Gabinete de Estratégia e Estudos

GEE Paper

158

Janeiro de 2021

The Impact of R&D tax incentives in Portugal

Rita Bessone Basto | Ana Martins | Guida Nogueira

Gabinete de Estratégia e Estudos do Ministério da Economia e da Transição Digital
Office for Strategy and Studies of the Ministry of Economy and Digital Transition
Rua da Prata, n.º 8 – 1149-057 Lisboa – Portugal
www.gee.gov.pt
ISSN (online): 1647-6212

The Impact of R&D tax incentives in Portugal [1]

Rita Bessone Basto [2], Ana Martins [2], Guida Nogueira [2]

Abstract

The competitiveness of an economy increasingly depends on its ability to innovate. Theory suggests that innovation makes an important contribution to growth both at the firm level and at the national level. Innovative economies that deliver new differentiated products and services and/or develop more efficient production processes are often more productive, more resilient and adaptable in the face of adversity and change, and better able to support higher living standards and thus greater well-being. However, because knowledge is a public good, without government support, private agents are likely to underinvest in R&D, as it usually leads to higher social returns than private ones. In this context, it is strategically important to use public funds to promote innovative activity in firms to achieve the optimal level of R&D investment. Since 2000, indirect public support through tax credits has become more prominent and is currently the main form of public R&D support for most OECD countries. This paper evaluates the impact of SIFIDE, the Portuguese system of tax incentives to corporate R&D investment, on firms' behaviour. The results show the effectiveness of SIFIDE in promoting investment in R&D, both through the impact of the program on intangible investment and on R&D staff.

Keywords: R&D tax credits, Innovation, BERD, SIFIDE, Propensity score matching, Differences-in-Differences.

JEL Classification: O31; O32; H25; H32; C31

Note: This article is sole responsibility of the authors and do not necessarily reflect the positions of GEE or the Portuguese Ministry of Economy and Digital Transition.

[1] The authors are thankful to Chiara Criscuolo, Ana Filipa Fernandes, João Ferreira, Ricardo Paes Mamede, Susana Peralta, Henrique Pereira, José Carlos Pereira, Ricardo Pinheiro Alves, Sílvia Fonte Santa, António Bob dos Santos and António Simões for the valuable comments and suggestions, and to ANI – Agência Nacional de Investigação and Statistics Portugal for the data provided. We also thank Irma Buznic and Diogo Monteiro for research assistance. Errors and omissions are our own.

[2] Gabinete de Estratégia e Estudos, Ministério da Economia e da Transição Digital

1. Introduction

The competitiveness of an economy increasingly depends on its ability to innovate, either on the creation of new products and services, or on the development of more efficient production processes. Globalization and the reorganization of international trade in global value chains confer greater value added to the phases of the production process requiring more technology and innovation. The transition towards a digital economy promotes the greater participation of the services sector in international trade and global value chains, which further contributes to this trend.

Given the importance of innovation and technological development, several countries implement policies aimed at promoting research and development (R&D). Public intervention in this area can take several forms such as public investment or financial support to the private sector R&D. Public financial support to the private sector generally consists of direct subsidies and grants or tax incentives[3] to firms investing in R&D.

Several factors can justify public support for this type of investment. The most used argument refers to the existence of market failures associated with R&D. Indeed, positive externalities arising from the dissemination of knowledge and the transfer of new technologies imply that firms do not receive the full economic benefits associated with their R&D investments, resulting in a sub-optimal provision of the good from a social point of view (Arrow, 1962; Aghion and Howitt, 1997). Moreover, there is a large uncertainty concerning the return on these investments as they do not always translate into innovation of comparable magnitude. In addition, the intangible nature of R&D investment makes it difficult to be accepted as collateral in the financing of such activities by the private sector.

A problem typically associated with public support for R&D is the difficulty to design policies that encourage firms to undertake R&D projects that benefit society, but at the same time, are not profitable enough for private firms to implement them on their own – otherwise public support would merely replace private investment instead of leading to additional investment (Wallsten, 2000). Ideally, an efficient policy should promote socially desirable projects, that otherwise would not be undertaken by the private sector: either because the social benefit is much higher than the private one or because firms face significant financial constraints that prevent them to invest in these projects. However, the difficulty to identify such projects may affect the degree to which public policies can mitigate existent market failures (Lerner, 2013).

