock is calculated using book values as reported in accounts for the starting values and then investment data from the ONS surveys, which would be collected on a different basis to the accounts data. In particular, whereas the FAME accounts data reports at entity level which sometimes is globalised, the ONS has asked larger, multi-plant businesses to report by different plants.

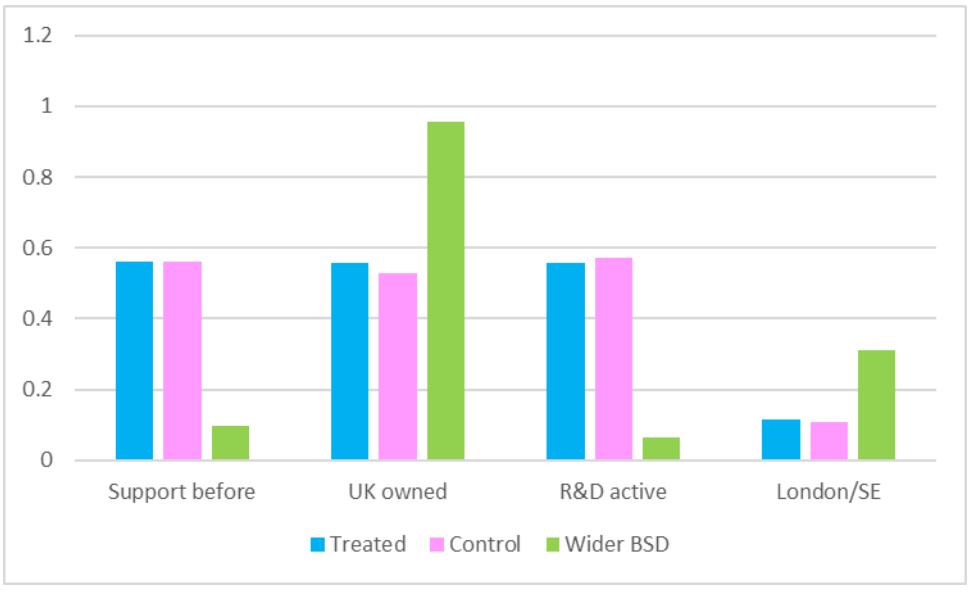
17. The focus for the capital stock were the two assets: firstly, plant and machinery and secondly vehicles. Then, the capital stock, K, at time t and for asset i in industry j is computed using a perpetual inventory model:

$$K_{i,t}=(1-\partial)K_{i,t-1}+I_{i,t}$$

18. Where *I* is the investment and δ is the depreciation rate. Industry specific plant and vehicles depreciation rates were taken from Rincon-Aznar et al. (2017), provided at 2-digit SIC. A few steps had to be taken to calculate initial capital stocks for each year. For firms that filed an annual account, initial stocks were calculated by using the firm-level book value of plant and vehicle in 2009 divided by the employment reported in the accounts and then multiplied by the employment in the ONS ARD for 2009. To fill gaps, book values were used to calculate a 2009 estimate of average plant and vehicles per employee by industry. This was estimated using only using SMEs in FAME and this was used to give initial stocks to the businesses that (were too small to) complete detailed accounts. Where businesses had multiple plants and the plants had different SICs the industry specific plant or vehicle stock per employee ratio was used to ensure that the initial stocks in a plant were appropriate.

19. The ARD is a sample survey so – while the largest 8,000 or so businesses have a complete panel – the vast majority of firms only appear intermittently. This means the annual investment is missing for many years for individual businesses. Investment per employee was calculated using years that were completed by businesses. As employment is available each year, this ratio was used to interpolate and extrapolate for missing years. Deflators for capital stock were derived using the ONS non-financial balance sheets.

Figure 4.1: Characteristics of Supported Businesses and Comparator Groups

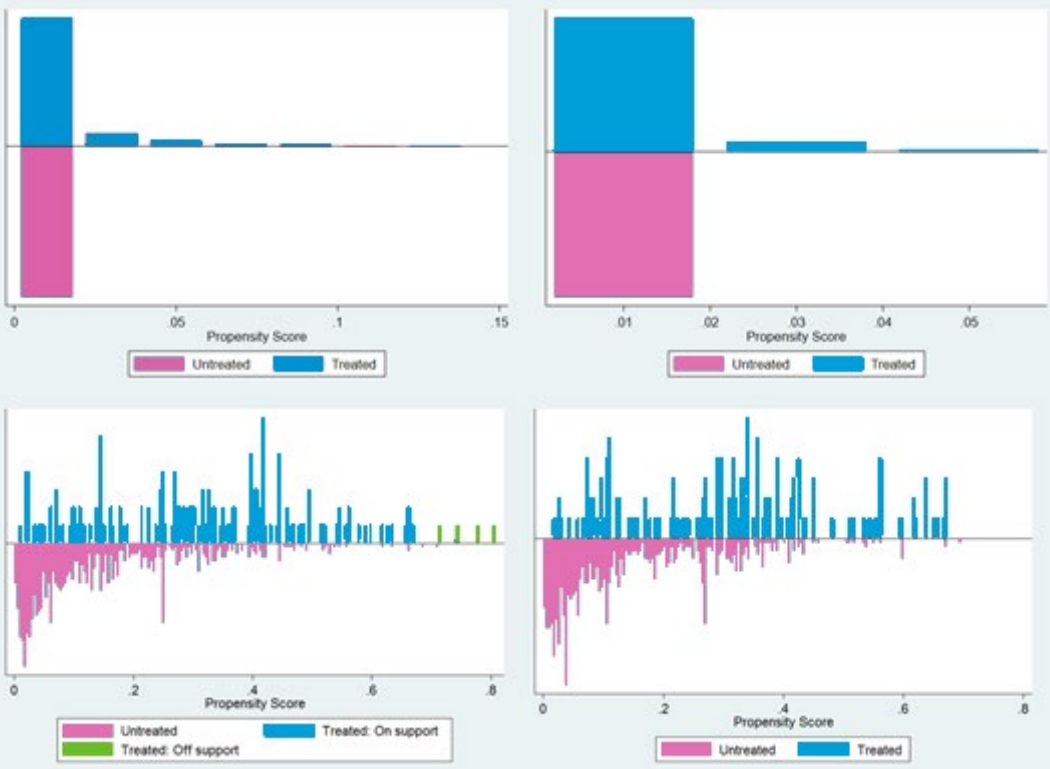


20. Propensity score matching controls for observable characteristics which may also affect selection into treatment. Figure 4.1 indicates how the selection model, when used to identify comparable unsupported businesses using propensity scores, delivers a set of businesses that are similar in terms of receiving support before, their ownership, whether they conduct R&D and their location. Whereas, for example, over 50% of RGF Project beneficiaries are R&D active, the wider business population has only 5%. Through matching such characteristics are seen in the control.

21. Figure 4.2 presents the propensity scores after matching for the BSD/ARD pool in the top panel and the applicant pool in the lower panel. Balance tests, such as those in the Figure 4.1, suggest the PSM can – on average – balance on the observed characteristics of the businesses. These figures give the detail on the one-to-one matches. The x-axis is the chance of being selected, the propensity score, and above the x-axis in each figure is the distribution of these scores for the supported businesses; below the line is the scores for the matched unsupported businesses.

22. The upper panel shows matches using the full BSD/ARD. A high proportion of the treated and matched are at the lowest scores in the left side of the figure. The preferred model has a distribution of propensity scores which is wider, reflected in the maximum scores of 0.15 rather than 0.05 in model I. However, there is a comparable spread in the businesses identified for the comparator. This means that the matching has delivered a set of counterfactual businesses that look similar to those receiving support.

Figure 4.2: Density distribution of propensity scores



Top Left, matching to the BSD, preferred model, and **Top Right**, Model II.

Matching to the rejected applicants Model I **Bottom: Left; Top Right:** Model II.

Note: Plots of propensity scores indicate the frequency of the scores of the treated in the top red half and the scores of matched untreated in blue. The two upper plots are for the BSD match pool, the two lower are from the matching done to the applicant match pool.

23. While the matching using the BSD does leave a number of observations unmatched exactly in terms of propensity score, this is less than when using the applicant pool to identify a comparable group. The lower panel indicates many beneficiaries have high propensity scores when the matching uses the pool of rejected applicants for selecting the counterfactual and there are few matched businesses in that part of the distribution. This is a consequence of the pool of rejected businesses being small and – for the businesses with a very high chance of receiving support – there are no rejected businesses that look similar statistically.

24. The number of rejected applicants available for matching is low and many supported businesses are found to be too different to any of the businesses in the rejected applicant pool to find a match. The matching is unable to find comparable businesses for about 10% of the supported businesses. These tend to be the larger businesses[8]. Further there are many rejected applicants that are matched to more than one supported firm. Across all 162 projects, the matching procedure identifies only 92 different businesses. Matching without replacement would lead to a substantial decrease in the sample size suggesting there is not a common support between treated and rejected applicants (Austin, 2011). For these reasons the BSD pool is preferred for identifying and constructing a counterfactual for the RGF project beneficiaries.

25. Selection for RGF projects did include a scoring system, which was used to assess the business cases made by individual projects to secure funding. A discontinuity approach was considered, which would involve focusing on the set of businesses that were just above and just below the score at which applications were judged value for money. As a counterfactual, this regression discontinuity design has some advantages in that the projects proximate to cut-off can be viewed as highly comparable bar the fact that some were not funded. The sample size however again prevented this being implemented as a counterfactual approach with a relatively small number of businesses being near the cut-off.

Employment Impacts

26. The last section looked at the selection into RGF Regional Projects, allowing a comparison group of businesses to be identified. This section explores the net additional impact RGF support has had on employment by comparing any change in beneficiary businesses with the matched counterfactual. With an outcome variable that is relatively simple, it is possible to use difference-in-difference estimation to compare the change observed in a treated group with that seen in the control group. Comparing across models and matched groups also allows some initial analysis of the sensitivity of employment outcomes to the control group used.

27. Figure 4.3 indicates a range of variables tracked in the data for the supported businesses and comparison groups. The businesses were supported across a number of

[8] Relaxing the common support does not affect the estimate of average treatment effects.

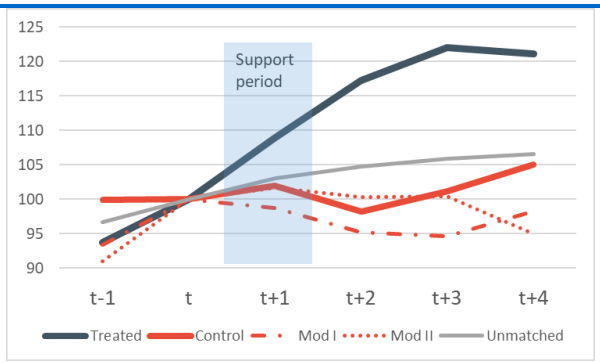
years. Growth in employment amongst beneficiary businesses is observed, but the question is whether this would have occurred without support. Different control groups are used to estimate this, using counterfactuals derived from combinations of different match pools and model specifications. The difference is the average treatment effect on treated (ATT). By comparing ATTs across match pools and model specifications, this section presents a range of results on the ATT and explains key differences. Here the difference-in-difference can be estimated by looking at change over time and across the supported and comparable businesses.

28. Figure 4.3 illustrates the growth in employment seen in RGF beneficiaries is high and larger than all matched control groups. The enterprise level employment is similar to that seen in the plant level. However, in the final year of the graphs there is a slight acceleration in employment growth at the plant level not seen across the enterprise in which the reporting unit is positioned.

Figure 4.3: RGF Project supported businesses compared to comparators

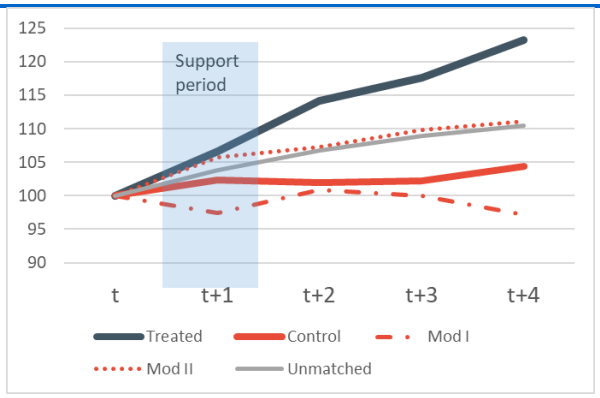
Employment at enterprise level consider the change across whole businesses. Remembering that the matching is at reporting unit level, this then is an estimate for a wider set of establishments linked to the plant supported with RGF projects.

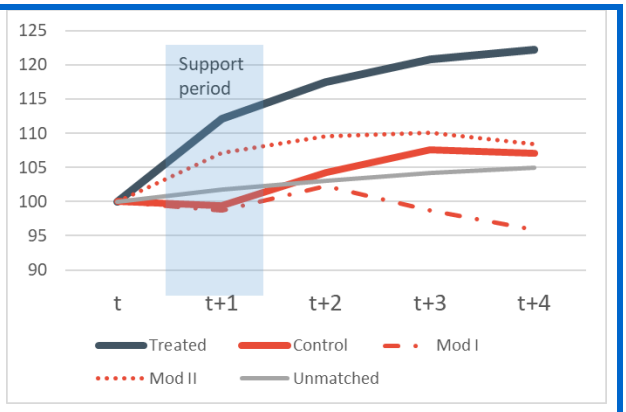
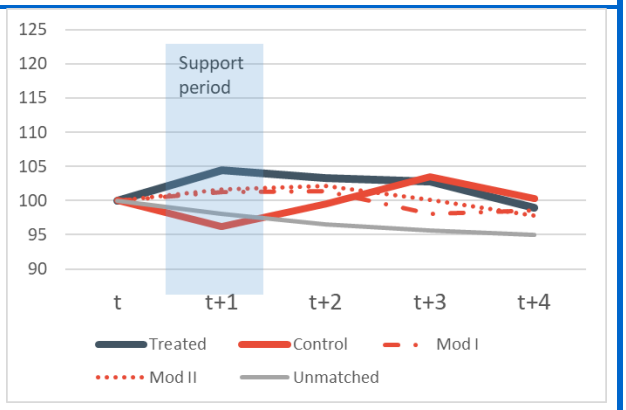
One feature to highlight is that the pre-support growth in employment is found differ between the control group and supported. This suggests the matching has provided comparator businesses that were on a somewhat different, around 5% growth trajectory difference to the supported before RGF support.



Employment at reporting unit level indicates the employment seen at the establishment level. The preferred model grows somewhat slower than one of the alternative models but faster than the other model.

However, employment growth in the supported reporting units rises steeply throughout the period, with a slight pick up at the end of the period, also seen in the preferred counterfactual. There are 185 businesses in both these groups.



The **gross value added** at the business level available for many of the supported reporting units, but not all. As GVA is assessed using a survey, and small and medium sized businesses will only periodically be sampled, so the GVA is imputed for businesses on reporting unit employment to fill gaps.	
The **GVA per employee** at reporting unit level is a productivity measure. However, it is a difficult-to-measure performance metric. It both has gaps in survey response but also has the issue of being the ratio of two measures, each with statistical noise. However, some pick up in productivity is seen in the priod of support but the counterfactual then does catch up on this metric.	

29. Tables 4.2 and 4.3 indicate the analysis of the additional employment effects of the RGF projects, summarising the differences in employment growth and their statistical significance. Employment growth is estimated for two periods, a period two years after support and a longer four-year period after support. The change seen in supported businesses was compared to that seen in control groups, pooling across all RGF project beneficiaries. So, in the 185 supported businesses average employment was 14.2% higher in supported units two years after projects had started and 23.3% higher four years after.

30. The table then tests whether this is higher than that of comparable groups. The impact of the RGF is summarised by the difference-in-difference. A positive, significant difference implies evidence that the supported businesses outperform the control group. When businesses are selected from the wider BSD using a model that only uses firmographic characteristics such as size, industry, location, (Model I), the control group's employment grows somewhat so that the difference-in-difference is 10.8% and highly significant. This is also the case in the preferred control after 2 years.

Table 4.2: Estimates of Additional Employment Growth in Scheme 1

		Difference-in difference (t-stat)		
Model used	**Growth in Treated**	**Control – preferred model**	**Model I**	**Model II**
Using the BSD difference in differences estimates				
Log emp change (RU, t+2)	14.2%	12.0% (3.25***)	10.8% (3.37***)	4.2% (1.37)
Log emp change (ent, t+2)	17.3%	19.4% (3.18***)	18.8% (3.66***)	12.8% (3.03***)
Log emp change (RU, t+4)	23.3%	18.1% (3.21***)	26.4% (4.62***)	10.5% (2.00**)
Log emp change (ent, t+4)	21.1%	15.3% (2.28**)	20.3% (3.18***)	24.3% (2.80***)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels. RU is analysis at reporting unit level focusing on supported plants/establishments; ent is at the whole enterprise level.

31. Table 4.3 then looks at estimates of the additional job years. The growth in the years of employment in supported firms has been estimated in chapter 3. The ratio of the log employment growth estimates of Table 4.2 suggests that 29%-86% of reporting unit employment growth is seen in supported businesses but not in potential comparators.

Table 4.3: Estimates of jobs created for Regional Projects

Model used	**Net additional job years created**	**Gross job years created from treatment**	**Additionality ratio**	**2yr Growth in Treated**	**Difference-in-Difference**	**t-stat**
Scheme 1: Regional Projects						
Preferred model	49,417		86%		12.0%	3.25***
Model I	45,299	57,653	79%	14%	11.0%	3.37***
Model II	16,472		29%		4.0%	1.37

Formula for calculation:

$$\text{Net additional job years created} = \text{Gross job years created} * \frac{Treatment\ effect\ (ATT)}{\text{Growth rate in treated group}}$$

Notes: Table reports the net total number of job years created from treatment-year to three years after. Additionally ratio is calculated as the ATT-estimate divided by the growth rate in the treated group. T-stat for ATT from PSM analysis listed. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

32. There were 57,653 years of employment seen in the supported reporting units and Table 4.3 suggests that 49,417 of these would be additional, with alternative models suggesting 16,472 to 45,299.

33. The financial performance of supported businesses was also analysed. The sample sizes for this analysis are small as – whereas the BSD is a census of all significant businesses – the ARD is a sample and analysis has to focus on the beneficiaries that are in surveys. The box indicates that for measures of GVA, some imputation has been used with reporting unit employment used to fill in the trends where GVA measures were missing. Figure 4.3. then presents some results. The imputation may mean that the productivity measure could be flat due to the GVA measure being correlated to

employment. It suggests that the firm-level evidence can only provide a first indication of the productivity effects (and a later section provides a more robust analysis).

BOX: Panel estimations of support effects

The previous analysis identifies a counterfactual and then tracks performance. The underlying data, for the large businesses that were supported by projects, can also be analysed as a panel. Unlike smaller businesses, the ONS data for a range of variables beyond outcomes is tracked – such as the capital stock noted above.

There is often unobserved heterogeneity in the sample of businesses that is being analysed. In a panel, there are different approaches to tackle this, such as analysing the variable removing a business-specific average from it (demeaning) or to take the first differences in variables. However, especially when the panel has a relatively short time-series, some correlation between the disturbance process and the dependent variable remains. This means that estimates can be biased and a range of modelling techniques, that use panel data, have become available to take account of this and been applied to ONS business data to understand productivity impacts (e.g. Harris et al., 2003). Key to support this analysis has been to: consider outcomes beyond sales and employment at a whole business level, especially the gross value added at plant level; and construct panels widening the variables to consider more determinants of productivity, such as capital stock.

Panel estimation was undertaken using mixed effects estimators. The real gross value added was modelled on capital stock, employment estimates both at reporting unit and enterprise level with various lag models. Models varied with all including the plant capital stock and employment measures, but then varying by whether vehicles and software stock levels were included. The treatment dummy was positive for all models and significant for all but ones with the most complex lag structures.

Earnings Effects of Regional Projects

34. Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses. At the time of treatment start, earnings growth in supported businesses is higher than in other businesses. Employees that took up a new job in supported businesses enjoyed a wage premium; when employees leave a supported business, their earnings tend to decrease.

35. Table 4.4 summarises the earnings data. Employees in project beneficiaries are categorised as “supported” starting from the year the business started receiving RGF support and every year thereafter (unless they leave the business). Employees at supported businesses earn more than the wider employee population. This is further boosted by higher overtime pay. Supported businesses also have a high proportion of fulltime staff. A very low proportion of employees is female (14% in supported units and 21% in the wider supported business). This is likely to be due to many supported businesses being in manufacturing.

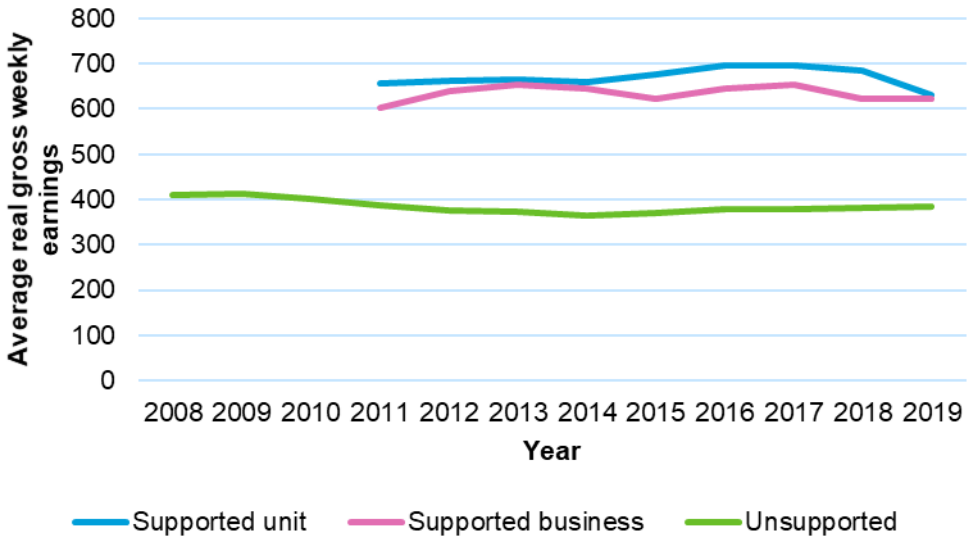
Table 4.4: Earnings data summary statistics for projects

	Supported unit		Supported business		Wider ASHE	
	Mean	SD	Mean	SD	Mean	SD
Basic weekly pay (real)	626	310	618	330	455	379
Weekly overtime pay (real)	52	116	34	95	14	85
Gross weekly earnings (real)	743	356	715	421	490	423
Total weekly hours	39.7	6.2	38.7	7.1	33.3	11.1
Weekly overtime hours	2.4	5.3	1.9	5.0	1.1	3.5
Age	42.4	11.7	42.5	11.9	40.7	12.8
Female	0.1	0.4	0.2	0.4	0.5	0.5
Full-time	1.0	0.2	0.9	0.2	0.7	0.5
Public sector employer	0	0	0	0	0.3	0.4
Observations	5,509		6,672		2,022,060	

36. Figure 4.4 plots average earnings in businesses from the start of the RGF project. Weekly earnings are considerably higher at supported businesses. Moreover, the earnings seem to have recovered faster from the financial crisis. While average earnings in the wider ASHE fell between 2009 and 2013 and stayed flat thereafter, earnings growth picked up again in supported units from 2013. This is not the case at the supported businesses outside the supported unit.

37. However, the fact of higher earnings cannot be attributed to RGF support since the supported businesses are very different from the wider business community. Rather, it shows that supported businesses operate in activities with higher value-added, higher productivity, and a more skilled workforce than the average UK business. It then suggests that the additional jobs created are high quality. A question that arises then is whether – had the employment not been created – the individuals would merely have received a high quality, comparable job elsewhere.

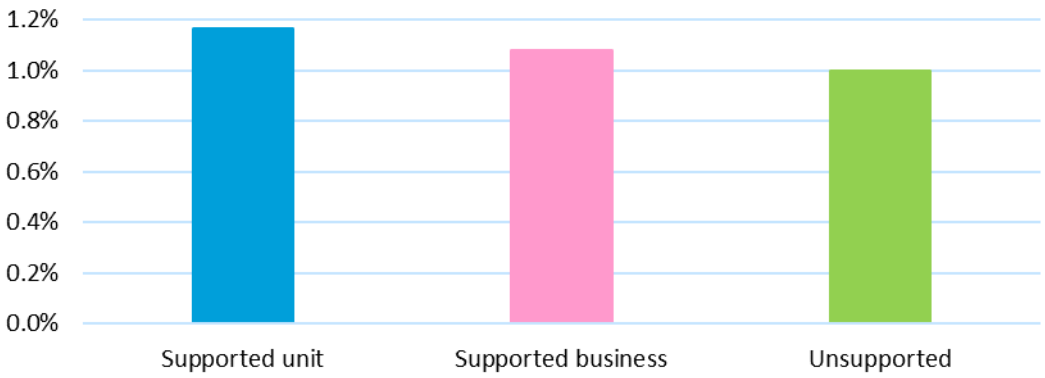
Figure 4.4: Average earnings in RGF Regional Project supported businesses



Note: Averages were calculated in logs and then exponentiated to reduce the impact of exceptionally high earnings.

38. Interpretation is possible through Figure 4.5, which looks at earnings growth around the time of the start of the RGF Regional Projects. These figures only include individuals continuously employed by the same business between consecutive years, so they are not affected by businesses' hiring and firing decision. Earnings of employees at non-supported businesses grew by 1% annually. Note that this only includes workers continuously employed at the same firm for two consecutive years. At supported units, earnings growth was close to 1.2% from the year before support start to the year of support start. At supported businesses outside the supported unit, earnings grew by 1.1%.

Figure 4.5: Earnings growth around the time of support start



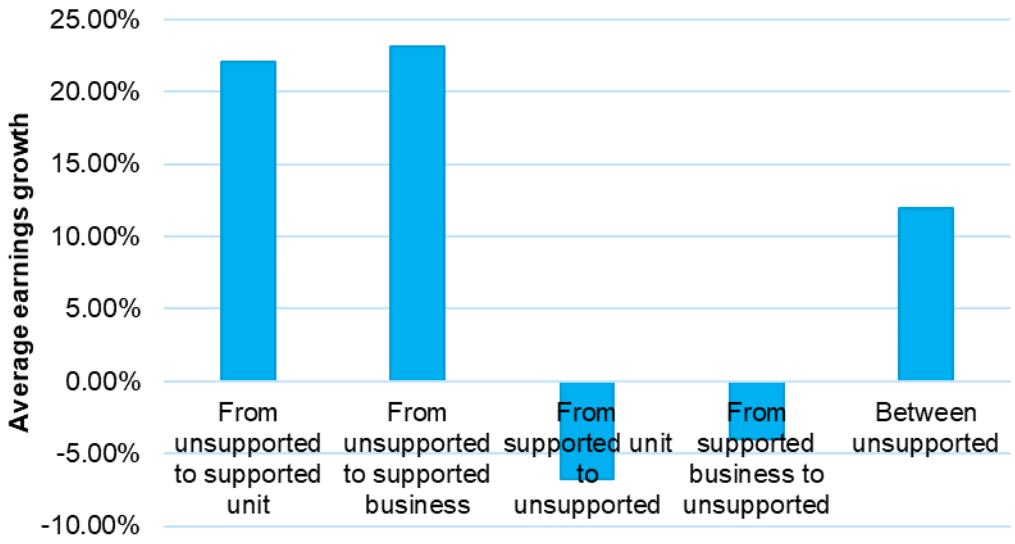
39. A second way to investigate whether individuals that take up the additional jobs are benefitting from higher pay that they otherwise would not have received is to exploit the panel structure of the ASHE data. The next figure looks at the wage effect of job switching

to or from a supported business. This is a popular technique when analysing ASHE, as it allows to control for individual characteristics, that are otherwise difficult to observe in data, for example a qualification or an entrepreneurial ability (D'Costa & Overman, 2014; Gibbons et al., 2014).

