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# Business performance of Enterprise Connect participants

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## Abstract

This paper assesses the impact of participation in the Enterprise Connect (EC) program on firm performance. A counterfactual (non-treated) set of firms is constructed using observable characteristics in the Business Longitudinal Analysis Data Environment (BLADE). Average treatment effects on the treated (ATT) are estimated to compare the outcome of treated firms to that of the counterfactuals and obtain a reliable estimate of the average 'additional' impact of the EC program. The results show that firms that received a Business Review and a grant from the EC program performed better in terms of growth in turnover, employment and capital expenditure, as well as higher rates of survival compared to similar non-participating firms. However, the size and direction of impacts differ across cohorts and industries.

**JEL Codes:** H25, L25, L26

**Keywords:** Firm Performance, Impact Analysis, Innovation, Public Policy, Entrepreneurship



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## Key points

- Linking Departmental program data with the Business Longitudinal Analysis Data Environment (BLADE) enables an empirical impact study of the Enterprise Connect program on participant firms
- EC participant firms had higher performance than non-participants firms, in terms of growth in turnover, employment, capital expenditure and survival rates
- Micro and other small employing participant firms were driving the growth in turnover, employment and capital expenditure
- Manufacturing firms and firms in the Other Services industries contributed more to growth in turnover, employment and capital expenditure
- Firms participating in both the EC and the R&D Tax Incentive (RDTI) program outperform firms only participating in the RDTI program in terms of turnover growth

# 1. Introduction

Enterprise Connect (EC) was launched on 21 May 2008 to provide advisory services tailored to the needs of Australian Small and Medium sized Enterprises (SMEs). Matched grants were also provided to assist participants implement the advice received. This paper uses the identifiable characteristics of participants to develop a quasi-control group of similar firms. This allows change in financial performance of EC participants to be compared with this counterfactual group in order to control for external factors when estimating the impact of EC on participants. The impact of the EC program is separately measured for each cohort, where a cohort is defined by the year in which the firm receives assistance. Results for each cohort are then combined into a pooled result to provide a general outcome. The analysis is further split into three major industries: Manufacturing, PST and Other Services firms.<sup>1</sup>

The closure of EC was announced in May 2014 with the majority of program activities concluded by December 2014. The new Entrepreneurs' Programme (EP) was announced in May 2014. EP drew together some of the key elements of a number of closing programs including EC. EP is an important pillar of both the National Industry and Competitiveness Agenda and the National Innovation and Science Agenda (NISA).

The Business Management element of EP built on and improved the Business Review service and the Tailored Advisory Service Grant provided under EC. Therefore it is expected that this paper will help inform policy development of the EP. This research is to update and expand on exploratory work the ABS undertook in 2013<sup>2</sup>, and to provide a standardised assessment strategy, that can be repeated as financial data on the EP is made available over 2015–16 to 2018–19.

## 2. Enterprise Connect Background

### 2.1 History

The EC program was launched on 21 May 2008 as a network of twelve centres located around Australia with over 100 advisers dedicated to delivering business improvement services to Australian SMEs.

The Centres worked with industries as diverse as manufacturing, clean technology, defence, resources and the creative sector, the services were available to businesses whether they were located in metropolitan areas, country centres or remote Australia.

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<sup>1</sup> Services industries used in this paper follow the standard ABS definition of service industries, however PST is excluded as the PST industry is analysed separately. See ABS catalogue 1301.0 for an overview of service industries  
<http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/1301.0Main+Features1772012>

<sup>2</sup> Office of the Chief Economist (2014) *Australia Industry Report 2014*, Canberra, Department of Industry, Innovation and Science, p.173–180

Delivery of the EC program was built on the previous Australian Industry Productivity Centres (AIPC) program. The AIPC was launched on 3 October 2007 to provide business improvement services to firms throughout Australia. Eligible firms were those in both manufacturing and service-related sectors deemed to be trade-exposed. Performance of early cohorts may reflect the AIPC program rather than the EC program.

## 2.2 Objective and rationale

The overarching objective of the EC program was to provide SMEs with better access to new ideas, knowledge and technologies, to enable business to become more innovative, efficient and competitive and to lift productivity across Australian industry. Measuring the change in outcome variables such as turnover, employment, export sales, capital expenditure and survival rates attempts to assess the success of the EC program in achieving its objectives.

The market failure that the EC program was created to address was the failure of SMEs to seek professional advisory services to address strategic management issues in their businesses. The 'average' SME owner often lacked a formal business management qualification or experience. Managers/owners generally have extensive technical expertise and knowledge of their business, but lacked formal business management capability, including an understanding of technology or markets, or an inadequate capacity to absorb new technology. Gaps in these capabilities impede their adaptation to new technologies and ability to respond to new opportunities, leading to transition failures or learning failures.

## 2.3 Services and grants

The original EC program core services included the Business Review and the Tailored Advisory Service.

- The **Business Review** (BR) provided SMEs with a holistic assessment of their current performance, including benchmarking and a set of recommendations for improvement and growth.
- Firms that completed a Business Review could apply for a **Tailored Advisory Service grant** to cover half the cost, up to a maximum grant of \$20,000 (excluding GST), of engaging a consultant to implement Business Review recommendations.

Two other core services were introduced later. These included the Researches in Business grant which was introduced in 2009 and the Continuous Improvement Program which was introduced in 2011.

- **Researchers in Business** (RIB) provided up to \$50,000 in matched funding for SMEs to engage a researcher to help develop and implement a new idea with commercial potential.
- **Continuous Improvement Program** (CIP) built on a Business Review by incorporating the measurement of critical business information that would be the foundation of the continuous improvement process. The two cycle CIP engagement enabled sufficient time to implement and firmly embed the changes, with the ability to measure the outcomes and achievements. CIP

also gave participants access to another \$20,000 in matched funding through Tailored Advisory Service grants.

Only firms that received a Business Review and subsequently succeeded in applying and receiving a grant (Tailored Advisory Service and Researchers in Business) are analysed in this paper.<sup>4</sup>

## 2.4 Eligibility

To be eligible for all EC services and grants a business must:

- Possess an Australian Company Number (ACN) or Australian Business Number (ABN) for remote businesses
- Have revenue or expenditure between \$750,000 and \$100 million (depending on industry sector or region) in the current financial year or one of the two preceding financial years
- Be solvent
- Have operated in Australia and filed Business Activity Statements showing ongoing trading in at least three full consecutive years
- Be operating in an eligible industry sector or region
- Comply with its obligations under the Workplace Gender Equality Act 2012

## 3. Descriptive statistics

### 3.1 Participant counts

Firms participating in the EC program are classified by their cohort. The cohort of each firm is defined by the year the participant firm first engaged in the program. In the first year of the program there were 69 participants (Table 3.1). The overwhelming majority of grants are TAS grants (96.5 per cent) followed by RIB grants (2.7 per cent).<sup>3</sup>

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<sup>3</sup> The remainder are CIP grants

<sup>4</sup> Data on Business Review only program participants are dropped from the analysis at this time due to concerns over data quality for this group.

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Table 3.1: Pre-linked departmental data, counts

Cohort	EC firm count
2007–08	69
2008–09	339
2009–10	525
2010–11	645
2011–12	710
2012–13	648
2013–14	609
2014–15	271
Total	3,816

Notes: Unique firms counts

Source: Department of Industry, Innovation and Science (2018)

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To study firm performance across time using administrative data I ensure that the unique identifier (ABN) corresponds to a single firm and that there are non-missing values. Consequently businesses are excluded from the analysis if the following occurs:

- No ABN in EC data
- Business is part of a GST grouping for ATO reporting purposes
- Business is part of a complex business that is known to operate across multiple industries or has multiple ABNs (complex firm)<sup>4</sup>

Table 3.2 shows the number of businesses linked to the Business Longitudinal Analysis Data Environment (BLADE) after applying these restrictions.