Although grants and tax incentives are both designed to fund private expenditure on R&D, the two types of financial support may have different implications on project selection, on the government budget and on firm's behaviour. With grants, which usually take the form of an interest-free or non-reimbursable loan, the evaluation of the project is made by the state agency and the selection depends on its raking among all national projects and on the budgetary endowment. With tax credits, the evaluation of the project and decision to invest is left to the firm, on the assumption that the market promotes greater efficiency in the

[3] According to the European Commission, tax incentives can be grouped into four major segments: i) Tax Credits (deduction from tax collection, depending on R&D expenses); ii) Enhanced Allowance (reduction of the tax base through an overvaluation of R&D expenses); iii) Accelerated Depreciation (reduction of the tax base through an overvaluation of Tangible Fixed Assets depreciation) and iv) Patent Box (reduction of tax payable related to intellectual property income). However, tax credits are the most common instruments. Portuguese government provides a tax credit regime (SIFIDE) and a Patent Box, in addition to various non-tax incentives (SI for Technological R&D, Productive Innovation Voucher, etc.).
(https://ec.europa.eu/taxation_customs/sites/taxation/files/resources/documents/taxation/gen_info/economic_analysis/tax_papers/country_fiches.pdf)

allocation of resources. However, given the fact that tax credits are granted as long as eligibility criteria are met, these incentives may lead to a higher degree of budgetary uncertainty. In addition, they may more easily give rise to firms' rent seeking behaviour, whereby the investment is implemented with the main purpose of receiving tax incentives.

While there is no clear conclusion on the most successful approach to foster R&D, direct support through grants, may be more appropriate to encourage projects with a greater gap between private and social benefits. By contrast, tax credits encourage firms to prioritize projects with higher private benefits. As such, they have the advantage of not altering firms' choices, presumably with better information than the State on the quality of their R&D projects.

These difficulties in ensuring the effectiveness of public policies reinforces the importance to conduct policy evaluations. Evaluations should analyse whether incentives lead to additional R&D investment and are not are merely replacing private funding (i.e. crowding out). In addition, it is important to consider that investment in R&D is not usually the ultimate goal of the policy, but a vehicle through which companies become more innovative, productive and competitive. Therefore, a more complete assessment should also focus on less immediate, but potentially more important, impact of R&D (e.g. on productivity, firms' profitability, or degree of internationalisation).

The evaluation of public policies is usually complicated by endogeneity issues that arise from the fact that neither the application for public supported programmes nor the approval of such projects occurs by chance, but are dependent upon firm's characteristics that also influence their performance and consequently the outcome of the program. Firms that are more likely to obtain higher returns on investment are also more likely to apply (self-selection) and public support is usually granted to these firms (public selection, in the case of grants). Both mechanisms can introduce bias into the analysis, which makes it difficult to properly distinguish between the impact of the program and the impact of those characteristics that make certain firms more likely to participate.

Several studies have analysed the impact of R&D incentives with results not always consensual. The reasons behind this divergence can be attributed to the inherent characteristics of the program (type of incentive, objectives, country and the effectiveness of monitoring agencies) but also to the methodology used, in particular whether the selection bias is taken into account.

Among the most widely used evaluation methodologies, that attempt to reduce the risk of selection bias, are matching and differences-in-differences methods. Matching methods compare the outcome of firms that have benefited from the policy (treated firms) with that of a control group composed of similar firms, in all relevant characteristics, except the fact that they have not applied for the program. To the extent that this control group has been selected by controlling for the firms' characteristics that determine both the probability of application and the outcome of the programme, it constitutes an appropriate counterfactual for comparison. With the differences in differences method, treated with non-treated firms are compared before and after the implementation of the program. To the extent that these differences result from time-invariant factors, the estimated coefficients for the impact of the program will also be non-biased.

This paper evaluates the impact of SIFIDE, the Portuguese system of tax incentives to corporate R&D investment, on firms' behaviour. This analysis seeks to distinguish between crowding-out and additionality

effects. Furthermore, it will also assess the persistence of the impact over different time horizons (contemporary effects, 1 year and 3 years after the completion of the program).

In addition to the more immediate impact of the policy (on intangible investment and R&D staff), the analysis will also assess the impact on variables that may be indirectly affected by incentives, such as the degree of internationalization of firms.