40. Figure 4.6 compares earnings of job switchers to and from RGF Regional Project supported units and wider businesses to earnings of employees moving between other businesses and those who do not change jobs. Switchers to and from RGF Regional Project supported businesses are considered if the switch occurred in the year of first support by the RGF or any year thereafter.

41. The figure shows a large premium for changing jobs to a business unit that is supported by an RGF Regional Project. Individuals get on average a 22% boost to their earnings when moving to a supported unit. At around 23%, the premium is even slightly higher when moving to a part of a business that has not been supported directly. In contrast, employees earn on average almost 7% less when moving away from a supported unit. The effect of moving jobs from somewhere else in a supported business is smaller, with an earnings loss of only 4%. Anybody moving jobs between unsupported businesses in the wider ASHE enjoyed an increase in earnings of about 12%. The table below the chart provides more details on these findings. The earnings growth figures are quite volatile with high standard deviation.

Figure 4.6: Earnings growth of job changers



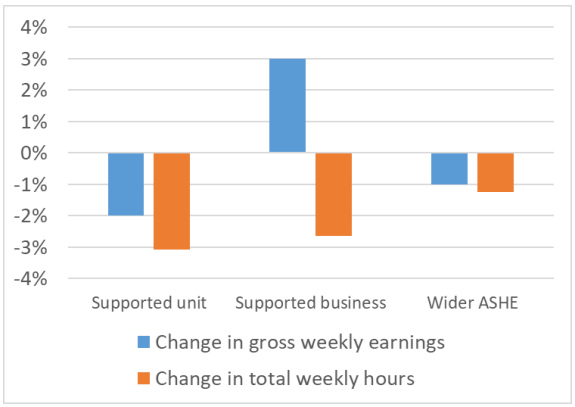
	Earnings growth	SD	Number of observations
From unsupported to supported unit	22.05%	0.41	151
From unsupported to supported business	23.15%	0.49	177
From supported unit to unsupported	-6.72%	0.56	75
From supported business to unsupported	-4.02%	0.56	136
Between unsupported	11.96%	0.63	74486

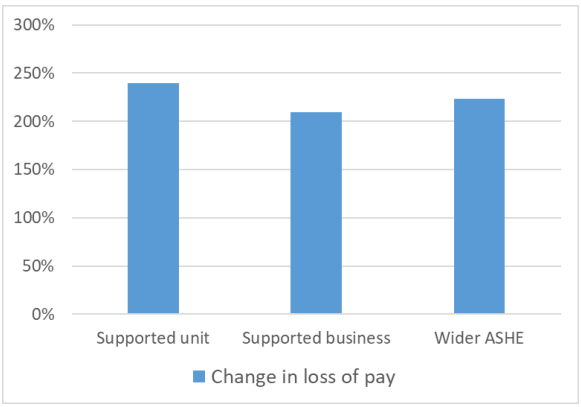
Initial effects from the Covid-19 pandemic

42. As ASHE is conducted in April each year, the 2020 survey captures the labour market at the beginning of the first lockdown caused by the Covid-19 pandemic in the UK. Comparing 2020 to 2019 results on earnings and hours worked gives some initial indications of the impacts of the lockdown. Crucially, ASHE also records a marker for workers whose pay was lower due to illness or furlough.

43. Figure 4.7 shows the effects at businesses supported by Regional Projects. Both earnings and hours fell at supported units, however, a larger extent in hours suggests businesses absorbed some of the impact on their employees. In contrast, when looking at the whole business, hours fell while earnings actually increased. This may be related to changes in the work force, where lower earning employees were more likely to be laid off. The evidence also suggests that businesses made use of furlough, with the share of employees experiencing loss of pay increasing more than three-fold.

Figure 4.7: Covid-19 lockdown effect on businesses supported by regional projects





Impacts beyond Employment and Earnings

44. The previous results have focused on employment impacts, with Figure 4.3 indicating some analysis using GVA measures but where imputation has filled gaps. To widen the analysis to impacts beyond employment and turnover, but assess statistical significance more robustly, the focus returns to individual supported plants, respondents to the ONS Annual Business Survey, ABS.

45. The financial performance of supported businesses that were included in the surveys was analysed. The sample sizes for this analysis are small – whereas the BSD is a census of all significant businesses – since the ARD is a sample and analysis has to focus on the RGF beneficiaries that are surveyed. Also, based on the responses to the survey imputed values fill in gaps seen over time – a solution which allows a difference-in-difference analysis but with some caveats.

46. As noted in the earlier box, the ARD goes beyond the BSD's focus on turnover and employment. Each year, for the largest businesses, the value added is collected, collecting data about their expenditures on staff, purchases of materials and services and investment in different assets. The dataset is at a detailed level asking large multi-establishment businesses about the economic activity within an individual plant or groups of establishments, with ONS judging an appropriate level of detail that is not overly burdensome.

47. Propensity score modelling was again used to identify a control group. This modelling has used only the respondents in the ARD and the average characteristics of the businesses before support has been used to identify the counterfactual businesses. Further, to increase the sample size, average was taken across three years prior to treatment. Because businesses will typically not be surveyed by ONS every year, this increases the overlap between project beneficiaries and ARD considerably.

Table 4.5: Impacts beyond Employment in RGF Project Supported Businesses

Variable	Unit	Impact estimates	
		Effect	Significance
Employment	Log growth	10%	At 10%
Turnover	Log growth	2-15%	No
Gross value added	£'000	£13,354	Sometimes
Remuneration	Log growth	19%	At 5%
Purchases	Log growth	20%	Sometimes
Capital Expenditure	Log growth	40%	No
Observations	Plants	127	

48. A comparison group was identified, and Table 4.5 presents the change in a range of variables for RGF project beneficiaries in comparison with the matched control group. The analysis focuses on 127 supported plants that are found in the ARD, comparing with matched unsupported plants in the ARD.

49. The effects of the RGF support on employment growth are consistent with the results seen in the BSD analysis. The supported plants have employment growth that is about 10% faster than that of comparable plants. The growth rates are higher than the earlier analysis since the focus here is the individual supported establishment, compared to the previous growth estimates' focus on whole enterprises. This means that the strong growth seen in supported plants would have been combined with that seen in a wider set of establishments perhaps experiencing modest growth.

50. There is also evidence consistent with this employment growth in employee remuneration growth in the RGF beneficiaries. The total wage bill has risen about 19% faster in supported plants than comparable businesses. Pay is a proxy for labour productivity, and – when complemented by the significant growth in employment in the supported businesses – suggests that the job creation following support results in labour moving towards more productive businesses. The compositional effect will be positive, with in aggregate there being an increased number of well-paid, productive jobs.

Table 4.6: Additional Growth in GVA and Turnover for Scheme 1

		Difference-in difference (t-stat)		
Model used	**Growth in Treated**	**Control – preferred model**	**Model I**	**Model II**
Using the BSD/ARD difference in differences estimates				
Log real turnover (RU, t+2)	14.2%	11.2% (1.33)	9.7% (1.20)	2.0% (0.26)
Log real GVA (t+2)	17.5%	12.7% (2.06**)	14.3% (2.18**)	6.7% (1.17)
Log real turnover (RU, t+4)	15.5%	12.1% (1.30)	18.8% (1.97**)	4.3% (0.49)
Log real GVA (t+4)	22.2%	14.2% (1.94*)	27.5% (3.41***)	12.8% (1.66*)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

51. While it is possible to discern higher GVA, purchases and capital expenditure in supported businesses, these performance indicators generally have a high variance. Statistical tests are often insignificant. There are estimation issues with the ARD, especially the limited sample size of observations in this analysis.

Concluding remarks

52. RGF Regional Projects started in 2011 and, by 2015, contracted jobs had passed its peak. The job years estimated in monitoring data is somewhat higher than the new jobs found in the ONS data, reflecting the payrolls of the business. For economic impact evaluation, these gross impacts are adjusted to take account of what would have happened without support. There were 57,653 years of employment seen in the supported reporting units and the differential growth rates suggests that 49,417 of these would be additional, with alternative models suggesting 16,472 to 45,299. Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses. At the time of treatment start, earnings growth in supported businesses is higher than in other businesses. Employees that took up a new job in supported businesses enjoyed a wage premium; when employees leave a supported business, their earnings tend to decrease.

53. Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses. At the time of treatment start, earnings growth in supported businesses is higher than in other businesses. Employees that took up a new job in supported businesses enjoyed a wage premium; when employees leave a supported business, their earnings tend to decrease.

5 Impacts of RGF Programmes

This chapter presents estimates of the impacts of the National and Regional Programmes, using results from an econometric analysis of ONS administrative data. Programmes involved RGF supporting intermediaries to then provide support to businesses, usually SMEs or start-ups. Lists of supported businesses and unsuccessful applicants have been collected from the Programmes. The chapter first assesses employment, growth and survival using firm-level data. It then presents the results from the beneficiary survey conducted amongst beneficiary businesses.

Findings

- National Programmes and Regional Programmes are a diverse set of support measures made available to businesses through intermediaries, such as LEPs, banks, Local Authorities, or Higher Education Institutions. The individual incidences of support were collected from the 138 programmes. They were also asked about the applicants that did not meet the criteria for support and these businesses provided a pool from which the counterfactual could be selected.
- Overall, the growth in employment seen in the National Programmes was between 14.0% and 30.5%; for the Regional Programmes, the range was 18.9% to 31.9%. The comparator businesses also grew but there was a positive and generally significant difference, with this difference being 8.1% and 15.7% for the National Programme and 6.9% to 18.5% for the Regional Programmes.
- Employment in the businesses supported by National Programmes grew by 57,547 job years. Using the growth seen in supported businesses but not seen in the comparators, 34,944 years of employment are additional in the National Programmes. For the Regional Programmes, there is 48,607 years of additional employment (though the growth seen in the businesses did not differ as much with the counterfactual as was the case for the National Programmes).
- The quality of employment has been analysed, using surveys of the earnings linked to the business of employees. Average earnings at National and Regional Programme supported businesses were much higher than both those in unsuccessful applicants and the wider ASHE population in the first programme cohorts (in 2012).
- The analysis of employees that switched between supported, unsupported businesses and the businesses that applied but were unsuccessful reveal a

premium of 18% when switching jobs to a supported business. In comparison, the premium is only 12% when moving to an unsuccessful applicant business. Employees who leave a supported business and join a business in the wider ASHE saw their earnings decline by 2% on average. In contrast, employees who left an unsuccessful applicant business to join a business in the wider ASHE experienced an earnings-increase of 20% on average. Employees changing jobs between businesses in the wider ASHE gained an earnings-increase of 11%.

1. National Programmes are primarily asset finance and similar schemes, where banks and intermediary lenders distribute loans to business beneficiaries, the end beneficiaries, supporting access to finance for smaller businesses that might otherwise struggle to secure funding. Regional Programmes are a diverse set of support measures made available to businesses through intermediaries. Most intermediaries are public and arm's length bodies such as LEPs, Local Authorities, or Higher Education Institutions.

2. Since the interventions support smaller businesses through intermediaries, lists of beneficiaries and unsuccessful applicants were collected from the intermediaries. The lists were then be linked to the employment, turnover and other firm-level data held in the ONS Secure Research Service.

3. The econometric analysis estimates impact in terms of employment, turnover and productivity of the National and Regional Programmes in financial years following receipt of support. For beneficiaries are supported over 2012-2017 impact measures looked at growth four years after treatment. The timeframe was chosen to balance the need for longer term impacts and the recognised difficulty of controlling for confounding factors when trajectories are longer.

Impacts of the National and Regional Programmes

4. The econometric analysis presents estimates of the additional employment and turnover in businesses benefiting from the National and Regional Programmes, which are a diverse set of support measures made available to businesses through intermediaries. Most intermediaries are public and arm's length bodies such as LEPs, Local Authorities, or Higher Education Institutions.

Table 5.1: Amount of Funding Per Treatment Year

	National Programmes		Regional Programmes	
Treat Year	Total Funding (£)	Count of Programmes	Mean Funding (£)	Count of Programmes
2011	£145m	4	£133m	12
2012	£122	7	£309m	33
2013	£166m	10	£224m	38
2014	£80m	10	£157m	22
2015	£40m	1	£2m	1
Total	£533m	32	£824m	106

5. Table 5.1 presents the amounts that intermediaries were awarded for the financial year where programmes began. The Scheme 3 National Programmes were larger than the Regional, with the former run by national organisations at a larger scale than the more local Regional Programmes of Scheme 4.

6. In terms of the timings of the support for businesses, the gap between awarding grants to intermediaries and the subsequent disbursement to businesses should be noted. The Table indicates funding by when programmes were initiated. The individual incidences of support provided further detail about the timing of support to individual business and this richer picture forms the basis of the firm-level econometrics. These timings were collected from the 138 programmes, who completed a data request to list their individual beneficiaries including timings for support. They were also asked about the applicants that did not meet the criteria for support and these businesses provided a pool from which the counterfactual could be selected.

Selection Modelling for National and Regional Programmes

7. A control group of businesses that is statistically similar to the supported businesses is used to establish whether RGF support has additional impacts over and above what would have happened without support. To estimate the additional impact, the control group – unlike the Regional Projects – is selected from the unsuccessful applicants. Tests of the matching suggest this provides a good counterfactual. The matching processes seek to find unsupported businesses similar to the beneficiaries and, even before using matching, the unsuccessful applicants are similar in terms of the observable characteristics. Furthermore, unlike the projects, there is a large pool of unsuccessful applicants from which to draw comparable businesses, sufficiently large enough to find matches for all beneficiaries.

8. To select comparable businesses, propensity score matching (PSM) is used. Caliendo and Kopeinig (2005) provides an overview of the approach. A first step is to model the selection process used by RGF, estimating the chance of receiving support using a probit model. The modelling provides a measure called the propensity score which is used to construct the counterfactual group. A business is selected from the untreated businesses that has a propensity score closest to each of the supported businesses (i.e. based on all observed characteristics they are as likely to have received RGF support).

9. The preferred counterfactual was determined in terms of the pool from which a comparable businesses was selected (unsuccessful applicants was preferred) and the variables used in the propensity score (the preferred model was one that included past support received by the business). Matching with replacement is used as the unsuccessful applicant pool is smaller in size compared to the supported group of businesses, meaning an unsupported business from the match pool can be the “nearest neighbour” match for multiple treated businesses (Rosenbaum, 2002). An example model of estimates of factors leading to selection into an RGF programme is in Table 5.2.

10. The probit models what characteristics of a business make it likely that a business will be supported by RGF. The explanatory variables are real turnover, low pay,[9] manufacturing[10] and high-tech[11] sectors, firm age, number of local units, the Herfindahl Index,[12] public sector employment and population density (at the LEP level), the fact of non-RGF support and real value of that support. A binary variable for the region of the business is used so that the regional patterns in the support could be estimated. The dependent variable is binary that takes the value of one for the business that receives support and is zero otherwise.

11. The modelling indicates that size, whether a business is in manufacturing and the receipt of other support are correlated with being supported by RGF. The last variable, receipt of other government support, was prepared for the study by linking to the BSD a database of Innovate UK, Department of International Trade and other smaller support measures.

12. A large-scale beneficiary survey was conducted during 2015/16 asking programme beneficiaries about their experience of the RGF and also including questions about the local labour market. The box indicates some findings about the integration of labour market tightness questions in selecting a counterfactual. The matching using this data did lower treatment effects described later but by a relatively small effect.

BOX: Integrating additional evidence about the local labour market

A largescale survey was conducted of RGF programme beneficiaries, with results reported separately. The beneficiary survey included questions copied from the Employer Skills Survey (ESS) about labour markets asking about hard-to-fill vacancies. In the previous section, the difference in employment growth between the support businesses and the counterfactual was used to derive the additional employment due to RGF.

To test whether the post-intervention labour market matters for the policy impact estimation, an interaction variable is used to estimate how employment growth differs between firms experiencing hard-to-fill vacancies and those that were not based on their responses to the questions in the beneficiary survey. To identify a control, the ESS was linked into the BSD and the sample responding to the questions on labour market tightness used as a pool to

[9] Classified as Textiles, clothing, SIC07 13 and 14; Retail, SIC07 45, 47, 77.22 and 95.2; Hospitality, SIC07 55 and 56; Security, SIC07 80.1; Cleaning, SIC07 81.2 and 96.01; Social care, SIC07 87, 88.1, and 86.10/2; Hairdressing, SIC07 96.02 and 96.04; Agriculture, SIC07 1 and 3; Food processing, SIC07 10; Food processing, SIC07 10; Leisure/Travel/Sport, SIC07 59.14, 92 and 93; Employment agencies, SIC07 78.10/9 and 78.2; Childcare, SIC2 85.1 and 88.91.
[10] Classified as Manufacturing, Companies House SIC07 10110/33200 (all).
[11] Classified as Energy, SIC03 11.1 and 11.2; Electronic publishing, SIC03 22.1 and 22.3; Life Sciences, SIC03 24.4 and 33.1; Composites and other advanced materials, SIC03 25.24, 26.15 and 26.82; Precision Engineering and precision components, SIC03 28.52); Machinery and Equipment not classified elsewhere, SIC03 29 (all); Computer equipment & office machinery, SIC03 30.01 and 30.02; Electrical equipment, SIC03 31.1, 31.2, 31.4 and 31.62; Electronic equipment & components , SIC03 32.1, 32.2, and 32.; Medical & surgical equipment, SIC03 33.1, 33.2, 33.3 and 33.4; Transport Equipment, SIC03 34.10 and 34.3; Aerospace & related activities, SIC03 35.3; Manufacture of Games and Toys High-Tech Service Activities, SIC03 36.5; Telecommunications, SIC03 64.2 Software development & consultancy, SIC03 72.2; Web/internet services, SIC03 72.6; Other computer, SIC03 72.1, 72.3, 72.4, 72.5, and 72.6; R&D (natural sciences & engineering), SIC03 73.1; Architectural & engineering activities, SIC03 74.2; Technical testing & analysis, SIC03 74.3; Security and related activities, SIC03 74.6.
[12] Herfindahl index of market concentration 2007 (based on sales per 2-digit SIC sector).

draw the control as – for this sub-sample – there will be evidence on hard-to-fill vacancies for a comparator set of businesses.

The hypothesis is that beneficiaries experiencing hard-to-fill vacancies post-intervention were less able to realise the full benefits of the policy. On other hand, those operating in a more favourable labour market post-support should experience greater employment growth. Indeed, this is what is found for the cohort supported in 2012 but the interaction is insignificant for the cohort supported in 2013. Overall, this additional information could lower policy effects by a few percentage points.

Table 5.2: Probit Models for National and Regional Programmes, 2012

	Scheme 3: National Programmes			**Scheme 4: Regional Programmes**		
Match pool	**Unsuccessful Applicants**		**BSD**	**Unsuccessful Applicants**		**BSD**
Model specification	**Mod I**	Mod II	**Mod I**	**Mod I**	Mod II	**Mod I**
Age	0.04 (4.04***)	0.04 (4.38***)	0.00 (0.61)	-0.01 (-0.85)	-0.01 (-0.83)	-0.02 (-3.23***)
Age squared	0.00 (-3.35***)	0.00 (-3.63***)	0.00 (-1.42)	0.00 (0.78)	0.00 (0.75)	0.00 (2.25**)
Live units in enterprise	0.00 (-1.23)	0.00 (-1.24)	0.00 (-1.74)	0.00 (0.38)	0.00 (0.30)	0.00 (-0.43)
UK owned	0.27 (3.69***)	0.26 (3.60***)	0.26 (7.11***)	-0.04 (-0.42)	-0.05 (-0.44)	0.01 (0.16)
High technology industry (=1)	-0.22 (-3.29***)	-0.19 (-2.74***)	-0.02 (-0.49)	0.15 (1.57)	0.10 (1.05)	0.22 (4.43***)
Manufacturing industry (=1)	0.53 (8.69***)	0.60 (9.56***)	0.66 (22.11***)	0.22 (2.45**)	0.17 (1.79)	0.44 (8.86***)
Low paid industry (=1)	-0.07 (-0.93)	-0.08 (-1.05)	-0.26 (-7.62***)	0.02 (0.17)	0.03 (0.33)	-0.16 (-3.00***)
Hirfindhal index	-0.07 (-0.93)	-0.04 (-0.61)	0.01 (0.29)	-0.14 (-1.07)	-0.17 (-1.27)	-0.03 (-0.45)
Public sector emp LEP	-0.12 (-7.76***)	-0.12 (-7.60***)	0.01 (1.61)	0.06 (1.97**)	0.06 (1.93)	0.08 (5.72***)
Popn density LEP	-0.18 (-4.60***)	-0.19 (-4.66***)	-0.02 (-1.15)	-0.28 (-4.24***)	-0.28 (-4.13***)	-0.10 (-3.58***)
Gvt support before		-0.23 (-5.57***)			0.15 (2.87***)	
Value of support before		0.51 (4.71***)			0.07 (0.48)	
Constant	1.63 (4.47***)	1.58 (4.32***)	-3.34 (-18.8***)	-2.52 (-3.85***)	-2.57 (-3.90***)	-3.93 (-12.5***)
Pseudo R2	0.13	0.14	0.13	0.18	0.18	0.14
Observations	2,727	2,727	190,309	2,096	2,096	187,722

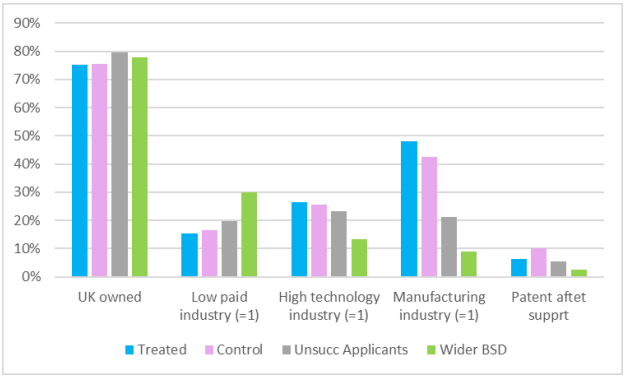
13. Details about the characteristics of the supported programme businesses are in Annex A. Business beneficiaries in Regional Programmes are about the same size in terms of the median, but with larger average employment, than beneficiaries of National Programmes in terms of employment and turnover. This suggests some skewness with larger businesses having been supported. They are also slightly less likely to be in manufacturing and are on average younger than beneficiaries of National Programmes. They are also marginally more likely to have been in receipt of other non-RGF support than National Programme beneficiaries and do – on average – receive larger amounts through these alternative streams. The effect this may have on assessing additional impacts was controlled for by using these past support measures when identifying comparison groups of businesses.

14. Broadly, alongside these differences, National and Regional Programme beneficiaries share key characteristics. They are both more like the general business

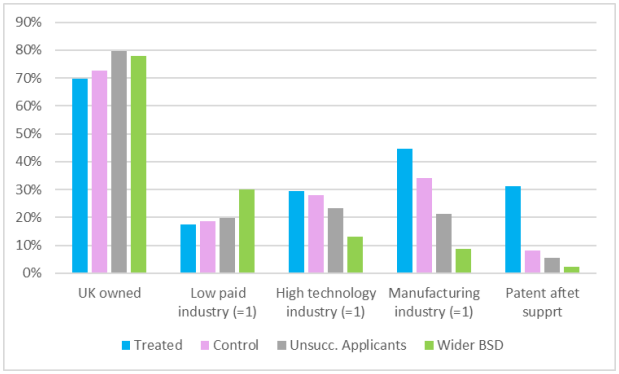
population than beneficiaries of Regional Projects. Comparing beneficiaries to unsuccessful applicants reveal that firms successfully applying for programme support are smaller than unsuccessful applicants in terms of employees and turnover most years, but slightly less likely to have received other forms of non-RGF support.

15. It is important to check the matching quality. Checks firstly look at the average characteristics of the supported businesses and the selected control businesses. Figure 5.1 indicates some key characteristics of the supported businesses, the businesses selected after matching, the unsuccessful applicants and the wider BSD. The focus is the cohort of businesses supported in 2013. The Programmes supported SMEs and so the characteristics in the figure highlight that the four groups are similar except in the high level of manufacturing SMEs that were selected into the programmes. Also, the wider BSD has a higher proportion of businesses that are in low paying industries and a lower proportion in high technology.

Figure 5.1: Characteristics of Supported Businesses and Comparator Groups, 2013



Scheme 3: National Programmes



Scheme 4: Regional Programmes

16. There are statistical tests to confirm that the two groups are similar. The attention then turns to whether individual businesses are matched to appropriate unsupported businesses in terms of the propensity score.

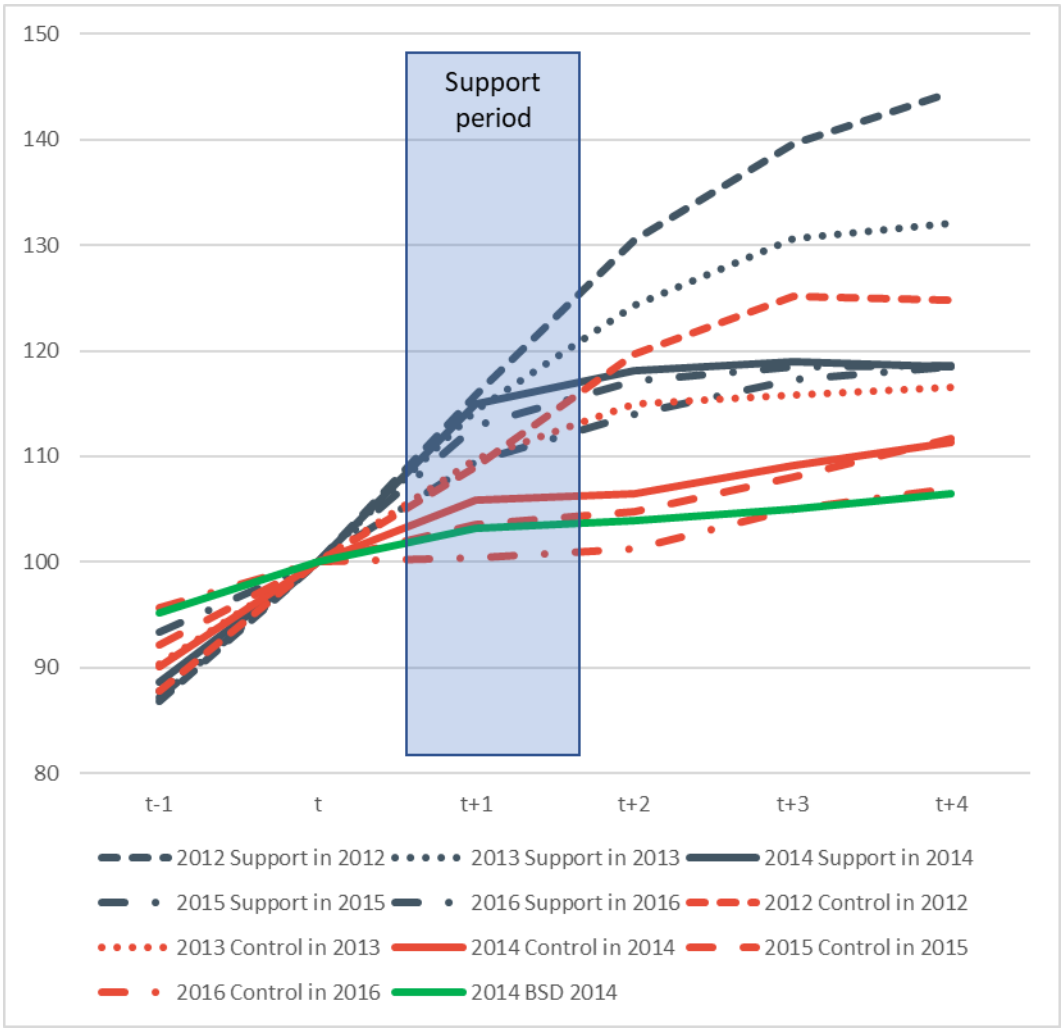
17. A second test, also used in this work, is to check how sensitive the overall results are to the possibility some aspect of the selection process has been missed. These tests model how the amount of bias that would be needed to make estimates insignificant. Annex C indicates the results of these analyses. Generally, the programme beneficiaries have been easier to match (than the other schemes) and – as the next section highlights – results are robust to alternative specifications suggesting that the counterfactual impact analysis is less affected by alternative specifications.