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<sup>4</sup> The ABS units model permits a many to many relationship of ABS unit identifiers and ABNs.

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Table 3.2: BLADE linked data, counts

Cohort	EC firm count
2007–08	61
2008–09	304
2009–10	469
2010–11	599
2011–12	664
2012–13	623
2013–14	586
2014–15	263
Total	3,569

Source: BLADE (2001–02 to 2014–15)

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### 3.2 Participant characteristics

The average EC program participant is a small to medium sized private company on the east coast (NSW, VIC or QLD) (Table 3.3). A high share of participants are in Manufacturing and Professional, Scientific and Technical Services industries. About one third (37.0 per cent) of EC participants are in the Manufacturing industry. EC firms are on average more likely to be a private company (74.8 per cent), R&D active (14.3 per cent) and exporting (33.0 per cent). Characteristics on an all firm benchmark are also provided so the characteristics of EC participants can be compared to the ‘average’ employing firm in the Australian economy.<sup>5</sup>

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<sup>5</sup> Employing firms more accurately represent the ‘average’ firm, as a large share of non-employing businesses often include arrangements such as residential and commercial property strata bodies and corporate and trust structures whose main purpose is legal or financial in nature.



Table 3.3: The proportion of EC participants by various metrics

Characteristic	EC participants	All firm benchmark*
<i>Firm size</i>		
Micro (1–4 employees)	9.6	69.9
Small (5–19 employees)	45.3	23.6
Medium (20–199 employees)	42.4	6.1
Large	2.7	0.4
<i>Location</i>		
NSW	32.3	34.8
VIC	18.1	25.6
QLD	21.0	19.4
SA	11.7	6.2
WA	11.5	10.1
Other States	5.4	4.0
Exporter <sup>a</sup>	33.0 <sup>a</sup>	4.8
R&D active <sup>b</sup>	14.3 <sup>b</sup>	0.6
<i>Industry</i>		
Manufacturing	37.0	5.2
PST	16.0	13.0
Other Services	32.8	58.1
Unknown/other industries	14.2	23.7
<i>Type of legal organisation</i>		
Propriety Limited	74.8	52.4
Trust	18.3	22.1
Other	6.9	25.5

Notes: \*Other Services here are ABS defined service industries, excluding PST

<sup>a</sup>33.0 per cent) of EC participants firms were exporting in their treatment year. Exporter

<sup>b</sup>14.3 per cent of EC participant firms were conducting R&D in their treatment year

\*All employing firms

n/a denotes data is unavailable or data has been confidentialised to ensure that they are not likely to enable identification of a particular business.

Source: BLADE (2001–02 to 2014–15)

## 4. Data and methodology

### 4.1 Propensity score matching and the average treatment effect on the treated (ATT)

To understand the impact of the EC program on firm performance, I construct a sample of treated (EC program participants) and establish a counterfactual (non-participants or untreated) set of firms that are as similar as possible in terms of observable characteristics prior to the policy intervention.<sup>6</sup> This technique is referred to as propensity score matching (PSM), was first advanced by Rosenbaum and Rubin (1983).<sup>7</sup> I then compare outcomes of treated firms to the untreated (difference in differences or DID) to obtain a reliable estimate of the average 'additional' impact of the EC program. This difference is also referred to as the average treatment effect on the treated (ATT).<sup>8</sup> For the remainder of the analysis, the average treatment effect on the treated will be referred to as the ATT or simply the average treatment effect.

As is the case for most government programs, the counterfactual is never observed and therefore needs to be constructed. This is because a particular firm cannot both participate and not participate in the EC program.<sup>9</sup> Furthermore, firms do not participate in the EC program randomly. An improper set of counterfactuals could lead to selection bias.<sup>10</sup>

More formally, let  $Y_1$  equal the outcome of interest (e.g. turnover) for firms that participate in the EC program, and let  $Y_0$  equal the outcome of interest for firms that do not participate in the EC program. Let  $z$  denote the treatment indicator, which takes the value 1 for treated firms and 0 for untreated firms.

To estimate the ATT,

$$E(Y_1 - Y_0 | z = 1) = E(Y_1 | z = 1) - E(Y_0 | z = 1)$$

However, the second term is not observed for the treated. It is only observed for firms who are untreated,

$$E(Y_0 | z = 0)$$

Assuming that given a propensity score  $P(X)$  estimated based on a vector of observable characteristics, the expected outcomes do not depend on the treatment status, then the treatment effect can be estimated since

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<sup>6</sup> Characteristics used for matching are discussed later in Section 4.4

<sup>7</sup> Rosenbaum, PR & Rubin RB (1985) The Central Role of the Propensity Score in Observational Studies for Causal Effects *Biometrika*, 70(1), pp. 41-55

<sup>8</sup> Difference in difference estimates are typically considered to be average treatment effects on the treated, rather than average treatment effects. This is because DID estimates are generally thought of as applying to a particular group that was treated, rather than to a population that could have been treated.

<sup>9</sup> A particular firm must either participate or not participate, it cannot do both

<sup>10</sup> Selection bias cannot be completely removed, rather it is minimised

$$E(Y_0|z = 1, P(X)) = E(Y_0|z = 0, P(X))$$

And therefore the estimated ATT using the observable relationship is:

$$\underline{E(Y_1|z = 1, P(X)) - E(Y_0|z = 0, P(X))}$$

## 4.2 The use of matching estimators in measuring the impact of government programs

While there is wide use of matching estimators in assessing the impact of government programs, there is limited use in the innovation program space, and even less so in the Australian context.

Rafi (2017) assessed the impact of participation in the South Australia Innovation and Investment Funds on firm performance via a nearest neighbour matching (NNM) estimator.<sup>11</sup> Here, NNM is used rather than PSM due to the relatively low number of covariates required for matching.<sup>12</sup> Bakhtiari (2017) also uses NNM to study whether firms that received a CleanTech Investment Program grant outperformed their non-CleanTech counterparts.<sup>13</sup>

Frontier Economics was commissioned by the UK Department for Business, Energy & Industrial Strategy and Innovate UK to study the economic impact of public sector support for private sector innovation. Frontier Economics used propensity score matching to examine the performance of firms receiving grants from innovative UK schemes and firms accessing services from the National Measurement System, compared to a constructed counterfactual of firms from the general business population.<sup>14</sup>

## 4.3 Linking program with BLADE data

In order to estimate the effect of the EC program, information on firm characteristics and outcomes are used from the Business Longitudinal Analysis Data Environment (BLADE). The BLADE is comprised of integrated administrative tax data and existing ABS survey data using the ABS business register as the integrating spine. The administrative tax data in the BLADE is best described as a census of Australian firms. The conceptual basis of BLADE is aligned with the ABS economic statistics unit model that is the basis for

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<sup>11</sup> Rafi, B (2017) *Participation in South Australian Innovation and Investment Funds: Impact on firm performance*, Canberra, Department of Industry, Innovation and Science

<sup>12</sup> Office of the Chief Economist (2018) *Program Insights Report 2018*, Canberra, Department of Industry, Innovation and Science, Chapter 3

<sup>13</sup> Bakhtiari, S (2017) *Business Dynamics of Clean Energy Policy*, Canberra, Department of Industry, Innovation and Science

<sup>14</sup> Department for Business, Energy & Industrial Strategy (2017) *The Impact of Public Support for Innovation on Firm Outcomes*, BEIS Research Paper Number 3

producing Australian economic statistics. For further information on BLADE, refer to Rafi & Hansell (2018).<sup>15</sup>

The three core ABS business surveys included in BLADE are:

- Economic Activity Survey (EAS): EAS is a core data source for national accounts estimates of value-added by industry and collects a wealth of balance sheet and other information.
- Business Characteristics Survey (BCS): The BCS is used to construct cross-sectional population estimates of innovation and information technology use.
- Survey of R&D, Business Expenditure on R&D (BERD)

The main administrative data in BLADE is from the ATO and includes:

- Business Activity Statements (BAS): All businesses registered for GST purposes must submit either monthly, quarterly or annual BAS to the ATO. Variables of interest to researchers include total sales; export sales; non-capital purchases; capital purchases; and, wages, salaries and other payments.
- Business Income Tax (BIT): BIT data encompasses four broad classes of reporting entities: companies, trusts, partnerships and sole proprietors. BIT data has a wealth of balance sheet information, such as assets, liabilities, bad debts and the like.
- Pay As You Go (PAYG): Businesses are required to submit statements on behalf of employees reporting income earned over each fiscal year. In the BLADE all employment data are aggregated to the ABN level, so no individual employee can be identified.

