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**Working Paper**

## The role of business subsidies in job-creation start-ups, gazelles and incumbents

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# The Role of Business Subsidies

in Job Creation of Start-ups, Gazelles and Incumbents

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## Contents

|          |                                                                                          |           |
|----------|------------------------------------------------------------------------------------------|-----------|
|          | Abstract                                                                                 | 2         |
| <b>1</b> | <b>Introduction</b>                                                                      | <b>3</b>  |
| <b>2</b> | <b>Data and some descriptive findings</b>                                                | <b>4</b>  |
|          | 2.1 Introduction to data                                                                 | 4         |
|          | 2.2 Descriptive findings on start-ups, gazelles and incumbents                           | 6         |
| <b>3</b> | <b>Evaluation of the impacts of business subsidies on growth</b>                         | <b>7</b>  |
| <b>4</b> | <b>Empirical findings</b>                                                                | <b>9</b>  |
| <b>5</b> | <b>Conclusions</b>                                                                       | <b>13</b> |
|          | References                                                                               | 15        |
|          | Annex 1: Description of the variables in two-stage least squares<br>random effects model | 16        |
|          | Annex 2: Difference-in-differences estimation results                                    | 17        |

## **Tiivistelmä**

Tutkimuksessa verrataan yritystukien työllisyysvaikutuksia nopeasti kasvavissa nuorissa yrityksissä, muissa nuorissa yrityksissä sekä vanhemmissa yrityksissä. Yritystuet jaotellaan kolmeen luokkaan: t&k-tuet, työllistämistuet ja muut tuet. Kaikki suomalaiset yritykset vuosilta 2003-2008 sisältävän aineiston analyysin tulokset viittaavat siihen, että yritystukien vaikutus työllisyyteen on erilainen nopeasti kasvavissa nuorissa yrityksissä kuin muissa yrityksissä. Kokonaisuutena sekä aloittelevissa että vanhemmissa yrityksissä kaikilla yritystuilla on positiivinen vaikutus työllisyyteen tukien myöntövuonna. Työllistämistukia ja muita tukia saaneet yritykset kasvoivat myös tukivuoden jälkeen nopeammin kuin tukea saamattomat. Sen sijaan nopeasti kasvavissa nuorissa yrityksissä yritystuet eivät näyttäisi tuovan lisäsykäystä työllisyyden kasvuun tuen myöntövuonna eikä sen jälkeen verrattuna tukea saamattomiin nopeasti kasvaviin yrityksiin.

**Asiasanat:** Yritystuet, työ- ja elinkeinopolitiikka, kasvu, Suomi

## **Abstract**

Our data concerning the whole Finnish company population from the years 2003-2008 suggest that the impacts of business subsidies on employment growth differ more between high-growth start-ups and other firms than between start-ups and over five years old incumbents. All subsidies seem to relate positively to the contemporary employment growth both among start-ups and incumbents. Furthermore, our data show that both the employment of start-ups and older incumbents receiving employment or other subsidies grow more than that of non-subsidized firms after subsidy reception. Instead, we find that business subsidies do not provide significant further boost for the contemporary or after-subsidy growth of gazelles. There are apparently some other factors dominating the growth of young high-growth firms making them to grow strongly, in many cases, with or without subsidies.

**Key words:** Public subsidies, technology policy, growth, Finland

**JEL:** J23, L10, O33

## 1 Introduction

High-growth firms are relatively few but they play an important role in economies as they generate a disproportionally large share of employment growth (see, e.g., Cunningham, 2008; Henrekson and Johansson, 2010; OECD, 2010).<sup>1</sup> In Finland, growth enterprise policy is set high on policy agenda and forms a key part of innovation and industrial policy.<sup>2</sup> Particularly new firms are seen as the potential engines of growth but – as great uncertainties relate to newly established firms' future success and their funding is thus often regarded too risky by venture capitalists – this potential may never materialize. For this reason, various forms of public funding and subsidized services are targeted for newly established companies.

In this study, we explore two different groups of young companies called *start-ups*: firms that are up to two years old and those that are up to five years old. We chose the first age limit to inspect as young firms as possible, given our database: financial data from the firms established less than two years ago are not often available. The latter category of young firms is chosen as it is the age limit of the OECD for young high-growth firms (OECD, 2010), and as it is also rather consistent with practical policy concerning the allocation of business subsidies for young firms.<sup>3</sup>

We are also interested in young, high-growth firms that are called *gazelles*, though there is no consensus in the economic literature on the definition of gazelles (see, e.g., Henrekson and Johansson, 2010). In this study, the group of gazelles comprises 10% fastest growing firms among start-ups. The reference group of *incumbents* comprises all firms that are over five years old at a given year. We use the total populations of start-ups, gazelles and incumbents in Finland from 2003 to 2008 in our empirical analysis.

According to our data, start-ups firms obtain more subsidies per employee than older firms. It is an interesting question whether public support for start-ups and young high-growth firms provides a boost for their growth, and whether the relationship between business subsidies and job creation differs between start-ups and incumbents. Our empirical study investigates these issues by shedding light on the following three questions: i) Do business subsidies help start-ups to grow?, ii) Do business subsidies further speed up the growth of young high-growth firms?, iii) Do subsidies affect differently to young companies and older incumbents?

This study contributes to the empirical literature concerning the role of business subsidies in job creation (see, e.g., Girma, et al. 2007). Certain business subsidies, such as those allocated via the employment subsidy programs are designed to directly affect employment (see, e.g., Betcherman et al, 2010), while some other subsidy types may less directly contribute to

<sup>1</sup> Pajarinen and Rouvinen (2011) using the OECD definition of high-growth firms find that in Finland the proportion of high-growth firms was only about 5 percent of the firms employing at least 10 employees in 2006 and operating the whole period of 2006-2009. However, their share of new job creation during this period was nearly 50 percent.

<sup>2</sup> The Ministry of Employment and the Economy has a separate group located to its innovation department focusing on high-growth firms. The web page of the ministry defines this policy target as follows: "One of the Ministry of Employment and the Economy's group strategic policies is to promote new, growing and internationalising business activity. Practical tools for implementing this include business services that support growth, economic incentives and well-functioning venture capital markets" (<http://www.tem.fi>).

<sup>3</sup> In Finland, for instance, R&D subsidies targeted for young, growth-oriented companies can only be applied by firms that are under 6 years old.

the employment growth (see, e.g., Ebersberger, 2004). For instance, R&D subsidies may create jobs in a firm via the expansion of the firm's production activities arising from new product development. The empirical findings on the relationship between business subsidies and employment using data from different subsidy programs at different time periods are ambiguous. For instance, Betcherman et al. (2010) provides evidence on the positive employment effects of labor subsidies at the regional level. The firm-level study of Kangasharju and Venetoklis (2002), instead, finds that though labor subsidies relate positively to employment, they displace firms' own employment expenditures. Similarly, three empirical studies using Finnish firm-level data from different time periods make contradictory conclusions about the role of R&D subsidies in firms' employment growth. Ebersberger (2004) using data for the years 1994–2000 finds a significant positive relationship between R&D subsidies and employment. Kangasharju and Venetoklis (2002) and Koski (2010) – the former study using data for the years 1995–1998 and the latter for the years 1999–2003 – do not find any statistically significant relationship between a firm's reception of R&D subsidies and its employment growth.

Similar to this paper, the previous study of Koski and Pajarinen (2011) explores the relationship between employment growth and three business subsidy types (i.e. employment subsidy, R&D subsidy and other business subsidies) among the firms employing at least 10 persons. It finds a positive contemporary relationship between all business subsidy types and employment growth. It further suggests that R&D subsidies contribute to the firms' employment for one year after and employment and other subsidies for three years after the reception of subsidies. The reported study contributes to that of Koski and Pajarinen (2011) by focusing on the impacts of subsidies on start-ups and young high-growth firms. It further explores whether the growth dynamics, or the relationship between business subsidies and employment growth, are different among start-ups and among older incumbents.

The rest of the paper is organized as follows. Section 2 first introduces the database and business subsidy types analyzed in this study, and then presents some descriptive statistics findings concerning the sample firms. Section 3 presents the econometric models and the variables used in the estimations. Section 4 discusses major empirical findings arising from the estimations of the econometric models. Section 5 summarizes lessons learned from this study in the context of growth enterprise policy.