Employment Impacts

18. Figure 5.2 illustrates the growth trajectory for five cohorts – from 2012 to 2016 – of National Programme beneficiaries in blue and highlights the middle cohort in using a solid line for those supported in 2014 (i.e. financial year 2014/2015). The figure compares

beneficiary employment growth with growth observed in a control group derived using the propensity score matching approach of the last section in red. Each cohort has a matched group tracked over four years. The 2014 cohort is in bold dark blue, and the matched control is red.

Figure 5.2: Employment index National Programme Beneficiaries and Comparator Groups



Note: Indexed job growth for cohorts of National Programme beneficiaries and matched control groups – derived from Model II. Matched control groups are derived from the PSM procedure, unmatched illustrate the growth trajectory of the entire match pool without any matching in 2014.

19. The average growth rate in 749 businesses that successfully applied for RGF funds through National Programmes in the 2014 (financial year) is 18% over the period. In the other periods – indicated by various dashed lines – it is noticeable that early cohorts have higher employment growth. While businesses supported in 2014, 2015 and 2016 all have four-year employment growth of 6% in the later years, 11-15% in the three earliest cohorts. The figure also indicates in green the four-year growth in employment seen in the wider business population, as recorded in the BSD, after 2014. This is 6%, a figure similar to

employment growth seen in earlier and later windows as UK employment growth was relatively stable over the period).

20. The figure highlights that supported businesses out-perform comparable businesses. The growth seen after support is between 7% and 20% greater for the businesses supported in Scheme 3 National Programmes. Also, it indicates that matching may have been quite successful, in that the pre-support growth in employment observed in the counterfactuals (t-1) are quite close to the pre-support growth in the supported businesses.

21. Table 5.3 provides the detailed analysis of the difference-in-difference for each cohort (focusing on the growth two years after support) and different periods after support for the 2014 cohort. It shows firstly the growth in the supported businesses and then calculates the difference in growth when the supported businesses are compared to three potential comparators. The significance of the results is also indicated.

22. The treatment effect is statistically significant across the three models of control groups and the different pools from which the control group are selected. The table indicates results for two models selecting the control from unsuccessful applicants (Preferred and Model I/Applicant) and the final column indicates the performance differential when the wider population is used. There is a consistency across models and the preferred model generally has significant support impacts on employment growth and – though of similar magnitude – these are a little lower than the other models. This is a consequence of a better representation of selection.

Table 5.3: Estimates of Additional Employment Growth in Scheme 3

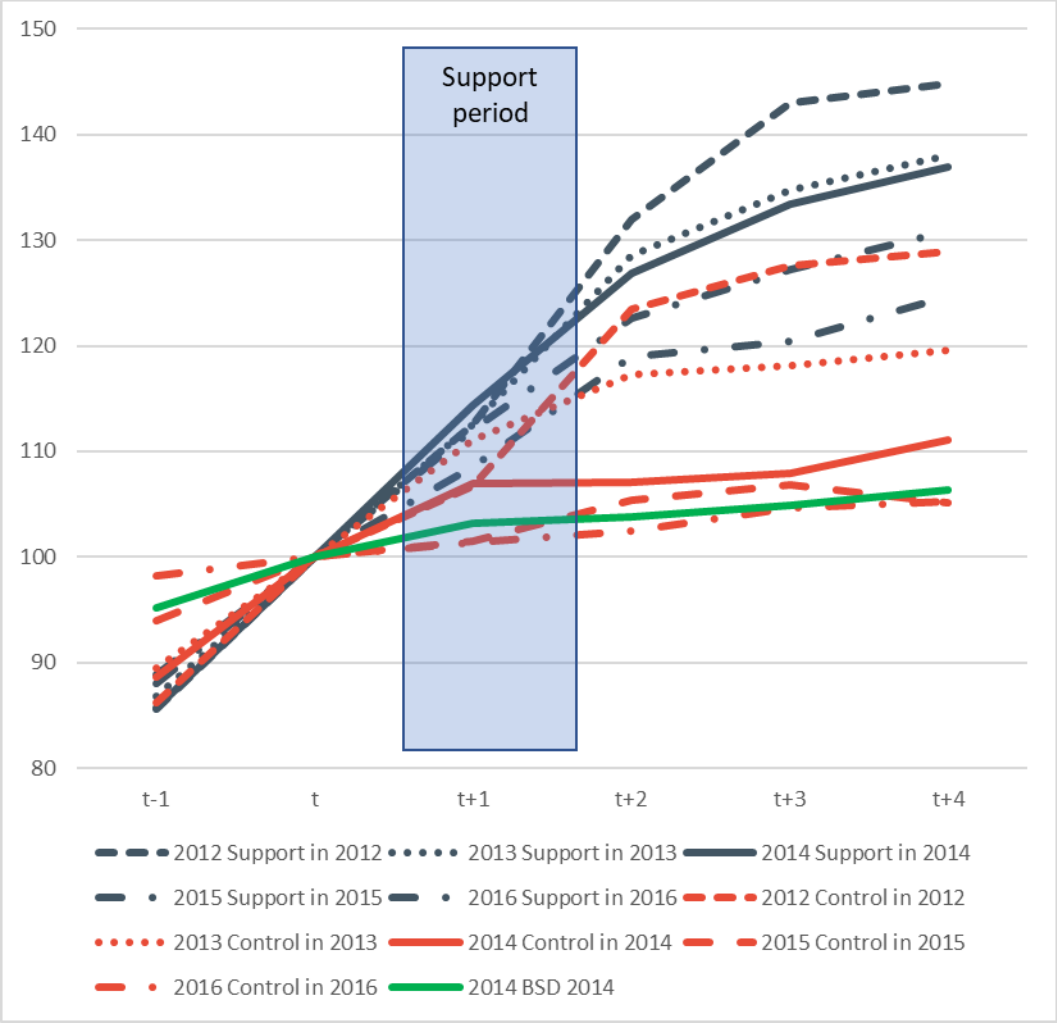
	Cohort	Businesses		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control – preferred model**	**Model I / Applicant**	**Model I / BSD**
Using the BSD difference in differences estimates						
Empl Growth, after 2 years	2014	749	18.1%	10.9% (3.24***)	11.7% (3.27***)	10.5% (3.24***)
Empl Growth, after 3 years	2014	749	19.0%	9.1% (2.33**)	11.6% (2.82***)	6.4% (1.69*)
Empl Growth, after 4 years	2014	749	18.4%	6.4% (1.45)	7.3% (1.58)	10.2% (2.16**)
Empl Growth, after 2 years	2012	899	30.5%	9.0% (3.34***)	12.1% (4.50***)	22.2% (7.15***)
Empl Growth, after 2 years	2013	642	24.3%	8.1% (2.44**)	10.4% (3.12***)	18.7% (5.28***)
Empl Growth, after 2 years	2015	687	14.0%	8.8% (2.58**)	9.5% (2.63***)	11.2% (2.89***)
Empl Growth, after 2 years	2016	787	17.2%	15.7% (4.60***)	12.8% (3.82***)	11.0% (3.31***)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

23. Comparing the job creation across the cohorts shows some evidence that while growth in employment is higher in earlier cohorts of support, the difference in growth with comparable businesses is quite stable. If anything, the more recent cohorts of support are – in their first years – showing slightly higher additional growth than the earlier cohorts. The annex provides figures comparing beneficiary employment growth with the growth observed in non-beneficiary groups.

24. The Regional Programme beneficiaries showed similar trends as the National Programme beneficiaries and Figure 5.3 is similar to Figure 5.2. The Regional Programme beneficiaries outgrow all comparators and across the cohorts, with the blue lines consistently lying above the red equivalents. Again, the figure highlights the 2014 cohort in a solid line, where employment growth was 36.9% over four years after support. The preferred counterfactual grows at 13.7% over the same period. The figure also indicates the pre-support growth trends of the supported and counterfactuals are close, suggesting that the matching has been successful in finding businesses on a similar growth trajectory prior to RGF support.

Figure 5.3: Employment index Regional Programme Beneficiaries and Comparator Groups



Note: Indexed job growth for cohorts of Regional Programme beneficiaries and matched control groups – derived from Model II. Matched control groups are derived from the PSM procedure, unmatched illustrate the growth trajectory of the entire match pool without any matching in 2014..

25. Table 5.3 then presents estimates of the difference-in-difference across the cohorts for two years after support and for three and four years after support for the 2014 cohort.

The 1,247 businesses that received support in 2014 grew at 26.9% in the first two years after support and 33.4% and 36.9% in the next two years.

26. As with Scheme 3, National Programmes, the difference-in-difference on growth is higher in the later cohorts, though the level of growth seen is higher in earlier cohorts. Difference-in-differences are again significant across estimates.

Table 5.3: Estimates of Additional Employment Growth in Scheme 4

	Cohort	Count		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control – preferred model**	**Model II / Applicant**	**Model I / BSD**
Using the BSD difference in differences estimates						
Empl Growth, after 2 years	2014		26.9%	18.5% (7.13***)	19.3% (7.46***)	23.4% (8.84***)
Empl Growth, after 3 years	2014	1247	33.4%	23.6% (7.86***)	23.7% (7.85***)	28.7% (9.13***)
Empl Growth, after 4 years	2014		36.9%	23.2% (6.73***)	23.8% (6.84***)	33.0% (8.83***)
Empl Growth, after 2 years	2012	272	31.9%	6.9% (1.24)	8.4% (1.53)	16.7% (2.58***)
Empl Growth, after 2 years	2013	1099	28.6%	9.6% (3.67***)	9.3% (3.44***)	17.7% (6.47***)
Empl Growth, after 2 years	2015	490	22.6%	16.3% (4.30***)	21.7% (5.30***)	21.9% (4.90***)
Empl Growth, after 2 years	2016	270	18.9%	16.1% (3.51***)	14.8% (2.99***)	14.1% (3.16***)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

27. Table 5.4 calculates the additional jobs for the two Programmes. Overall, the growth in employment seen in the National Programmes was between 14.0% and 30.5%; for the Regional Programmes, the range was 18.9% to 31.9%. The comparator businesses also grew but there was a positive and generally significant difference, with this difference being 8.1% and 15.7% for the National Programme and 6.9% to 18.5% for the Regional Programmes.

Table 5.4: Estimates of jobs created for Regional and National beneficiaries

Model used	Net additional job years created	Gross job years created from treatment	Additionality ratio	2yr Growth in Treated	Control – Preferred Model	t-stat
Scheme 3: National Programmes						
Supported in 2012	19724	27981	70%	30.5%	9.0%	3.34***
Supported in 2013	11633	17342	67%	24.3%	8.0%	2.44**
Supported in 2014	2369	6040	39%	18.1%	11.0%	3.24***
Supported in 2015	978	2737	36%	14.0%	9.0%	2.58**
Supported in 2016	241	3448	7%	17.2%	16.0%	4.6***
Total across cohorts	**34944**	**57547**				
Scheme 4: Regional Programmes						
Supported in 2012	3334	4272	78%	31.9%	7.0%	1.24
Supported in 2013	25676	39481	65%	28.6%	10.0%	3.67***
Supported in 2014	17008	51406	33%	26.9%	18.0%	7.13***
Supported in 2015	2344	8028	29%	22.6%	16.0%	4.3***
Supported in 2016	244	1591	15%	18.9%	16.0%	3.51***
Total across cohorts	**48607**	**104777**				

Formula for calculation:

$$\text{Net additional job years created} = \text{Gross job years created} * \frac{Treatment\ effect\ (ATT)}{\text{Growth rate in treated group}}$$

Notes: Table reports the net total number of job years created from treatment-year to three years after. Additionally ratio is calculated as the ATT-estimate divided by the growth rate in the treated group. T-stat for ATT from PSM analysis listed. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

28. The table indicates how the share of employment growth that is additional declines over the cohorts of support for both Regional and National Programmes. This could result from a variety of factors. Firstly, the RGF was support put into place in response to the Recession and – as the economic climate improved – the table may demonstrate that the effect of support, while still significant, became less effective. There may also be a reduced effect as the support widens beyond the initial set of businesses, which may be most ready to capitalise on the RGF programme.

29. Employment in the businesses supported by National Programmes grew by 57,547 job years. Using the growth seen in supported businesses but not seen in the comparators, 34,944 years of employment are additional in the National Programmes. For the Regional Programmes, there is 48,607 years of additional employment (though the growth seen in the businesses did not differ as much with the counterfactual as was the case for the National Programmes).

Firm survival impacts

30. For the programmes, the support provided to businesses affects their chance of survival. This differential survival rate could result in additional economic activity, occurring due to the support resulting in fewer businesses closing than otherwise would be the case.

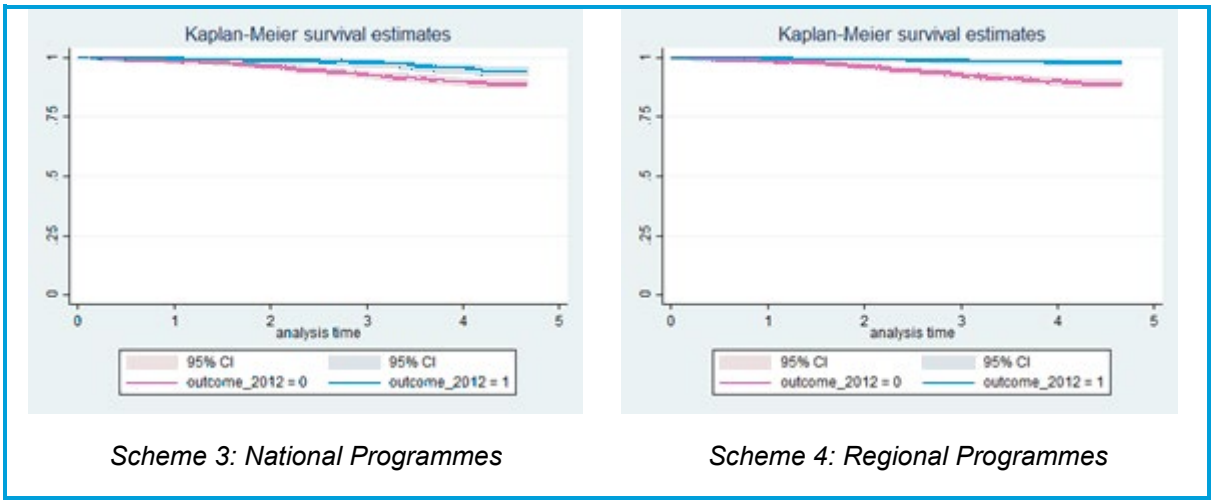
31. The variation in the survival rates of the samples of businesses that are supported each year is likely to be due to the characteristics of the supported businesses differing

from the wider BSD. So, as the businesses that RGF programmes support are larger or older than the wider BSD, their survival is likely to be higher than the wider BSD and these determine survival rates.

32. To control for this, the Box-Cox approach was used to model survival rates for the supported businesses, the wider BSD and the matched businesses. The approach is based on other studies (e.g. Moffat, 2013). The survival functions for the supported businesses and matched controls are presented in Figure 5.4 for the 2013 National and Regional Programme beneficiaries. The survival rates of businesses each year after support is plotted and – as expected – exhibits a fall as the graph moves to more recent years, reflecting that a share of businesses is likely to close each year.

33. In figure 5.4, the left panel presents the survival rates for the unsupported where the matched businesses is the lower line. Around the line are confidence levels, indicating how the survival rates are significantly lower than the survival rates for the supported businesses under scheme 3, with this indicated by the confidence intervals for the matched group not overlapping and being below the supported ones.

Figure 5.4: Business Survival Functions for programme supported in 2013



Scheme 3: National Programmes *Scheme 4: Regional Programmes*

34. On the right-hand side is the survival rate estimated for the supported businesses and the matched counterfactual, for scheme 4, the Regional Programmes. The matched control group is less likely to survive at each year following support.

35. A second analysis has then been performed to understand the impact on job years as survival has been impacted by support. This can go in two directions. On the positive side is the higher chance of a business surviving, resulting in job years increase. This is the case in 2012 for Scheme 4 (18 job years) and in 2013 for Scheme 4 (1,494 job years). However, if supported businesses are larger than the matched control group even after matching, then there is a negative job years impact because some businesses closed despite receiving support and were large. In 2012, this offsets Scheme 4's survival premium and 256 job years were lost despite support so that overall, 238 job years were lost rather than survival increasing the additional jobs. For the following year, however, this

is not the case. Supported businesses are larger, but overall, the higher survival rate means 774 additional job years. Firm closure does have an employment impact and the exit rates for businesses treated 2013 and 2014 are around 5% lower compared to similar unsuccessful applicants This translates into 1,167 job years safeguarded through lower exit rates amongst beneficiary businesses than comparable unsupported businesses using survival modelling.

36. Businesses supported by National Programmes experience increases in employment over the period after support. Reduced firm closure has an employment impact as jobs are lost if businesses fold. Comparing beneficiaries receiving support in 2012 through 2014 with matched unsuccessful applicants showed a differential rate of exit of between 3% and 8%. In total this translated into 236 job years saved.

37. For National Programmes this implies that few additional jobs are due to a survival premium that supported businesses attract. This may be because support is more recent than for Regional Programmes and differential survival rates are yet to be observed. It may also be because the nature of the support – a repayable loan is more common than a grant – meet investment needs of older businesses less likely to be facing the prospect of closing.

Earnings impacts and the quality of jobs

38. Workers are said to earn a "wage premium" if their wage is higher than it would be in a different business or occupation, given their ability, skills and experience. A premium may arise if the worker is more productive, and the higher wage reflects this. To estimate the impact of RGF support, wage premiums can be estimated. There is ample evidence that firm heterogeneity plays an important role in explaining differences in wages across firms, i.e. workers that look similar on paper earn significantly different wages depending on the firm they work for (Song et al., 2015). In a recent paper, Aghion et al. (2018) point to a significant wage premium that grows with the R&D intensity of a business.

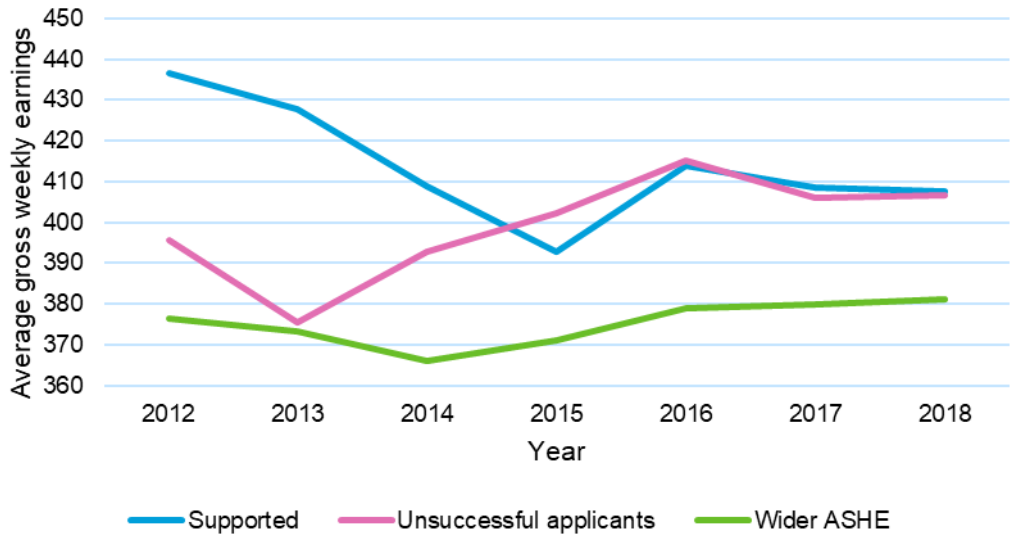
Earnings impacts in National Programme Beneficiaries

39. Figure 5.5 plots average earnings at businesses from the start of their support. The National Programmes differ from the Regional Projects in that there was no sustained wage premium in beneficiaries compared to unsuccessful applicants following support.

40. Average earnings at supported businesses were much higher than both those in unsuccessful applicants and the wider ASHE population in the first programme cohorts (in 2012). The premium over unsuccessful applicants however is not maintained in beneficiaries after 2012, and there is no evidence that beneficiary jobs were any different in quality to jobs in the unsuccessful applicants, though both groups have wages above the average in the wider ASHE population.

41. This is suggestive of change in the composition of supported businesses over time. It is also indicative – as noted for Regional Projects – that it is difficult to ascribe quality impacts to RGF interventions; rather it is probably more due to supported businesses and the unsuccessful applicants operating in activities with higher value-added, higher productivity, and a more skilled workforce than the average UK business.

Figure 5.5: Average earnings in RGF National Programme supported businesses

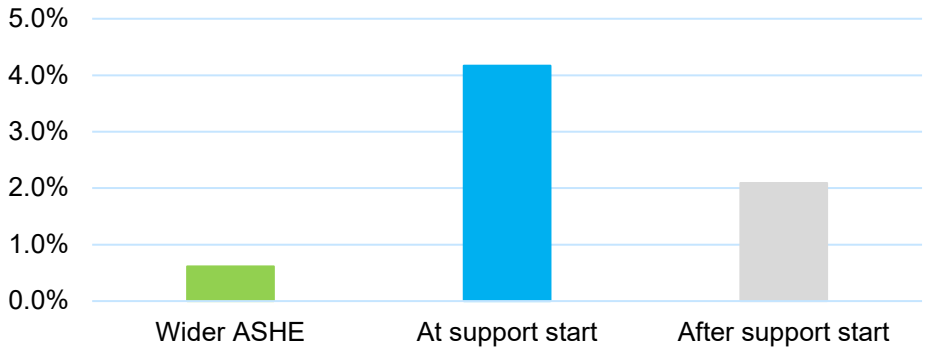


Note: Averages were calculated in logs and then exponentiated to reduce the impact of exceptionally high earnings.

42. As with previous analysis, looking beyond the level of wages might help to determine the quality of RGF jobs. To consider this issue further, Figure 5.6 presents the changes in wages seen in supported businesses, looking at earnings growth around the time of the start of the RGF National Programmes. These figures only include individuals continuously employed by the same business, so they are not affected by businesses' hiring and firing decision.

43. Earnings of employees at businesses in the wider ASHE grew by 0.6% annually. At supported units, earnings growth was over 4% from the year before support start to the year of support start. After the start of the support, earnings continued to grow at an average of around 2% annually.

Figure 5.6: Earnings Growth around the time of National Programme Support Start

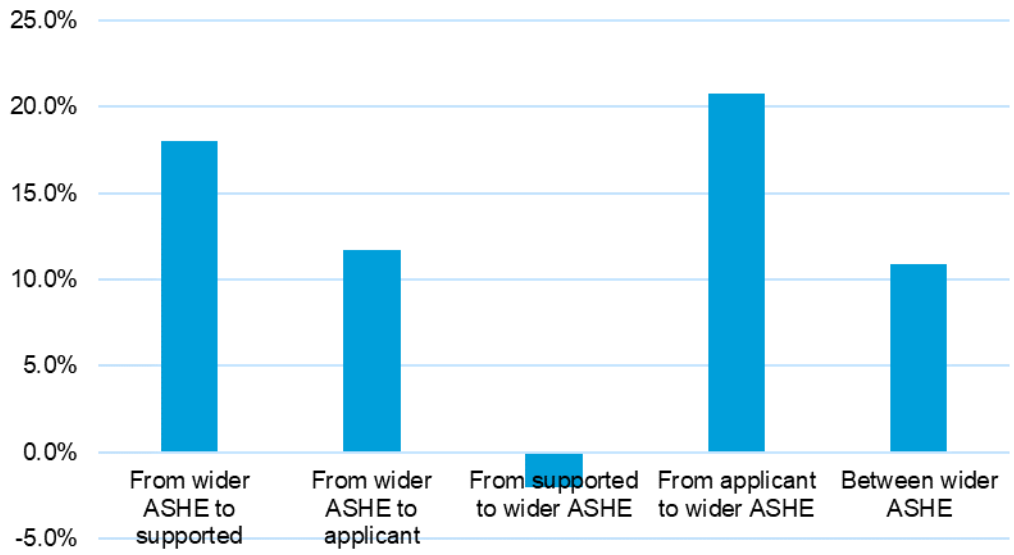


44. The panel structure of the ASHE data can provide another way to understand RGF jobs, as tracking the same person over time controls for that individual's characteristics, that are otherwise difficult to observe in data, for example qualifications or an entrepreneurial ability (D'Costa & Overman, 2014; Gibbons et al., 2014).

45. Figure 5.7 compares earnings of job switchers to and from an RGF National Programme beneficiary business to the earnings of employees moving between unsuccessful applicants, as well as businesses in the wider ASHE. Switchers to and from RGF National Programme supported businesses are considered if the switch occurred in the year of first support by the RGF or any year thereafter. Switchers are examples of employees in a supported business and unsupported, identical in every respect except being a year older.

46. The figure shows a premium of 18% when switching jobs to a supported business. In comparison, the premium is only 12% when moving to an unsuccessful applicant business. Employees who leave a supported business and join a business in the wider ASHE saw their earnings decline by 2% on average. In contrast, employees who left an unsuccessful applicant business to join a business in the wider ASHE experienced an earnings-increase of 20% on average. Employees changing jobs between businesses in the wider ASHE gained an earnings-increase of 11%.

Figure 5.7: Earnings growth of job changers for National Programme Support



	Earnings growth	SD	Number of observations
From wider ASHE to supported	18.0%	0.59	184
From wider ASHE to applicant	11.7%	0.63	144
From supported to wider ASHE	-2.0%	0.51	133
From applicant to wider ASHE	20.8%	0.63	146
Between wider ASHE	10.9%	0.61	112,733

1.

47. The analysis of earnings provides evidence that the employment created through RGF support are in businesses that have well-paid jobs, indicative of quality. The fact that the jobs are better quality suggests that the safeguarded and created jobs would tend to improve productivity, with those switching into the businesses raising their earnings. However, it should be noted that there is evidence that the wage premium is also present in the unsuccessful applicants for RGF support. This suggests that the jobs created are higher quality but that the support has not in itself raised the quality of the jobs.

Earnings impacts in Regional Programmes: Comparing with the National Programmes

48. Businesses supported through Regional Programmes pay somewhat higher wages than the general business population. The analysis distinguishes between beneficiary units, the specific plants, offices or branches where support was received, and beneficiary businesses, which include the whole enterprise group which was supported. Note that for small businesses with a single establishment, the unit and business are the same. Unsuccessful applicants to the scheme serve as a comparison group which may be more similar to the supported businesses than the wider ASHE population.

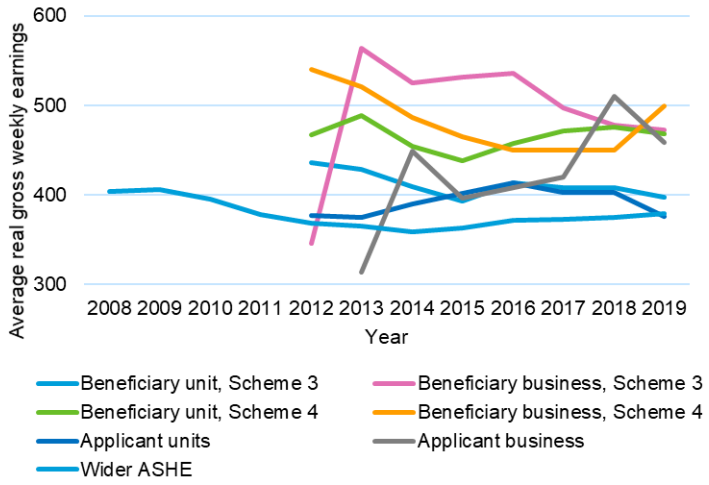
49. Table 5.4 shows summary statistics for the different groups. Earnings and hours worked are higher in Regional Programmes than in National Programmes. The difference is similar when comparing only the supported units or the whole businesses. Earnings at unsuccessful applicants fall in the middle.