#### 4.4 Data cleaning

The BLADE data covering years 2005–06 to 2014–15 yields over 21.3 million observations, where an observation is a combination of firm and year.

A number of filters are applied to the data to exclude outlying firms and other anomalies that could skew the treatment effects substantially.<sup>16</sup> These filters are described below.

##### **Large firms**

Firms whose turnover and employment lies in the top one percentile when pooling all observations from all years in the BLADE.

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<sup>15</sup> Hansell, D & Rafi, B. (2018) Firm-level Analysis using the ABS' Business Longitudinal Analysis Data Environment (BLADE), *Australian Economic Review*, 51(1), pp.132-138

<sup>16</sup> One or two very large firms entering the treatment or control group could dominate the averages, leading to unreliable estimates of ATTs for a given treatment and outcome

### **Complex firms<sup>17</sup>**

Complex firms in this context are those that are known to operate across multiple industries or have multiple ABNs. These firms are excluded from the analysis as turnover and employment cannot be properly apportioned to account for the operation on the treated subsidiary.

### **Unreliable reports**

Firms reporting zero employees or zero turnover in any year are excluded. These firms are deemed inactive or their reports are unreliable.

### **Imputing missing employment figures**

There is a strong relationship between the wages and salaries variable and the employment (FTE) variable in the BLADE, and this relationship is exploited to fill in the missing employment values when wages and salaries are reported by employment is missing. See Appendix B for more detail.

### **Multiple counts of assistance**

There are some firms that receive multiple grants. For these firms, the impact of assistance is measured from the first instance of assistance.

### **Characteristics used for matching**

The ANZSIC subdivision and state of location are included as control variables as industry subdivision and location. The FTE count will be used to proxy for the size of a firm. Export status and R&D status are binary dummy variables that are equal to one when a business has export sales<sup>18</sup> or R&D expenditure in the year of program treatment.

## **4.5 Model specification**

A propensity score for each firm is estimated using a logit model relating a dummy for treatment with a set of characteristics. The characteristics used for this estimation are described below. The model is estimated separately for each cohort (year of treatment). A separate estimate for propensities is also computed when restricting the sample to Manufacturing or PST and Other Services<sup>19</sup> firms. An example of the logit results can be found in Appendix C.

### **Controlling for selection bias**

Firm characteristics in the propensity score model should include all factors influencing both a firm's likelihood to be treated and its outcomes post treatment. In addition to including observable characteristics such as size, industry, location and type of legal organisation, variables that capture past firm performance should be included in the model. Past firm performance is a good

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<sup>17</sup> Complex firms are also discussed in section 3.1

<sup>18</sup> Exporter status in this paper is defined as export sales above \$2000 in a given year

indicator of a firms' willingness to grow. A positive past performance will increase the firms' prospects in being selected for an EC grant. Therefore, one year lagged growth rates of turnover and employment are included in the propensity score model specification.

Table 4.1: Propensity score model specification

Variable	Specification
Size	Number of employees (FTE)
Past firm performance	Turnover and employee growth rates, one year prior to treatment
Industry	2 digit ANZSIC subdivision
Exporter status	Dummy variable for exporting more than \$2000 in treatment year
Location	7 state dummy variables
Type of Legal Organisation	4 dummies – Public company, private company, trust or partnership
R&D status	Dummy variable for spending on R&D in treatment year

Notes: A dummy variable takes the value of 0 or 1 to indicate the absence or presence of a categorical effect.

Source: BLADE (2001–02 to 2014–15)

This model could still not factor in unobserved characteristics which means selection on unobservables remains an issue that could account for some of the estimated impact.

#### 4.6 Outcome variables

This paper investigates the ATT over time between program participants and a control group using the following outcome variables:

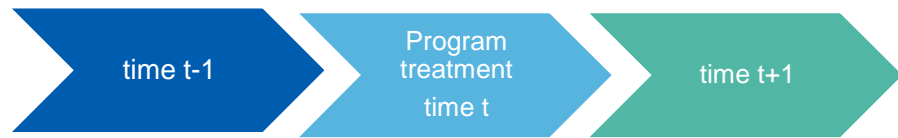
- Turnover
- Full-time equivalent employee numbers
- Export sales
- Capital expenditure
- Survival rates

These variables are measured from one year prior to participation, and subsequently follows those measures in one to four years post participation. In each year after participation, the ATT is computed and compared.

For example, Figure 4.1 shows the two year treatment effect is calculated from time  $t-1$  to time  $t+1$ , if time  $t$  is the year of program treatment.

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Figure 4.1: Two year treatment effect calculation



Notes: Time t is year of program treatment

Source: Department of Industry, Innovation and Science (2018)

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## 5. The impact of EC – pooled

In this section, results across cohorts are pooled together to measure the average treatment effect for all firms (by industry sector).

### 5.1 Turnover growth

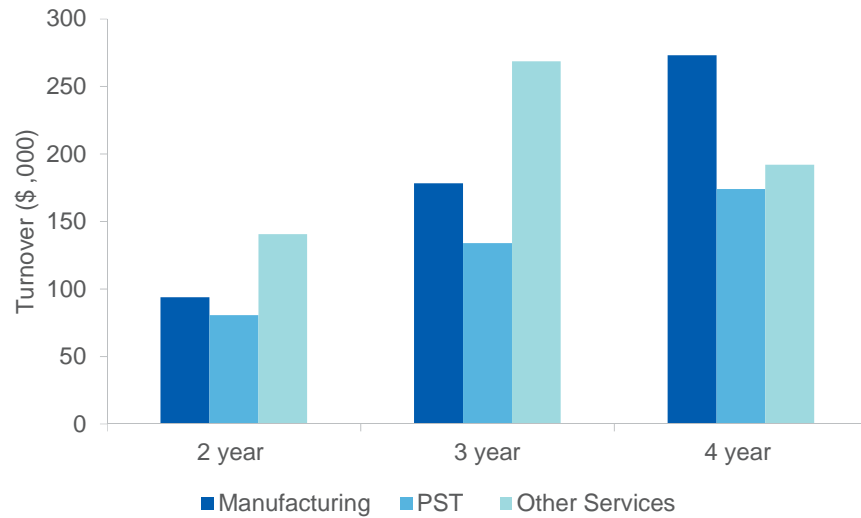
Figure 5.1 reports the ATT for the two year, three year and four year change growth in turnover by industry. The results show that EC firms in all industries experienced positive and statistically significant gains to their turnover. It is interesting to see micro and other small employing firms (between 1 and 19 FTE employees) are driving the growth in turnover (see Appendix C, Figure C.1).

The EC firms in Manufacturing experienced on average an additional \$94,000 growth in turnover within two years, an additional \$178,000 growth in turnover over a three years and an additional \$273,000 growth in turnover within four years.