## 2 Data and some descriptive findings

### 2.1 Introduction to data

Our database comprises financial data concerning 403,058 Finnish companies during the years 2003–2008 that is extracted from the database of Statistic Finland. During the sample time period, about 15 percent of the Finnish firms were up to two years old, and about 28 percent up to five years old. By definition, gazelles form 10 percent of start-ups. The financial data are combined with the database of Statistics Finland on the allocation of business subsidies in Finland during the sample years by the following four major organizations: Finnvera<sup>4</sup>, TEKES

<sup>4</sup> Finnvera is a specialized public financing company owned by the State of Finland. It offers loans, venture capital investments, and it is the only public provider of guarantees in Finland.

(the Finnish Funding Agency for Technology and Innovation), the Ministry of Employment and the Economy<sup>5</sup>, and the Ministry of Agriculture and Forestry.

We distinguish three subsidy categories in our empirical study: i) employment subsidies, ii) R&D subsidies, and iii) other business subsidies comprising direct subsidies, loans and guarantees which are largely aimed at supporting firms' investments and enlargement activities. In 2008, over 30,000 Finnish firms (i.e. almost 10 percent of total population of firms in Finland) received, in total, about 1.77 billion euro of public support from the covered major government subsidy programs. Direct business subsidies allocated in Finland, measured as a percentage of GDP, are close to the EU-15 average during the sample years.<sup>6</sup>

Employment subsidies for firms hiring unemployed persons – distributed via the Ministry of Employment and the Economy – should directly facilitate employment growth. Employment subsidies aimed at hiring an unemployed person vary between 430 and 770 euro per month – depending on the length of the unemployment prior to hiring and education of the employed person<sup>7</sup> – and can be obtained for up to 10 months.

R&D subsidies may not only contribute to a firm's employment indirectly and with some time lag via innovation but the expansion of the firm's R&D activities due to subsidies may also result in contemporary increase in the firm's employment. In Finland, Tekes allocates R&D grants and loans covering about 17 percent of all business subsidies. Tekes has some specific finance instruments designed for the innovative growth of small and medium sized firms and young companies<sup>8</sup>. A firm's potential for rapid (international) growth is one pre-requisite for R&D funding targeted to young, innovative companies.

Various other business subsidies in Finland are also targeted for the expansion of the firms' activities but our data do not comprise detailed information on the objectives of other subsidies allocated by the major public support agencies. As the public agencies allocating business subsidies have other project selection criteria of which relative importance compared to the employment effects are not known to us, the importance of the other subsidies for employment growth can only be determined empirically. Other subsidies include loans and guarantees provided by Finnvera<sup>9</sup>, the biggest provider of public support covering about 64 percent of the total support allocated for companies, and the mixture of different subsidies of the Ministry of the Employment and the Economy and the Ministry of Agriculture and Forestry. The share of the ministry of agriculture and forestry of public funding was relatively small, less than 4 percent of the total funds.

<sup>5</sup> The Ministry of Employment and the Economy was established in the beginning of the year 2008 as a merger of the two ministries, the Ministry of Trade and Industry and the Ministry of Labour. Prior to 2008, our data comprise the total public support of the two merged ministries.

<sup>6</sup> Source: Scoreboard data on state aid expenditures; [http://ec.europa.eu/competition/state\\_aid/studies\\_reports/expenditure.html](http://ec.europa.eu/competition/state_aid/studies_reports/expenditure.html).

<sup>7</sup> Longer period of unemployment and lower level of education increase the amount of subsidy a firm can obtain for hiring a person.

<sup>8</sup> "Small and medium-sized companies can obtain special funding for the procurement of expert services to support innovation activities and young innovative companies can obtain funding for growth and internationalisation." Source: <http://www.tekes.fi/en/community/Means/556/Means/1427>.

<sup>9</sup> Financing of start-up and growth companies is also in the center of Finnvera's activities: "Finnvera's operations are steered by the industrial and ownership policy goals laid down by the State. Among these goals are: increasing the number of starting enterprises; enabling financing for changes encountered by SMEs; and promotion of enterprise growth, internationalisation and exports" (<http://www.finnvera.fi/eng/Company/Finnvera-in-brief>).

## 2.2 Descriptive findings on start-ups, gazelles and incumbents

The average Finnish firm is small. Start-ups, and among them, gazelles had 3.2–4.6 employees, on average, while the average incumbent firm employed 6.5 people during the sample years.

Table 1 shows that a greater share of gazelles receives all three subsidy categories compared to the share of subsidy recipients among all start-ups and over five years old firms. About 9 percent of up to two years old gazelles received employment subsidies, while the corresponding percentages were 5 and 4, respectively, among start-ups and over five years old companies. Relatively few companies received R&D subsidies: 0.6 percent of start-ups, about 1 percent of gazelles, and 0.4 percent of incumbents.

| <b>Table 1</b> |                    | <b>Shares of receivers of business subsidies 2003–2008, %</b> |                             |                            |                            |                               |
|----------------|--------------------|---------------------------------------------------------------|-----------------------------|----------------------------|----------------------------|-------------------------------|
| Subsidy type   |                    | <i>Start-ups up to 2 y.</i>                                   | <i>Start-ups up to 5 y.</i> | <i>Gazelles up to 2 y.</i> | <i>Gazelles up to 5 y.</i> | <i>Incumbents (over 5 y.)</i> |
|                |                    |                                                               |                             |                            |                            |                               |
|                | R&D subsidy        | 0.56                                                          | 0.59                        | 1.44                       | 1.00                       | 0.41                          |
|                | Employment subsidy | 5.26                                                          | 5.10                        | 8.87                       | 7.09                       | 4.35                          |
|                | Other subsidy      | 3.50                                                          | 3.26                        | 6.62                       | 4.84                       | 2.28                          |
|                | No subsidy         | 91.46                                                         | 91.81                       | 85.06                      | 88.42                      | 93.53                         |

When we look at the order of magnitude of subsidies, we observe, however, that those start-up companies, and among them gazelles, that did receive subsidies got them clearly more per employee than older firms (see Table 2). The average annual R&D subsidy per employee for up to two years old start-ups was about 49,000 Euros and for gazelles 47,000 Euros, while the corresponding sum was about 16,000 Euros for older incumbents. Similarly, other subsidies (annually) per employee were about 44,000 Euros, on average, for the youngest group of start-up companies, while they were less than 27,000 Euros per employee for over five years old firms. Annual employment subsidies divided by the number of a firm's employees remained relatively small: they were less than 3,000 Euros for start-ups, and about 1,600 Euros for incumbents.

| <b>Table 2</b>                      |                    | <b>Subsidies per employee 2003–2008, 1000 euro, mean</b> |                             |                            |                            |                               |
|-------------------------------------|--------------------|----------------------------------------------------------|-----------------------------|----------------------------|----------------------------|-------------------------------|
| Subsidy type                        |                    | <i>Start-ups up to 2 y.</i>                              | <i>Start-ups up to 5 y.</i> | <i>Gazelles up to 2 y.</i> | <i>Gazelles up to 5 y.</i> | <i>Incumbents (over 5 y.)</i> |
|                                     |                    |                                                          |                             |                            |                            |                               |
|                                     | R&D subsidy        | 48.69                                                    | 33.30                       | 46.87                      | 39.80                      | 16.14                         |
|                                     | Employment subsidy | 2.74                                                     | 2.47                        | 2.54                       | 2.86                       | 1.64                          |
|                                     | Other subsidy      | 44.01                                                    | 37.60                       | 35.43                      | 33.46                      | 26.55                         |
| Average firm size (number of empl.) |                    | 3.80                                                     | 4.63                        | 4.44                       | 3.20                       | 6.51                          |

Table 3 outlines the results of the t-test between the average employment growth rates of subsidized and non-subsidized companies at the year of subsidy reception during the years 2003–2008. There is a statistically significant difference in the employment growth of subsidized and

non-subsidized firms among all sub-samples. Those firms that have received subsidies have grown faster during the year of subsidy reception than those that have not received any subsidies. The estimations of econometric models, of which results are reported in Section 4, provide a more profound analysis on both contemporaneous and lagged impacts of different subsidies on employment growth.