Results will be broken-down by sector, firm size, and according to the firms' previous record with intangible investment and propensity to R&D, in order to identify segments particularly affected by the incentive system. To increase the robustness of the analysis both matching and differences-in-differences methodologies are used, with several matching methods, specification of the variables and models to estimate differences-in-differences coefficients.

2. Corporate R&D Tax Incentive System (SIFIDE)

The Portuguese system of tax incentives to corporate R&D investment (SIFIDE) is an instrument that aims to increase the competitiveness of companies by supporting their research and development effort by deducting these costs from corporate tax collections (tax credit). SIFIDE was created in 1997 and has undergone several revisions. The original system was discontinued between 2004 and 2005, reintroduced in 2006 and replaced in 2011 by SIFIDE II. The new system incorporated most of the features of the previous one with some changes aimed at increasing its attractiveness to companies.

The tax credit on R&D expenses, in the part that has not been subject of other non-repayable grants, is calculated based on two rates:

1. The base Rate: applicable on the amount of total R&D expenditure in the current year (32.5%).
2. The incremental rate: applicable to the increase in R&D expenditure compared to the average of the previous two years (50% up to a maximum of € 1,500,000.00).

In the case of SMEs that started their activity less than 2 years ago and have not benefited from the Incremental rate, an additional 15pp is added to the Base Rate (i.e. 47.5% of total R&D expenses).

$$\boldsymbol{Tax\ credit} = 0{,}325 * Tot_t + I$$

$$\boldsymbol{I} = 0{,}5 * \left[Tot_t - \left(\frac{Tot_{t-1}+Tot_{t-2}}{2}\right)\right] \text{ up to a limit of €1,500,000 or}$$

$$\boldsymbol{I} = 0{,}15 * Tot_t \ (if\ micro\ ou\ SME\ with\ less\ than\ 2\ years)$$

$$Tot = total\ eligible\ expenditures$$

Finally, if the firm has insufficient tax collection to benefit from tax credits, the deduction may be carried forward until the eighth immediate financial year.

Eligible expenditures are defined in Decree-Law No. 162/2014 (see Box 1). These include expenditures related to the company's effort with R&D (e.g. personnel expenses, fixed assets, operating assets and other R&D related activities), the external contracting of R&D activities, the acquisition of output from this effort (e.g. acquisition of patents), and the participation in the capital of R&D entities. Expenditures considered in the application for a programme must be implemented during the year of the tax exercise or during the first six months of the following year[4].

Box 1 - SIFIDE II: eligible expenditures according to Decree-Law No. 162/2014:

Acquisitions of tangible fixed assets, with the exception of buildings and land, provided that they are acquired in a new state and in proportion to their allocation to R&D activities;
Expenditure on staff with a minimum educational qualification of level 4 of the National Qualifications Framework, directly involved in R&D activities;
Expenditure with the participation of management in the organization of research and development institutions;
Operating costs, up to a maximum of 55 % of staff expenditures with a minimum of educational qualifications of level 4 of the National Qualifications Framework directly involved in R&D;
Expenditure in contracting R&D activities from public entities or similar with recognised capacity for research and development;
Participation in the capital of R&D institutions and contributions to investment funds, public or private, to finance companies dedicated mainly to research and development;
Costs of registration and maintenance of patents;
Costs with the acquisition of patents that are predominantly intended for research and development;
Expenditure on audits to research and development;
Expenses with demonstration actions related to supported R&D projects.

The eligibility of SIFIDE is extended to all corporate taxpayers residing in Portugal, as well as non-resident firms with a permanent establishment, with a principal activity in agriculture, industry, trade or services. Given the nature of the policy, there is no competition between firms or pre-selection of projects. Firms must meet the following criteria in order to be considered as eligible:

1. Firms' taxable profit are not determined by indirect methods;
2. Firms do not owe taxes or contributions to the State and Social Security or have these payments duly secured.

Firms can apply several times to the programme and with multiple projects, as long as these expenditures were not subject to other forms of financial support.

[4] Some additional considerations to apply: for firms employing PHDs (level 8) in R&D activities, related costs will be considered at 120%; large firms are not eligible to expenditures related to patent registry; costs with projects related to ecological products are considered at 110%.

SIFIDE allows companies to recover a significant part of their costs with research and development activities (up to 82.5% if the company has existed for more than 2 years and has not invested in R&D in the previous two years).