The EC firms in PST experienced on average an additional \$81,000 growth in turnover within two years, an additional \$134,000 growth in turnover within three years and an additional \$174,000 growth in turnover within four years.

The EC firms in Other Services experienced on average an additional \$141,000 growth in turnover within two years, an additional \$269,000 growth in turnover within three years and an additional \$192,000 growth in turnover within four years.

Figure 5.1: Growth in turnover (\$, 000), average treatment effect, pooled across cohorts, by industry sector



Notes: Length of the bars depicts the premium growth in turnover change relative to the counterfactual. Missing bars signify results that are not statistically significant.

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 5.2 Employment growth

Figure 5.2 reports the ATT for the two year, three year and four year growth in employment (number of FTE) by industry. EC firms across all industries experience positive and statistically significant gains to employment. It is interesting to see micro and other small employing firms (employing between 1 and 19 FTE employees) are driving the growth in employment (see Appendix C, Figure C.2).

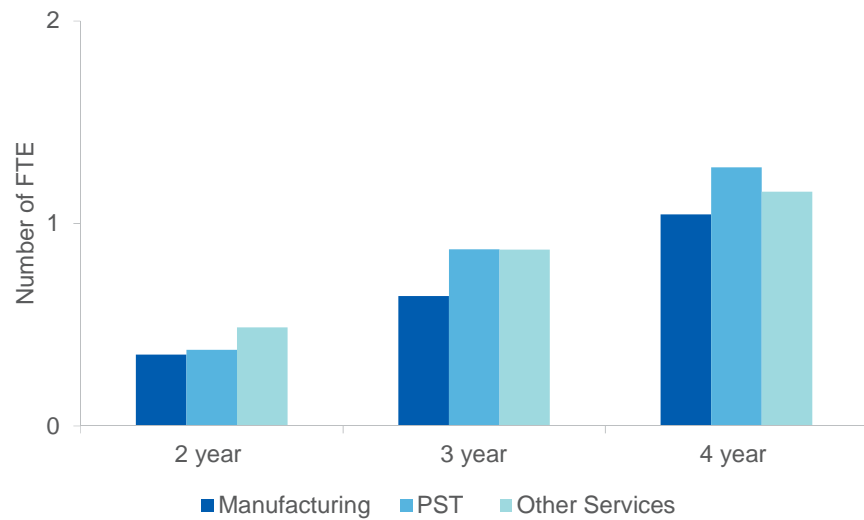
The EC firms in Manufacturing experienced on average an additional 0.35 FTE within two years, an additional 0.64 FTE within three years and an additional 1.04 FTE within four years.

The EC firms in PST experienced on average an additional 0.38 FTE within two years, an additional 0.87 FTE within three years and an additional 1.28 FTE within four years.

The EC firms in Other Services experienced on average an additional 0.49 FTE within two years, an additional 0.87 FTE within three years and an additional 1.16 FTE within four years.



Figure 5.2: Growth in employment (number of FTE), average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium in employment change relative to the counterfactual. Missing bars signify results that are not statistically significant.

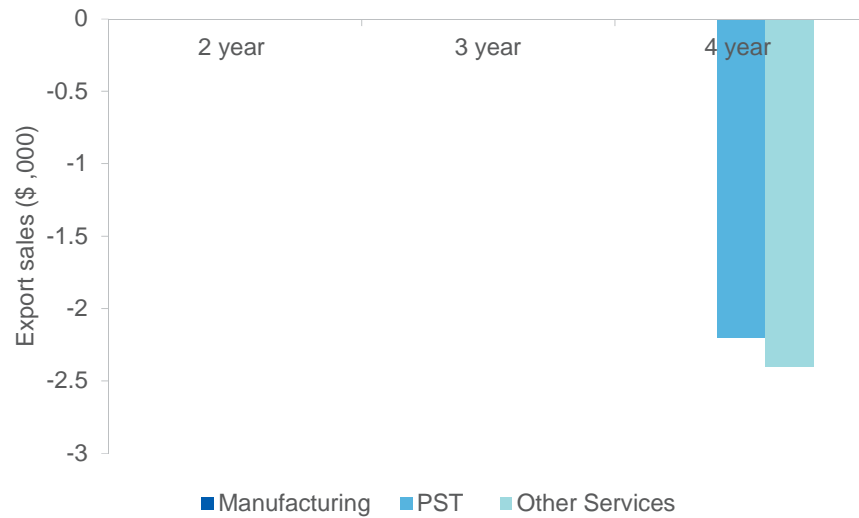
Source: BLADE (2001–02 to 2014–15) Author's calculations

### 5.3 Export sales growth

Figure 5.3 reports the ATT for the two year, three year and four year growth in export sales by industry.

The results for export sales growth are mostly not statistically significant due to small sample numbers associated with the export sales variable. This is because only a small proportion of Australian businesses are exporters (roughly 65,000 businesses in any given year).

Figure 5.3: Growth in export sales (\$, 000), average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium growth in export sales change relative to the counterfactual. Missing bars signify results that are not statistically significant.

Source: BLADE (2001–02 to 2014–15) Author's calculations

#### 5.4 Increase in capital expenditure

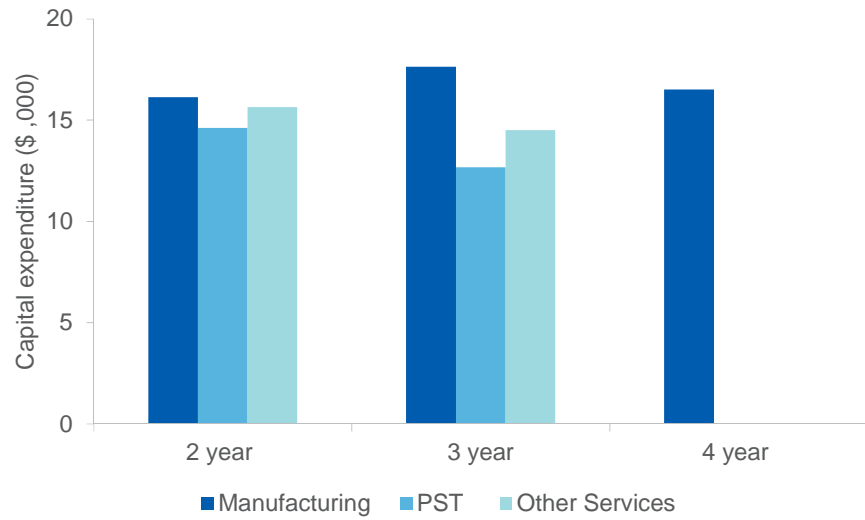
Figure 5.4 reports the ATT for the two year, three year and four year growth in capital expenditure by industry.

The EC firms in Manufacturing experienced on average \$16,100 growth in capital expenditure compared to non-participant firms in the same industry within two years, \$17,600 growth within three years and \$16,500 within four years.

The EC firms in PST experienced on average \$14,600 growth in capital expenditure compared to non-participant firms in the same industry within two years and \$12,700 growth within three years.

The EC firms in Other Services experienced on average \$15,600 growth in capital expenditure compared to non-participant firms in the same industry within two years and \$14,500 growth within three years.

Figure 5.4: Growth in capital expenditure (\$, 000), average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium growth in capital expenditure change relative to the counterfactual. Missing bars signify results that are not statistically significant.

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 6. The impact of EC by cohort

The following analysis is done separately by each cohort.<sup>20</sup>

### 6.1 Turnover

Table 6.1 reports the ATT between EC and non-EC participants for turnover growth within two, three, four and five years, by cohort and industry.

Manufacturing firms and Other Services firms appear to benefit from the EC program the most in terms of turnover growth, as do later cohorts of the program in general. The relatively weak performance in the early cohorts may reflect the AIPC program rather than the EC program. The lack of statistically significant results in the early cohorts may also reflect the smaller sizes of these cohorts.