**Table 3 The average growth rates of subsidized vs. non-subsidized firms 2003–2008**

|                      | <i>Start-ups<br/>up to 2 y.</i> | <i>Start-ups<br/>up to 5 y.</i> | <i>Gazelles<br/>up to 2 y.</i> | <i>Gazelles<br/>up to 5 y.</i> | <i>Incumbents<br/>(over 5 y.)</i> |
|----------------------|---------------------------------|---------------------------------|--------------------------------|--------------------------------|-----------------------------------|
| All firms            | 56%                             | 31%                             | 395%                           | 243%                           | 7%                                |
| Subsidized firms     | 117%                            | 68%                             | 506%                           | 332%                           | 24%                               |
| Non-subsidized firms | 50%                             | 27%                             | 376%                           | 232%                           | 6%                                |
| T-test               | p<0.01                          | p<0.01                          | p<0.01                         | p<0.01                         | p<0.01                            |

### 3 Evaluation of the impacts of business subsidies on growth

We measure a firm's employment growth by the relative change in the number of the firm's employees between year  $t$  and  $t-1$  (variable  $EMP\_GROWTH$ ). The key explanatory variables capturing the role of business subsidies are measured by the following three variables: i) The variable  $EMPL\_SUBSIDY$  captures the order of magnitude of unemployment subsidy allocated for a firm at a given year divided by the firm's turnover, ii) the order of magnitude of a firm's R&D subsidy at a given year divided by the firm's turnover is measured by the variable  $RD\_SUBSIDY$ , and iii) the variable  $OTHER\_SUBSIDY$  covers all other business subsidies a firm has obtained at a given year divided by the firm's turnover (see previous section for a more detailed discussion on subsidies covered in the other subsidy category).

We use two estimation methods to evaluate the impacts of business subsidies on the firms' growth. First, we estimate the two-stage least squares random effects model with endogenous business subsidy variables<sup>10</sup>:

$$EMP\_GR_{it} = \alpha_0 + \alpha_1 RD\_SUBSIDY_{it} + \alpha_2 EMPL\_SUBSIDY_{it} + \alpha_3 OTHER\_SUBSIDY_{it} + \alpha_4 S_{1it} S_{2it} + \alpha_5 S_{1it} S_{3it} + \alpha_6 S_{2it} S_{3it} + \alpha_7 S_{1it} S_{2it} S_{3it} + \sum_j \beta_j C_{it} + u_i + \varepsilon_{it} \quad (\text{Model 1})$$

where on the right hand side, the first three explanatory variables are the fitted values of endogenous subsidy variables received from the first-stage of the estimation in which the subsidy variables are explained by the instrumental variables.  $S_i$  denote dummy variables for three subsidy types distinguishing the firms that received a subsidy type  $i=1 \dots 3$  from the other companies, and they are used for capturing the interaction effects of different subsidy types. Vector  $C$  comprises  $j$  control variables added to the estimated equation.

<sup>10</sup> Business subsidies may be endogenous, for instance, due to the employment goals and picking-up-the-winners strategies of those who make the subsidy decisions. We tested endogeneity of the three subsidy variables using the total annual subsidy budget for each type of subsidy a firm applied for as an instrument. We first estimated a model that explains the potentially endogenous variable with all exogenous variables and instruments. The saved residual from the estimated model was then included as an additional explanatory variable in the model explaining employment growth as a function of set of exogenous and potential endogenous variables. The estimated coefficient for residual was statistically significant in case of all three subsidy types.

Second, we estimate the model using the difference-in-differences method. The difference-in-differences technique removes biases that could originate from the permanent differences between the subsidized and non-subsidized firms and from the aggregate factors affecting employment growth. The (log) level of employment of firms that received a certain type of subsidy in 2004 is compared to the (log) level of employment of firms that didn't receive the subsidy in 2004. The sample is restricted to those firms that didn't receive any subsidies in 2003, the sampled before-subsidy year for employment. We do estimations using different after-subsidy years – i.e. years 2005, 2006, 2007 and 2008 – to investigate the presence of possible lagged effects of subsidies to the firms' employment.

The equation that is estimated for two cross-sections, before- and after-subsidy year, can be written as follows (after dropping the firm-specific  $i$ -indicators for simplicity):

$$\begin{aligned} EMP = & \alpha_0 + \alpha_1 S_1 + \alpha_2 S_2 + \alpha_3 S_3 + \alpha_4 S_1 S_2 + \alpha_5 S_1 S_3 + \alpha_6 S_2 S_3 + \alpha_7 S_1 S_2 S_3 \\ & + \delta_0 dT + \delta_1 dTS_1 + \delta_2 dT2S_2 + \delta_3 dTS_3 + \delta_4 dTS_1 S_2 + \delta_5 dTS_1 S_3 + \delta_6 dTS_2 S_3 \\ & + \delta_7 dTS_1 S_2 S_3 + \sum_j \beta_j C_j + u, \end{aligned} \quad (\text{Model 2})$$

where the variable EMP denotes log number of employees of a firm. Coefficients  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  capture differences in employment between the subsidized firms and other firms *prior* to the reception of a subsidy type. Likewise, the coefficients of the interaction terms of subsidy dummies measure differences between firms that have received different types of subsidies simultaneously and other firms prior to subsidy reception. The after-subsidy time dummy dT measures the time-related changes (due to certain aggregate factors) in employment that would occur without subsidies. Coefficients  $\delta_1$ ,  $\delta_2$  and  $\delta_3$  capture the effects of three subsidies at after-subsidy year d2. Similarly,  $\delta$ -coefficients for the interaction terms measure the after-subsidy effects of simultaneously received subsidies.

Models 1 and 2 are estimated separately for the two age groups of start-up firms and gazelles, and incumbents to explore whether the impact of business subsidies on growth vary between the different sub-groups of firms.

The empirical literature suggests that an increase in demand for a firm's products or expansion of production activities is likely to relate positively to the firm's employment growth (see, e.g., Koski and Pajarinen, 2011). We capture the growth in the production of a firm's existing products by the firm's turnover growth deflated by the industry level producer price index<sup>11</sup> (variable SALES\_GROWTH).

There is mixed evidence concerning the role of R&D in the firm's growth as prior empirical studies report positive, negative and non-significant relationship between R&D and growth (Stam and Wennberg, 2009). These diverse findings apply also to the studies concerning new firms though some progress has been made by detecting that innovation or R&D facilitates growth only among a small subset of fast-growing firms (see, e.g. Stam and Wennberg, 2009). The variable RD captures a firm's R&D intensity (i.e. R&D expenditures divided by sales).

<sup>11</sup> For industrial companies, the deflator is a producer price index (PPI) at 2-digit level. For service firms, as we lack information from various service sectors and as about 70 percent of GDP comprises services, we use the GDP deflator to deflate the sales of service firms.

The previous empirical studies further suggest that the ownership of a firm may affect its growth (see, e.g., Beck et al. 2005). We use dummy variable FOR\_OWN and GOV\_OWN to distinguish firms that are, respectively, foreign-owned and government-owned from other firms. A firm's size is controlled by the dummy variables MEDIUM, LARGE and XLARGE, and age by the variable AGE that is the log number of years since the establishment of the firm. Financial performance may also have an influence on growth.<sup>12</sup> We control for both the profitability (ROI) and financial strength (EQUITY). We further control for time-, industry- and location-specific variation in the firm's employment growth by the dummy variables.

#### *Instrumental variables:*

As the order of magnitude of subsidies a firm may receive is bounded and affected by the government's subsidy budgets for the agencies allocating different types of subsidies, we use the total annual budgets of subsidy types a firm has applied for as the instrumental variables for the endogenous subsidy variables (see, e.g., Wallsten, 2000, for a similar approach). The instrumental variables are measured by the government budgets allocated for R&D subsidies (TOTAL\_RD\_SUBSIDY), employment subsidies (TOTAL\_EMPL\_SUBSIDY) and other subsidies (TOTAL\_OTHER\_SUBSIDY) in Finland at a given year for types of subsidies which a firm has applied for. We are able to distinguish three types of R&D subsidies: direct subsidies, loans, and capital loans. The instrumental variable TOTAL\_RD\_SUBSIDY covers the total budgets of R&D subsidy types a firm has applied for.<sup>13</sup> Other subsidies cover various different types of subsidies as well, and we have applied similar methodology to the calculation of the instrumental variable TOTAL\_OTHER\_SUBSIDY. In addition, all exogenous variables are used as instruments. Annex 1 reports more detailed description and summary statistics of the variables.