Table 5.4: Earnings data summary statistics for programmes

	Beneficiary unit S3		Beneficiary unit S4		Beneficiary bus S3		Beneficiary bus S4		Applicant unit		Applicant bus		Wider ASHE	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Basic weekly pay (real)	424	225	501	312	497	251	499	324	437	290	464	291	456	380
Weekly overtime pay	33	87	23	65	33	81	20	64	22	57	26	70	14	77
Gross weekly earnings (real)	472	258	541	344	580	289	559	392	482	313	512	329	492	425
Total weekly hours	38.6	10.5	38.4	8.8	39.1	9.2	38.2	7.7	36.4	10.4	37.9	11.0	33.2	11.1
Weekly overtime hours	2.1	5.0	1.6	4.2	2.1	5.0	1.3	4.0	1.7	4.1	1.8	4.9	1.1	3.5
Age	41.8	13.4	41.7	12.9	41.5	12.3	40.3	12.1	39.5	12.8	40.4	12.6	40.7	12.8
Full-time	0.9	0.4	0.9	0.3	0.9	0.3	0.9	0.3	0.8	0.4	0.8	0.4	0.7	0.5
Public sector employer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4
Observations	3314		5691		2505		8907		3011		3948		1994799	

50. Figure 5.8 shows earnings trajectories over time. Note that supported businesses only enter the calculation from the year of support start, while unsuccessful applicants enter from the application year. These averages are calculated at the business level and do not account for potential changes in the composition of the labour force over time. Real earnings are highest in national programme supported businesses but have been falling over time. Earnings at supported units by national programmes were lower on average and have fallen at a similar rate. In contrast, earnings at units supported by regional programmes have risen in recent years. Earnings in the wider ASHE population are the lowest. They fell after the financial crisis of 2008 and grew moderately since 2014.

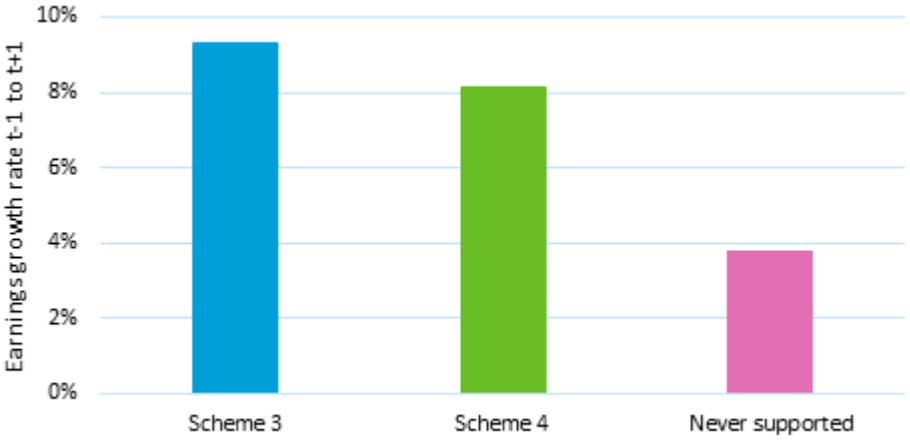
Figure 5.8: Average earnings in RGF Programme supported businesses



Note: Averages were calculated in logs and then exponentiated to reduce the impact of exceptionally high earnings.

51. Figure 5.9 looks closer at the changes in earnings around the time of support start. It looks at earnings of workers who were continuously employed by supported businesses from the year before support start to the year after support start. The figure shows that earnings grew at almost 10% in firms supported by national programmes and 8% in firms supported by regional programmes. In contrast, earnings grew only by around 4% for workers continuously employed for two years by the same firm in the wider ASHE.

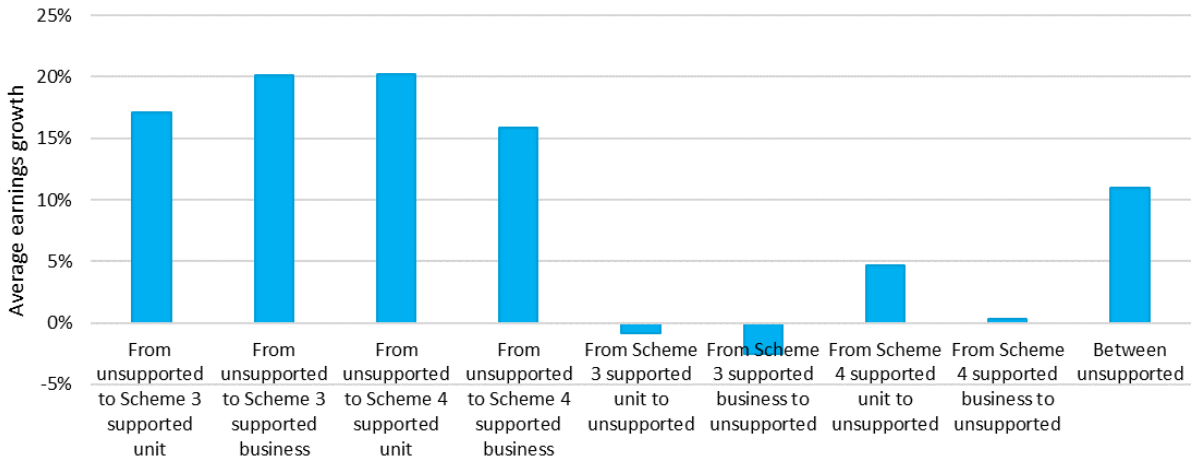
Figure 5.10: Earnings growth around the time of support start



52. Figure 5.11 takes a different angle and looks at earnings for workers who take up a new role at supported businesses. A job change is generally associated with substantial earnings growth, as the last column in figure 5.11 shows. Note that this only includes those who start a new job at a different firm from employment in another firm, not from unemployment, inactivity, school or university. Those taking up employment at a supported unit or businesses see their earnings increase between 15% and 20%. This contrast with

those who leave employment at those firms to start a new job somewhere else: they experience moderate earnings increases of up to 5%, or small losses.

Figure 5.11: Earnings growth of job changers



	Earnings growth	SD	Number of observations
From unsupported to Scheme 3 supported unit	17.12%	0.58	210
From unsupported to Scheme 3 supported business	20.08%	0.61	147
From unsupported to Scheme 4 supported unit	20.22%	0.55	370
From unsupported to Scheme 4 supported business	15.86%	0.46	604
From Scheme 3 supported unit to unsupported	-0.81%	0.50	177
From Scheme 3 supported business to unsupported	-2.49%	0.46	126
From Scheme 4 supported unit to unsupported	4.69%	0.57	255
From Scheme 4 supported business to unsupported	0.31%	0.49	374
Between unsupported	10.97%	0.61	125,684

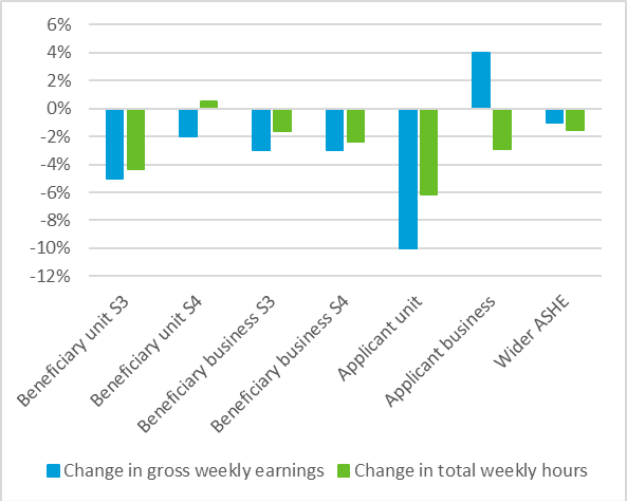
2.

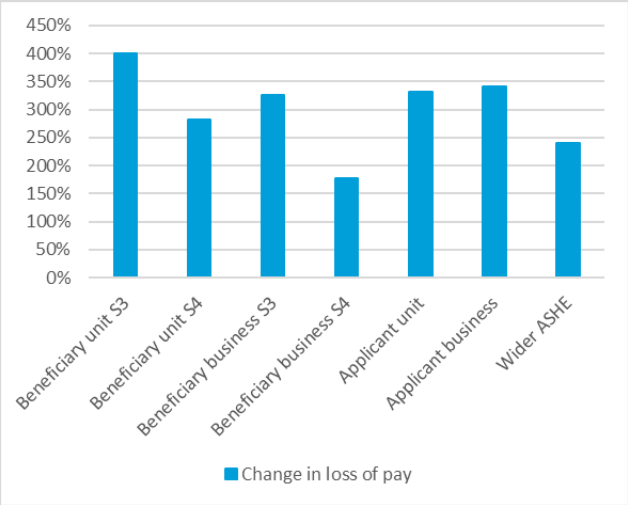
Initial results on effects from the Covid-19 pandemic

53. As ASHE is conducted in April each year, the 2020 survey captures the labour market at the beginning of the first lockdown caused by the Covid-19 pandemic in the UK. Comparing 2020 to 2019 results on earnings and hours worked gives some initial indications of the impacts of the lockdown. Crucially, ASHE also records a marker for workers whose pay was lower due to illness or furlough.

54. Figure 5.12 shows the effects at businesses supported by National and Regional Programme schemes. For supported businesses, earnings dropped slightly more than hours worked, suggesting that firms cut pay and did not only reduce hours. Earnings and hours dropped to a larger extent than in the wider ASHE. The right panel suggests that businesses made use of the furlough scheme, as the share of employees who lost pay was multiple times higher than in 2019.

Figure 5.12: Covid-19 lockdown effect on businesses supported by national and regional schemes





Turnover and Productivity Impacts

55. Moving from employment impacts to assessment of turnover and productivity, the analysis found a higher growth rate in sales amongst treated beneficiaries across both comparison groups and models. The treatment effect was statistically significant in both the matched businesses from the wider BSD, and the matched unsuccessful applicants where applicants were matched also on receipt of other support. However, the effect is not apparent in all National Programme cohorts, with the later cohorts showing weak turnover growth.

56. The difference in productivity growth is generally insignificant between supported businesses and those in comparable unsupported businesses. Real turnover growth therefore is comparable to the growth seen in employment. The exception is the National Programmes later cohorts, where low real turnover growth combined with strong employment growth amongst supported business leading to a fall in real turnover per employee. Graphs for each cohort are annexed.

Analysis of National Programmes

57. Businesses receiving support in National Programmes in the 2012-14 cohorts have seen a consistent and steady growth in sales since the RGF, exceeding the performance of both comparator businesses in the wider BSD and unsuccessful applicants. In this first (2012) cohort of support, the level of growth was higher than the overall sample of unsuccessful applicant starting immediately at the year of treatment.

58. This is illustrated in Figure 5.13 below. After 2014, the picture does change with the matched counterfactual showing stronger growth than the supported. This leads to a negative difference-in-difference, and this is more pronounced for the productivity index. The reasons for later rounds of National Programmes having less impacts of turnover could be a consequence of the economy being in a stronger cycle than the period immediately after the recession; it could also reflect somewhat different businesses which are growing but taking longer to translate employment growth into sales.

Figure 5.13: Real Turnover Index and Turnover per Employee for National Programme Beneficiaries and Comparator Groups

Note: Indexed real turnover growth for 2012 and 2016 cohort of programme beneficiaries and control groups. Matched control groups are derived from the PSM procedure, unmatched illustrate the growth trajectory of the entire match pool without any matching. Each growth trajectory is indexed at its baseline value.

59. The average growth rate among beneficiaries receiving RGF funds through National Programmes in the 2012 (financial year) was 48% over the four-year period following support. Similar to employment, this is consistently higher than the average growth in the matched control groups with matched unsuccessful applicants experiencing slightly low growth rate than the unmatched.

Table 5.5: Turnover Difference-in-Differences by Cohort, National Programmes

	Cohort	Businesses		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control - preferred model**	**Model I / Applicant**	**Model II / Applicant**
Using the BSD difference in differences estimates						
Turnover Growth, 2yr	2012	899	22.9%	15.5% (4.1***)	20.0% (5.2***)	27.7% (6.7***)
Turnover Growth, 2yr	2013	642	17.8%	20.7% (4.3***)	20.2% (4.1***)	18.4% (3.7***)
Turnover Growth, 2yr	2014	749	21.8%	13.1% (2.44**)	14.8% (2.7***)	16.2% (3.2***)
Turnover Growth, 2yr	2015	687	3.7%	-6.5% (-1.25)	-6.8% (-1.32)	-4.8% (-0.96)
Turnover Growth, 2yr	2016	787	7.4%	2.8% (0.53)	2.8% (0.53)	4.1% (0.83)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

60. For businesses securing funding in subsequent years, the turnover growth was higher than the matched control groups and the difference statistically significant in early cohorts, but growth does not outpace the control by 2016.

Table 5.6: Turnover per Employee Difference-in-Differences by Cohort, National Programmes

	Cohort	Businesses		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control - preferred model**	**Model I / Applicant**	**Model II / Applicant**
Using the BSD difference in differences estimates						
Productivity Growth, 2yr	2012	899	-5.8%	6.0% (1.63)	7.0% (1.96**)	4.9% (1.32)
Productivity Growth, 2yr	2013	642	-5.2%	11.6% (2.51**)	8.9% (1.92*)	-0.3% (-0.06)
Productivity Growth, 2yr	2014	749	3.1%	2.0% (0.41)	2.8% (0.56)	5.2% (1.12)
Productivity Growth, 2yr	2015	687	-9.0%	-14.1% (-2.8***)	-14.9% (-3.1***)	-14.4% (-3.1***)
Productivity Growth, 2yr	2016	787	-8.3%	-11.2% (-2.22**)	-8.9% (-1.73*)	-6.2% (-1.29)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

61. The analysis of productivity growth did not yield statistically significant differences between the treated and the control groups and vary markedly across the cohorts. Broadly, sales growth is tracking employment growth. Productivity changes are generally harder to discern because the productivity ratio is more volatile, especially because turnover – the only financial metric that is available for small businesses in the ONS data – is only a proxy for the changes in value added seen in the businesses and can be quite noisy making productivity measures imprecise.

Analysis of Regional Programmes

62. Business beneficiaries displayed higher turnover growth than the matched control groups across all cohorts and the difference statistically significant. In the 2012 and 2016 cohorts, plotted below, beneficiaries' turnover grew around 40% in each cohort; compared

with around half this rate for the matched unsuccessful applicants. This trend held true across all cohorts (see annexed graphs and table below), with beneficiaries growing at around 36%, followed by unsuccessful applicants who grew between 19% and 17%, and then the BSD matched sample who fluctuated between negative growth and 10%. The additionality ratio is also higher for the matched BSD than the matched unsuccessful applicants. Tables 5.7 and 5.8 indicate a more consistent picture across cohorts for the Regional Programmes than the National, in terms of two-year difference in differences: they are significant for real turnover growth and positive, but the productivity measure is generally insignificant suggesting the productivity effects by this measure are modest.

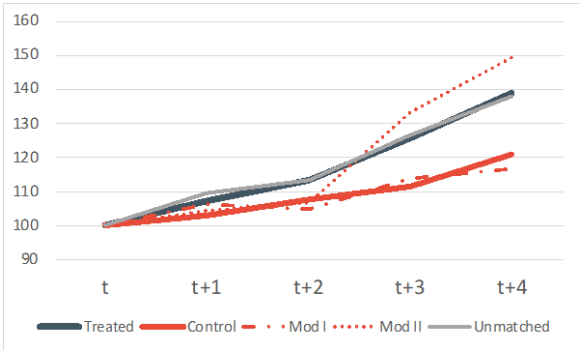
Table 5.7: Turnover Difference-in-Differences by Cohort, Regional Programmes

	Cohort	Count		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control - preferred model**	**Model II / Applicant**	**Model I / BSD**
Using the BSD difference in differences estimates						
Turnover Growth, 2yr	2012	272	13.5%	5.3% (0.80)	8.4% (1.30)	6.4% (0.96)
Turnover Growth, 2yr	2013	1099	13.9%	8.0% (2.10**)	8.8% (2.32**)	10.0% (2.8***)
Turnover Growth, 2yr	2014	1247	22.8%	18.5% (4.9***)	17.8% (4.6***)	23.2% (6.4***)
Turnover Growth, 2yr	2015	490	26.9%	23.2% (3.9***)	30.8% (4.7***)	26.0% (4.3***)
Turnover Growth, 2yr	2016	270	24.3%	27.4% (3.6***)	26.8% (3.5***)	28.1% (3.8***)

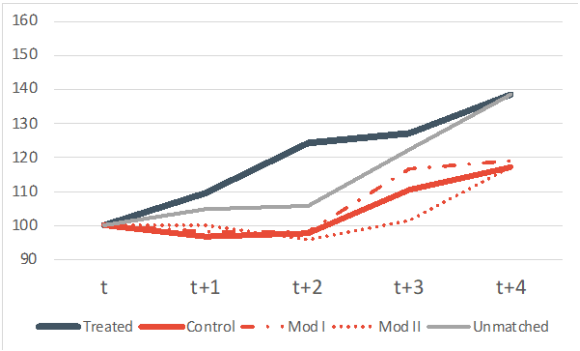
Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

63. Real turnover growth rates increased slightly across the cohorts, with the highest growth rate (36%) displayed among businesses supported in 2015 compared to 13% for the 2012 and 2013 cohorts respectively. However, the figures indicate growth picks up in earlier cohorts and potentially the impacts have had time to mature and that the time-scales applied are appropriate.

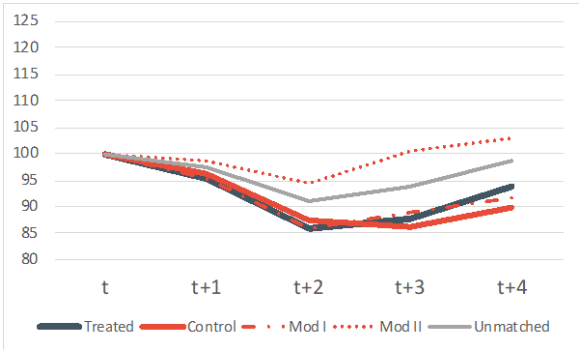
Figure 5.14: Real Turnover Index and Turnover per Employee for Regional Programme Beneficiaries and Comparator Groups



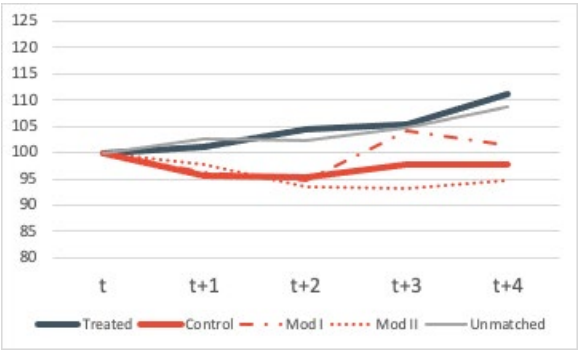
Real Turnover, 2012



Real Turnover, 2016



Real Turnover per Employee, 2012



Real Turnover per Employee, 2016

Note: Indexed real turnover growth for 2012 and 2016 cohort of programme beneficiaries and control groups. Matched control groups are derived from the PSM procedure, unmatched illustrate the growth trajectory of the entire match pool without any matching. Each growth trajectory is indexed at its baseline value.

64. The productivity analysis of Regional Programmes did not yield statistically significant differences between the treated and the control groups. Productivity growth fluctuated across the cohorts, with businesses supported in 2012 and 2014 displaying small positive productivity gains, but businesses supported in 2013 showing a small negative growth.

Table 5.8: Turnover per Employee Difference-in-Differences by Cohort, Regional Programmes

	Cohort	Count		Difference-in difference (t-stat)		
Model used			**Growth in Treated**	**Control - preferred model**	**Model II / Applicant**	**Model I / BSD**
				Using the BSD difference in differences estimates		
Productivity Growth, 2yr	2012	272	-14.0%	-1.4% (-0.22)	0.0% (0.00)	-8.8% (-1.34)
Productivity Growth, 2yr	2013	1099	-11.4%	-1.5% (-0.43)	-0.4% (-0.12)	-6.5% (-2.02**)
Productivity Growth, 2yr	2014	1247	-3.2%	0.0% (0.00)	-1.3% (-0.37)	-0.1% (-0.04)
Productivity Growth, 2yr	2015	490	3.5%	5.9% (1.11)	7.5% (1.29)	3.5% (0.67)
Productivity Growth, 2yr	2016	270	4.5%	9.7% (1.38)	10.5% (1.40)	11.8% (1.74*)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

Concluding remarks

65. This chapter presents estimates of the impacts of the National and Regional Programmes, using results from an econometric analysis of ONS administrative data. Programmes involved RGF supporting intermediaries to then provide support to businesses, usually SMEs or start-ups. Lists of supported businesses and unsuccessful applicants have been collected from the Programmes. The chapter first assesses employment, growth and survival using firm-level data. It then presents the results from the beneficiary survey conducted amongst beneficiary businesses.

66. Overall, additional employment has been achieved in both programmes, with supported businesses outpacing comparable businesses across all cohorts. There is also some modest additional employment due to the enhanced survival of businesses. There is evidence that the jobs are of higher quality, with wage analysis. Turnover measures are proving more complex picture. That may be a measurement issue, as the sales of a firm can only proxy for value added measures.

67. The analysis of earnings provides evidence that the employment created through RGF support are in businesses that have well-paid jobs, indicative of quality. The fact that the jobs are better quality suggests that the safeguarded and created jobs would tend to improve productivity, with those switching into the businesses raising their earnings. However, it should be noted that there is evidence that the wage premium is also present in the unsuccessful applicants for RGF support. This suggests that the jobs created are higher quality but that the support has not in itself raised the quality of the jobs.

6 Advanced Manufacturing Supply Chain Initiative Impacts

The Advanced Manufacturing Supply Chain Initiative (AMSCI) is a large-scale programme that has supported UK advanced manufacturing supply chains to boost competitiveness. The programme has received RGF funding of £276m as grant and has exceeded its targets in terms of Private Sector Match funding and reported jobs. AMSCI beneficiary businesses were treated in financial years 2012 to 2017 and have benefitted from both additional employment and higher wages.

Furthermore, businesses that benefited from AMSCI support pay substantially higher wages than those that did not and therefore, employees who start a new job at a supported business can earn a substantial wage premium. Among supported businesses, primes pay the highest wages with wages at supply chain businesses significantly lower, but still above the wider ASHE sample.

The chapter first assesses the employment, turnover and productivity effects of the AMSCI programme. It then moves to analyse the earnings impacts and quality of jobs at AMSCI supported businesses.

Findings

- The AMSCI supported businesses experienced strong employment growth. From year of treatment to four years later for those businesses treated 2012-2015[13] 87,305 years of employment were generated through new jobs.
- The analysis indicates that 27% of the employment growth is additional, in not being seen in the comparable businesses over the period. For the 389 supported AMSCI businesses, this equates to a total 23,572 additional years of employment out of the 87,305, an average of 61 per enterprise.
- The supported enterprises experienced a growth in employment of 20% and a growth in real turnover of 23% over the four-year period post support.

1. The Advanced Manufacturing Supply Chain Initiative (AMSCI) was set up in 2011 as a competitive fund run as part of the RGF, alongside the other support schemes. It sought to address traditional market failures associated with imperfections in financial markets, spillover effects of R&D activity, and the challenge for firms to internalise the full

[13] Due to smaller sample sizes, only 2012-2015 employment data could be published

benefits of training. It was designed to improve the global competitiveness of UK advanced manufacturing supply chains. Funding was made available to support research and development, skills training and capital investment to help UK supply chains achieve world-class standards and encourage major new suppliers to locate in the UK.

Impacts of the Advanced Manufacturing Supply Chain Initiative

2. Funding was allocated over seven discrete competitive funding rounds, and £276m has been committed to projects.

3. A scoping report and early assessment of additionality of the programme was published by BEIS in 2015 (BIS, 2015). The study identified benefits related to raising of capital, R&D and training expenditure amongst beneficiary firms as potential benefits of the programme. These could then have a positive impact on productivity (in terms of labour productivity and Total Factor Productivity). The study also considered that if this translated into reductions in output prices it could lead to an increase in the market share of programme beneficiaries and could then be accompanied by an increase in overall output (GVA) and employment. If this strengthening of the competitiveness of manufacturing supply chains were to occur, it would help beneficiary firms resist competition from non-domestic suppliers and support domestic firms to increase exports.

4. Most of the funding was drawn down in 2015 and the mean amount of funding per treated business was about £455,000.

Selection Modelling for AMSCI

5. The beneficiary list covered 686 incidences of support, accounting for a total of £276m of investment; 61% were AMSCI beneficiaries and 39% were beneficiaries of the National Aerospace Technology Exploitation Programme (NATEP), a fund supported through Scheme 5. 645 were able to be matched to enterprise numbers in the SRS, leaving 473 individual businesses. Where businesses received multiple instances of support, businesses were accounted for once at the first incidence of support and the total amount of funding each businesses received was calculated. 392 unique businesses were identified for matching to the ONS register using their year of first support equal to BSD year, accounting for £222m of support.

6. The analysis uses statistical matching to identify comparable businesses to act as the counterfactual. Propensity score matching is used to match each supported business to the one that most closely resembles it from the unsupported businesses. In this instance, looking at pre-support trends and propensity score balance tests support using the rejected applicants as opposed to the wider BSD in order to provide an appropriate counterfactual.

7. Table 6.1 shows the probit regression results to model the probability of being treated using the rejected applicants. Successful applicants across all rounds were pooled

together as the sample sizes were too small to do separately by year of support; the model was run for years 2012 to 2015. The highlights how selection from the rejected applicants tends to choose smaller, more knowledge intensive companies who have received government support before and are located outside of London and the South East.

8. The model using the wider BSD is also indicated and shows that almost all characteristics prove significant to selection. This highlights how the matching has to do far more work when selecting from the wider business population to find a counterfactual.

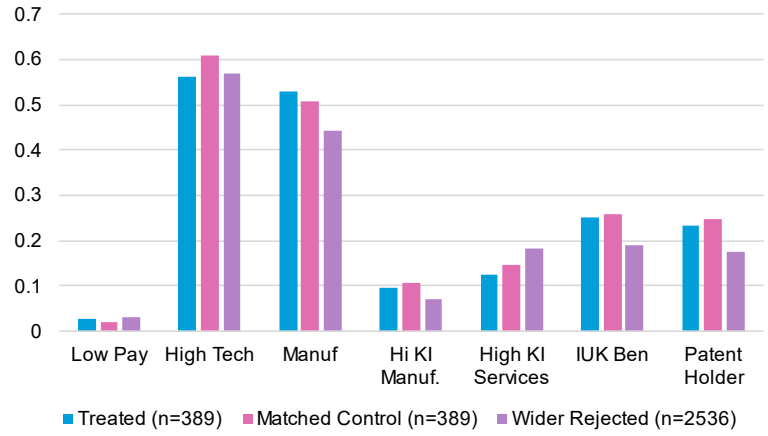
Table 6.1: Probit models of Selection for AMSCI Beneficiaries

Match pool	**Rejected Applicants**	**Wider BSD**
	Co-eff	**Co-eff**
Live Local Units	0.00	0.00
Uk Only		(-0.18)***
Scaleup	-0.72	-0.40
Lowpay		(-0.45)***
Hightech		0.27***
Manufacturing	0.32***	0.51***
Highly Knowledge Intensive Manufacturing	0.11	0.04
High Knowledge Intensive Service	(-0.61)***	(-0.17)**
High Med Manufacturing	(-0.27)**	(-0.13)**
High Med KI Serv	0.34**	0.25***
Patent Holder	(-0.07)	0.17***
IUK Ben	0.21**	0.75***
Herfindahl Index	0.23**	0.15***
Lagged Log Employment	0.08	0.17***
Lagged Log Real Turnover	(-0.03)	(-0.06)***
Support Before	0.16**	0.54***
London South East		(-0.19)***
Cohort dummies	Included	Includes
Employment categories	Included	Included
Turnover categories	Not included	Included
Pseudo R2	0.32	0.32
Observations	2,929	2280854

Note: The table reports the probit estimates of businesses selection for AMSCI funding. The dependent variable equals one for supported companies and zero for all others. BSD years have been stacked with modelling in terms of the year from support for each cohort and then cohort dummies added. All explanatory variables are lagged one year. Robust standard errors. *, **, *** stand for statistical significance at 10%, 5% and 1% level, respectively.