<sup>20</sup> A cohort is defined as the flow of new participants in a given financial year.

Table 6.1. Turnover ATT (thousands of dollars), by cohort and industry

Cohort	Years	Manufacturing	PST	Other Services
2007–08	2			-410.0
	3	238.7		-441.8
	4			-518.4
	5			-949.4
2008–09	2	166.0		186.5
	3	159.3	-220.7	353.3
	4	280.2	-748.6	528.5
	5	401.3	-734.1	735.0
2009–10	2			
	3			
	4	251.3		259.7
	5	253.0	413.9	293.6
2010–11	2			177.9
	3	142.6		231.8
	4	206.6		314.5
	5	125.3	62.8	129.1
2011–12	2	201.5	155.4	153.1
	3	255.7	101.6	186.9
	4	314.6	186.8	308.1
2012–13	2			194.7
	3	238.7		-410.0
2013–14	2			-441.8

Notes: All values shown in table are significant at 10 per cent. Blank cells are results that are not statistically significant. N/a denotes sample size is too small to calculate a value.

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 6.2 Employment

Table 6.2 reports the ATT between EC and non-EC participants for employment (FTE) growth within two, three, four and five years, by cohort, industry and program element.

EC firms appear to benefit from the EC program in terms of employment growth, as do later cohorts of the program in general. The relatively weak performance in the early cohorts may reflect the AIPC program rather than the EC program. The lack of statistically significant results in the early cohorts may also reflect the smaller sizes of these cohorts.

Table 6.2. Employment (number of FTE) ATT, by cohort and industry

Cohort	Years	Manufacturing	PST	Other Services
2007–08	2			
	3			
	4			
	5			
2008–09	2	0.8		0.8
	3	0.8	-1.2	1.4
	4	0.7	-1.2	1.9
	5	1.5		1.6
2009–10	2			
	3			
	4	0.7		
	5	0.9	1.3	1.3
2010–11	2			0.2
	3		0.4	0.7
	4	0.8	0.7	0.9
	5	0.2	0.7	0.3
2011–12	2	0.8	1.3	0.7
	3	0.7		0.6
	4	1.1	0.7	1.0
2012–13	2	0.3	0.5	0.6
	3			
2013–14	2			

Notes: All values shown in table are significant at 10 per cent. Blank cells are results that are not statistically significant. N/a denotes sample size is too small to calculate a value.

Source: BLADE (2001–02 to 2014–15) Author's calculations

### 6.3 Export sales

The export sales variable is unable to be studied by cohort, due to small sample sizes.<sup>21</sup>

### 6.4 Capital expenditure

Table 6.3 reports the ATT between EC and non-EC participants for capital expenditure growth within two, three, four and five years, by cohort and industry.

The EC firms across all industries appear to benefit from the EC program in terms of additional investment in capital, particularly in later cohorts.

Table 6.3. Capital expenditure ATT (thousands of dollars), by cohort, industry and program element

Cohort	Years	Manufacturing	PST	Other Services
2007–08	2			40.2
	3			
	4			
	5			
2008–09	2	13.6		
	3	19.6	22.4	
	4	16.7		15.9
	5	29.1	24.6	
2009–10	2			
	3	15.0		
	4	12.0		9.5
	5	11.3	14.3	
2010–11	2	16.1	8.3	8.8
	3	23.3	12.2	11.3
	4	20.6	11.3	11.9
	5	18.3	16.2	11.1
2011–12	2	20.1	14.4	10.3
	3	13.1	9.0	15.2
	4	12.1	9.9	15.0
	5			
2012–13	2	19.5	20.1	21.5
	3			40.2
2013–14	2			

Notes: All values shown in table are significant at 10 per cent. Blank cells are results that are not statistically significant. N/a denotes sample size is too small to calculate a value.

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 7. The impact of EC on R&D Tax Incentive participants

Understanding the extent of participation across multiple government programs is an important consideration for evaluation efforts. If the participation is not taken into account, impacts of an individual program will almost certainly be overstated.<sup>22</sup>

There are close linkages between complementary DIIS programs, particularly the EC and R&D Tax Incentive<sup>23</sup> (RDTI) programs, therefore it is important to acknowledge the firms that participate in both of these programs by measuring the impact of EC participation on the RDTI participant population. Out of all EC participants, 15.3 per cent registered for the RDTI or the R&D Tax Concession in at least one year between 2001-02 and 2014-15. Any difference within the RDTI participant group in the performance of EC participants against non-EC participants firms can be attributed to the EC program.<sup>24</sup>

The following section discusses the difference in firm performance of RDTI firms engaging in the EC program versus RDTI firms that do not engage with the EC program.<sup>25</sup>

### 7.1 Turnover growth

Figure 7.1 reports the ATT between EC and non-EC RDTI participants for the two year, three year and four year change growth in turnover, pooled across cohorts.

RDTI participant firms that also participated in the EC program experienced on average higher turnover growth within three to four years compared to RDTI firms that did not participate in the EC program. The impact of the EC program on RDTI firms is positive. These results imply firms that are already participating in the RDTI receive additional benefit by also participating in the EC program.

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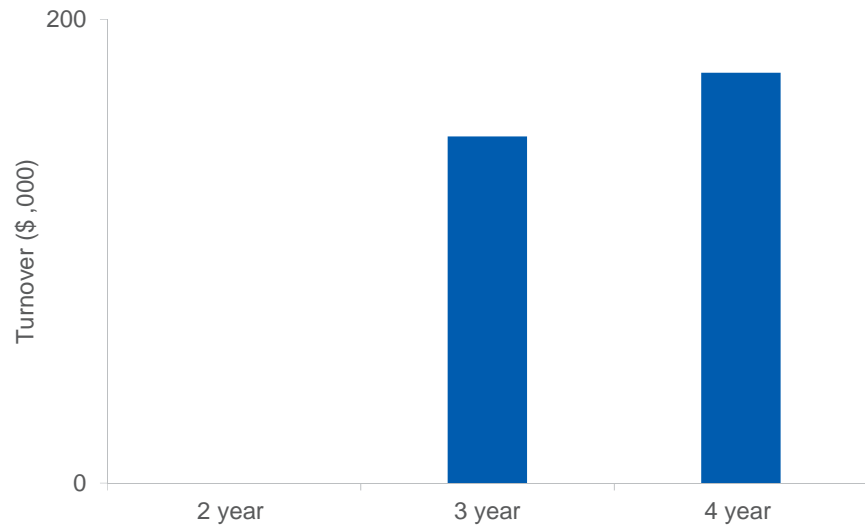
<sup>22</sup> Horne, M (2018) *Firms that receive multiple instances of assistance from DIIS programs*, a forthcoming OCE staff paper

<sup>23</sup> The RDTI program encourages industry investment in R&D and is a broad-based program that is accessible to all industry sectors. The RDTI program commenced in 2011-12 and was preceded by the R&D Tax Concession (RDTC)

<sup>24</sup> Provided relevant observables are used in the matching process as used earlier in the paper (Table 4.1)

<sup>25</sup> Engagement in the RDTI is defined as accessing the RDTI program (or preceding RDTC program) at least once between 2001-02 and 2014-15

Figure 7.1: Growth in turnover (\$, 000) for RDTI firms, average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium growth in turnover change relative to the counterfactual. Missing bars signify results that are not statistically significant.