## **4 Empirical findings**

The instrumental variable estimations suggest that the contemporary relationship between different business subsidy types and employment growth is not similar among different subgroups of firms. Both among incumbents and start-ups, all business subsidies relate positively to the employment growth at the year of subsidy reception. Instead, subsidies do not seem to have much effect on the employment growth of young high-growth companies. Merely R&D subsidies seem to weakly contribute (at  $p=0.10$ ) to the contemporary growth in the employment of gazelles.

The difference-in-differences estimations<sup>14</sup> suggest that, among incumbents, the firms that have received employment subsidies have employed a relatively higher number of employees through the four years following the subsidy reception, compared to their employment prior

<sup>12</sup> It can be argued that firms are in a continual struggle to grow, and only those with superior financial performance will be able to gain additional market share, see, e.g., Dosi, et al. (2008), Marsili (2001) and Metcalfe (1998).

<sup>13</sup> For instance, if a firm has applied for only loans, the variable TOTAL\_RD\_SUBSIDY takes the value of total government budget of R&D loans at a given year.

<sup>14</sup> See Annex 2 for detailed tables of the difference-in-differences estimation results.

**Table 4** The estimation results of the two-stage least squares random effects model for employment growth

|                | <i>Start-ups<br/>up to 2 y.<br/>EMP_GROWTH<br/>Coef./S.E</i> | <i>Start-ups<br/>up to 5 y.<br/>EMP_GROWTH<br/>Coef./S.E</i> | <i>Gazelles<br/>up to 2 y.<br/>EMP_GROWTH<br/>Coef./S.E</i> | <i>Gazelles<br/>up to 5 y.<br/>EMP_GROWTH<br/>Coef./S.E</i> | <i>Incumbents<br/>(over 5 y.)<br/>EMP_GROWTH<br/>Coef./S.E</i> |
|----------------|--------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------|
| RD_SUBSIDY     | 0.205 ***<br>(0.049)                                         | 0.047 ***<br>(0.015)                                         | 0.564<br>(0.332)                                            | 0.172<br>(0.114)                                            | 0.017 ***<br>(0.005)                                           |
| EMPL_SUBSIDY   | 0.026 **<br>(0.011)                                          | 0.019 ***<br>(0.004)                                         | 0.043<br>(0.074)                                            | -0.025<br>(0.027)                                           | 0.015 ***<br>(0.001)                                           |
| OTHER_SUBSIDY  | 0.043 ***<br>(0.012)                                         | 0.015 ***<br>(0.004)                                         | 0.055<br>(0.072)                                            | 0.032<br>(0.029)                                            | 0.012 ***<br>(0.001)                                           |
| SALES_GROWTH   | 10.569 ***<br>(0.134)                                        | 2.529 ***<br>(0.041)                                         | 8.967 ***<br>(0.520)                                        | 9.834 ***<br>(0.304)                                        | 0.004<br>(0.002)                                               |
| CAPITAL_GROWTH | 0.828 ***<br>(0.076)                                         | 0.156 ***<br>(0.023)                                         | 5.743 ***<br>(0.861)                                        | 2.711 ***<br>(0.339)                                        | 0.018 **<br>(0.008)                                            |
| RD             | -0.260 ***<br>(0.035)                                        | -0.116 ***<br>(0.009)                                        | -0.588 ***<br>(0.217)                                       | -0.190 **<br>(0.078)                                        | -0.040 ***<br>(0.003)                                          |
| MEDIUM         | 0.385 ***<br>(0.094)                                         | 0.286 ***<br>(0.035)                                         | 0.578<br>(0.577)                                            | 0.561 **<br>(0.220)                                         | 0.059 ***<br>(0.008)                                           |
| LARGE          | 0.734 ***<br>(0.131)                                         | 0.427 ***<br>(0.051)                                         | 2.979 ***<br>(0.838)                                        | 1.342 ***<br>(0.294)                                        | 0.100 ***<br>(0.011)                                           |
| XLARGE         | 5.386 ***<br>(0.276)                                         | 2.427 ***<br>(0.109)                                         | 30.394 ***<br>(1.772)                                       | 14.607 ***<br>(0.662)                                       | 0.322 ***<br>(0.024)                                           |
| ROI            | 0.004<br>(0.010)                                             | 0.021 ***<br>(0.004)                                         | -0.093<br>(0.086)                                           | -0.059 **<br>(0.027)                                        | 0.014 ***<br>(0.001)                                           |
| EQUITY         | -0.276 ***<br>(0.060)                                        | -0.157 ***<br>(0.026)                                        | -0.253<br>(0.547)                                           | -0.384 **<br>(0.171)                                        | -0.067 ***<br>(0.005)                                          |
| AGE            | -1.038 ***<br>(0.046)                                        | -0.592 ***<br>(0.014)                                        | -0.584<br>(0.389)                                           | -0.431 ***<br>(0.090)                                       | -0.058 ***<br>(0.004)                                          |
| FOR_OWN        | 0.645 ***<br>(0.248)                                         | -0.018<br>(0.102)                                            | 8.218 ***<br>(1.970)                                        | 3.901 ***<br>(0.756)                                        | 0.026<br>(0.018)                                               |
| GOV_OWN        | -1.106 **<br>(0.459)                                         | -0.814 ***<br>(0.174)                                        | -1.764<br>(5.156)                                           | -1.472<br>(1.378)                                           | 0.032<br>(0.023)                                               |
| RDSxEMPS       | -0.306<br>(0.890)                                            | -0.461<br>(0.270)                                            | 1.256<br>(3.397)                                            | -2.600<br>(1.635)                                           | -0.132<br>(0.082)                                              |
| RDSxOTHS       | -1.085<br>(0.616)                                            | -0.124<br>(0.198)                                            | -3.202<br>(3.401)                                           | -0.623<br>(1.352)                                           | -0.060<br>(0.071)                                              |
| EMPSxOTHS      | 0.120<br>(0.256)                                             | 0.162<br>(0.089)                                             | 1.490<br>(1.520)                                            | 0.165<br>(0.569)                                            | -0.013<br>(0.029)                                              |
| RDSxEMPSxOTHS  | -0.600<br>(1.371)                                            | -0.746<br>(0.419)                                            | -5.779<br>(6.931)                                           | 0.296<br>(2.489)                                            | 1.265 ***<br>(0.130)                                           |
| Constant       | 1.382 ***<br>(0.309)                                         | 0.570 ***<br>(0.127)                                         | 5.692 **<br>(2.340)                                         | 2.998 ***<br>(0.803)                                        | 0.266 ***<br>(0.037)                                           |
| Industries     | Yes                                                          | Yes                                                          | Yes                                                         | Yes                                                         | Yes                                                            |
| Regions        | Yes                                                          | Yes                                                          | Yes                                                         | Yes                                                         | Yes                                                            |
| Years          | Yes                                                          | Yes                                                          | Yes                                                         | Yes                                                         | Yes                                                            |
| Observations   | 77819                                                        | 222020                                                       | 8035                                                        | 25898                                                       | 771622                                                         |
| Wald(Model)    | 7943.490 ***                                                 | 7245.362 ***                                                 | 937.162 ***                                                 | 2027.519 ***                                                | 2750.996 ***                                                   |
| R2             | 0.052                                                        | 0.018                                                        | 0.107                                                       | 0.082                                                       | 0.003                                                          |

The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, and \*\* significance level of 5%.

to having employment subsidies, than other companies. Those over five years old firms that obtained other subsidies seem to grow more in regard to their employment than other incumbents for the period of two years after the subsidy.