After its reintroduction in 2006, the System was not subject to major structural changes - the methodology used for the calculation of tax credits remained, but the list of eligible expenditures, the base rate, the incremental rate, the incremental value limit, and the carry-forward option (see Table 2.1) suffered some changes. Since its reintroduction, the amount of tax credits granted to companies has more than doubled (EUR 227 million in 2017, compared to EUR 92 million in 2006).

Table 2.1 - Evolution of SIFIDE

Fiscal year	Legislation	Designation	Base rate	Incremental rate	Incremental Value Limit	Carry forward option
1997	Decree-Law nº 292/97	SIFIDE	8%	30%	250.000 €	3 years
1998						
1999						
2000						
2001	Decree-Law nº 197/2001		20%	50%	500.000 €	6 years
2002						
2003						
2004	Decree-Law i nº 23/2004	SIFIDE was not in force - it was replaced by the Investment Tax Reserve (RFI)				
2005						
2006	Law nº 40/2005				750.000 €	
2007						
2008						
2009	Law nº 10/2009		32,50%		1.500.000 €	
2010	Law nº 3B/2010					
2011	Law nº 55A/2010	SIFIDEII				
2012	Law nº 4B/2011					
2013	Decree-Law nº 82/2013					
2014	Law nº 83C/2013 &					8 years
2015	Decree-Law i nº					
2016	162/2014					
2017	Law nº 42/2016					
2018	Law nº 114/2017					

As mentioned, tax credits, compared to other R&D support policies, may give origin to firms' rent-seeking behaviour (used as a cost optimisation strategy), may introduce budgetary uncertainty (as the loss of tax revenue is more difficult to predict than costs with grants or cash transfers, where resources are committed), and may contribute to the crowding-out of private investment, to the extent that some R&D projects could have been implemented in the absence of public support. Although other forms of support do not exclude many of these problems, they could be minimized given the state evaluation of the project. Furthermore, the fact that the benefits from SIFIDE are relatively uniform among firms, may undermine its efficiency as R&D may be particularly relevant in some sectors or type of firms.

Tax credits, however, have the advantage of conferring to firms the decision to select projects, potentially more knowledgeable of the associated benefits/costs than the state. Furthermore, implementation is

relatively simple, administrative cost are low (notwithstanding the mandatory detailed reporting of the project and investment costs under SIFIDE) and provides greater stability to the levels of R&D investments, as they depend less on budgetary endowments or political decisions.

The government is an important source of financing for R&D activities. Between 2004 and 2017, direct public funding of R&D activities in the European Union ranged between 29% and 35% of total expenditure on R&D activities and between 25% and 31% in the OECD (Table 2.2). Portugal compared well above average in a range of 41% to 57% in the same period. In the business sector, the weight of direct public financing of R&D activities in Portugal was 5,5% in 2018, compared with 4,8% in OECD countries.

Table 2.2: Share of direct public funding of R&D by execution sector

% total R&D expenditure in the respective execution sector

Country	Execution sector	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
UE28	All sectors	35,2	34,4	33,6	33,3	33,8	34,9	34,8	33,3	32,8	32,5	31,9	31,1	30,2	29,3	
OECD	All sectors	30,5	29,7	28,9	28,5	29,4	31,4	31,3	30,0	29,3	28,3	27,3	26,9	25,7	25,2	24,9
Portugal	**All sectors**	**57,5**	**55,2**	**48,6**	**44,6**	**43,7**	**45,5**	**45,1**	**41,8**	**43,1**	**46,4**	**47,1**	**44,3**	**42,6**	**41,0**	**40,6**
UE28	Business Sector	8,0	7,1	7,1	6,8	7,0	6,9	7,1		6,5		6,1	5,9	5,3	5,1	
OECD	Business Sector	7,1	6,8	6,8	6,8	8,1	9,0	8,1	7,2	7,0	6,5	5,9	5,8	5,1	5,0	4,8
Portugal	**Business Sector**	**4,6**	**4,2**	**3,7**	**3,5**	**3,3**	**5,5**	**4,3**	**4,0**	**6,9**	**9,1**	**9,1**	**5,5**	**3,8**	**4,2**	**5,6**

Source: Eurostat and OECD

Since 2000 indirect public support through tax credits has become more prominent and is currently the main form of public R&D support for most OECD countries. This particularly true for Portugal as 17.5% of total R&D expenditure in the business sector was financed through tax credits in 2017 (Table 2.3 and figure 2.1).