9. Figure 6.1 provides some results of the matching in terms of the baseline profile of business selected into support. The statistical matching leads to a sample of comparable businesses similar in these characteristics. Using model I and matching to the rejected applicants, Figure 6.1 categorises the treated and control businesses and highlights their similarities.

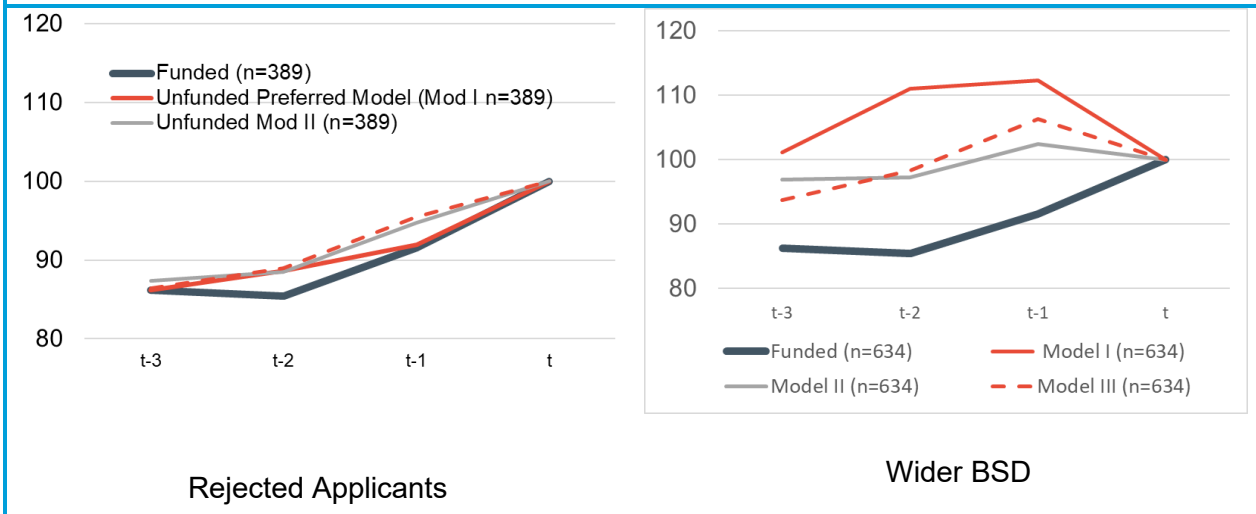
Figure 6.1 Profiles before and after matching



Source: AMSCI supported businesses linked to Business Structure Database and public database of projects funded by Innovate UK (IUK project before) and the patent register (patent holder). Knowledge intensive (KI) sectors as identified by Eurostat using indicators of skills mix. The control applicants include the matched enterprises from the rejected pool from year 2012 onwards.

10. Model I matches on size, in the form of categorical variables for employment and the number of live local units and approximates past growth using the scale-up dummy. This is a definition for fast growing companies by the Scale Up Institute, identifying businesses with more than 20% employment and turnover growth for the last three years. Furthermore, dummy variables for highly knowledge-intensive services and manufacturing are included, as is if the business is a patent holder. Lagged turnover and employment variables are included, as is a variable for whether or not the enterprise has been a beneficiary of Innovate UK support in the past, this indicates that the business are likely to be innovative. The model also includes a variable indicating whether or not the business has received any form of government support prior to receiving AMSCI support.

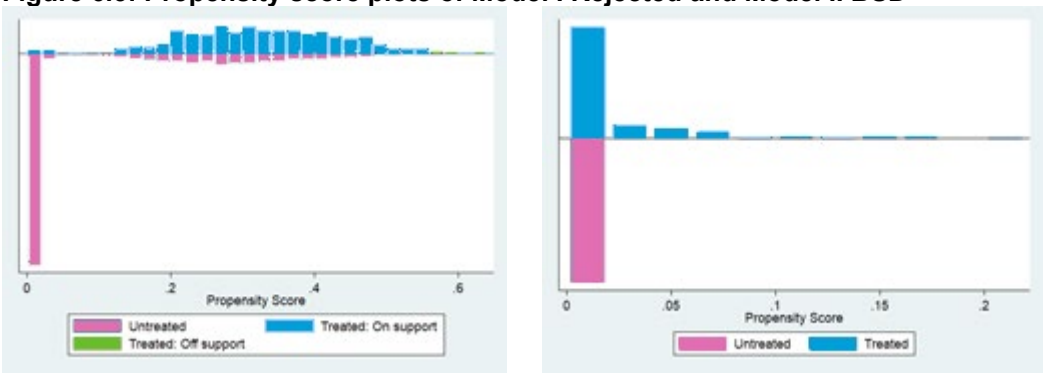
Figure 6.2: Pre-Support Employment Growth in AMSCI supported businesses and Comparators



Analysis of past employment growth for AMSCI beneficiaries and matched comparators: t-3 is three years before support, t-2 two etc. Figure indicates rejected applicants as comparator (left) and wider BSD (right)

11. The second model adds a categorial variables for turnover and a few more sectoral variables. Matching to the rejected applicants provided a more similar match of control businesses and model I provided a closer match when looking at pre-support employment levels. Figure 6.2 presents the pre-support employment trends for the businesses supported by AMSCI, the matched comparable businesses, and the pools of businesses from which the matching was undertaken. The supported businesses were growing at a similar pace to the matched rejected applicants using model I and this underlines the preference for the results using this model. For the BSD matching, the matched control groups do not follow the treated businesses as closely.

Figure 6.3: Propensity score plots of Model I Rejected and Model II BSD



12. Figure 6.3 supports the general finding that matching to the rejected applicants is more robust. For the wider BSD, the distribution of propensity scores for the matched

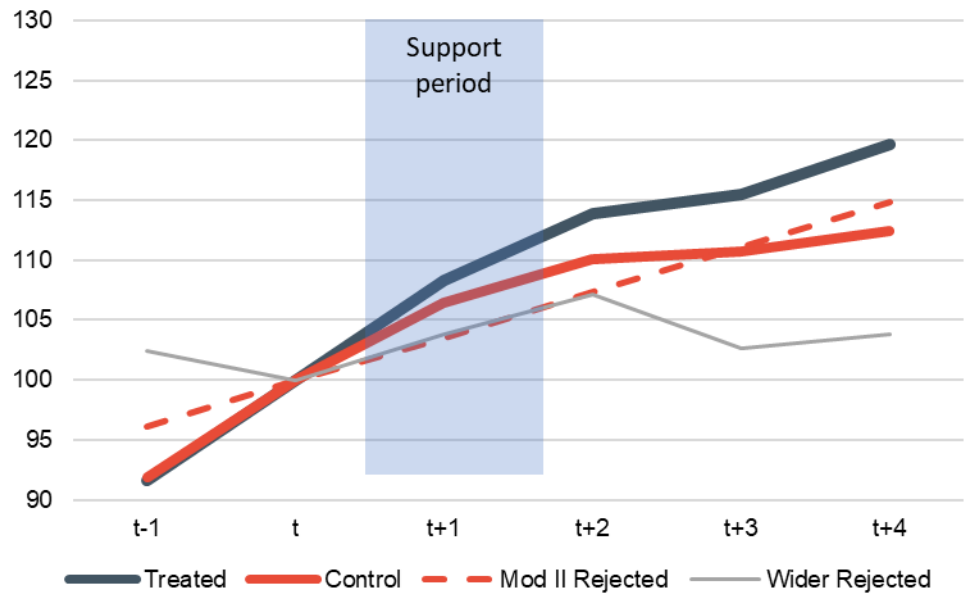
sample are bunched at the low end of propensity scores. For the rejected applicants, there is a greater variation of scores and the matching then provides comparison businesses for these scores.

Employment Impacts

13. The growth in employment is plotted below for the supported businesses and set of comparator businesses. Growth is measured in average log employment, so that any outliers do not unduly influence the estimation and so that the focus is on the growth in firm performance. In each figure, the performance is indexed so that, in the year before support, the value is 100.

14. Figure 6.4 indicates the employment change for beneficiary businesses. The line "Treated" is the index of employment for supported businesses, with observations stacked. So, all 389 supported business, where projects begun in different years, are recast in terms of the year projects started, so that the period *t* is the year before support. The "Control" line is the matched control group using the rejected applicants and the "Wider Rejected" line represents employment growth across the unmatched, rejected businesses. The green line presents model II for matching to the wider BSD applicants. The treated businesses are on a very similar growth trajectory to the control group until treatment and then experience stronger growth than the matched control group.

Figure 6.4 Employment change after support



Analysis of BSD linked to AMSCI beneficiaries and other datasets; Employment estimates with *t* before support then businesses are treated in a year-long financial year centring on *t+1*. Points *t* +2 and *t* +3, representing two and three years after the pre-support point; employment estimates centre on September in each year. BSD enterprises in this modelling were used in matching all cohorts of the supported businesses, hence sample sizes higher and businesses could be used more than once in the counterfactual.

15. The degree to which the growth rates differ can be tested using difference-in-difference, estimating how changes in employment in the treated and counterfactual (the first difference) then differs between the supported and control groups (the second

difference). Table 6.2 indicates estimates of this difference-in-difference for the preferred comparison group, the matched BSD, and two other models that use the rejected applicants pool:

- The growth over four years in employment is 19.7% in the supported businesses. This estimate is greater than comparable businesses over the four-year period.
- However, two years after support, where growth is 13.8%, the difference-in-difference estimates suggest around 3.4% of the growth is only seen in the supported businesses.

Table 6.3: Estimates of difference-in-differences

		Difference-in difference (t-stat)		
Model used	**Growth in Treated**	**Diff in Diff**	**Additionality[14]**	**BSD Mod II**
Using the Rejected difference in differences estimates				
Employment Growth, after 1 year	8.3%	1.7% (0.69)	21%	4.2% (1.95*)
Employment Growth, after 2 years	13.8%	3.4% (0.97)	24%	6.1% (1.99**)
Employment Growth, after 3 years	15.5%	4.4% (1.03)	28%	12.5% (2.72***)
Employment Growth, after 4 years	19.7%	6.4% (1.20)	32%	15.2% (2.79***)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels. Difference in Difference is growth in treated minus growth in control and additionality is the DID divided by the growth in treated.

16. The difference-in-difference estimates indicate that some of the growth that occurred in the supported businesses did not occur in the matched counterfactual. The table presents estimates for the four years after support, which does not prove individually significant, but pooling these estimates over the period does indicate the growth is significant. This is additional growth and an average of 27% of growth seen in the supported businesses is not observed in the comparable businesses. The preferred model's robustness has further been tested by recasting the treated and matched control as a panel and testing for treatment effects using fixed effects and dynamic panel. So, while there is evidence that attribution to the support measure may be difficult in any single year of support, the table above – which covers the growth in four successive years – does indicate the persistence in the difference is evidence that the trends seen are robust.

17. The gross job years for the four years from treatment to 2015 is 87,305. The additionality using the preferred model is 27%[15] indicating 23,572 years of employment were additional. For the 389 supported matched businesses, this is about 61 jobs per

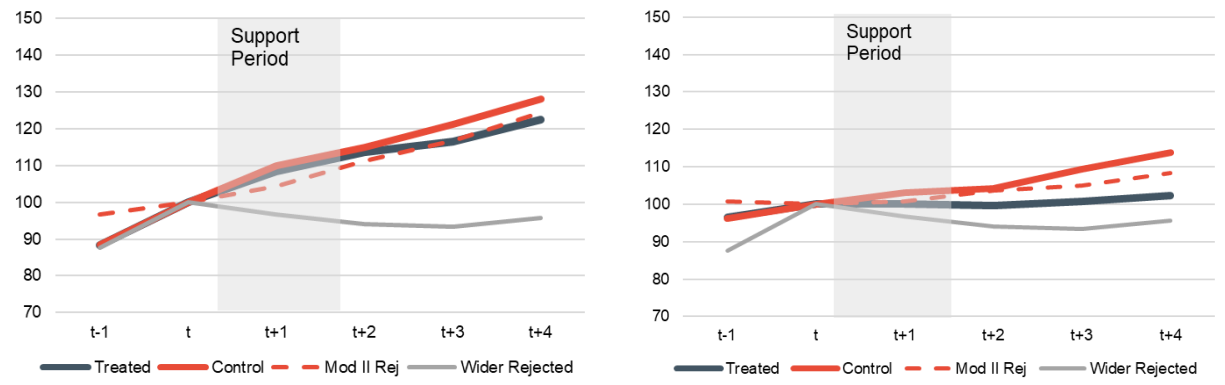
[14] Additionality is calculated by dividing the DID (treated-control) / treated

business. The cost of programme for the matched 389 business sample is £220m, implying a cost of £9,332 per additional job year.[16]

Turnover Impacts

18. Impacts of support on the real turnover and productivity changes for businesses are indicated in Figure 6.5. These are constructed in a similar manner to the employment figures. Growth is measured in average of log real turnover and the performance is indexed. Treated businesses experience stronger turnover growth than the control group and the wider rejected applicants. Productivity growth is also stronger in treated businesses than the control group.

Figure 6.5: Real Turnover and Productivity Growth in AMSCI supported businesses



Analysis of Rejected Beneficiaries linked to AMSCI beneficiaries and other datasets; Turnover estimates with *t* before support then businesses are treated in a year-long financial year centring on *t+1*. Points *t* +2 and *t* +3, representing two and three years after the pre-support point; employment estimates centre on September in each year. Rejected enterprises in this modelling were used in matching all cohorts of the supported businesses, hence sample sizes higher and businesses could be used more than once in the counterfactual.

19. Figure 6.5 indicates that turnover growth tracks employment trends, suggesting that as businesses expand their workforce, their sales are growing as well. The difference in difference in Table 6.5 suggests a growth of 22.4% in real turnover for the supported AMSCI businesses however, as the figure suggests, when compared to their comparators, the difference in differences are negative.

[16] Some of the beneficiaries dropped off due to their propensity scores being too high and therefore the £220m is the funding amount of the matched 389 businesses.

Table 6.5: Turnover growth difference-in-differences

		Difference-in difference (t-stat)		
Model used	**Growth in Treated**	**DID**	**Additionality**	**BSD Mod II**
Using the Rejected difference in differences estimates				
Turnover Growth, after 1 year	8.4%	-1.3% (-0.28)	-16%	8.5% (1.88*)
Turnover Growth, after 2 years	13.5%	-1.1% (-0.18)	-8%	13.4% (2.18**)
Turnover Growth, after 3 years	16.4%	-3.9% (-0.61)	-24%	22.5% (3.22***)
Turnover Growth, after 4 years	22.4%	-4.4% (-0.63)	-20%	24.4% (3.17***)

Notes: Table reports the difference-in-difference for variables. *, **, *** indicate statistical significance at the 10%, 5% and 1% levels.

20. The difference in difference estimates for productivity are again negative. However, they are not statistically significant for the control group. This is not surprising, as the variance of these measures tends to be high making precise estimation difficult. Further, where productivity is likely to be occurring alongside new products, affecting product quality positively, this may be unmeasured.

Table 6.6: Productivity growth difference-in-differences

	Difference-in difference (t-stat)	
Model used	**Growth in Treated**	**DID**
Using the Rejected difference in differences estimates		
1yr difference log real prod	0.1%	-3.0% (-0.64)
2yr difference log real prod	-0.4%	-4.4% (-0.75)
3yr difference log real prod	0.7%	-8.0% (-1.35)
4yr difference log real prod	2.2%	-10.2% (-1.73*)

Earnings impacts and the quality of jobs

21. This section explores the “wage premium” of AMSCI supported employment. The premium is that part of any higher wage after taking account of ability, skills and experience. A premium may arise if the worker is more productive, and the higher wage reflects this.

22. Businesses that benefitted from AMSCI support pay substantially higher wages than non-supported businesses. Among supported businesses, primes pay the highest wages with wages at supply chain businesses significantly lower, but still above the wider ASHE sample. Information on unsuccessful applicants to the scheme is also available. Their wages are lower than at primes but higher than at supply chain businesses. Employees who start a new job at a supported business earn a substantial wage premium, both at prime and supply chain businesses.

23. Table 6.3 summarises the earnings data. Employees in AMSCI beneficiaries are categorised as “supported” starting from the year the business started an AMSCI project and every year thereafter (unless they leave the business). Among all groups of

businesses considered – supported units in the prime businesses and supply chain, supported businesses outside the supported unit (considering primes and supply chain jointly), applicant units and businesses, and the wider ASHE – earnings are by far the highest in supported prime units. This is also reflected in slightly longer working hours and a slightly higher share of employees in full-time employment.

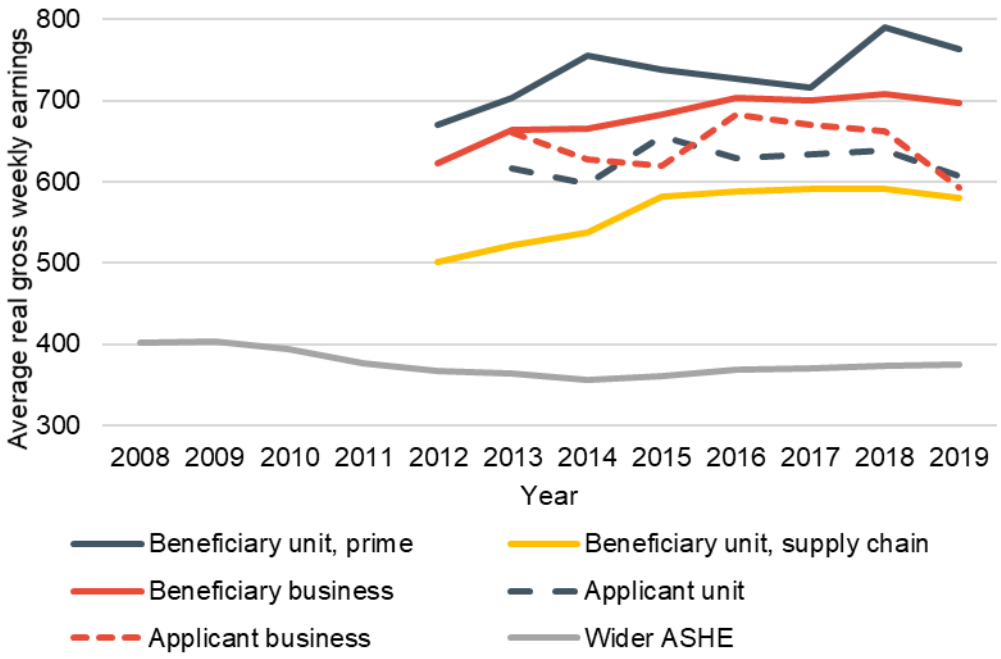
Table 6.7: Earnings data summary statistics

	Supported unit, prime		Supported unit, supply chain		Supported business		Applicant unit		Applicant business		Wider ASHE	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Basic weekly pay (real)	742	393	638	439	658	338	663	373	650	372	453	378
Weekly overtime pay (real)	36	77	19	65	27	74	24	79	31	100	14	77
Gross weekly earnings (real)	832	429	674	455	756	384	725	389	733	429	488	422
Total weekly hours	39.8	6.2	35.8	8.0	38.7	5.6	36.2	7.2	37.3	7.8	33.2	11.1
Weekly overtime hours	2.0	4.2	1.0	3.5	1.4	3.6	1.1	3.3	1.6	5.0	1.1	3.5
Age	40.8	12	42.8	11.9	42.3	11.4	42	12.1	42.7	12	40.7	12.8
Female	0.22	.41	0.38	0.49	0.26	0.44	0.29	0.46	0.28	0.45	0.52	0.5
Full-time	0.96	0.2	0.88	0.33	0.96	0.19	0.9	0.3	0.92	0.27	0.7	0.46
Public sector employer	0	0	0	0	0	0	0.01	0.095	0.02	0.14	0.25	0.43
Observations	783		2341		4873		5352		6640		2006929	

Note: The table presents a snapshot in 2018.

24. Figure 6.6 plots average earnings in businesses from the start of the AMSCI project. Weekly earnings are considerably higher at supported and applicant businesses. However, earnings growth seems to be faster at supported units and wider businesses than among the applicants. While earnings fell between 2008 and 2014 in the wider ASHE sample and then remained stable, earnings stayed stagnant at applicant businesses from 2013.

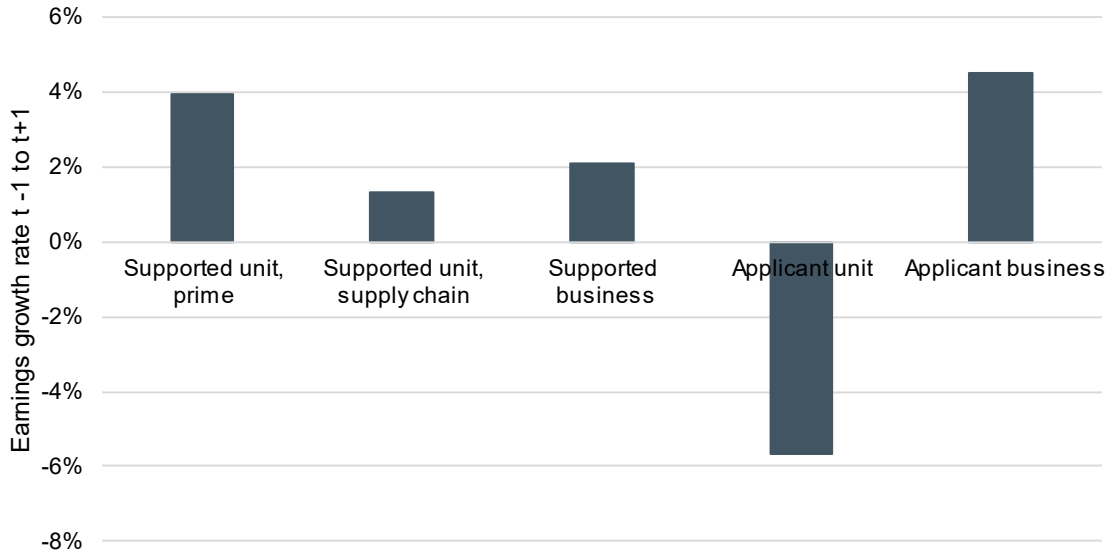
Figure 6.6: Average earnings in RGF Regional Project supported businesses



Note: Averages were calculated in logs and then exponentiated to reduce the impact of exceptionally high earnings.

25. Figure 6.7 looks at earnings growth around the time of the start of the AMSCI project. These figures only include individuals continuously employed by the same business between consecutive years, so they are not affected by businesses' hiring and firing decision. Supported units that are primes in their supply chain experience significant earnings growth of almost 2%. Meanwhile, supported units in the supply chain experience a decline in earnings of a similar magnitude. Supported businesses outside the supported units experience small earnings growth, smaller than unsuccessful applicants.

Figure 6.7: Earnings growth around the time of support start

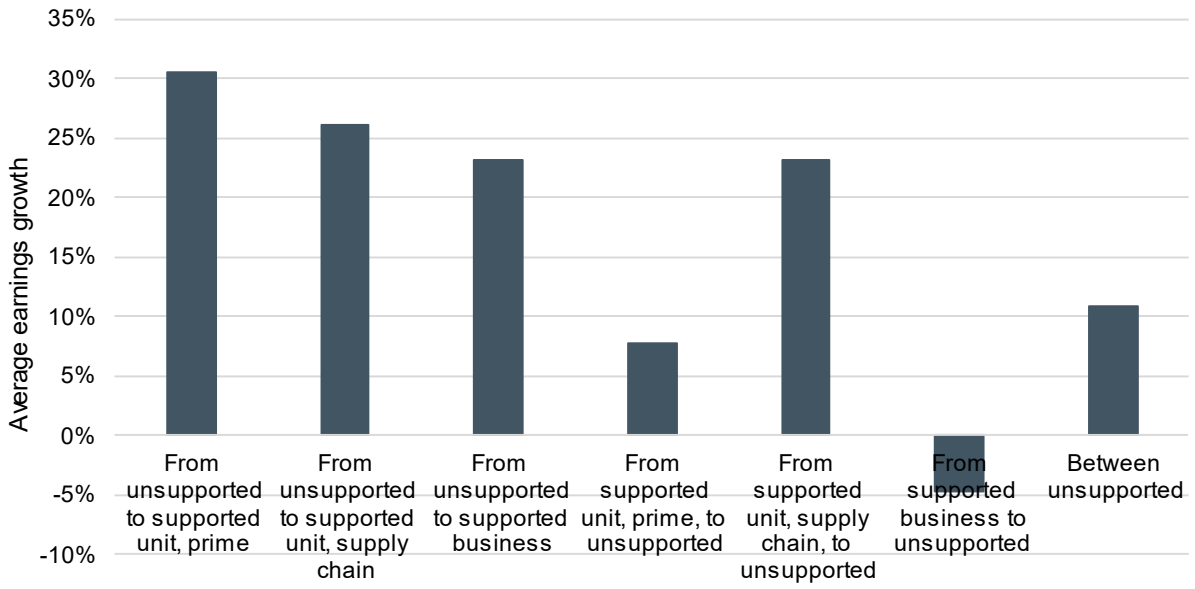


Note: Earnings growth from year of support start to first year after support start.
Includes earnings from employees that moved to the firms during this period, but could be restricted to those who stayed on payroll throughout.

26. Figure 6.8 looks at the wage effect of job switching to or from a supported business. Switchers to and from AMSCI project supported businesses are considered if the switch occurred in the year of first support or any year thereafter.

27. Figure 6.8 shows a large earnings premium from moving to a supported unit or business. Employees taking up a new job at a supported prime unit earn on average 30% more than in their previous job. For supported units in the supply chain, the figure is 26% and 23% for supported businesses. For employees who leave supported businesses, the results are mixed. Employees who leave a supported prime unit earn 8% more than in their previous job. However, this is less than the 11% earnings premium job changers between unsupported businesses in the wider ASHE population receive. Employees that leave a supported business in the supply chain still experience a substantial increase in their earnings, of 23%.