Like incumbents, start-ups that have received employment subsidies in 2004 show statistically significantly higher employment growth than non-subsidized start-ups during all four after-subsidy years. This applies both to the groups of firms up to two years old and firms up to five years old. Other subsidies, instead, do not seem to materialize as a higher employment growth among the youngest start-ups. Among start-ups up to five years old, they contribute to the firms' employment growth with a two-year lag. The youngest start-ups that have received R&D subsidies have grown less than other start-ups up to two years old during the two after-subsidy years. One possible explanation for this could be that very young innovative companies that receive R&D subsidies focus on research and/or development during the post-subsidy years making them to grow relatively slower than other start-ups. It seems, however, that youngest firms that have received both employment and R&D subsidy have grown more than other start-ups during the two years after the reception of subsidies. Interestingly, not any of the business subsidy types contributes to the employment growth of gazelles after subsidy reception.

**Table 5** Summary of the difference-in-differences estimation results

|                             | <i>T</i> | <i>T</i> +1 | <i>T</i> +2 | <i>T</i> +3 | <i>T</i> +4 | <i>Firms</i>            |
|-----------------------------|----------|-------------|-------------|-------------|-------------|-------------------------|
| <i>R&amp;D subsidies</i>    |          | 0           | 0           | 0           | 0           | Incumbents              |
|                             |          | –           | –           | 0           | 0           | Start-ups up to 2 years |
|                             | <b>S</b> | 0           | 0           | 0           | 0           | Start-ups up to 5 years |
|                             |          | 0           | 0           | 0           | 0           | Gazelles up to 2 years  |
|                             | <b>U</b> | 0           | 0           | 0           | 0           | Gazelles up to 5 years  |
| <i>Employment subsidies</i> | <b>B</b> | +           | +           | +           | +           | Incumbents              |
|                             |          | +           | +           | +           | +           | Start-ups up to 2 years |
|                             | <b>S</b> | +           | +           | +           | +           | Start-ups up to 5 years |
|                             |          | 0           | 0           | 0           | 0           | Gazelles up to 2 years  |
|                             | <b>I</b> | 0           | 0           | 0           | 0           | Gazelles up to 5 years  |
| <i>Other subsidies</i>      | <b>D</b> | +           | +           | 0           | 0           | Incumbents              |
|                             |          | 0           | 0           | 0           | 0           | Start-ups up to 2 years |
|                             | <b>Y</b> | 0           | +           | 0           | 0           | Start-ups up to 5 years |
|                             |          | 0           | 0           | 0           | 0           | Gazelles up to 2 years  |
|                             |          | 0           | 0           | 0           | 0           | Gazelles up to 5 years  |

The interactions of different subsidies did not have any statistically significant impact on the employment growth of older incumbents any of the four years following the subsidy reception.<sup>15</sup> The recently established companies seemed to benefit from the combination of employment and R&D subsidies. The estimated coefficient of the interaction term for a firm's reception of employment and R&D subsidies was positive and statistically significant for the two after-subsidy years among the start-ups under three years old.

<sup>15</sup> Detailed results of the estimations are presented in Annex 2.

Only very few gazelles in the sample up to the two years – of which we have comparative data from the years 2005–2008 – have received two or three subsidy types in 2004. Therefore, for the youngest group of gazelles, the interaction terms for subsidies are dropped from the estimations. To investigate the impacts of multiple subsidies among up to two years old gazelles, we controlled instead the reception of more than one subsidy type in 2004 by the dummy variable MULTI\_SUBSIDY. Young high-growth companies that received any type of business subsidy, or more than one subsidy type, did not seem to grow more than other young high-growth firms during the four years after the subsidy reception.

Our empirical findings suggesting that business subsidies positively contribute to the employment growth of start-ups leads to the further question on whether the subsidized start-ups that are not of high-growth type at the time of subsidy reception become later, after-subsidy reception, high-growth firms. A careful exploration of this question is out of the scope of this paper but we, nevertheless, made a simple empirical test. We divided the start-ups in 2004 to a group comprising those firms that received business subsidies in 2004 and to another group comprising those start-ups that did not receive any subsidies in 2004. As in the difference-in-differences estimations, the sample was further restricted only to those start-ups which did not receive any business subsidies in 2003.

The shares of subsidized and non-subsidized start-ups that became high-growth firms – according to our definition of high-growth start-ups comprising 10% highest growing share of start-ups – were calculated. The t-test for these shares during the four post-subsidy years was then undertaken between the non-subsidized and subsidized start-ups.

Table 6 reports the results of the t-tests separately for the start-ups up to two years old and for the start-ups up to five years old. We observe that clearly, among both start-up age groups, a higher share of subsidized than non-subsidized young firms grew into the high-growth firms during the four post-subsidy years. This preliminary finding hints that business subsidies targeted for start-ups may, indeed, have potential to contribute to the generation of high-growth firms.

| <b>Table 6    Percentage of start-up firms becoming high-growth firms after-subsidy years</b> |             |             |             |             |
|-----------------------------------------------------------------------------------------------|-------------|-------------|-------------|-------------|
|                                                                                               | <b>2005</b> | <b>2006</b> | <b>2007</b> | <b>2008</b> |
| <b><i>Start-ups up to 2 years</i></b>                                                         |             |             |             |             |
| Subsidized                                                                                    | 0.161       | 0.139       | 0.143       | 0.137       |
| Non-subsidized                                                                                | 0.094       | 0.103       | 0.101       | 0.100       |
| T-test                                                                                        | p<0.01      | p<0.01      | p<0.01      | p<0.03      |
| <b><i>Start-ups up to 5 years</i></b>                                                         |             |             |             |             |
| Subsidized                                                                                    | 0.131       | 0.158       | 0.158       | 0.150       |
| Non-subsidized                                                                                | 0.098       | 0.097       | 0.107       | 0.099       |
| T-test                                                                                        | p<0.01      | p<0.01      | p<0.01      | p<0.01      |

## 5 Conclusions

Our data concerning the whole Finnish company population from the years 2003–2008 suggest that the impacts of business subsidies on employment growth differs more between high-growth start-ups and other firms than between start-ups and older incumbents. All subsidies seem to relate positively to the contemporary employment growth of a firm both among start-ups and older incumbents. Furthermore, our data show that both start-ups and over five year old firms that have received employment subsidies and other subsidies typically targeted for the expansion of business activities have grown more in terms of employment in before-after subsidy comparison. Interestingly, we do not find similar effects among young high-growth companies. Business subsidies do not seem to provide significant further boost for the contemporary or after-subsidy growth of gazelles. In other words, there are apparently some other factors dominating the growth of young high-growth firms making them to grow strongly, in many cases, with or without subsidies.

It is not obvious why employment subsidies of which order of magnitude is relatively small have a clear positive contemporary and after-subsidy relationship lasting for the four post-subsidy years – that our data allow us to explore – both among start-ups and older incumbents. One possibility is that we fail to control some firm-specific variation that relates to the type of firms that are using employment subsidies. For instance, it seems possible that the firms that are about to move to the high-growth phase apply for and are granted more often employment subsidies for hiring new personnel.

Generally, R&D subsidies seem to have a positive contemporary relationship with employment growth but no notable after-subsidy impact or, among recently established companies, even negative short-term after-subsidy impact on the firms' employment growth. One explanation for this result is that the firms do employ more R&D personnel at the year they receive R&D subsidies but the R&D subsidy do not create substantially more jobs in firms after subsidy reception. Our data further suggest that the R&D subsidized firms do not generate innovation that would substantially affect their employment, on average, during the four after-subsidy years. It is, of course, possible that R&D subsidies promote innovation but data comprise, for instance, a mixture of process innovation reducing jobs and product innovation increasing jobs among our sample firms. It is also possible that a four-year time lag is not sufficient to catch employment impacts of innovation produced in R&D subsidized companies.

Young high-growth companies obtain business subsidies relatively more frequently than other firms. As the growth of gazelles – that are one of the primary sources of job creation in economies – seems to happen, by and large, irrespective of business subsidies, their allocation to the firms that are already of high-growth type seems as an inefficient allocation of public funds. Instead, subsidies should rather be carefully allocated to start-ups that are not yet of high-growth type but have potential to become a high-growth firm<sup>16</sup>. Indeed, our analysis indicates that a significantly higher percentage of subsidized start-ups than non-subsidized ones have become high-growth firms during the four post-subsidy years.

These lessons apply also to one of the most recent policy means targeted to promoting high-growth entrepreneurship in Finland: a new service model called “Growth channel” that the

<sup>16</sup> The characteristics of potential growth-oriented start-ups in Finland have been described, e.g., in Pajarinen et al. (2006).