Source: BLADE (2001–02 to 2014–15) Author's calculations

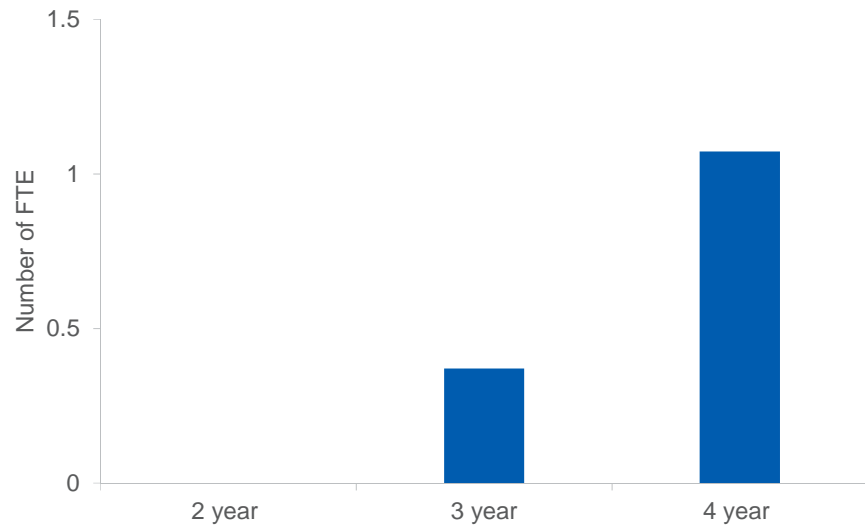
## 7.2 Employment growth

Figure 7.2 reports the ATT between EC and non-EC RDTI participants for the two year, three year and four year change growth in employment, pooled across cohorts.

RDTI participant firms that also participated in the EC program experienced on average higher employment growth within three to four years compared to RDTI firms that did not participate in the EC program.



Figure 7.2: Growth in employment (number of FTE), average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium in employment change relative to the counterfactual. Missing bars signify results that are not statistically significant.

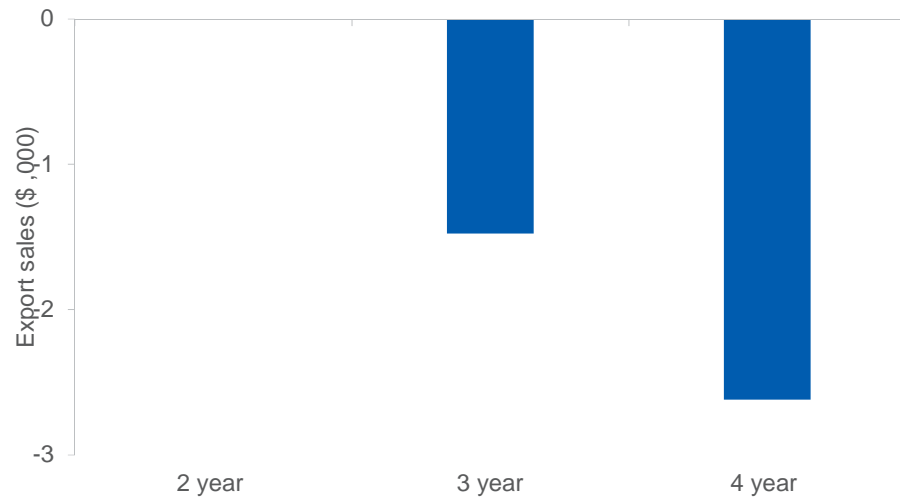
Source: BLADE (2001–02 to 2014–15) Author's calculations

### 7.3 Export sales growth

Figure 7.3 reports the ATT between EC and non-EC RDTI participants for the two year, three year and four year change growth in export sales, pooled across cohorts.

RDTI participant firms that also participated in the EC program experienced on average lower export sales growth within three to four years compared to RDTI firms that did not participate in the EC program.

Figure 7.3: Growth in export sales (\$, 000) for RDTI firms, average treatment effect, pooled across cohorts



Notes: Length of the bars depicts the premium growth in export sales change relative to the counterfactual. Missing bars signify results that are not statistically significant.

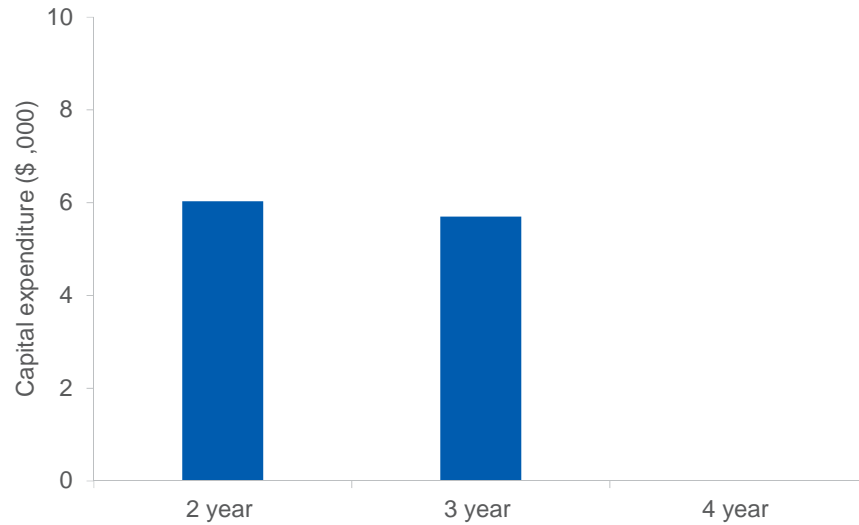
Source: BLADE (2001–02 to 2014–15) Author's calculations

#### 7.4 Capital expenditure growth

Figure 7.4 reports the ATT between EC and non-EC RDTI participants for the two year, three year and four year change growth in capital expenditure, pooled across cohorts.

RDTI participant firms that also participated in the EC program experienced on average higher investment in capital within two to three years compared to RDTI firms that did not participate in the EC program.

Figure 7.4: Growth in capital expenditure (\$, 000) for RDTI firms, average treatment Kaplan-Meier survival estimates effect, pooled across cohorts



Notes: Length of the bars depicts the premium growth in capital expenditure change relative to the counterfactual. Missing bars signify results that are not statistically significant.

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 8. The impact of the R&D Tax Incentive on EC participants

Section 7 discusses the impact of the EC program on R&D Tax Incentive participants, and in this section the converse is explored: what is the impact of the R&D Tax Incentive on firms already participating in the EC program?

It turns out the impact is minimal, as RDTI firms also participating in the EC program experience only an increase of 0.25 FTE after two years, compared to non-RDTI EC firms. All other results for this group are not statistically significant.

## 9. Impact on survival

As well as exploring the impact of the EC on firm performance, it is considered whether participation had any effect on the survival rate of EC participants. The following section is based on the survival analysis of another OCE staff research paper, however in this case the methodology is applied to departmental program participants rather than innovation and investment fund recipients.<sup>26</sup>

BLADE observes firms from 2001–02 to 2014–15, however firm survival time is calculated to be the number of years a firm appears in the BLADE from 2007-

<sup>26</sup> Rafi, B (2017) *Participation in South Australian Innovation and Investment Funds: Impact on firm performance*, Canberra, Department of Industry, Innovation and Science

08. This is to measure the relative survival rates between participants and non-participants from the first year the program came into existence. As the survival time is truncated, true survival time is likely to be different. A failure event occurs if a firm is not reported in the BLADE prior to 2014–15. Observations are pooled across cohorts.

Hazard ratios were estimated using a Cox regression to assess EC firms differed in terms of their relative risk of failure when compared to counterfactual firms. Additional dummies were included for the secondary and tertiary sectors to control for differences in rates of survival across these broad industry sectors.

Hazard ratios and decrease in the rate of failure show that EC participants were less likely to fail relative to non-participant firms (Table 9.1). While most other variables were statistically significant, they do not contribute substantially towards reducing the rate of failure.

Figure 9.1 more intuitively illustrates this point. The survival curves show the probability of survival at each point in time for EC and counterfactual firms.<sup>27</sup> The higher the survival curve, the higher the probabilities of survival over time. It is easy to see the survival curve for EC firms is higher than the survival curve for counterfactual firms.