Table 2.3: Share of public support for business R&D through tax incentives

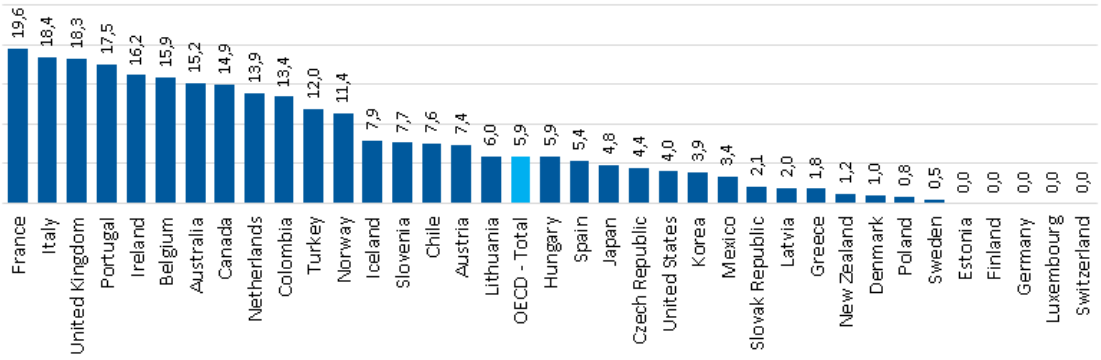
% total R&D expenditure performed by the business sector

País	Setor de Execução	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
UE28	Business Sector	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OECD	Business Sector	3,4	3,7	3,8	4,0	4,1	4,2	4,5	4,5	5,0	5,2	5,5	5,8	5,8	5,9	
Portugal	**Business Sector**			**12,5**	**14,4**	**11,6**	**12,8**	**12,8**	**14,8**	**12,8**	**14,3**	**16,5**	**19,1**	**18,2**	**17,5**	

Source: OECD

Figure 2.1: Weight of public financing to companies' R&D through tax credits

% total R&D expenditure performed by the business sector, 2017



Source: OECD

Note: The figures presented for the United States and Greece refer to 2016.

Tax incentives may differ across countries with respect to the tax base, applied rates or eligibility of expenditure. In particular, the tax base may depend on the volume of R&D expenditure or on an incremental factor (calculated on the basis of the increase in investment over a reference period). Although tax credits started to be mostly based on the volume rate, incremental rates, and hybrid schemes, such as SIFIDE, are increasingly common.

In the international context, SIFIDE is one of the most generous tax incentive systems (table 2.4). For SMEs and large profitable firms, the implied marginal incentive rate in Portugal is 39% (compared with 19% for the OECD average for SMEs and 14% for large companies). For SMEs and large companies with losses the implied marginal incentive rate in Portugal is 31% (compared with 17% for the OECD median for SMEs and 10% for large companies).

Table 2.4 - Country comparison of tax credit regimes to R&D investment

Country	R&D Tax incentive	Implied marginal tax incentive rate for profitable (or at a loss) SMEs
Belgium	Tax withholding; tax credit and subsidy	0,16 (0,15)
Czech Republic	Hybrid tax subsidy	0,21 (0,15)
France	Volume-based tax credit	0,43 (0,43)
Ireland	Volume-based tax credit	0,29 (0,23)
Italy	Incremental tax credit	0,20 (0,17)
Poland	Volume-based tax subsidy	0,22 (0,18)
Portugal	Hybrid tax credit	0,39 (0,31)
Spain	Hybrid tax credit and exemption from contribution to Social Security	0,33 (0,26)
UK	Volume-based tax subsidy	0,27 (0,27)

Source: OECD, R&D Tax Incentive Database - OECD R&D Tax Incentive$ BD (2019 edition) contains time series estimates based on tax credits and subsidies, by company size and profitability scenario. The subsidy rate is defined as 1 minus index B, a measure of revenue before tax required for the representative company to offset $1 R&D spent.

3. Literature review

3.1 Impact of R&D incentives

Several studies have analysed the effectiveness of R&D incentives, with results not always consensual. This may have to do with the design and diversity of support instruments granted (subsidies, tax credits, etc.), with the different objectives and variables used to measure the impact of public policies (investment in R&D, patent creation, productivity gains, etc.), but also with the diversity of methodologies used, level of data aggregation, different periods analysed, which make the various studies difficult to compare.