Ministry of Employment and the Economy develops in collaboration with other business subsidy and service providers. The idea is to provide long-term development and financing solutions for highly motivated SMEs with potential for rapid growth and internationalization.<sup>17</sup> Overall, our findings concerning the employment growth impacts of business subsidies on start-up firms are promising for those making practical policy decisions concerning the allocations of business subsidies – given that the focus in subsidy allocation is on *potential* growth and the picking-up-the-winners strategies are not used.

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<sup>17</sup> The impacts of this policy tool cannot yet be evaluated as it is still in pilot phase not available firms in all industrial sectors and in entire country until by autumn 2011.

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## Annex 1 Description of the variables in two-stage least squares random effects model

| Description of variable                                                                                                                   | Variable name  | Sample                                       |                                              |                                             |                                             |                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|----------------------------------------------|---------------------------------------------|---------------------------------------------|------------------------------------------------|
|                                                                                                                                           |                | Start-ups up to 2 y. Mean Standard deviation | Start-ups up to 5 y. Mean Standard deviation | Gazelles up to 2 y. Mean Standard deviation | Gazelles up to 5 y. Mean Standard deviation | Incumbents (over 5 y.) Mean Standard deviation |
| <b>Dependent variable:</b>                                                                                                                |                |                                              |                                              |                                             |                                             |                                                |
| The relative change in the number of firm's employees between year t and t-1.                                                             | EMP_GROWTH     | 0.5770<br>5.2768                             | 0.3115<br>3.2639                             | 4.0542<br>15.9462                           | 2.5072<br>9.2198                            | 0.0768<br>1.4580                               |
| <b>Explanatory variables:</b>                                                                                                             |                |                                              |                                              |                                             |                                             |                                                |
| Log firm's R&D subsidy obtained from Tekes relative to its turnover at a given year.                                                      | RD_SUBSIDY     | -11.4483<br>1.6105                           | -11.5470<br>1.6645                           | -11.5557<br>1.8751                          | -11.4100<br>1.7084                          | -11.9022<br>1.7189                             |
| Log firm's employment subsidy obtained from the ministry of employment and the economy relative to its turnover at a given year.          | EMPL_SUBSIDY   | -11.0431<br>2.2011                           | -11.1554<br>2.2047                           | -10.9447<br>2.6062                          | -10.8753<br>2.4075                          | -11.5437<br>2.1708                             |
| Log firm's other public business subsidies obtained at a given year.                                                                      | OTHER_SUBSIDY  | -11.1041<br>2.3394                           | -11.2308<br>2.3210                           | -10.9628<br>2.9291                          | -10.9546<br>2.5914                          | -11.6602<br>2.1939                             |
| The relative change in the firm's sales between year t and t-1                                                                            | SALES_GROWTH   | 1.723<br>110.140                             | 1.137<br>140.931                             | 9.743<br>332.150                            | 4.599<br>187.114                            | 1.380<br>784.432                               |
| The relative change in the firm's total assets between year t and t-1                                                                     | CAPITAL_GROWTH | 5.103<br>235.330                             | 3.534<br>297.231                             | 9.232<br>193.633                            | 5.783<br>150.909                            | 1.342<br>211.637                               |
| R&D intensity = log firm's annual R&D expenditures divided by a firm's turnover (public R&D subsidies subtracted)                         | RD             | -11.4373<br>1.5938                           | -11.5199<br>1.6799                           | -11.6139<br>1.6872                          | -11.4413<br>1.5973                          | -11.8422<br>1.7896                             |
| Dummy variable that gets value 1 if firm has 5-9 employees, and 0 otherwise.                                                              | MEDIUM         | 0.0564<br>0.2307                             | 0.0634<br>0.2438                             | 0.0806<br>0.2723                            | 0.0604<br>0.2383                            | 0.0894<br>0.2853                               |
| Dummy variable that gets value 1 if firm has 10-49 employees, and 0 otherwise.                                                            | LARGE          | 0.0366<br>0.1879                             | 0.0458<br>0.2091                             | 0.0505<br>0.2190                            | 0.0413<br>0.1989                            | 0.0805<br>0.2720                               |
| Dummy variable that gets value 1 if firm has at least 50 employees, and 0 otherwise.                                                      | XLARGE         | 0.0089<br>0.0938                             | 0.0111<br>0.1046                             | 0.0095<br>0.0968                            | 0.0074<br>0.0858                            | 0.0176<br>0.1315                               |
| Return on investment                                                                                                                      | ROI            | 1.1913<br>2.1122                             | 1.1576<br>2.0639                             | 1.0423<br>2.0012                            | 1.1580<br>2.0865                            | 0.7352<br>1.3094                               |
| Equity ratio                                                                                                                              | EQUITY         | 0.3747<br>0.3371                             | 0.3920<br>0.3382                             | 0.3313<br>0.3140                            | 0.3660<br>0.3325                            | 0.4704<br>0.3367                               |
| Log firm's age                                                                                                                            | AGE            | 0.5072<br>0.3078                             | 1.0544<br>0.4727                             | 0.3442<br>0.3466                            | 0.7684<br>0.5607                            | 2.6464<br>0.4803                               |
| Dummy variable that gets value 1 if firm has a foreign owner, and 0 otherwise.                                                            | FOR_OWN        | 0.0071<br>0.0840                             | 0.0092<br>0.0952                             | 0.0081<br>0.0896                            | 0.0063<br>0.0791                            | 0.0113<br>0.1057                               |
| Dummy variable that gets value 1 if firm is owned by government or municipality, and 0 otherwise.                                         | GOV_OWN        | 0.0019<br>0.0434                             | 0.0030<br>0.0544                             | 0.0011<br>0.0335                            | 0.0019<br>0.0430                            | 0.0060<br>0.0772                               |
| Interaction term that gets values 1 if firm received R&D subsidy and employment subsidy at a given year, and 0 otherwise.                 | RDSxEMPS       | 0.0008<br>0.0275                             | 0.0009<br>0.0301                             | 0.0027<br>0.0523                            | 0.0017<br>0.0407                            | 0.0010<br>0.0317                               |
| Interaction term that gets values 1 if firm received R&D subsidy and other subsidy at a given year, and 0 otherwise.                      | RDSxOTHS       | 0.0021<br>0.0454                             | 0.0024<br>0.0484                             | 0.0058<br>0.0763                            | 0.0042<br>0.0647                            | 0.0016<br>0.0396                               |
| Interaction term that gets values 1 if firm received employment subsidy and other subsidy at a given year, and 0 otherwise.               | EMPSxOTHS      | 0.0068<br>0.0824                             | 0.0064<br>0.0796                             | 0.0158<br>0.1247                            | 0.0112<br>0.1054                            | 0.0051<br>0.0710                               |
| Interaction term that gets values 1 if firm received R&D subsidy, employment subsidy, and other subsidy at a given year, and 0 otherwise. | RDSxEMPSxOTHS  | 0.0003<br>0.0186                             | 0.0004<br>0.0190                             | 0.0011<br>0.0335                            | 0.0006<br>0.0248                            | 0.0004<br>0.0203                               |
| + 17 industry dummies<br>+ regional dummies for 5 provinces in Finland<br>+ year dummies for 2004-2008                                    |                |                                              |                                              |                                             |                                             |                                                |