Figure 6.8: Earnings growth of job changers



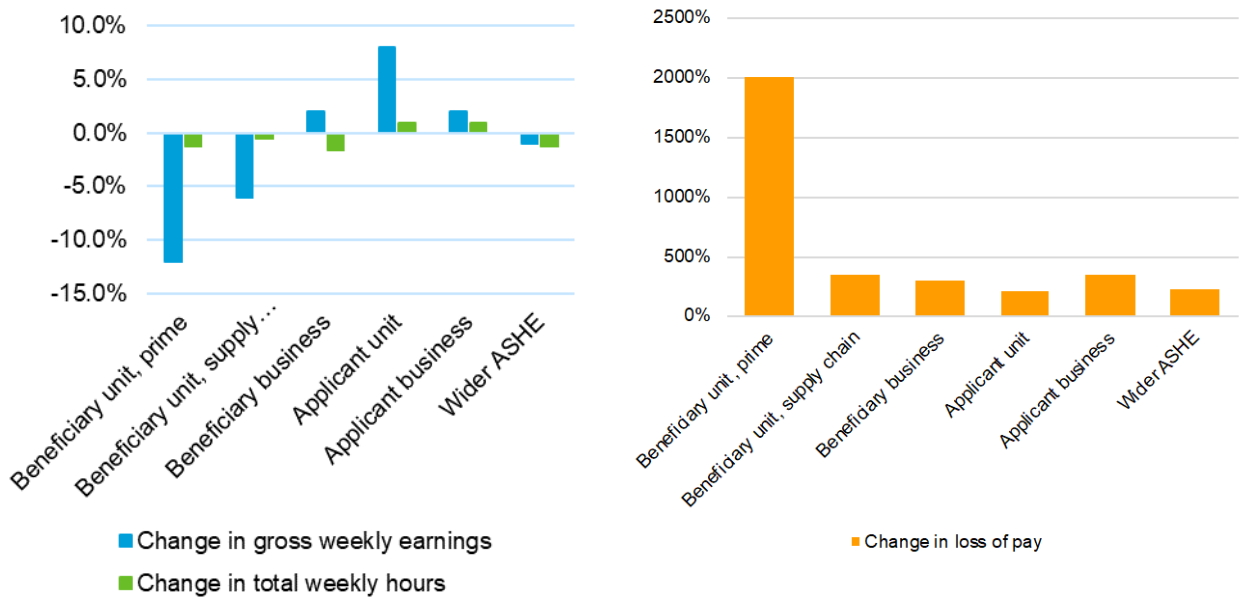
	Earnings growth	SD	Number of observations
From unsupported to supported unit, prime	30.52%	0.45	29
From unsupported to supported unit, supply chain	26.06%	0.53	101
From unsupported to supported business	23.18%	0.46	206
From supported unit, prime, to unsupported	7.77%	0.79	20
From supported unit, supply chain, to unsupported	23.21%	0.62	55
From supported business to unsupported	-4.75%	0.43	132
Between unsupported	10.80%	0.60	128,708

Initial results on effects from the Covid-19 pandemic

28. As ASHE is conducted in April each year, the 2020 survey captures the labour market at the beginning of the first lockdown caused by the Covid-19 pandemic in the UK. Comparing 2020 to 2019 results on earnings and hours worked gives some initial indications of the impacts of the lockdown. Crucially, ASHE also records a marker for workers whose pay was lower due to illness or furlough.

29. Figure 6.9 looks at effects at businesses supported by AMSCI. The picture is mixed across the different groups, with overall small declines in hours but large declines in earnings in beneficiary units both at primes and in the supply chains. In contrast, in the wider supported businesses and unsuccessful applicants, earnings increased.

Figure 6.9: Covid-19 lockdown effect on businesses supported by AMSCI



Concluding remarks

30. The AMSCI programme has supported advanced manufacturing supply chains to boost competitiveness. Through the £276m grant funding, the programme has led to the creation of 3,782 additional jobs as well as strong turnover growth for the supported businesses. These businesses also report a positive impact on earnings and the quality of jobs, highlighted through the significant wage premium and larger share of employees in full-time employment.

7 Place-Based Interventions

This chapter presents the econometric analysis of the economic impacts from the place-based interventions supported by the Regional Growth Fund (RGF). The RGF supported a wide range of place-based interventions, improving transport and rail infrastructure, or funding city redevelopments and investments in flood defences.

Transport and commercial infrastructure schemes make up the majority of these interventions, most of which are focused on 'unlocking' development sites which are otherwise unviable. Many of the area-based interventions have been evaluated through a case study approach reported in a separate part of this RGF evaluation. This chapter complements these findings by corroborating the evidence surrounding job creation and displacement.

Findings

- The RGF supported a wide array of area-based interventions from transport infrastructure to rail infrastructure to city redevelopments to flood defences.
- The number of additional jobs created considering jobs from displaced businesses shows that net creation attributable to the area-based interventions is 10,270. The total cost of interventions is £389m, implying a cost per additional job of £37,877. This finding is similar to the results from Gibbons et al. (2017) who use a similar methodology on the Single Regeneration Budget to estimate a cost per job of £39,675.
- Areas within 1km of place-based RGF support experienced faster employment growth than comparable locations elsewhere in England. Analysis also suggests that employment growth mainly occurs within 1km and had no effect beyond 4km.

1. The RGF supported investments into places under Scheme 2. The place-based initiatives include interventions at varying scale and purpose. Evaluating the economic effects of area-based initiatives is challenging, as they may affect many different economic outcomes and it is difficult to attribute the policy to the changes in economic outcomes. The econometric strand of the impact evaluation focuses on the business relocations into, the employment growth and some measures of the types of economic activity in the places that were supported through Scheme 2, with other more qualitative evidence being collected in a separate part of the RGF evaluation.

2. The first place-based programme began in financial year 2011 and the last, began in financial year 2016. Most programmes were between financial year 2013-2015. Transport and commercial infrastructure schemes make up the bulk of these interventions,

most of which are focused on 'unlocking' property development at sites which are otherwise constrained or unviable.

Assessing Impacts of Place-Based Interventions

3. Evaluating a place-based investment using a counterfactual is challenging. Often the locations will already be experiencing weaker economic growth, a reason the area is targeted for investment. As a result, evaluations of these type of initiatives typically suffer from policy endogeneity. Naïve comparisons between supported and unsupported areas will lead to biased estimates of the economic impact of such schemes. This is even after controlling for underlying factors, as some differences between supported and unsupported may persist and they may be unobservable in the data.

4. For this reason, the literature tends to compare neighbouring areas. The closer an area is to the supported area, the more likely it is to be similar to the supported area except for not benefiting from an area-based intervention.

5. Busso, Gregory and Kline (2013) have used unsupported areas for identification of economic impact, by using rejected and future Enterprise Zones as a comparison group. Neumark and Kolko (2010) developed complementary strategies that used nearby treated areas as controls. A series of other papers – Gobillon et al (2012), Mayer et al (2016) – used combinations of these strategies to study the effects of the French Zone Franche Urbaines (ZFUs).

6. Einiö and Overman (2016) used more finely spatially detailed data to further develop identification strategies based on comparisons to nearby untreated areas. Gibbons et al. (2017) estimate the impact of interventions supported by the Single Regeneration Budget using a “concentric rings” approach, as well as using the timing of SRB projects, to identify the impact on employment and local unemployment rates. A disadvantage of rings is that the areas may not be economically meaningful.

7. This study uses Lower Super Output areas (LSOAs), the lowest geography for ONS datasets, matching the LSOAs to the project areas, and using unsupported LSOAs as controls. The LSOAs were designed to have socio-economically meaningful boundaries. This can then mitigate the risk of using concentric rings for evaluative purposes, which lacks carefully considered boundaries.

Approach to Evaluating Place-Based Impacts

8. The Business Structure Database (BSD) can be analysed by areas, with sufficient spatial detail to investigate whether there are any location-specific impacts on employment, turnover and labour productivity growth as well as firm creation. Some of the positive economic effects of place-based interventions may also be driven by displacement

from neighbouring areas/regions. In other words, net growth at the wider regional level will either be less or zero if the growth witnessed in the supported area comes at the detriment of other neighbouring areas. As a result, net inflow of businesses into the areas supported by the RGF is also examined.

9. However, in many cases it is often the aim of the interventions to attract and concentrate formerly geographically dispersed businesses into one area. The economic rationale of concentrating businesses in one area is to create additional productivity through so-called “agglomeration effects”. Certain kinds of displacement may therefore be desirable, even more so if it involves encouraging growth in more deprived areas.

10. Part of this work is the representation of the RGF interventions by geography and timing (i.e. drawdown of RGF funding). The findings on economic outcomes are derived from panel data of firms in England from September 2010 to September 2020. The analysis is complicated by the fact the geographical spread of the policies cannot be fully discerned from management information alone. As the place-based interventions do not correspond exactly to existing administrative boundaries each area supported by the RGF is matched to a Lower Layer Super Output Area (LSOA) based on the postcode recorded in the monitoring information. Neighbouring LSOAs within a given distance from the supported areas are then used for comparative purposes.

11. In line with recent work on evaluations of place-based interventions the effects of the policy are compared with firms in supported areas at varying distances. Like a difference-in-differences model, spatial and time-differencing (i.e. comparing differences between areas over time) is employed. However, a departure from the standard difference-in-differences model is the fact that “treated” and “untreated” areas cannot be properly designated. Other firms within LSOAs close to an LSOA benefitting from an RGF intervention should be affected (i.e. “treated”) more intensively than areas further away with intensity decreasing monotonically with distance.

12. The number of additional jobs created considering jobs from displaced businesses shows net creation attributable to the place-based interventions is 10,270, implying a cost per additional job of £37,877. This finding is similar to the results from Gibbons et al. (2017) who use a similar methodology on the Single Regeneration Budget to estimate a cost per job of £39,675.

13. Commercial developments are the most cost effective at displacing businesses. On aggregate, the cost per displaced job is £18,900 which is slightly lower in comparison with recent studies such as Mayer et al. (2012). However, this literature focused on a shorter and earlier period during better economic conditions. Comparing the results presented here with the data collected from the case study research allows the findings to be corroborated, it was found that commercial and transport projects received the highest amounts of relocators and there is no evidence that the port infrastructure resulted in a net influx of businesses to the supported areas, which is confirmed by the qualitative

interviews with key informants from those projects (see case study for Port of Liverpool for full detail).

Overview of Spatial Interventions

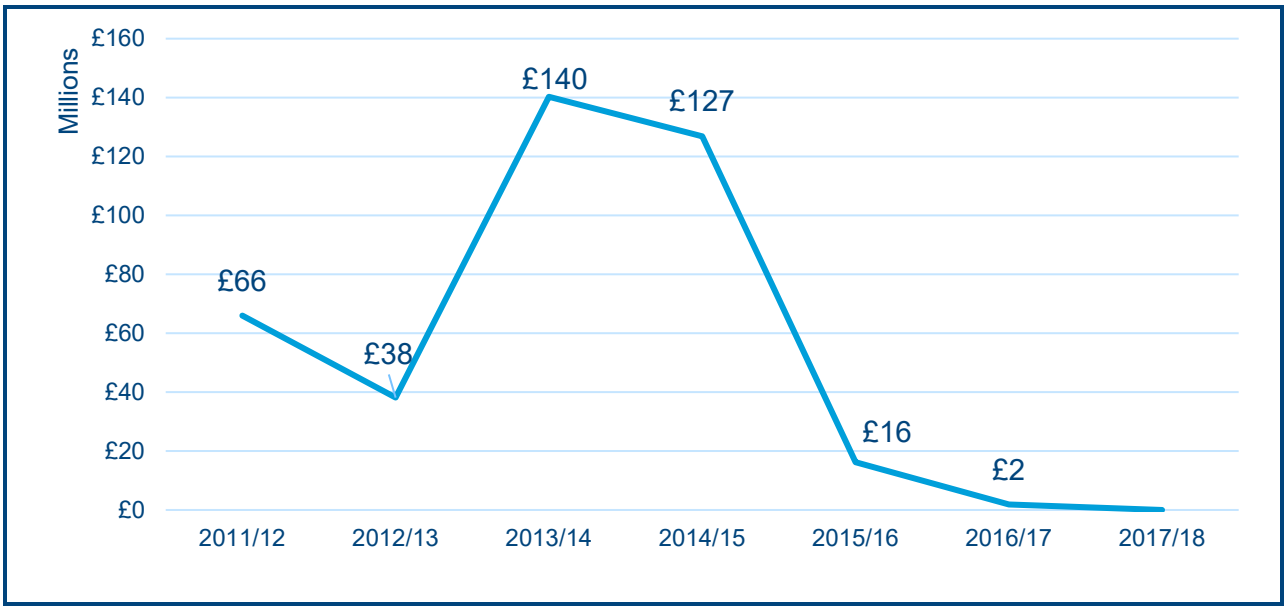
14. The monitoring data has been coded to differentiate between area- and firm-level interventions. This process yielded 38 distinct area-based interventions representing roughly £389m of RGF funding.

15. Several of the larger area-based interventions were picked up as case studies. This included the three largest of the area-based interventions, West of England LEP's Revolving Infrastructure Fund (budgeted £40m), the enabling works of Port of Liverpool's Post-Panamax Container Terminal (budgeted £35m), and the North Liverpool City Fringe Employment and Investment programme (budgeted £25m).

16. The other area-based interventions sampled for case studies were Bradford city council's City Centre development scheme, Birmingham council's road scheme to divert the A45, the Southampton Docks "Platform for Prosperity", Burnley council's two programmes on reinstatement of the Todmorden curve and development of an Aerospace Supply Chain Park, Wakefield Council's regeneration of four housing sites, the Sunderland City Deal Infrastructure Development, Newcastle Science City, and Leeds city council's Flood Alleviation Scheme.

17. An important aspect of any evaluation is understanding the timing of impacts therefore Figure 7.1 plots when the funding for the 38 projects was contracted to occur.

Figure 7.1: Timing of RGF Funding for Area-Based Interventions



18. The Figure shows the bulk of funding was drawn down during financial years 2013/14 and 2014/15 representing 69% of total funding for the place-based interventions.

As a result, it is expected initial economic impacts in terms of business creation, relocation and other economic effects should be observed towards the end of 2015.

19. Total Place-Based Programmes comprised 38 distinct area-based interventions representing roughly £389m of RGF funding. Of these Programmes the evaluation sampled 16 case studies covering a total grant value of £134m (Table 7.1). Supported areas have a higher proportion of disadvantaged people as they have the lowest proportion of economically active residents and the highest proportion of young and long-term unemployed people.

Table 7.1: Evaluation Coverage

Count	Grant	Econometric Analysis*	Case Studies
38	£389m	38 programmes (100%) £389 Grant Funding	16 programmes (43%) £230 Grant Funding (60%)

*Coverage is presented as percentage of grant allocated. Note that the spatial econometric analysis covered all (38, grant £389m) place based interventions in scope for evaluation.

Typology of RGF Interventions

20. The RGF has supported a wide range of area-based interventions. The type of interventions which have received investments can be categorised into the following:

a. Transport Infrastructure

b. Commercial Development

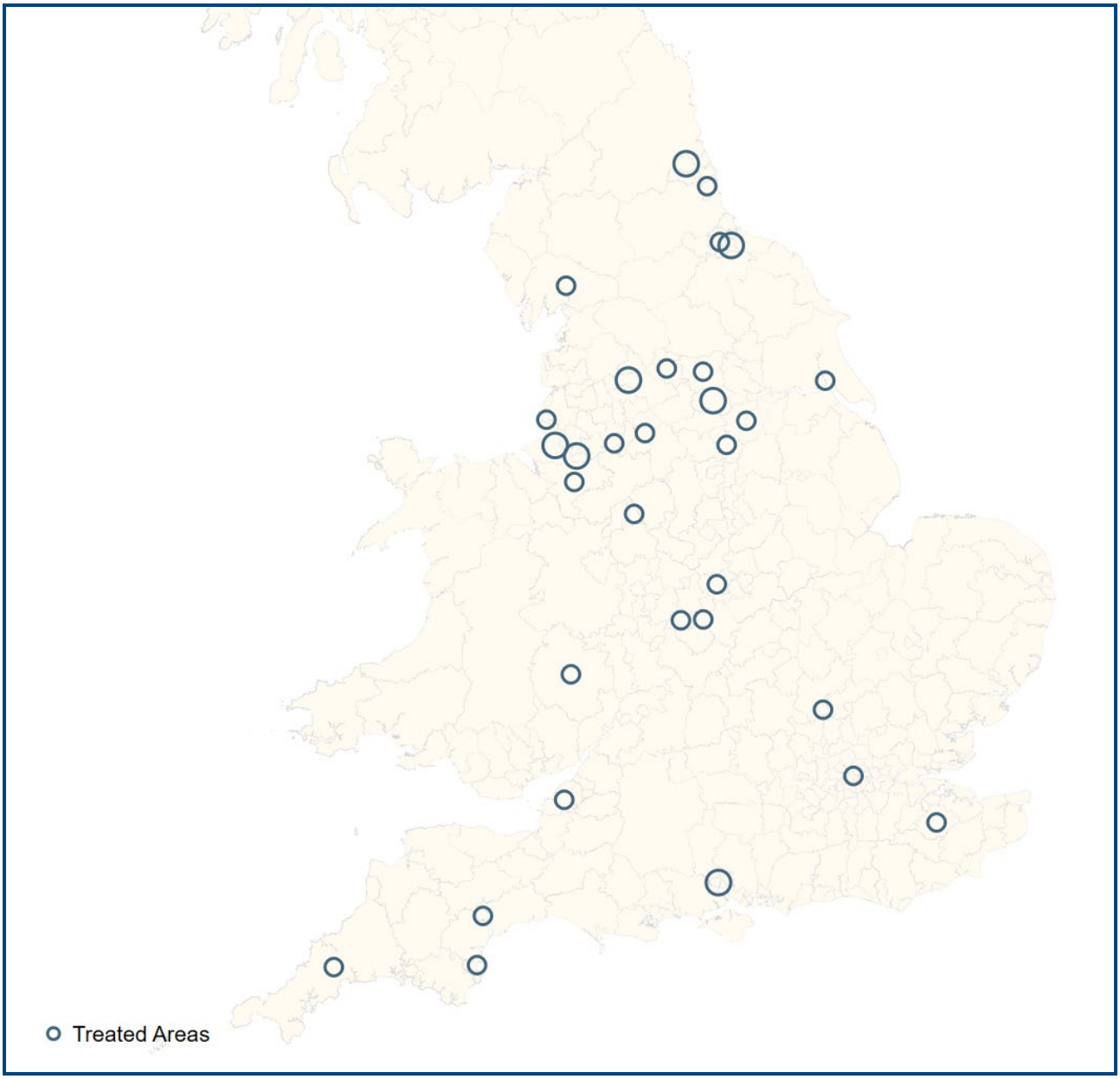
c. Housing Development

d. Port Infrastructure

21. The transport infrastructure projects funded through the RGF are mainly small scale in nature and have primarily been funded to support the release of employment sites rather than improve transport connectivity. An improvement in flood defences may unlock new development sites that would otherwise be unviable due to risk of flooding. Therefore, flood defences have been categorised as commercial developments.

22. Most projects are intended to stimulate additional direct and indirect jobs in the targeted areas and further afield. Many of the projects may also result in the relocation of businesses from neighbouring areas or to the creation of new businesses. They may also create additional productivity through attracting businesses and concentrating them in one area and benefitting from economies of agglomeration.

Figure 7.2: Location of Area-Based Interventions



23. Figure 7.2 illustrates the geographical spread of the RGF sponsored area-based interventions across England by the 31 Local Authority Districts in which the 38 area interventions are located. The areas of Tees Valley, Liverpool and Leeds benefitted from the highest concentration of interventions. Liverpool received three distinct types of interventions: investments in port infrastructure, housing and commercial developments.

Spatial differences over time

24. The main method to estimate impact of the RGF place-based interventions is spatial and time-differencing as per recent evaluation work on other place-based programmes. With any ex-post evaluation of an economic policy the important economic concepts of additionality and displacement need to be investigated. Additionality refers to whether the policy could generate positive outcomes beyond what would have occurred

without government intervention. It is impossible to know what would have happened in any of the chosen locales had they not been allocated RGF resources for critical infrastructure. In the literature on causal inference (see Heckman et al., 1999, DiNardo and Lee, 2011) a way of solving this additionality problem is by comparing treated sites with nearby suitable control groups.

25. There are caveats to looking at proximate areas as comparators. Businesses might decide to relocate close to a supported site because their product demand is higher due to the intervention or to fill a place in a commercial development, pulling up employment in nearby areas and down in areas further away (displacement effect). Therefore, evaluating the extent of additionality may be confounded by displacement if comparisons are made with nearby areas, themselves affected by the support.

26. The main methodological issue is that some of the place-based interventions under study have a geographical spread not known at the start. This is because each project is only given a postcode in the monitoring information. As a result, the use of spatial differencing using strict boundaries (i.e., measuring the difference between an area and its neighbour) cannot be used to estimate impact because the stable unit treatment value assumption17 cannot be met. In other words, identification relies on the assumption that spillovers of these policies are limited geographically within certain boundaries.

27. A way to overcome these problems is to understand the treatment effect varies with intensity at different distances from an RGF sponsored intervention. The standard difference-in-differences approach is altered to allow the control group to change in size by varying geographical distances of comparison firms (the control group will increase in size when more geographically distant firms are included in the analysis). This approach assumes all firms within a given distance of an intervention are treated, with areas close to an intervention receiving the treatment more intensively than areas further afield. The intensity of the effect is expected to decrease monotonically with distance.

$$\Delta y_i = \beta_0 + \beta_1 T_{ir} + u_i \; ; \qquad i = [1, \ldots., n(d)]$$

28. Where Δy_i is the within-firm logarithmic change in employment, turnover and labour productivity growth between 2010 and 2020. T_{ir} is a binary indicator equal to one if a firm *i* is located in an LSOA benefitting from an RGF supported intervention and 0 otherwise. The sample size is n(d) which is an increasing monotonic function of the geographical distance (d) of the control group.

[17] The stable unit treatment value assumption requires that the observation on one unit should be unaffected by the particular assignment of treatments to the other units (Cox, 1958).

Econometric Analysis of Place-Based Programmes

29. The RGF data was gathered from the monitoring information provided by BEIS. Each project has a postcode to locate where the intervention took place. The postcodes were matched to LSOAs. Neighbouring LSOAs within a given radius from the supported areas are then used for comparative purpose.

30. Data on economic variables was derived from two sources. Data on employment, sales, labour productivity, business creation, destruction and relocation stems from the Business Structure Database (BSD) which provides an annual snapshot of the Inter-Departmental Business Register (IDBR). This dataset contains information on over 3 million businesses accounting for approximately 99% of economic activity in the UK and includes each business' name, postcode and total employment and turnover (although it is missing for plants). The BSD contains enterprise and plant-level data that is already geocoded to geographical units including LSOAs from the 2001 and 2011 Censuses. Therefore, it is possible to measure the stock and flow of establishments and plants to and from supported LSOAs over time.

31. Area-based socio-economic indicators derive from the 2011 Census providing information on economic activity, socio-economic status (NS-SEC), ethnicity and size of the area (acreage). Again, the Census data is available for several different geographies. The UK 1991 Census also provides a rich set of similarly defined area characteristics. The smallest geographical unit is the Enumeration District for England and Wales. To maintain consistency, data at the slightly larger LSOA level is extracted. LSOAs are aggregations of groups of four to six adjacent Output Areas. In 2011 there are 34,753 LSOAs in England and Wales with an average population of 1,614.

32. After choosing LSOA as the geographical unit for the study and matching the postcodes from the management information to identify supported LSOAs, geodetic[18] distances between each "treated" LSOA and all "untreated" LSOAs are calculated using LSOA centroids. The treated areas are then compared to control areas at varying distances from within 1km to 5km.

Descriptive Statistics

33. Information on project location and amount of funding has been collected from the monitoring data. Descriptive statistics disaggregating by distance to the project LSOAs are presented in Table 7.1. It shows the employment and unemployment rates, the skills of the workforce as measured by the National Statistics Socio-economic Classification System, and other resident and area characteristics. These descriptive statistics are presented by varying the distances of how far the unsupported LSOAs are from the supported areas. Although the differences across LSOAs when varying the distances between them do not

[18] Geodetic distance is the length of the shortest curve between two points along the surface of a mathematical model of the earth.

appear to be large, the differences do diminish as areas become closer to the supported areas. However, the supported areas have a higher proportion of disadvantaged people as they have the lowest proportion of economically active residents and the highest proportion of young and long-term unemployed people.

Table 7.2: Socio-economic Indicators of RGF Supported and Unsupported Areas

	All Areas (Supported and Unsupported within 10 km)	Supported Areas	Unsupported Areas within 5km	Unsupported Areas within 2km	Unsupported Areas within 1km
Number of LSOAs	6199	34	2372	493	113
As a % of working population:					
Economically active	60.44	55.11	59.47	56.87	55.98
Self-employed	9.09	6.63	8.25	7.76	7.73
Full time Students	3.65	5.32	3.69	4.67	5.24
Young unemployed aged 16-24	1.41	1.61	1.48	1.56	1.53
Long-term Unemployed	2.08	2.40	2.13	2.25	2.30
Higher managerial	10.46	7.03	9.40	8.16	8.35
Lower managerial	20.39	15.95	18.89	17.23	16.95
Intermediate occupations	11.90	10.84	11.82	10.78	10.36
Small employers and own account workers	8.18	7.05	7.80	7.66	7.66
Lower supervisory occupations	6.49	7.44	6.89	6.87	6.66
Semi-routine occupations	13.52	14.65	14.50	14.76	14.34
Routine occupations	11.37	13.37	12.62	13.38	13.19
Area of Land					
Acreage	248.98	431.45	164.28	111.116	129.63
As a % of total population:					
White British	69.30	80.52	78.66	76.45	75.02
Mixed	3.17	0.95	1.32	1.23	1.18
Asian/ Asian British	10.85	2.04	2.85	2.62	2.68
Black/ Black British	6.23	12.33	11.51	15.06	16.28
Other Ethnic Group	1.94	2.73	5.18	4.10	3.95

Data

34. Spatial and business data has been collected to provide an assessment on whether there are any initial impacts in terms of employment, turnover and labour productivity growth as well as firm creation. Some of the positive economic effects of area-based interventions may also be driven by displacement from neighbouring areas/regions. In other words, net growth at the wider regional level will either be less or zero if the growth witnessed in the supported area comes to the detriment of other neighbouring areas.

35. As a result, net inflow of businesses into the areas supported by the RGF is also examined. However, in many cases, it is often the aim of area-based interventions to attract and concentrate formerly geographically dispersed businesses into one area. The economic rationale of concentrating businesses in one area is to create additional productivity through so-called “agglomeration effects”. Displacement may also be desirable, for instance if it involves a rebalancing of growth towards more deprived areas.

36. Table 7.3 compares the firms that have relocated to the supported areas with those that have relocated away between the years 2011 to 2020. The firms are quite similar in terms of their observable characteristics. However, there is some indication the relocating firms are better performing than the firms that left the area. They have undergone a higher rate of both employment and turnover growth. Additionally, the firms that relocate into the supported areas seem to be more focussed in the knowledge intensive sectors.

Table 7.3: Comparing the Relocators

Type of Firm	Age	High Tech (%)	Scaleup (%)	Knowledge Intensive Industry (%)	Manuf (%)	Single Plant (%)	Mean Emp	Mean Turn (000s)	Emp Growth 2011-2020 (%)	Real Turn Growth 2011-2020 (%)
Relocated to Supported Area	9	11%	12%	25%	5%	96%	16	247814	13%	24%
Relocated away from Supported Area	11	12%	12%	31%	4%	96%	15	138752	-14%	13%

37. The net inflow of jobs to all supported areas for the period 2010-2020 is 20,548, and the total RGF expenditure of £389m implies the cost of a displaced job is £18,900. This estimate is slightly less than Mayer et al. (2012), who estimate the cost per relocated job of up to 31,450 euros for the Zones Franches Urbaines (ZFU) policy, however have a shorter time period.

Employment Impacts

38. In line with recent work on evaluations of area-based interventions the effects of the policy are compared with firms in supported areas at varying distances. The number of additional jobs created shows net creation attributable to the area-based interventions is 10,370 implying a cost per additional job of £37,877. This finding is similar to the estimate calculated by Gibbons et al. (2017) who calculate a cost per job of £39,675 for the Single Regeneration Budget.