Most studies analyse the impact of policies in terms of the input of innovation (R&D effort) or on its more immediate output (new products or production processes and patent creation). By contrast, studies that analyse the less immediate impact of R&D on company performance, such as productivity or degree of internationalization are relatively scarcer in the literature.

A typical concern of these studies is to examine the extent to which public financing replaces or complements private investment on R&D. Ideally, public policies should finance socially beneficial projects, which would not otherwise be carried out. However, it is not always easy for authorities managing R&D incentive programs to identify firms with viable projects, but with financial constraints or other factors that prevent them from implementing them. Thus, there is a risk that the incentives do not contribute to additional investment in research, but only to replace private with public funding (crowding-out).

Most recent empirical studies analysing the impact of R&D incentives conclude for positive effects on private investment in R&D (i.e. complementarity). However, there are also a considerable number of papers which, although rejecting the hypothesis of full crowding-out, do not exclude that of partial crowding-out – i.e. incentives contribute to a greater volume of R&D investment than would otherwise exist, but the additional investment does not exceed the cost incurred with the policy measure – and studies that have mixed results (positive effects for certain countries, industries or size of enterprise) and inconclusive results. In a literature review Zuniga-Vicente et al. (2014) concluded that although studies confirming the hypothesis of additionality prevail, a significant group of studies show some substitution between public and private funding or even inconclusive effects – in 77 studies examined, 60% reported additional effects, 20% crowding-out and 20% obtained inconclusive results. Some authors have concluded that the additional effect (crowding-in) is greater in SME, in business services (Castellacci and Lie, 2015) and in high-tech companies (Czarnitzki and Delanote,2015).

Among recent studies in European economies, examples of various types of results concerning the impact of public support for R&D can also be found.

Carboni (2011) and Duguet (2004) found some evidence of additionality in studies conducted respectively on Italy and France. Hud and Hussinger (2015) analysed the impact of R&D subsidies in Germany between 2006 and 2010, and concluded that, although the additional effect prevailed for most years analysed, some crowding-out was observed in 2009 due to the greater reluctance of companies to invest during a crisis period.

Aristei et al. (2015), did not find evidence of additionality, concerning the impact of incentives (subsidies or tax credits) to industry between 2007 and 2009 in some European countries (Germany, France, Italy, the

United Kingdom and Spain). This analysis, which relied on both parametric and non-parametric methods (propensity score matching), suggested, however, that public funding contributed to avoid a reduction of R&D investment in the context of the international financial crisis. These results are consistent with those of other studies where the hypothesis of full crowding-out was rejected, without however proving an additionality effect on private investment [5].

Czarnitzki and Hunermund examine the impact of R&D subsidies under the Eurostars project on firms' growth (measured through employment) and failed to find positive effects for a group of worse quality projects. According to the authors, the results are not attributed to crowding out but to the low quality of many of the projects funded under the program.

If the diversity of results concerning the immediate impact of R&D incentives makes it difficult to reach general conclusions, results are even more disperse when studies analyse other less immediate impacts of incentives (output of research or firm performance). One possible explanation may lie in the fact that these effects take longer to materialize and are therefore more difficult to capture by most empirical studies.

Czarnitzki et al. (2011), for example, conclude for the positive impact of public policies on some indicators of product innovation without, however, showing significant effects on firm performance (company profitability, international market shares and competitiveness). Einiö (2014) concludes that subsidised companies in Finland show, on average, increases in R&D investment, sales, employment and (with a 3-year time lag) in productivity. Cin et al. (2017), conclude that R&D incentives had a positive impact on R&D expenditure and productivity in manufacturing companies in Korea. However, Bravo-Biosca et al. (2013), on a study of several OECD countries, show negative effects of tax incentives on productivity and employment growth.

With regard to studies on the Portuguese economy, Mamede and Simões (2019) analyse the effectiveness of SIFIDE in 2006 and 2007 and conclude that for each euro lost in tax collection more than one euro is spend by firms on R&D, thus confirming additionally.

3.2. Methodologies used

According to David et al. (2000) much of the studies carried out until the end of the 1990s were based on linear regressions and did not take into account the problem of endogeneity between the determinants of the application and the impact of the programs, which may give rise to inconsistent estimates of the causal effect [6]. In particular, the fact that many firms with good projects do not apply for public support tends to underestimate the effectiveness of tax incentives if this bias is not controlled.