## Annex 2 Difference-in-differences estimation results

| Table 7 The estimation results of the difference-in-differences models for employment: start-ups up to 2 years |                                               |                                               |                                               |                                               |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
|                                                                                                                | <i>T=2005</i><br><i>log(EMP)</i><br>Coef./S.E | <i>T=2006</i><br><i>log(EMP)</i><br>Coef./S.E | <i>T=2007</i><br><i>log(EMP)</i><br>Coef./S.E | <i>T=2008</i><br><i>log(EMP)</i><br>Coef./S.E |
| dT                                                                                                             | -0.112 ***<br>(0.013)                         | -0.114 ***<br>(0.016)                         | -0.099 ***<br>(0.018)                         | -0.124 ***<br>(0.020)                         |
| d_rd_subs                                                                                                      | 0.641 **<br>(0.295)                           | 0.672 **<br>(0.295)                           | 0.669 **<br>(0.315)                           | 0.451<br>(0.303)                              |
| d_empl_subs                                                                                                    | 0.185 ***<br>(0.040)                          | 0.153 ***<br>(0.038)                          | 0.165 ***<br>(0.040)                          | 0.167 ***<br>(0.042)                          |
| d_other_subs                                                                                                   | 0.102 **<br>(0.047)                           | 0.088<br>(0.049)                              | 0.088<br>(0.052)                              | 0.106<br>(0.055)                              |
| rd_subsXempl_subs                                                                                              | -0.731 **<br>(0.284)                          | -0.710 ***<br>(0.274)                         | -0.878 ***<br>(0.282)                         | -0.592<br>(0.303)                             |
| rd_subsXother_subs                                                                                             | -0.555<br>(0.519)                             | -0.532<br>(0.499)                             | -0.221<br>(0.472)                             | -0.393<br>(0.588)                             |
| empl_subsXother_subs                                                                                           | -0.183<br>(0.108)                             | -0.209 **<br>(0.106)                          | -0.191<br>(0.110)                             | -0.202<br>(0.116)                             |
| dTXrd_subs                                                                                                     | -0.515 **<br>(0.251)                          | -0.523 **<br>(0.239)                          | -0.438<br>(0.238)                             | -0.090<br>(0.340)                             |
| dTXempl_subs                                                                                                   | 0.113 ***<br>(0.034)                          | 0.118 ***<br>(0.033)                          | 0.161 ***<br>(0.037)                          | 0.141 ***<br>(0.041)                          |
| dTXother_subs                                                                                                  | -0.019<br>(0.041)                             | 0.047<br>(0.047)                              | 0.024<br>(0.048)                              | 0.037<br>(0.051)                              |
| dTXrd_subsXempl_subs                                                                                           | 0.831 ***<br>(0.284)                          | 0.856 ***<br>(0.312)                          | 0.181<br>(0.315)                              | 0.587<br>(0.430)                              |
| dTXrd_subsXother_subs                                                                                          | 0.655<br>(0.483)                              | 0.086<br>(0.331)                              | -0.171<br>(0.348)                             | -0.260<br>(0.558)                             |
| dTXempl_subsXother_subs                                                                                        | 0.000<br>(0.180)                              | 0.150<br>(0.142)                              | 0.181<br>(0.145)                              | 0.162<br>(0.161)                              |
| Number of firms                                                                                                | 10862                                         | 10100                                         | 9230                                          | 8599                                          |
| Wald(Model)                                                                                                    | 369.864 ***                                   | 372.168 ***                                   | 407.028 ***                                   | 383.617 ***                                   |
| Adj. R <sup>2</sup>                                                                                            | 0.682                                         | 0.688                                         | 0.704                                         | 0.702                                         |

\* Control variables: Constant, log sales, log total assets, RD, ROI, EQUITY, AGE, FOR\_OWN, GOV\_OWN, and industry and regional dummies. Interaction terms rd\_subsXempl\_subsXother\_subs and dTXrd\_subsXempl\_subsXother\_subs omitted due to too few observations. The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, \*\* significance level of 5%.

**Table 8** The estimation results of the difference-in-differences models for employment: start-ups up to 5 years

|                                 | <i>T=2005</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2006</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2007</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2008</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> |
|---------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| dT                              | -0.055 ***<br>(0.005)                                | -0.052 ***<br>(0.006)                                | -0.036 ***<br>(0.007)                                | -0.063 ***<br>(0.008)                                |
| d_rd_subs                       | 0.378 ***<br>(0.118)                                 | 0.372 ***<br>(0.125)                                 | 0.361 ***<br>(0.129)                                 | 0.319 ***<br>(0.121)                                 |
| d_empl_subs                     | 0.192 ***<br>(0.023)                                 | 0.182 ***<br>(0.023)                                 | 0.183 ***<br>(0.023)                                 | 0.187 ***<br>(0.024)                                 |
| d_other_subs                    | 0.047<br>(0.027)                                     | 0.042<br>(0.027)                                     | 0.036<br>(0.028)                                     | 0.043<br>(0.029)                                     |
| rd_subsXempl_subs               | -0.081<br>(0.247)                                    | -0.068<br>(0.247)                                    | -0.144<br>(0.268)                                    | -0.086<br>(0.261)                                    |
| rd_subsXother_subs              | -0.072<br>(0.206)                                    | -0.062<br>(0.207)                                    | -0.038<br>(0.208)                                    | -0.089<br>(0.216)                                    |
| empl_subsXother_subs            | -0.160 **<br>(0.072)                                 | -0.145 **<br>(0.071)                                 | -0.089<br>(0.069)                                    | -0.106<br>(0.070)                                    |
| rd_subsXempl_subsXother_subs    | 0.044<br>(0.382)                                     | 0.015<br>(0.373)                                     | -0.061<br>(0.428)                                    | -0.037<br>(0.446)                                    |
| dTXrd_subs                      | -0.100<br>(0.100)                                    | 0.015<br>(0.155)                                     | -0.176<br>(0.110)                                    | 0.151<br>(0.200)                                     |
| dTXempl_subs                    | 0.123 ***<br>(0.018)                                 | 0.114 ***<br>(0.019)                                 | 0.101 ***<br>(0.021)                                 | 0.105 ***<br>(0.022)                                 |
| dTXother_subs                   | 0.004<br>(0.020)                                     | 0.050 **<br>(0.024)                                  | 0.022<br>(0.025)                                     | 0.028<br>(0.027)                                     |
| dTXrd_subsXempl_subs            | 0.216<br>(0.170)                                     | 0.128<br>(0.256)                                     | 0.447<br>(0.272)                                     | 0.047<br>(0.394)                                     |
| dTXrd_subsXother_subs           | 0.057<br>(0.202)                                     | -0.265<br>(0.226)                                    | -0.045<br>(0.215)                                    | -0.399<br>(0.305)                                    |
| dTXempl_subsXother_subs         | 0.031<br>(0.080)                                     | 0.024<br>(0.064)                                     | -0.006<br>(0.068)                                    | -0.017<br>(0.071)                                    |
| dTXrd_subsXempl_subsXother_subs | -0.210<br>(0.382)                                    | 0.010<br>(0.520)                                     | -0.441<br>(0.412)                                    | 0.075<br>(0.560)                                     |
| Number of firms                 | 33911                                                | 32013                                                | 2978                                                 | 27827                                                |
| Wald(Model)                     | 1173.175 ***                                         | 1182.656 ***                                         | 1179.878 ***                                         | 1157.821 ***                                         |
| Adj. R2                         | 0.719                                                | 0.720                                                | 0.732                                                | 0.731                                                |

\* Control variables: Constant, log sales, log total assets, RD, ROI, EQUITY, AGE, FOR\_OWN, GOV\_OWN, and industry and regional dummies. The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, \*\* significance level of 5%.

**Table 9** The estimation results of the difference-in-differences models for employment: gazelles up to 2 years

|                     | <i>T=2005</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2006</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2007</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2008</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> |
|---------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| dT                  | 0.664 ***<br>(0.060)                                 | 0.775 ***<br>(0.072)                                 | 0.852 ***<br>(0.081)                                 | 0.714 ***<br>(0.088)                                 |
| d_rd_subsidies      | 0.425<br>(0.269)                                     | 0.668 **<br>(0.313)                                  | 0.446<br>(0.307)                                     | 0.305<br>(0.210)                                     |
| d_empl_subsidies    | 0.260 **<br>(0.107)                                  | 0.154<br>(0.114)                                     | 0.181<br>(0.112)                                     | 0.090<br>(0.121)                                     |
| d_other_subsidies   | 0.212<br>(0.121)                                     | 0.062<br>(0.124)                                     | 0.210<br>(0.149)                                     | 0.202<br>(0.152)                                     |
| dTXrd_subsidies     | -0.255<br>(0.272)                                    | -0.511<br>(0.279)                                    | -0.360<br>(0.269)                                    | -0.359<br>(0.250)                                    |
| dTXempl_subsidies   | 0.052<br>(0.066)                                     | 0.072<br>(0.079)                                     | 0.086<br>(0.094)                                     | 0.078<br>(0.109)                                     |
| dTXother_subsidies  | -0.016<br>(0.092)                                    | 0.117<br>(0.103)                                     | -0.039<br>(0.126)                                    | -0.081<br>(0.129)                                    |
| MULTI_SUBSIDIES     | 0.038<br>(0.189)                                     | 0.192<br>(0.198)                                     | 0.029<br>(0.198)                                     | 0.227<br>(0.187)                                     |
| Number of firms     | 1215                                                 | 1037                                                 | 935                                                  | 889                                                  |
| Wald(Model)         | 282.427 ***                                          | 309.585 ***                                          | 344.926 ***                                          | 332.802 ***                                          |
| Adj. R <sup>2</sup> | 0.767                                                | 0.794                                                | 0.818                                                | 0.826                                                |

\* Control variables: Constant, log sales, log total assets, RD, ROI, EQUITY, AGE, FOR\_OWN, GOV\_OWN, and industry and regional dummies. The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, \*\* significance level of 5%.