Table 9.1: Survival analysis, hazard ratios

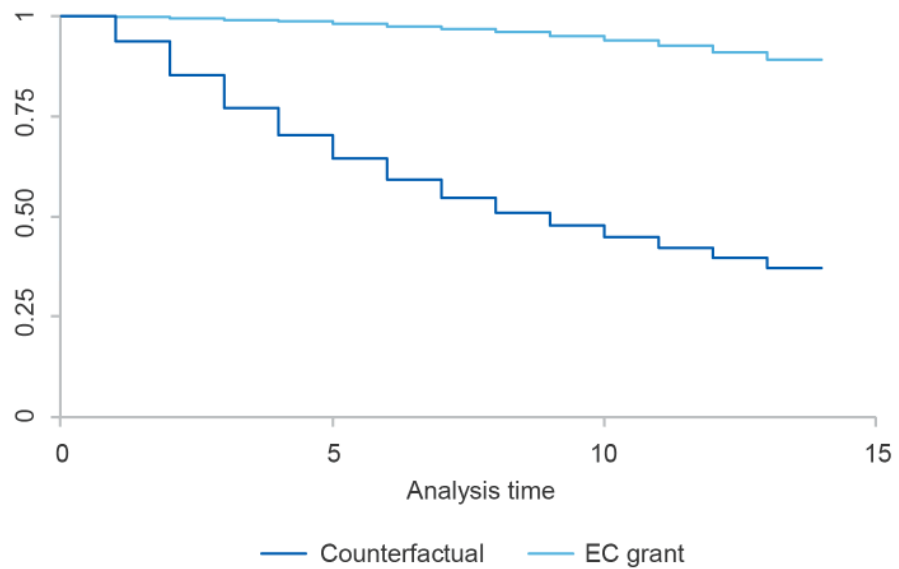
	Hazard ratio	Decrease in rate of failure (per cent) <sup>a</sup>
EC firms	0.26***	74
Manufacturing	1.20	-20
PST	1.10***	-10
Other Services	1.28***	-28
Average Turnover	1.00***	
Average FTE	0.98***	
n	1,294,903	

Notes: <sup>a</sup>Decrease in the rate of failure is (1 – hazard ratio) \*\*\*significant at 1 per cent

Source: BLADE (2001–02 to 2014–15) Author's calculations

<sup>27</sup> At time 0, the probability of survival is 100 per cent, and declines over time.

Figure 9.1: Kaplan-Meier survival estimates



Notes: The survival curves shows the probability of survival at each point in time

Source: BLADE (2001–02 to 2014–15) Author's calculations

## 10. Discussion

There is evidence that EC participants outperform non-participant firms through higher firm performance. The impact is demonstrated by growth in the pace of turnover, employment (FTE), capital expenditure growth and higher survival rates. Small firms are driving these results. Part of this differential may be attributed to selection into the EC program, however care has been taken to minimise selection bias by including all factors influencing both a firm's likelihood to be treated and its outcomes post treatment.

In general, Manufacturing firms and Other Services firms are contributing more to growth in turnover, employment and capital expenditure, compared to PST firms.

Firms participating in both the EC and the R&D Tax Incentive (RDTI) programs outperform firms only participating in the EC program in terms of turnover growth, implying EC firms receive additional benefit by also participating in the RDTI program.

EC participants have a much higher chance of survival than non-participants.

In the future it would bring further insights if analysis is undertaken on the EC participants that only received a Business Review. The performance of this group of firms could be compared against the group of firms already addressed in this paper.

## 11. References

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## Appendix A – Imputing employment figures

$$\log(FTE) = \alpha_0 + \alpha_1 \log(wages) + \sum \delta_t + \sum \gamma_j + \varepsilon$$

Where  $\delta_t$  denotes a year dummy variable for each financial year  $t$

Where  $\gamma_j$  denotes an industry dummy variable for each industry  $j$

This regression displays a high  $R^2$  value of 0.95, which means that the imputation noise is negligible. Using this model and the reported wages and salaries variable, FTE values are computed where wages and salaries information is available but FTE values are missing.

## Appendix B – Logit results

Figure B.1: Logit results for EC Manufacturing EC firms (pooled, all years)

Variable	Coefficient
Turnover growth (t-1 to t)	0.12***
Employment growth (t-1 to t)	0.10**
Employment (FTE in time t)	0.10***
Export status	0.88***
R&D status	1.65***
Subdivision 12	-0.64***
Subdivision 13	-0.20**
Subdivision 14	0.32***
Subdivision 15	0.08
Subdivision 16	0.11
Subdivision 17	0.52**
Subdivision 18	0.11
Subdivision 19	0.35***
Subdivision 20	0.04
Subdivision 21	0.44***
Subdivision 22	0.25***
Subdivision 23	-0.11
Subdivision 24	0.18***
Subdivision 25	-0.14*
NSW	0.58**
VIC	0.15
QLD	0.47*
SA	1.36***
WA	0.31
TAS	1.62***
NT	-1.13**
Proprietary Limited	0.04
Family Partnership	-3.08***
Other Partnership	-1.54***
Trust	-0.05
Cohort 9	1.41***
Cohort 10	1.73***
Cohort 11	1.81***
Cohort 12	1.89***
Cohort 13	1.58***
Cohort 14	1.57***



Cohort 15	0.55***
Constant	-5.88***
n	199,499
LR $\chi^2(30)$	5188.36
Prob > $\chi^2$	0.000

Notes: \*\*\*significant at 1 per cent \*\*significant at 5 per cent \*significant at 10 per cent

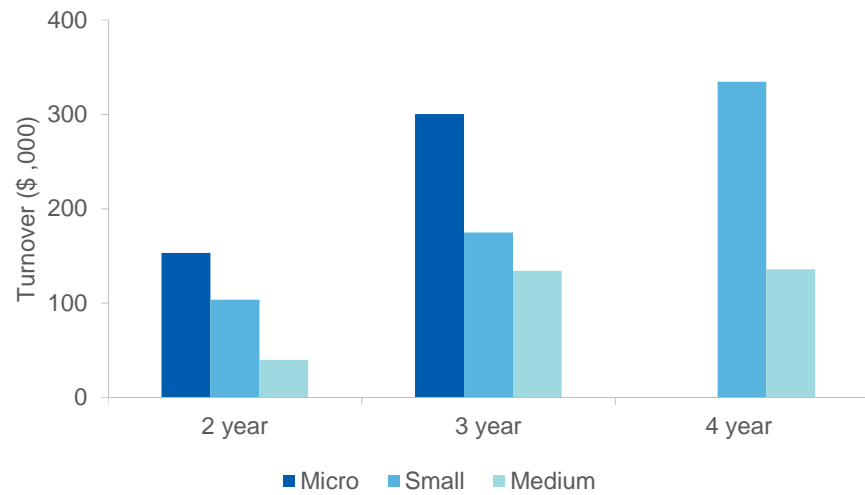
Source: BLADE (2001–02 to 2014–15) Author's calculations

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## Appendix C – Performance by firm size

Please note four year changes for micro firms were unable to be calculated for turnover, employment, export sales and capital expenditure growth due to insufficient sample numbers.