The causal impact of a given phenomenon or treatment would be easily obtained if we could simultaneously compare the performance of the same individual with and without exposure to the treatment. In the impossibility of doing so, the ideal would be to resort to a controlled random experiment. However, given the difficulty in randomly submitting individuals to treatments, these experiences are not always feasible.

[5] See for example, Almus and Czarnitzki (2003), Czarnitzki and Licht (2006), Gonzalez and Pazó (2005), Cerulli and Poti (2012), also based on matching methods.
[6] See also Hall and Van Reenen (2000) for a critical review on methodologies to analyze the impact of R&D incentives.

To solve the problem, several methods can be used: structural models, sampling methods, instrumental variables, and matching methods (such as the Propensity Score) and differences-in-differences. The latter two are most often used, since it is not always easy to correctly specify the structural model or identify a variable that can constitute an appropriate instrument (i.e. correlated, with the incentive, but not with the impact of the policy).

Assuming that the impact of the policy could be measured by comparing the results of 'treated' companies (subject to the policy) with the results that these companies would have had in the absence of the program, the Average Treated Effect (ATE) would be defined by:

$$\tau_{\mathrm{ATE}} = \frac{\sum_{i=0}^{n} \tau i}{n} = \frac{\sum_{i=0}^{n} [y_i(1) - y_i(0)]}{n}$$

being yi (1) the result of the companies treated after the program and yi (0) the result of the companies treated in the absence of the program.

Since yi (0) is non observable, the Propensity Score Matching method (Rosenbaum & Rubin, 1983) makes the comparison by replacing that result with that of a counterfactual composed by firms with a probability of treatment, conditional on a set of relevant observable variables in the pre-treatment period (Xi), similar to the group of treated individuals (T). This probability is calculated using a probit model:

$$\mathrm{P}\,(\mathrm{X_i}) = \mathrm{Prob}\,(\mathrm{T_i} = 1 \mid \mathrm{X_i}) = \alpha_0 + \sum_{i=1}^{k} \beta_i X_i + \varepsilon$$

After determining the control group, the causal impact is obtained by comparing the performance of the two groups after treatment (Average Treated Effect on the Treated - ATT):

$$\tau_{\mathrm{ATT}} = \frac{\sum_{i=0}^{n} \tau_{\mathrm{i}}}{n} = \frac{\sum_{i=0}^{n} [y_{\mathrm{i}}(1) - y\mathrm{C_i}(0)]}{n}$$

being yCi (0) the result of the control group.

The fact that the model allows controlling for the variables that can influence both the probability of treatment and the results of the program, can eliminate the endogeneity resulting from the selection bias. However, this estimator is only valid in the absence of other factors, non-observable or omitted, that affect the treatment and the outcome, thus violating the hypothesis of conditional independence.

Although there is no way to test directly for the conditional independence hypothesis, it is more easily satisfied with the use of a greater number of control variables. However, some uncertainty may always persist about how many and which variables should be used.

The Differences-in-Differences (DiD) method seeks to reduce bias by controlling for the effect of non-observable factors invariant in time that may affect the outcome (see for example Card & Krueger, 1994; Angrist & Pischke, 2008). The causal impact of treatment (DiD) is obtained by comparing the performance of participants (T) and non-participants (C) before (0) and after treatment (1), literally through a difference of differences:

$$\text{DiD} = (\bar{Y}_1^T - \bar{Y}_0^T) - (\bar{Y}_1^C - \bar{Y}_0^C)$$

This impact can be estimated using the following equation:

$$Y_{it} = \alpha_0 + \alpha_1 t + \alpha_2 T_i + \alpha_3 t*T_i + \sum \beta_i X_{it} + \varepsilon_{it}$$

being α_3 the parameter of interest, which results from the interception of the treatment variable (Ti = 1 if the company was treated, or zero if not) with the time variable (t) that assumes the value of 1 for the period after treatment, and zero otherwise. Thus, α_1 is the coefficient of the common temporal effect between the period before and after treatment, α_2 measures the impact of the intemporal difference between treated and untreated firms and α_3 captures the effect of the treatment.