**Table 10** The estimation results of the difference-in-differences models for employment: gazelles up to 5 years

|                         | <i>T=2005</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2006</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2007</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2008</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> |
|-------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| dT                      | 0.554 ***<br>(0.024)                                 | 0.596 ***<br>(0.027)                                 | 0.606 ***<br>(0.028)                                 | 0.549 ***<br>(0.032)                                 |
| d_rd_subs               | 0.767 **<br>(0.309)                                  | 0.731 **<br>(0.359)                                  | 0.571<br>(0.321)                                     | 0.289 **<br>(0.126)                                  |
| d_empl_subs             | 0.254 ***<br>(0.056)                                 | 0.262 ***<br>(0.060)                                 | 0.278 ***<br>(0.063)                                 | 0.262 ***<br>(0.067)                                 |
| d_other_subs            | 0.167 **<br>(0.066)                                  | 0.141 **<br>(0.066)                                  | 0.156 **<br>(0.068)                                  | 0.184 **<br>(0.075)                                  |
| rd_subsXempl_subs       | 0.059<br>(0.361)                                     | -0.084<br>(0.484)                                    | -0.079<br>(0.495)                                    | 0.160<br>(0.458)                                     |
| rd_subsXother_subs      | -0.504<br>(0.424)                                    | -0.203<br>(0.420)                                    | -0.019<br>(0.427)                                    | 0.176<br>(0.321)                                     |
| empl_subsXother_subs    | -0.086<br>(0.174)                                    | -0.129<br>(0.223)                                    | -0.053<br>(0.203)                                    | -0.130<br>(0.224)                                    |
| dTXrd_subs              | -0.606<br>(0.334)                                    | -0.422<br>(0.269)                                    | -0.404<br>(0.225)                                    | -0.040<br>(0.148)                                    |
| dTXempl_subs            | 0.051<br>(0.041)                                     | -0.000<br>(0.046)                                    | 0.023<br>(0.054)                                     | -0.034<br>(0.059)                                    |
| dTXother_subs           | -0.065<br>(0.064)                                    | -0.027<br>(0.063)                                    | -0.040<br>(0.068)                                    | -0.083<br>(0.066)                                    |
| dTXrd_subsXempl_subs    | 0.231<br>(0.290)                                     | 0.262<br>(0.321)                                     | 0.079<br>(0.311)                                     | -0.480<br>(0.399)                                    |
| dTXrd_subsXother_subs   | 0.308<br>(0.415)                                     | -0.071<br>(0.342)                                    | -0.200<br>(0.358)                                    | -0.220<br>(0.360)                                    |
| dTXempl_subsXother_subs | 0.126<br>(0.144)                                     | 0.181<br>(0.200)                                     | 0.122<br>(0.197)                                     | 0.257<br>(0.210)                                     |
| Number of firms         | 3404                                                 | 3177                                                 | 3052                                                 | 2765                                                 |
| Wald(Model)             | 530.847 ***                                          | 629.086 ***                                          | 701.741 ***                                          | 697.781 ***                                          |
| Adj. R2                 | 0.755                                                | 0.795                                                | 0.811                                                | 0.830                                                |

\* Control variables: Constant, log sales, log total assets, RD, ROI, EQUITY, AGE, FOR\_OWN, GOV\_OWN, and industry and regional dummies. Interaction terms rd\_subsXempl\_subsXother\_subs and dTXrd\_subsXempl\_subsXother\_subs omitted due to too few observations. The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, \*\* significance level of 5%.

**Table 11** The estimation results of the difference-in-differences models for employment: Incumbents

|                                 | <i>T=2005</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2006</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2007</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> | <i>T=2008</i><br><i>log(EMP)</i><br><i>Coef./S.E</i> |
|---------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| dT                              | -0.057 ***<br>(0.002)                                | -0.060 ***<br>(0.002)                                | -0.046 ***<br>(0.002)                                | -0.090 ***<br>(0.003)                                |
| d_rd_subs                       | 0.261 ***<br>(0.044)                                 | 0.256 ***<br>(0.045)                                 | 0.269 ***<br>(0.045)                                 | 0.246 ***<br>(0.046)                                 |
| d_empl_subs                     | 0.243 ***<br>(0.011)                                 | 0.232 ***<br>(0.011)                                 | 0.234 ***<br>(0.011)                                 | 0.232 ***<br>(0.012)                                 |
| d_other_subs                    | 0.080 ***<br>(0.016)                                 | 0.074 ***<br>(0.016)                                 | 0.075 ***<br>(0.016)                                 | 0.077 ***<br>(0.016)                                 |
| rd_subsXempl_subs               | -0.103<br>(0.106)                                    | -0.115<br>(0.107)                                    | -0.148<br>(0.114)                                    | -0.209<br>(0.114)                                    |
| rd_subsXother_subs              | 0.125<br>(0.118)                                     | 0.126<br>(0.117)                                     | 0.084<br>(0.108)                                     | 0.084<br>(0.109)                                     |
| empl_subsXother_subs            | -0.045<br>(0.045)                                    | -0.032<br>(0.045)                                    | -0.046<br>(0.046)                                    | -0.051<br>(0.047)                                    |
| rd_subsXempl_subsXother_subs    | -0.208<br>(0.182)                                    | -0.189<br>(0.184)                                    | -0.115<br>(0.184)                                    | -0.116<br>(0.181)                                    |
| dTxrd_subs                      | 0.022<br>(0.034)                                     | -0.053<br>(0.049)                                    | -0.062<br>(0.043)                                    | -0.022<br>(0.044)                                    |
| dTxempl_subs                    | 0.070 ***<br>(0.008)                                 | 0.061 ***<br>(0.009)                                 | 0.052 ***<br>(0.010)                                 | 0.053 ***<br>(0.011)                                 |
| dTxother_subs                   | 0.027 **<br>(0.010)                                  | 0.032 ***<br>(0.012)                                 | 0.013<br>(0.013)                                     | 0.005<br>(0.014)                                     |
| dTxrd_subsxempl_subs            | -0.163<br>(0.088)                                    | 0.007<br>(0.107)                                     | -0.185<br>(0.188)                                    | 0.088<br>(0.119)                                     |
| dTxrd_subsxother_subs           | -0.164<br>(0.101)                                    | -0.087<br>(0.117)                                    | -0.047<br>(0.104)                                    | -0.132<br>(0.112)                                    |
| dTxempl_subsxother_subs         | 0.033<br>(0.030)                                     | 0.004<br>(0.036)                                     | -0.003<br>(0.038)                                    | 0.011<br>(0.038)                                     |
| dTxrd_subsxempl_subsxother_subs | 0.222<br>(0.191)                                     | 0.155<br>(0.202)                                     | 0.299<br>(0.277)                                     | 0.049<br>(0.229)                                     |
| Number of firms                 | 122419                                               | 119168                                               | 111776                                               | 106537                                               |
| Wald(Model)                     | 6344.767 ***                                         | 6218.510 ***                                         | 6103.916 ***                                         | 5925.364 ***                                         |
| Adj. R2                         | 0.769                                                | 0.769                                                | 0.775                                                | 0.776                                                |

\* Control variables: Constant, log sales, log total assets, RD, ROI, EQUITY, AGE, FOR\_OWN, GOV\_OWN, and industry and regional dummies. The robust firm cluster-specific standard errors are reported in the parentheses. Significance levels are reported on superscripts, where \*\*\* denotes significance level of 1%, \*\* significance level of 5%.





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