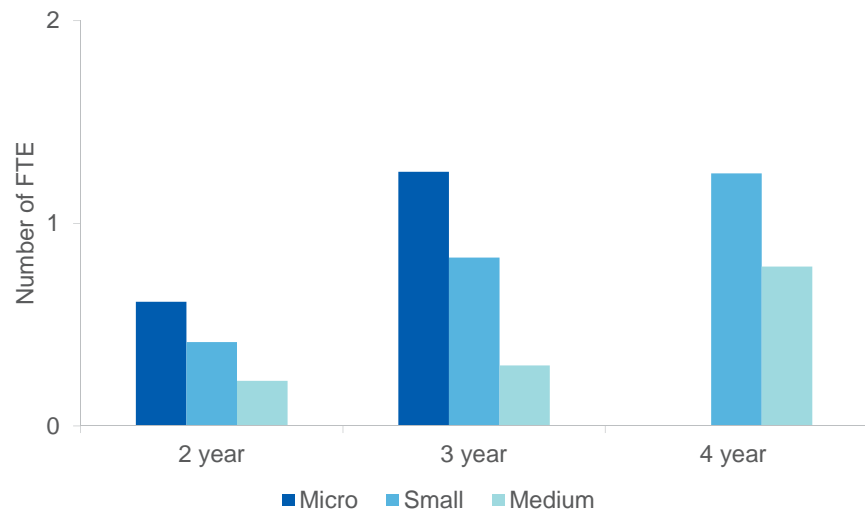
Figure C.1: Growth in turnover (\$, 000), average treatment effect, pooled across cohorts, by firm size



Notes: Length of the bars depicts the premium growth in turnover change relative to the counterfactual. Missing bars signify results that are not statistically significant. Four year changes for micro firms were unable to be calculated due to insufficient sample numbers.

Source: BLADE (2001–02 to 2014–15) Author's calculations

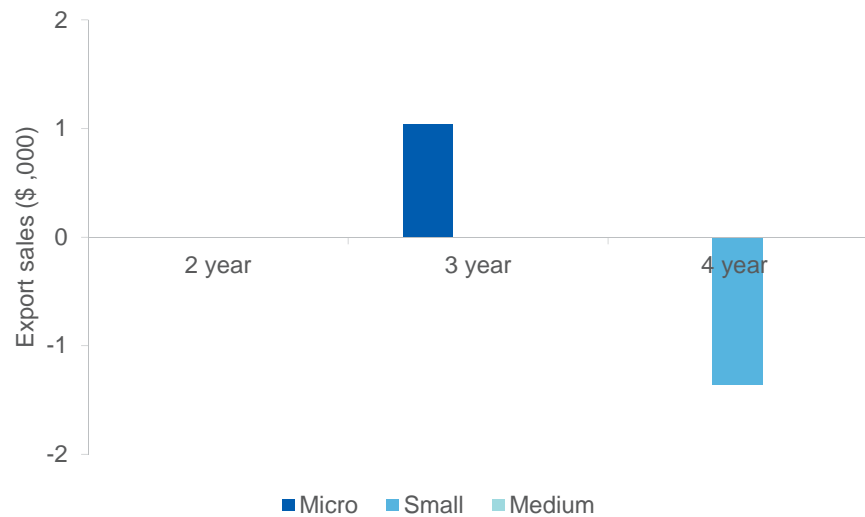
Figure C.2: Growth in employment (number of FTE), average treatment effect, pooled across cohorts, by firm size



Notes: Length of the bars depicts the premium in employment change relative to the counterfactual. Missing bars signify results that are not statistically significant. Four year changes for micro firms were unable to be calculated due to insufficient sample numbers.

Source: BLADE (2001–02 to 2014–15) Author's calculations

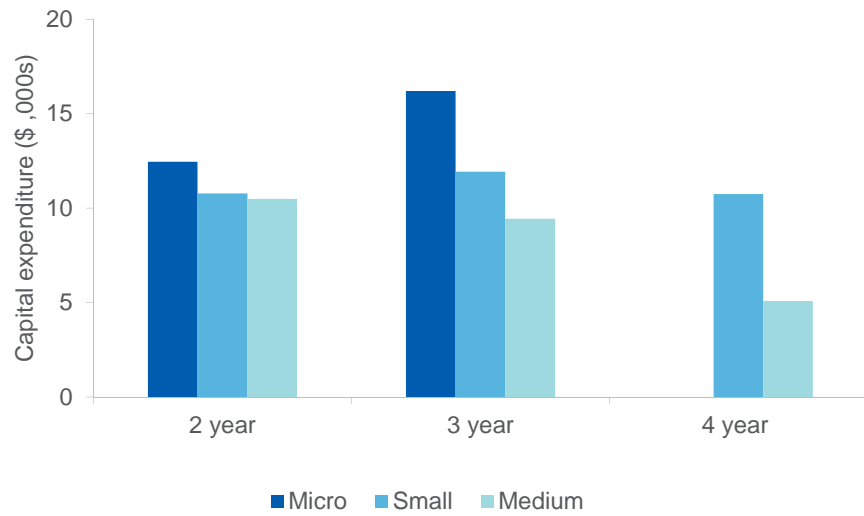
Figure C.3: Growth in export sales (\$, 000), average treatment effect, pooled across cohorts, by firm size



Notes: Length of the bars depicts the premium growth in export sales change relative to the counterfactual. Missing bars signify results that are not statistically significant. Four year changes for micro firms were unable to be calculated due to insufficient sample numbers.

Source: BLADE (2001–02 to 2014–15) Author's calculations

Figure C.4: Growth in capital expenditure (\$, 000), average treatment effect, pooled across cohorts, by firm size



Notes: Length of the bars depicts the premium growth in capital expenditure change relative to the counterfactual. Missing bars signify results that are not statistically significant. Four year changes for micro firms were unable to be calculated due to insufficient sample numbers.

Source: BLADE (2001–02 to 2014–15) Author's calculations

Table C.1: Average treatment effects by firm size

Variable (growth)	Firm size	Years post treatment	ATT
Turnover	Medium	2Y	39.9
Turnover	Medium	3Y	134.1
Turnover	Medium	4Y	135.8
Turnover	Micro	2Y	153.0
Turnover	Micro	3Y	300.1
Turnover	Micro	4Y	n/a
Turnover	Small	2Y	103.7
Turnover	Small	3Y	174.8
Turnover	Small	4Y	334.5
FTE	Medium	2Y	0.2
FTE	Medium	3Y	0.3
FTE	Medium	4Y	0.8
FTE	Micro	2Y	0.6
FTE	Micro	3Y	1.3
FTE	Micro	4Y	0.0
FTE	Small	2Y	0.4
FTE	Small	3Y	0.8
FTE	Small	4Y	1.2
Export sales	Medium	2Y	
Export sales	Medium	3Y	
Export sales	Medium	4Y	
Export sales	Micro	2Y	
Export sales	Micro	3Y	1.0
Export sales	Micro	4Y	
Export sales	Small	2Y	
Export sales	Small	3Y	
Export sales	Small	4Y	-1.4
Capital expenditure	Medium	2Y	10.5
Capital expenditure	Medium	3Y	9.4
Capital expenditure	Medium	4Y	5.1

Notes: Missing values signify results that are not statistically significant. Four year changes for micro firms were unable to be calculated due to insufficient sample numbers.

Source: BLADE (2001–02 to 2014–15) Author's calculations)

## ABS Disclaimer

The results of this study is based, in part, on ABR data supplied by the Registrar to the ABS under *A New Tax System (Australian Business Number) Act 1999* and tax data supplied by the ATO to the ABS under the *Taxation Administration Act 1953*. These require that such data is only used for the purpose of carrying out functions of the ABS. No individual information collected under the *Census and Statistics Act 1905* is provided back to the Registrar or ATO for administrative or regulatory purposes. Any discussion of data limitations or weaknesses is in the context of using the data for statistical purposes, and is not related to the ability of the data to support the ABR or ATO's core operational requirements. Legislative requirements to ensure privacy and secrecy of this data have been followed. Only people authorised under the Australian Bureau of Statistics Act 1975 have been allowed to view data about any particular firm in conducting these analyses. In accordance with the Census and Statistics Act 1905, results have been confidentialised to ensure that they are not likely to enable identification of a particular person or organisation.