39. This section examines the effect of the RGF area-based interventions on workplace employment at the establishment given the MI data suggests the schemes have a substantive component designed to create direct and indirect jobs. Newly created jobs may also translate into greater sales and changes in labour productivity in firms directly

and indirectly affected. Thus, the effects on employment, turnover and productivity are examined between 2010 and 2020. Since the spatial scale of the potential impact is not known a priori different estimates are produced using different distance bands to define whether an LSOA is 'close' to an LSOA benefitting from RGF area-based intervention.

40. Table 7.4 presents the coefficients and standard errors when estimating difference-in-differences in employment, turnover and productivity growth from 2010 to 2020. These are firm-level regression with no control variables. The point estimate suggests LSOAs close to RGF supported LSOAs added 20,500 jobs per LSOA, more than LSOAs elsewhere in England. The estimates reported in the first row of Table 6.5 suggest areas within 1km of RGF supported LSOAs experienced faster employment growth than comparable locations elsewhere in England. The estimates become gradually smaller as firms in LSOAs from further afield are included.

Table 7.4: Evaluation Coverage

Average Within-Firm Growth	Average Growth in Supported Areas	Difference-in-Difference Estimates using Control Firms within Varying Distances (%)				
		<5km	<4km	<3km	<2km	<1km
Employment Growth (2011-2020)	15%	5.3***	6.5***	7.0***	5.8***	8.7***
		0.8	0.8	0.8	0.8	0.9
Turnover Growth (2011-2020)	12%	6.7***	7.2***	7.2***	9.5***	11.5***
		1.2	1.2	1.2	1.2	1.3
Productivity Growth (2011-2020)	-2%	1.2	0.6	0.3	4.2***	3.3***
		1.1	1.1	1.1	1.1	1.3

41. The analysis has provided evidence the policy has resulted in the relocation of establishments and plants and created additional employment compared to neighbouring LSOAs. Further, the total budgeted cost of the interventions is known to be £389m which can be transformed into a unit-resource measure by taking into account deadweight and displacement of jobs.

Table 7.5: Additionality Calculations

Gross Jobs Created in Supported Areas (A)	38,581[19]	
Jobs Relocated from Outside Areas (B)	20,548[20]	
Net Jobs Created in Supported Areas (C: A-B)	18,033	
Net Additional Jobs Created in Supported Areas (C) x two different additionality ratios	Lower bound Estimate: 7,643[21]	Upper Bound Estimate: 10,370[22]

Concluding remarks

42. This chapter presents the econometric analysis of the economic impacts from the area-based interventions supported by the RGF. The RGF supported a wide array of area-based interventions from transport infrastructure to rail infrastructure to city redevelopments to flood defences.

43. The number of additional jobs created considering jobs from displaced businesses shows that net creation attributable to the area-based interventions is 10,370. The total cost of interventions is £389m, implying a cost per additional job of £37,512. This finding is similar to the estimate calculated by Gibbons et al. (2017) who calculate a cost per job of £39,675 for the Single Regeneration Budget. In terms of cost per year of employment, assuming that new employment last for three years, this would mean a cost per year of employment of £12,504, associated with 31,110 years of employment.

[19] Data in 2020 gives number of employees at 295,786 in 2020. Dividing this by 1.15 gives 257,205 as the number of employees in September 2010. Therefore, gross jobs is 28,581 (295786-257205).

[20] This number is the net number of businesses relocating into and out of the treatment areas (relocate to treatment – relocate to control) multiplied by the average number of employees for 2020 (amount of employees/ number of establishments). The number includes net employees for both plants and enterprises.

[21] Lower bound estimate is calculated by choosing the additionality ratio of 42.4% (15.1-8.7)/15.1 * 100) estimate from the difference-in-differences analysis in table 7.4 when only control firms within 1km of the supported firms closes neighbouring firms within the supported LSOA.

[22] Upper bound estimate is computed the same way as the lower bound but with an additionality ratio of 56.9% (15.1-6.5/15.1*100) estimated from the difference-in-difference analysis which included control firms in LSOAs from within 4 kilometres to the firms in the supported LSOAs

8 Conclusions

The Regional Growth Fund has allocated £2.8bn to programmes and projects since 2011. A challenge has been to estimate additional economic impact, taking account of what would have happened without RGF support. This report looks at the quantitative approaches taken to evaluate economic impacts for each of the Schemes. The results presented focus on estimates of the effects that are attributable to the Fund. The results cover employment, turnover and indicators of the quality of the additional jobs.

1. The evaluation of the RGF has used linked datasets to quantitatively assess impacts. A focus is on approaches that develop robust counterfactuals to identify effects of RGF support that are additional. Methods have been developed to identify place-, firm- and employee-level comparisons.

2. RGF Regional Projects started in 2011 and, by 2015, contracted jobs had passed its peak. For economic impact evaluation, these gross impacts are adjusted to take account of what would have happened without support. There were 57,653 years of employment seen in the supported reporting units and the differential growth rates suggests that 49,417 of these would be additional, with alternative models suggesting 16,472 to 45,299. Businesses supported through RGF Regional Projects pay substantially higher wages than non-supported businesses. From the start of treatment, earnings growth in supported businesses is higher than in other businesses. Employees that took up a new job in supported businesses enjoyed a wage premium; when employees leave a supported business, their earnings tend to decrease.

3. For the National Programmes, lists of beneficiaries had to be obtained and matched to the ONS registers. Collating lists of beneficiaries is complex, and some coverage issues are present for the National Programmes. This collation was also required for the Regional Programmes, but the businesses linked to the ONS data have created a level of jobs quite close to the reported new jobs in RGF monitoring systems. This could be because the businesses are filling jobs over and above the contracted RGF jobs.

4. Overall, the growth in employment seen in the National Programmes was between 14.0% and 30.5%; for the Regional Programmes, the range was 18.9% to 31.9%. The comparator businesses also grew but there was a positive and generally significant difference, with this difference being 8.1% and 15.7% for the National Programme and 6.9% to 18.5% for the Regional Programmes.

5. Employment in the businesses supported by National Programmes grew by 57,547 job years. Using the growth seen in supported businesses but not seen in the comparators, 34,944 years of employment are additional in the National Programmes. For

the Regional Programmes, there is 48,607 years of additional employment (though the growth seen in the businesses did not differ as much with the counterfactual as was the case for the National Programmes).

6. The AMSCI programme has supported advanced manufacturing supply chains to boost competitiveness. Through the £276m grant funding, the programme has led to the creation of 23,572 additional years of employment as well as strong turnover growth for the supported businesses. These businesses also report a positive impact on earnings and the quality of jobs, highlighted through the significant wage premium and larger share of employees in full-time employment.

44. The RGF supported a wide array of area-based interventions from transport infrastructure to rail infrastructure to city redevelopments to flood defences. A parallel report presents a case study of these complex programmes. This study has found that the number of additional jobs created, considering jobs from displaced businesses shows that net creation attributable to the area-based interventions is 10,270. The total cost of interventions is £389m, implying a cost per additional job of £37,512. This finding is similar to the estimate calculated by Gibbons et al. (2017) who calculate a cost per job of £39,675 for the Single Regeneration Budget. In terms of cost per year of employment, assuming that new employment last for three years, this would mean a cost per year of employment of £12,504.

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Annex A: Details of Approach

The following section will outline the formal PSM model. Analysis used the Stata routine *psmatch2*. Treatments have been categorised to the treatment variable $\mathrm{Treat_{it}}$ equal to 1 if an enterprise i receives support in period t. Let $\Delta \mathrm{y}^{1}_{\mathrm{i,t+1}}$ be the employment of enterprise i at time t+1 after receiving treatment in period t and let $\Delta \mathrm{y}^{0}_{\mathrm{i,t+1}}$ be the hypothetical performance of the same enterprise i at the same time t+1 had it not received treatment in period t. The employment effects of the treatment in enterprise i, called the average treatment effect on the treated, can then be expressed as follows:

$$\hat{\alpha} = E\left(\Delta y^{1}_{i,t+1} \middle| Treat_{it} = 1\right) - E(\Delta y^{0}_{i,t+1} \middle| Treat_{it} = 1) \qquad (1)$$

The second term in equation (2), - $\mathrm{E}(\Delta \mathrm{y}^{0}_{\mathrm{i,t+1}} \middle| \mathrm{Treat_{it}} = 1)$, is the counterfactual mean or the hypothetical employment change in enterprises supported, had they not received the treatment. Since this term is unobservable, a proxy needs to be found for the counterfactual mean. In experimental studies, the selection problem is dealt with by random assignment of treatment, which ensures that every individual has ex ante the same chance of receiving treatment (Ravallion, 2003). Non-experimental studies try to replicate this by applying propensity score matching. The main idea behind this approach is to find a control group that is like the treatment group in all respects except the exposure to the treatment (Ravallion, 2003). A group of enterprises must be found that is like those benefitting from the Catapult in all relevant characteristics, prior to the actual treatment. The estimation of the causal effect in this case becomes:

$$\hat{\alpha} = E\left(\Delta y^{1}_{i,t+1} \middle| Treat_{it} = 1, X_{i,t-1}\right) - E(\Delta y^{0}_{i,t+1} \middle| Treat_{it} = 0, X_{i,t-1}) \qquad (2)$$

where $\mathrm{E}\left(\Delta \mathrm{y}^{1}_{\mathrm{i,t+1}} \middle| \mathrm{Treat_{it}} = 1, \mathrm{X_{j,t-1}}\right)$ is the mean employment change at time t+1 of the enterprises being supported at time t; $\mathrm{E}(\Delta \mathrm{y}^{0}_{\mathrm{i,t+1}} \middle| \mathrm{Treat_{it}} = 0, \mathrm{X_{i,t-1}})$ is the mean employment change of the control group at time t+1; and $\mathrm{X_{i,t-1}}$ is a vector of observed conditioning covariates in the pre-treatment year t-1. By matching enterprises whose covariates are closely aligned in the pre-treatment year it is possible to derive the causal effect of support on employment or an outcome. A practical constraint arising from the application of such matching techniques is that exact matching across multiple covariate indices poses high demands to the data available. Rosenbaum and Rubin (1983) suggest that this problem of dimensionality can be significantly reduced by matching on a single index: the propensity score, or the probability of receiving treatment conditional on the relevant pre-treatment covariates. Using the propensity score, the equation for the average effect of support becomes:

$$\hat{\alpha} = E\left(\Delta y^{1}_{i,t+1} \middle| Treat_{it} = 1, p(X_{i,t-1})\right) - E(\Delta y^{0}_{i,t+1} \middle| Treat_{it} = 0, p(X_{i,t-1})) \qquad (3)$$

where p is a propensity score conditional on $\mathrm{X}_{\mathrm{j,t-1}}$. The average effect of support on employment is estimated as the difference between the mean employment change of treated enterprises and that of enterprises that had ex-ante similar likelihood of being supported but were not.

For consistent estimates of the employment effects, two key assumptions must hold: the conditional independence and the common support assumption. Conditional independence means that there are no unobservable differences between supported and non-supported enterprises after conditioning for $\mathrm{X}_{\mathrm{i,t-1}}$, so that any systematic differences in outcomes can be attributed to the treatment (Imbens 2004, Smith and Todd 2005). The assumption can be stated formally as:

$$\left(\Delta y^{1}_{i,t+1}, \Delta y^{0}_{i,t+1}\right) \perp Treat_{i,t} | \, X_{i,t} \qquad (4)$$

where $\perp$ indicates orthogonality between two variables. This is a strong assumption, as there can still be differences after conditioning for the observable covariates available in the data. In some cases, this issue is addressed by using employment change as the outcome variable and looking at the differences in this outcome between treatment and control groups (Sarkisyan et al. 2009). This is known as difference-in-difference or double difference matching, where the first difference removes the unobserved heterogeneity and restores conditional independence and the second produces the impact estimates (Smith and Todd 2005, Essama-Nssah 2006). This method is used for impact estimation in this study.

The common support assumption requires an overlap in the distribution of covariates between the treated units and the control group members to make matching possible. This is stated formally as:

$$0 < \Pr\left(Treat_{it} = 1 | X_{i,t-1}\right) < 1 \qquad (5)$$

If the two assumptions hold, the mean outcome of the non-treated enterprises acts as a counterfactual for the outcome trend beneficiaries would have shown in absence of the treatment.

Researchers have relied on propensity score matching, which uses a single variable (the propensity score) to undertake the matching. The propensity score is estimated by means of a probit model in which the dependent variable is a dummy equal to 1 in the year an enterprise receives treatment and 0 otherwise. A probit estimation of propensity to receive support is estimated, i.e.:

$$P(Treat_{it} = 1 | X_{i,t-1}, Z_{i,t-1}) \qquad (6)$$

where $\mathrm{Treat}_{\mathrm{it}}$ is the dummy for support; $\mathrm{X}_{\mathrm{i,t-1}}$ includes all enterprise level variables that affect the probability of receiving treatment, $\mathrm{Z}_{\mathrm{i,t-1}}$ controls for external factors that are likely to affect the probability of receiving treatment and $\mathrm{Treat}_{\mathrm{ti}}$ are state dummies reflecting environmental aspects. One of the required conditions in the propensity score matching

analysis is that the variables included in the model should not be affected by the treatment. To ensure this, the firm-specific variables used in the model are lagged one year.

After having estimated the propensity scores for each enterprise in the Business Structures Database, first-time beneficiaries are matched with non-beneficiaries using nearest-neighbour (1:1 ratio) matching where the unit chosen from the pool of non-beneficiary businesses (i.e. an untreated enterprise j) as a match for beneficiaries (i.e. a treated enterprises i) is the one closest in terms of the propensity score. Given the size of the control group, the data is sorted randomly prior to the matching procedure to avoid systematic bias due to ties in the data. The matching procedure formally is:

$$\left|p_i - p_j\right| = \min_{k \in \{Treat=0\}} \{|p_i - p_k|\} \quad (7)$$

A common problem in PSM is the occurrence of bad matches (i.e. the nearest neighbour is not very near). Several tests, detailed in Annex B, have been employed to check the quality of matches. The procedure is run on each year of the sample, ensuring that new beneficiaries are matched to enterprises in the same year. The model is specified to restrict the matching pool to enterprises never receiving any support. Further, the common support assumption, discussed earlier, rules out the perfect predictability of support given the observed covariates. This ensures the existence of potential matches in the pool of non-treated enterprises from the BSD.

Propensity score matching is primarily around the characteristics of the supported businesses. The next tables expand on the evidence presented in the report for Schemes 1, 3 and 4. Some additional figures about the Scheme 3 and 4 post support trends are also plotted.

Table A1: Summary Statistics for RGF Regional Projects Scheme 1: Supported in 2011/2, 2012/3 and 2013/4

	Successful (N=188)			Total (N=587,637)		
Statistic	Mean	Median	Std. dev	Mean	Media n	Std. dev
Employment	1194.5	172.6	2884.5	44.7	9.0	793.5
Geo mean	174.4	172.5	8.8	11.5	9.0	2.8
Local unit employment	584.2	160.0	1124.0	44.0	9.0	774.7
Geo mean	134.2	149.6	7.0	11.5	9.0	2.8
Turnover (£'000)	436172	23477	1167238	7224	604	276896
Geo mean	27033	23023	15	669	587	4.30
No. of Non-RGF interventions	1.03	1.00	0.93	0.08	0.00	0.32
Value of Non-RGF interv'tions	539174	0.00	2008591	4639	0.00	200216
No. of local units	7.93	1.40	29.29	1.28	0.60	21.10
Age (years)	25.05	26.00	12.28	15.80	13.00	11.39
High Tech (%)	53	-	48	10	-	29
Low Pay (%)	2	-	13	37	-	48
Manufacturing (%)	69	-	44	10	-	29
Public sector employment (%)	21	-	3	19	-	3
Population density	1002	477	1241	1481	622	1735
Herfindahl Index	0.18	0.16	0.18	0.09	0.04	0.15

Notes: The table presents the descriptive statistics for the sample of successful project beneficiaries. Mean and median values correspond to the cross-sectional values of individual businesses time-series averages. Average for employment and turnover are presented giving the corresponding geometric mean alongside the arithmetic mean for each.

Tables A2-6: Summary Statistics for RGF Schemes 3 and 4 (National and Regional Programmes)

Table A2: Summary Statistics for RGF Schemes 3 and 4 (2012)

	Scheme 3 Successful (N = 914)			Scheme 4 Successful (N = 276)			Unsuccessful (N = 1849)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Employees	30.35	14.00	100.53	243.14	14.00	2013.43	72.69	6.00	918.98
Real Turnover	3180.17	1306.71	8130.67	189577.00	1158.58	2479168.00	8041.82	451.33	69614.27
Number of non-RGF interventions	0.50	0.00	0.80	0.77	0.50	0.99	0.51	0.00	0.80
Real Value of Non-RGF interv'tions	304.11	0.00	1491.83	647.57	0.00	5785.82	184.83	0.00	1211.12
No. Local Units	1.21	1.00	10.72	1.30	1.00	1.79	1.06	0.00	6.24
Age (years)	16.34	14.00	11.93	15.40	12.00	12.59	12.03	8.00	11.39
High Tech	0.21	0.00	0.41	0.29	0.00	0.45	0.23	0.00	0.42
Low Pay	0.14	0.00	0.35	0.16	0.00	0.37	0.19	0.00	0.39
Manufacturing	0.44	0.00	0.50	0.38	0.00	0.49	0.22	0.00	0.41
Public Sector Employment (%)	20.34	20.50	2.96	21.14	21.10	2.26	21.02	20.80	2.60
Herfindahl Index	0.17	0.07	0.34	0.17	0.07	0.25	0.18	0.08	0.33
	Non-applicant S3 (N = 214684)			Non-applicant S4 (N = 214786)					
	Mean	Median	SD	Mean	Median	SD			
Employees	5.80	1.00	233.58	5.78	1.00	233.36			
Real Turnover	1196.95	111.57	147135.50	1186.98	111.53	146290.60			
Number of non-RGF interventions	0.02	0.00	0.16	105.28	87.30	36.62			
Real Value of Non-RGF interv'tions	8.40	0.00	535.21	100.22	100.60	1.91			
No. Local Units	0.81	1.00	0.44	0.00	0.00	0.00			
Age (years)	11.39	8.00	10.38	0.02	0.00	0.16			
High Tech	0.13	0.00	0.33	18.99	18.90	2.70			
Low Pay	0.29	0.00	0.46	100.20	99.40	3.70			
Manufacturing	0.05	0.00	0.23	1556.79	476.49	1972.61			
Public Sector Employment (%)	18.99	18.90	2.70	1196.12	111.58	147091.50			
Herfindahl Index	0.13	0.06	0.27	11.39	8.00	10.38			

The summary statistics are pre-treatment characteristics.

Unsuccessful applicants could have applied to either Scheme 3 or 4.

Table A3: Summary Statistics for RGF Schemes 3 and 4 (2013)

	Scheme 3 Successful (N = 666)			Scheme 4 Successful (N = 1114)			Unsuccessful (N = 2053)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Employees	65.66	6.00	779.26	65.66	6.00	779.26	5.86	1.00	232.21
Real Turnover	7670.36	428.10	68488.15	7670.36	428.10	68488.15	1078.72	107.70	120784.80
Number of non-RGF interventions	0.49	0.00	0.78	0.49	0.00	0.78	0.02	0.00	0.16
Real Value of Non-RGF interv'tions	165.06	0.00	1113.31	165.06	0.00	1113.31	8.21	0.00	551.21
No. Local Units	1.01	0.00	6.20	1.01	0.00	6.20	0.82	1.00	0.43
Age (years)	11.94	8.00	11.44	11.94	8.00	11.44	11.49	8.00	10.64
High Tech	0.24	0.00	0.42	0.24	0.00	0.42	0.13	0.00	0.33
Low Pay	0.20	0.00	0.40	0.20	0.00	0.40	0.30	0.00	0.46
Manufacturing	0.21	0.00	0.41	0.21	0.00	0.41	0.05	0.00	0.23
Public Sector Employment (%)	21.01	20.80	2.60	21.01	20.80	2.60	18.98	18.90	2.70
Herfindahl Index	11.94	8.00	11.44	11.94	8.00	11.44	0.14	0.07	0.27
	Nonapplicant S3 (N = 216264)			**Nonapplicant S4 (N = 216391)**					
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**			
Employees	5.86	1.00	232.21	5.84	1.00	232.04			
Real Turnover	1078.72	107.70	120784.80	1069.49	107.70	120097.40			
Number of non-RGF interventions	0.02	0.00	0.16	0.02	0.00	0.16			
Real Value of Non-RGF interv'tions	8.21	0.00	551.21	8.15	0.00	549.34			
No. Local Units	0.31	0.00	5.85	0.31	0.00	5.84			
Age (years)	11.49	8.00	10.64	11.49	8.00	10.64			
High Tech	0.13	0.00	0.33	0.13	0.00	0.33			
Low Pay	0.30	0.00	0.46	0.30	0.00	0.46			
Manufacturing	0.05	0.00	0.23	0.05	0.00	0.23			
Public Sector Employment (%)	18.98	18.90	2.70	18.97	18.90	2.70			
Herfindahl Index	0.14	0.07	0.27	0.14	0.07	0.27			

The summary statistics are pre-treatment characteristics.

Unsuccessful applicants could have applied to either Scheme 3 or 4.

Table A4: Summary Statistics for RGF Schemes 3 and 4 (2014)

	Scheme 3 Successful (N = 762)			Scheme 4 Successful (N = 1263)			Unsuccessful (N = 2309)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Employees	22.56	10.00	64.13	61.10	15.00	439.04	60.47	6.00	732.08
Real Turnover	2500.73	746.36	10386.01	20085.20	1284.03	374957.50	7615.31	372.34	70028.59
Number of non-RGF interventions	0.48	0.00	0.81	0.62	0.00	0.88	0.46	0.00	0.76
Real Value of Non-RGF interv'tions	118.78	0.00	632.43	209.52	0.00	1357.88	0.46	0.00	0.76
No. Local Units	0.65	0.00	1.48	1.87	1.00	28.10	147.87	0.00	1030.75
Age (years)	13.99	10.00	11.97	15.55	12.00	12.49	11.67	7.00	11.41
High Tech	0.22	0.00	0.41	0.29	0.00	0.45	0.24	0.00	0.43
Low Pay	0.16	0.00	0.37	0.13	0.00	0.33	0.20	0.00	0.40
Manufacturing	0.37	0.00	0.48	0.38	0.00	0.49	0.20	0.00	0.40
Public Sector Employment (%)	20.40	20.50	2.94	21.91	21.70	2.56	20.97	20.80	2.61
Herfindahl Index	0.17	0.06	0.35	0.18	0.09	0.31	0.18	0.09	0.31
	Nonapplicant S3 (N = 222351)			**Nonapplicant S4 (N = 222565)**					
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**			
Employees	5.83	1.00	226.24	5.81	1.00	226.06			
Real Turnover	1120.40	108.41	114865.50	1111.43	108.41	114219.90			
Number of non-RGF interventions	0.02	0.00	0.16	0.02	0.00	0.16			
Real Value of Non-RGF interv'tions	7.73	0.00	545.95	7.67	0.00	544.24			
No. Local Units	0.30	0.00	5.66	0.30	0.00	5.65			
Age (years)	11.26	7.00	10.82	11.26	7.00	10.82			
High Tech	0.13	0.00	0.34	0.13	0.00	0.34			
Low Pay	0.29	0.00	0.45	0.29	0.00	0.45			
Manufacturing	0.05	0.00	0.22	0.05	0.00	0.22			
Public Sector Employment (%)	18.97	18.40	2.70	18.97	18.40	2.70			
Herfindahl Index	0.14	0.07	0.27	0.14	0.07	0.27			

The summary statistics are pre-treatment characteristics.

Unsuccessful applicants could have applied to either Scheme 3 or 4.

Table A5: Summary Statistics for RGF Schemes 3 and 4 (2015)

	Scheme 3 Successful (N = 703)			Scheme 4 Successful (N = 508)			Unsuccessful (N = 2475)		
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
Employees	13.88	5.00	35.88	76.93	14.00	908.78	60.25	6.00	738.54
Real Turnover	790.70	254.89	1532.89	9364.85	1134.53	96532.08	7508.02	371.03	70719.32
Number of non-RGF interventions	0.42	0.00	0.74	0.62	0.00	0.91	0.42	0.00	0.74
Real Value of Non-RGF interv'tions	136.35	0.00	987.02	286.96	0.00	1094.89	136.35	0.00	987.02
No. Local Units	0.94	0.00	6.13	0.85	1.00	2.20	0.94	0.00	6.13
Age (years)	11.89	7.00	11.42	15.93	12.00	13.05	11.89	7.00	11.42
High Tech	0.24	0.00	0.43	0.32	0.00	0.47	0.24	0.00	0.43
Low Pay	0.20	0.00	0.40	0.15	0.00	0.35	0.20	0.00	0.40
Manufacturing	0.20	0.00	0.40	0.38	0.00	0.49	0.20	0.00	0.40
Public Sector Employment (%)	20.97	20.80	2.65	21.37	20.80	2.70	20.97	20.80	2.65
Herfindahl Index	0.17	0.08	0.30	0.18	0.09	0.30	0.17	0.08	0.30
	Nonapplicant S3 (N = 227961)			**Nonapplicant S4 (N = 228332)**					
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**			
Employees	5.84	1.00	218.17	5.82	1.00	218.00			
Real Turnover	1088.75	111.24	111186.90	1079.60	111.23	110565.70			
Number of non-RGF interventions	0.02	0.00	0.16	0.02	0.00	0.16	*The summary statistics are pre-treatment characteristics.*		
Real Value of Non-RGF interv'tions	7.01	0.00	531.49	6.96	0.00	529.71			
No. Local Units	0.29	0.00	5.81	0.29	0.00	5.77	*Unsuccessful applicants could have applied to either Scheme 3 or 4.*		
Age (years)	11.13	7.00	10.96	11.13	7.00	10.96			
High Tech	0.13	0.00	0.34	0.13	0.00	0.34			
Low Pay	0.28	0.00	0.45	0.28	0.00	0.45			
Manufacturing	0.05	0.00	0.22	0.05	0.00	0.22			
Public Sector Employment (%)	18.97	18.40	2.70	18.96	18.40	2.70			
Herfindahl Index	0.13	0.07	0.27	0.13	0.07	0.27			

Table A6: Summary Statistics for RGF Schemes 3 and 4 (2016)

	Scheme 3 Successful (N = 817)			Scheme 4 Successful (N = 278)			Unsuccessful (N = 2520)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Employees	59.87	3.00	1179.33	1.10	1.00	0.32	61.99	6.00	790.95
Real Turnover	4828.67	180.00	94061.17	0.95	1.00	3.24	7791.79	392.02	73224.72
Number of non-RGF interventions	0.24	0.00	0.58	0.64	0.00	0.92	0.41	0.00	0.73
Real Value of Non-RGF interv'tions	71.76	0.00	732.12	193.24	0.00	784.34	131.23	0.00	976.03
No. Local Units	1.37	0.00	24.92	0.95	1.00	3.24	0.98	0.00	6.63
Age (years)	10.48	6.00	10.84	17.94	14.00	12.74	12.58	8.00	11.49
High Tech	0.23	0.00	0.42	0.28	0.00	0.45	0.25	0.00	0.43
Low Pay	0.19	0.00	0.40	0.14	0.00	0.35	0.20	0.00	0.40
Manufacturing	0.11	0.00	0.31	0.47	0.00	0.50	0.20	0.00	0.40
Public Sector Employment (%)	19.51	20.00	1.86	21.90	22.20	2.48	20.94	20.80	2.64
Herfindahl Index	0.17	0.07	0.31	0.17	0.08	0.28	0.17	0.08	0.30
	Nonapplicant S3 (N = 233727)			**Nonapplicant S4 (N = 234406)**					
	Mean	**Median**	**SD**	**Mean**	**Median**	**SD**			
Employees	5.72	1.00	212.81	5.70	1.00	212.56			
Real Turnover	1071.81	111.03	109580.50	1064.74	111.03	109254.80			
Number of non-RGF interventions	0.02	0.00	0.15	0.02	0.00	0.15			
Real Value of Non-RGF interv'tions	6.32	0.00	541.13	6.27	0.00	539.28			
No. Local Units	0.28	0.00	5.42	0.28	0.00	5.38			
Age (years)	11.03	7.00	11.09	11.03	7.00	11.09			
High Tech	0.14	0.00	0.34	0.14	0.00	0.34			
Low Pay	0.28	0.00	0.45	0.28	0.00	0.45			
Manufacturing	0.05	0.00	0.22	0.05	0.00	0.22			
Public Sector Employment (%)	18.95	18.40	2.70	18.95	18.40	2.70			
Herfindahl Index	0.13	0.07	0.27	0.13	0.07	0.27			

The summary statistics are pre-treatment characteristics.

Unsuccessful applicants could have applied to either Scheme 3 or 4..

Table A7: Plots of Programme Difference-in-Difference for Scheme 3

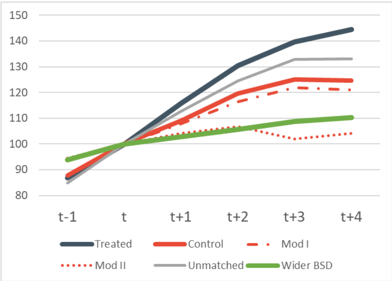
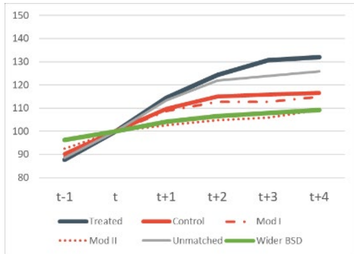
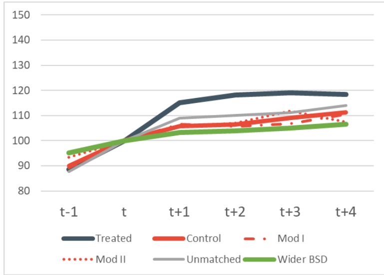
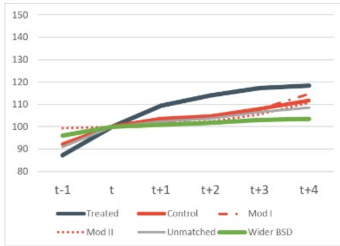
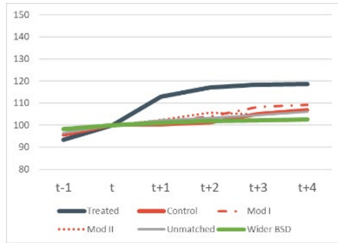
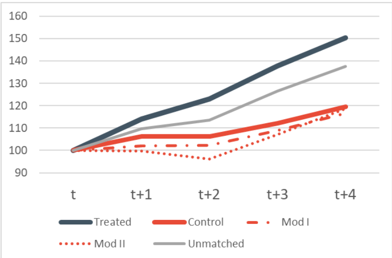
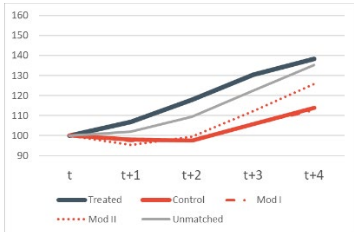
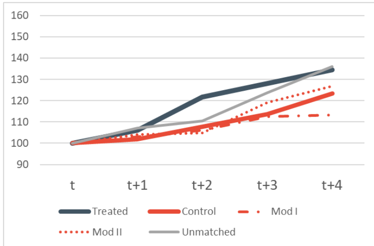
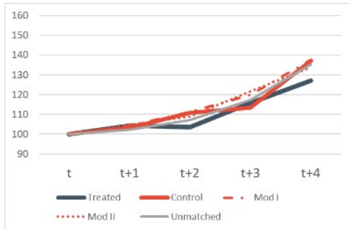
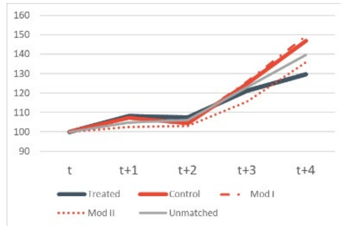
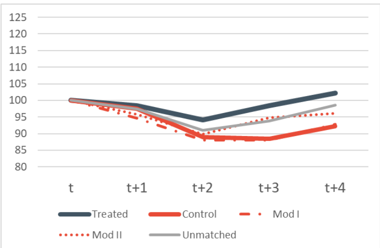
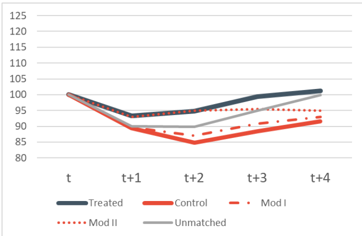
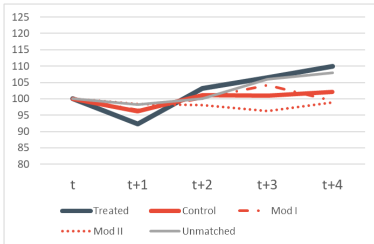
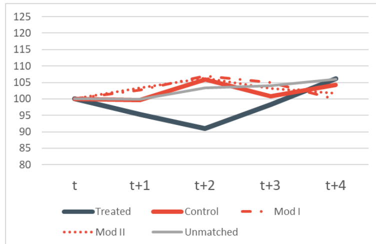
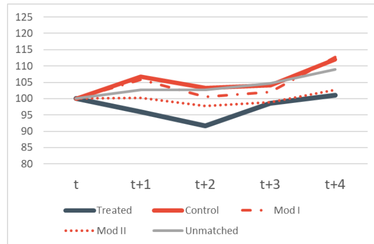
Scheme 3: 2012 Cohort	Scheme 3: 2013 Cohort	Scheme 3: 2014 Cohort	Scheme 3: 2015 Cohort	Scheme 3: 2016 Cohort
		Employment difference-in-differences		
				
		Real Turnover difference-in-differences		
				
		Real Turnover per Employee difference-in-differences		
				

Table A8: Plots of Programme Difference-in-Difference for Scheme 4

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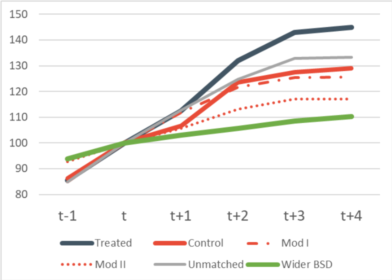
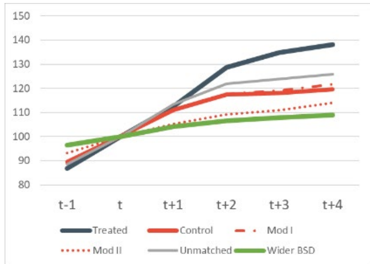
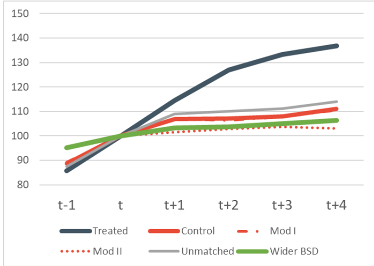
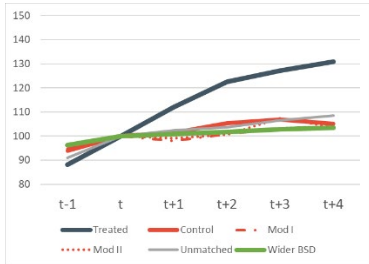
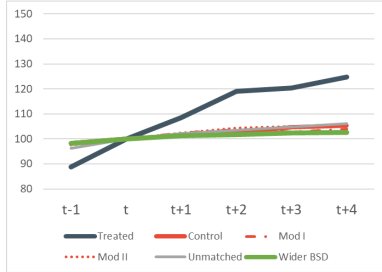
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
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<tr><td colspan="5">Real Turnover difference-in-differences</td></tr>
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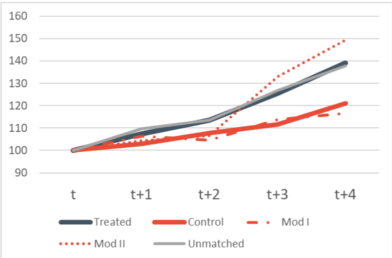
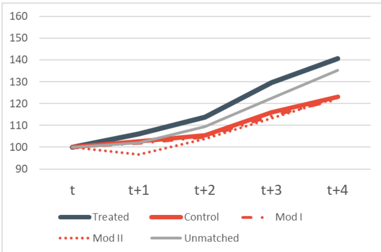
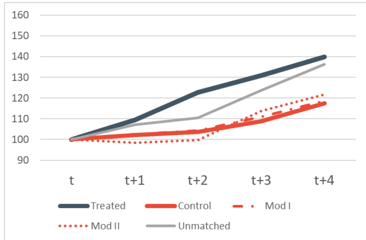
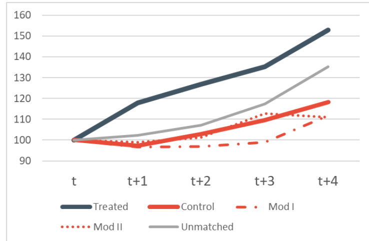
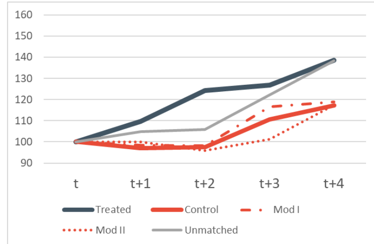
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
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<tr><td colspan="5">Real Turnover per Employee difference-in-differences</td></tr>
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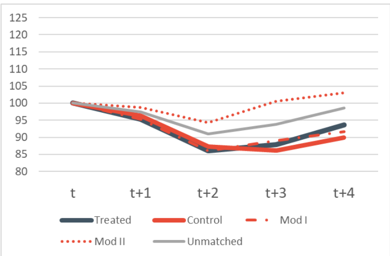
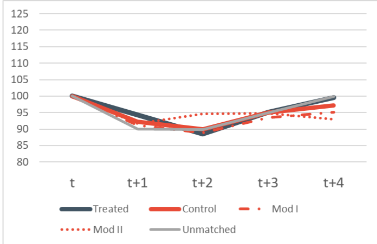
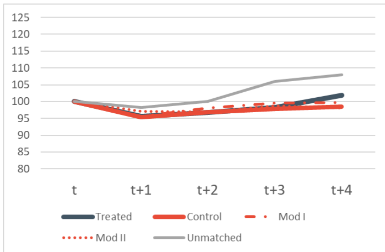
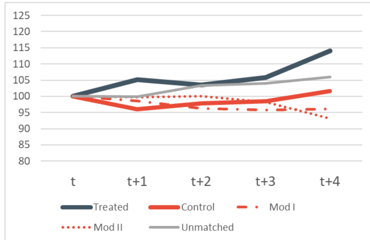
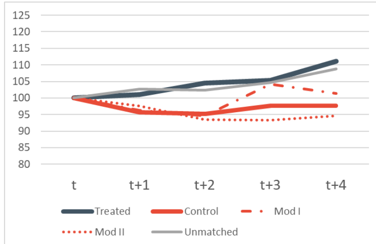
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
</table>

Annex B: Sensitivity Tests

Tests look at the balance of observable variables before and after propensity score matching. This shows whether the matching is successful. If there was a statistically significant result before the matching, the PSM should remove this and lead to a balanced treatment and control group. The balance across all variables is measured post matching.

PSM attempts to mimic a randomised control trial by matching treated businesses with those that are similar on all observable characteristics. In effect, the counterfactual contains businesses that have the same probability of being treated as those that received support. However, the analysis may be biased if there are unobservable variables that drive selection into treatment as well as the outcome (employment growth, turnover growth etc). One possible variable is managerial capability and ambition. If more ambitious managers are more likely to seek support, the supported businesses would differ in an important respect from untreated businesses, and it may be the manager's ambition rather than the support that causes higher growth.

A first check on the validity of a match is to a visual check to identify whether the matching has covered the range of propensity scores. Table B1 indicates the scores of the supported (above the axis) and then scores of the matches (below the axis) for Schemes 1, 3 and 4. Scheme 5 is reported in chapter 6. The plots indicate a reasonable match with the PSM selecting a counterfactual set of businesses that cover the range of the scores of the supported.

Scheme 1 is only matched to the wider BSD and this provides a relatively tight set of scores near the zero score, because so few of the BSD population are supported. Where the match is to rejected applicants (the preferred model and model I in the centre of the table) the full range of scores are matched and so matching is more precise. The matching is weaker for Scheme 3 in the later years and this corresponds to some earlier results.

Further, estimates of how robust results are to unobservable bias (Rosenbaum bounds tests) can check the sensitivity of impacts to alternative assumptions about the matching, using the Stata command rbounds. It assesses "how strongly an unmeasured confounding variable must affect selection into treatment in order to undermine the conclusions about causal effects from matching analysis" (DiPrete and Gangl, 2004). Different levels of hidden bias can be expressed in terms of the odds ratio, gamma Γ, of two matched observations being treated. If matching is unbiased, observations with the same observable characteristics have the same probability of being treated. When Γ=2, an unmeasured cofounding variable causes one observation to be twice as likely to be selected into treatment than the matched observation with the same observable characteristics (Peel and Makepeace, 2009).

The method then assumes that there is a known factor causing bias to the level of Γ, and that the treatment effect from this bias can be stripped out. Once this is done, whether the

treatment effect remains significant is tested. In this fashion, starting with zero bias, the treatment effect can be computed and the effect of the assumption of ever larger bias then tested.

The Rosenbaum bounds estimation for different matching models used in this study. For different levels of Γ, it gives the upper- and lower-point estimates of the treatment effects, under the assumption of negative and positive selection bias, respectively. It also gives significance levels for these estimates under the null hypothesis that the true treatment effect is zero at a certain level of positive or negative bias. The upper- and lower-point estimates can be interpreted in terms of a – usually – increasing cone of possible values as Γ rises. Where the cone begins to include zero, then that is the level of bias in the matching that would render the treatment results insignificant.

The tables give the treatment effect: called Hodges-Lehman (HL) point estimate. Estimates should be the same at Γ=1, but differ slightly at zero bias from earlier difference-in-difference calculations because HL estimates the median, rather than the mean treatment effect. The point estimate of the treatment effect is based on the difference in the outcome variable, in this case log employment growth, for each matched pair. The differences between pairs, Δi are ranked, and for adjacent Δi, the average is computed. The median of these values gives the HL point estimate. P-values and confidence intervals around this estimate can be obtained using Wilcoxon sign ranking.

Table B1: Rosenbaum bounds test for log employment growth (Scheme 3 National Programmes)

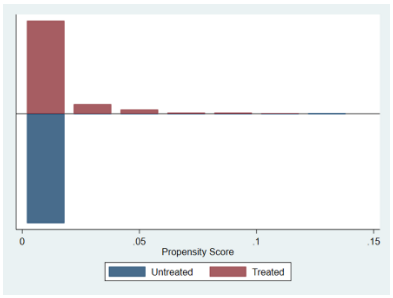
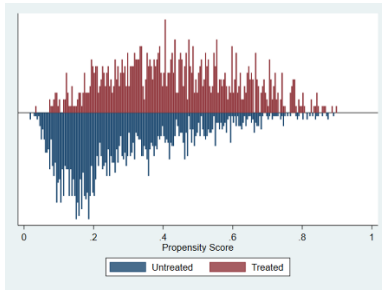
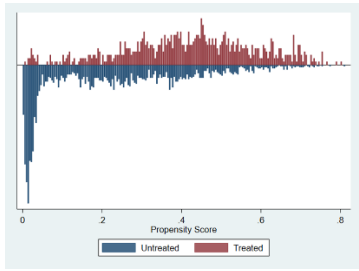
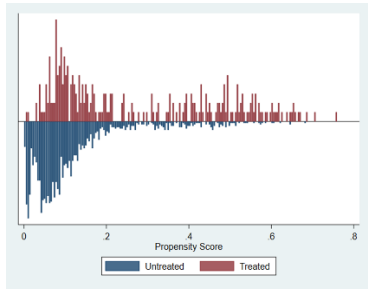
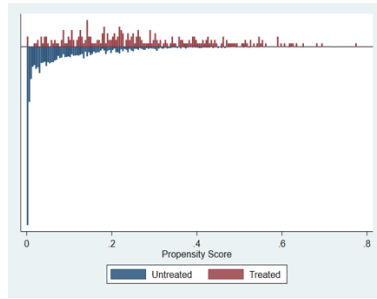
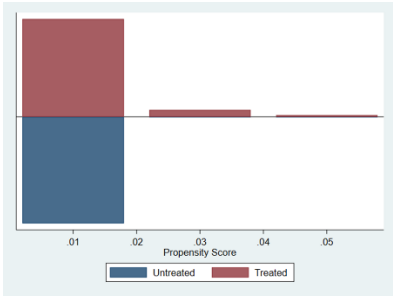
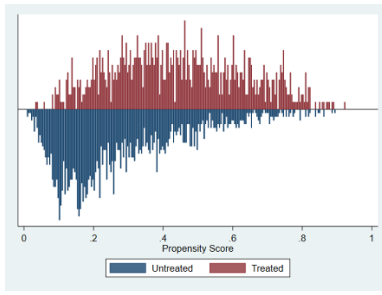
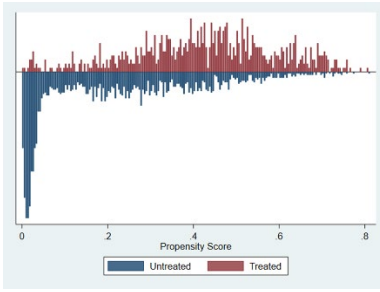
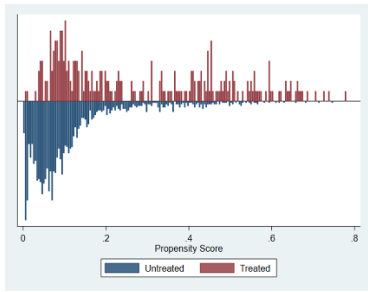
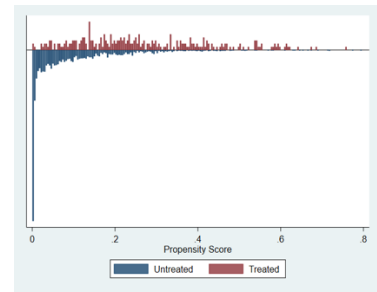
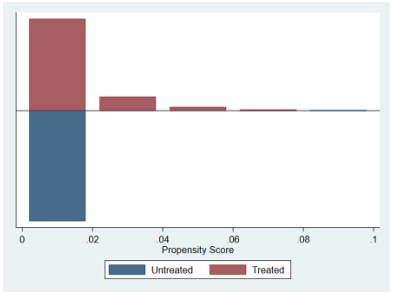
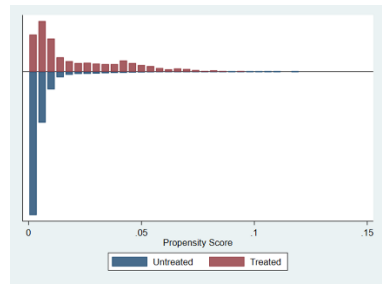
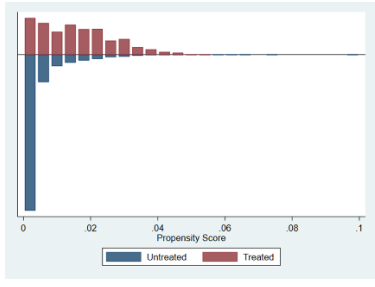
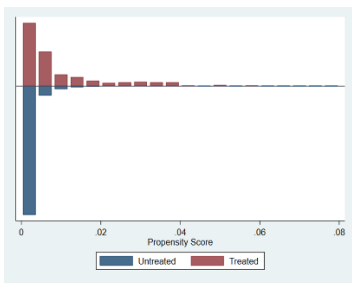
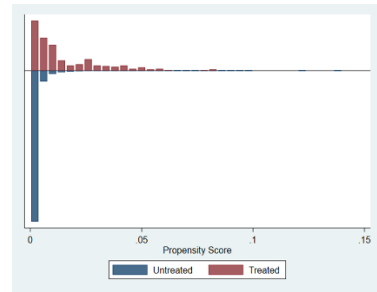
Scheme 1	Scheme 3: 2012 Cohort	Scheme 3: 2016 Cohort	Scheme 4: 2012 Cohort	Scheme 4: 2016
Preferred Counterfactual				
				
Alternative model I				
				
Alternative model II				
				

Table B2: Rosenbaum bounds test for log employment growth (Scheme 3 National Programmes)

		2012				2014				2016			
		Significance of selection effect		Point estimate		Significance of selection effect		Point estimate		Significance of selection effect		Point estimate	
Mode l	Γ	Positive	Negative	Upper	Lower	Positive	Negative	Upper	Lower	Positive	Negative	Upper	Lower
Match pool: BSD													
I	1	0	0	0.236	0.236	0	0	0.1	0.1	0	0	0.055	0.055
	1.04	0	0	0.224	0.25	0.001	0	0.087	0.116	0	0	0.04	0.065
	1.08	0	0	0.211	0.262	0.002	0	0.076	0.129	0.001	0	0.027	0.077
	1.12	0	0	0.2	0.275	0.008	0	0.066	0.143	0.003	0	0.015	0.091
	1.2	0	0	0.178	0.298	0.05	0	0.041	0.162	0.023	0	0	0.112
	1.3	0	0	0.152	0.325	0.23	0	0.011	0.193	0.134	0	0	0.134
	1.5	0	0	0.107	0.375	0.811	0	-0.019	0.24	0.686	0	0	0.185
II	1	0	0	0.235	0.235	0.07	0.07	0.037	0.037	0	0	0.07	0.07
	1.04	0	0	0.222	0.249	0.152	0.027	0.023	0.053	0	0	0.058	0.084
	1.08	0	0	0.21	0.261	0.276	0.009	0.008	0.064	0	0	0.048	0.095
	1.12	0	0	0.198	0.273	0.43	0.003	0	0.077	0	0	0.036	0.112
	1.16	0	0	0.175	0.297	0.73	0	-0.011	0.101	0.003	0	0.013	0.13
	1.3	0	0	0.149	0.325	0.937	0	-0.041	0.129	0.027	0	0	0.144
	1.5	0	0	0.104	0.376	0.999	0	-0.091	0.178	0.366	0	0	0.203
Match pool: Applicants													
I	1.00	0	0	0.117	0.117	0.172	0.172	0.024	0.024	0	0	0.112	0.112
	1.04	0	0	0.104	0.132	0.31	0.081	0.009	0.04	0	0	0.091	0.115
	1.08	0.001	0	0.09	0.145	0.476	0.033	0	0.054	0	0	0.083	0.137
	1.12	0.002	0	0.078	0.158	0.64	0.012	-0.005	0.068	0	0	0.067	0.144
	1.20	0.027	0	0.053	0.183	0.876	0.001	-0.032	0.092	0.002	0	0.047	0.169
	1.30	0.18	0	0.025	0.211	0.981	0	-0.063	0.124	0.023	0	0.012	0.203
	1.50	0.817	0	-0.024	0.264	1	0	-0.113	0.179	0.352	0	0	0.248
II	1.00	0	0	0.129	0.129	0.027	0.027	0.059	0.059	0	0	0.091	0.091
	1.04	0	0	0.115	0.144	0.069	0.008	0.042	0.073	0	0	0.077	0.108
	1.08	0	0	0.102	0.157	0.147	0.002	0.027	0.088	0.001	0	0.062	0.117
	1.12	0.001	0	0.089	0.171	0.264	0.001	0.012	0.102	0.002	0	0.053	0.134
	1.20	0.01	0	0.064	0.197	0.564	0	0	0.13	0.019	0	0.023	0.144
	1.30	0.095	0	0.036	0.226	0.86	0	-0.032	0.161	0.124	0	0	0.173
	1.50	0.692	0	-0.014	0.28	0.997	0	-0.082	0.221	0.685	0	0	0.204

Table B3: Rosenbaum bounds test for log employment growth (Scheme 4 Regional Programmes)

		2012				2014				2016			
		Significance of selection effect		Point estimate		Significance of selection effect		Point estimate		Significance of selection effect		Point estimate	
Mode l	Γ	Positive	Negative	Upper	Lower	Positive	Negative	Upper	Lower	Positive	Negative	Upper	Lower
Match pool: BSD													
I	1	0	0	0.239	0.239	0	0	0.181	0.181	0	0	0.084	0.084
	1.04	0	0	0.224	0.255	0	0	0.168	0.194	0	0	0.077	0.091
	1.08	0	0	0.21	0.27	0	0	0.156	0.205	0	0	0.067	0.097
	1.12	0	0	0.197	0.282	0	0	0.144	0.219	0.001	0	0.059	0.106
	1.2	0.001	0	0.172	0.308	0	0	0.12	0.242	0.004	0	0.045	0.118
	1.3	0.004	0	0.141	0.339	0	0	0.092	0.27	0.017	0	0.034	0.137
	1.5	0.05	0	0.086	0.394	0.011	0	0.045	0.321	0.117	0	0.008	0.172
II	1	0	0	0.204	0.204	0	0	0.194	0.194	0	0	0.1	0.1
	1.04	0	0	0.189	0.218	0	0	0.18	0.207	0	0	0.091	0.109
	1.08	0.001	0	0.173	0.233	0	0	0.167	0.221	0	0	0.084	0.112
	1.12	0.002	0	0.159	0.248	0	0	0.154	0.235	0.001	0	0.078	0.121
	1.16	0.009	0	0.131	0.277	0	0	0.13	0.259	0.003	0	0.063	0.139
	1.3	0.034	0	0.102	0.31	0	0	0.103	0.289	0.015	0	0.041	0.162
	1.5	0.201	0	0.047	0.365	0.005	0	0.054	0.345	0.11	0	0.017	0.199
Match pool: Applicants													
I	1.00	0.006	0.006	0.144	0.144	0	0	0.161	0.161	0	0	0.096	0.096
	1.04	0.012	0.003	0.13	0.163	0	0	0.145	0.175	0	0	0.091	0.105
	1.08	0.024	0.001	0.114	0.178	0	0	0.131	0.189	0.001	0	0.081	0.112
	1.12	0.043	0	0.102	0.191	0	0	0.118	0.203	0.002	0	0.07	0.12
	1.20	0.108	0	0.072	0.22	0	0	0.092	0.228	0.007	0	0.053	0.136
	1.30	0.25	0	0.04	0.254	0.003	0	0.064	0.259	0.028	0	0.038	0.152
	1.50	0.627	0	-0.017	0.313	0.244	0	0.013	0.317	0.17	0	0.009	0.178
II	1.00	0.014	0.014	0.127	0.127	0	0	0.167	0.167	0	0	0.096	0.096
	1.04	0.028	0.007	0.11	0.144	0	0	0.153	0.181	0	0	0.087	0.107
	1.08	0.049	0.003	0.094	0.16	0	0	0.14	0.194	0	0	0.079	0.112
	1.12	0.082	0.001	0.078	0.174	0	0	0.126	0.205	0.001	0	0.067	0.122
	1.20	0.181	0	0.048	0.203	0	0	0.102	0.231	0.005	0	0.054	0.141
	1.30	0.363	0	0.018	0.238	0	0	0.074	0.26	0.02	0	0.039	0.159
	1.50	0.743	0	-0.037	0.298	0.112	0	0.026	0.317	0.134	0	0.014	0.195

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