However, this estimator is only valid in the absence of non-observable factors with effects variable in time. That is, even if comparability between the two groups could be ensured before treatment, the method may be compromised if for example macroeconomic shocks occurred during treatment affect the two groups differently, contributing to overestimating or underestimating the true effects of treatment.

3. Database and descriptive characteristics of companies

This paper uses three different databases: information on SIFIDE applications from 2006 to 2015, obtained from ANI (Agência Nacional de Investigação); data on firms' accounts – Sistema de Contas Integradas das Empresas (SCIE) – and data on firms' staff – Quadros de Pessoal – obtained from INE (Statistics Portugal), from 2004 to 2017. The use of these three databases made it possible to cross information on SIFIDE projects with a wide range of variables on the characteristics of firms and their employees. To ensure greater uniformity of information, some inconsistencies and outliers were cleared from the database leaving us with 3 537 579 observations of information at the level of the firm [7].

Between 2006 and 2015, 8230 Projects were financed under SIFIDE for 2,274 companies. During the first year of SIFIDE II, 404 projects were approved. Except for the period between 2009 and 2011, probably a consequence of the international financial crisis, the number of applications and projects approved displays an increasing trend reaching 1093 in 2015 (Table 4.1).

Table 4.1: SIFIDE applications and projects approved

Year of Application	No. Applications	No. Projects Approved	Rate of Approval (%)
2006	424	404	95
2007	647	600	93
2008	897	804	90
2009	1057	891	84
2010	1001	839	84
2011	970	800	82
2012	924	864	94
2013	1038	943	91
2014	1057	992	94
2015	1157	1092	94
Total	**9172**	**8229**	**90**

A significant number of companies use SIFIDE to finance various R&D projects. However, companies with only one or two applications are more frequent (650 and 454 with 1 and 2 approved projects, respectively – Graph 4.1). The approval rate of projects is high, with about 90% of projects approved on average (depending on the year of application, the approval rate ranged between 82% and 95%).

Although access to SIFIDE is not limited to any particular sector, the largest number of applications occurred in sectors 3 (Manufacturing - Section C of NACE Rev. 2) and 6 (Business Services – Sections J-N, excl. K of NACE Rev. 2), representing respectively 55% and 29% of the total. This sectoral concentration has remained relatively stable from 2006-2015, with a slight increase in Manufacturing, at the expense of sector 6 (Figure 4.4).

[7] Observations eliminated included those with negative intangible investment, negative total assets, a ratio of intangible investment over total assets of over 100.

Table 4.2: Projects approved in SIFIDE, sectoral disaggregation (NACE Rev.2 Section)

Sectors of activity (NACE Rev. 2)	No. Proj. Approved	Structure (%)
1 - Agriculture, forestry and fisheries (Section A)	57	0,7
2 -Extractive Industries (Section B)	29	0,4
3 - Manufacturing (Section C)	4512	54,8
4 - *Utilities* and Construction (Sections D-F)	444	5,4
5 - Wholesale and retail trade, Accommodation and catering (Sections G-I)	692	8,4
6 - Business services (Sections J-N, excl. K)	2401	29,2
7 - Other services (Sections P-S)	95	1,2
Total	**8229**	**100**

Figure 4.1: Number of projects approved, by company and average amount of tax credit

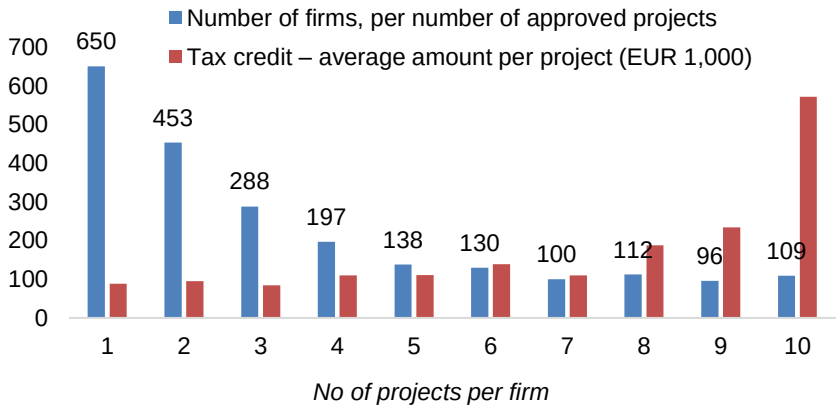
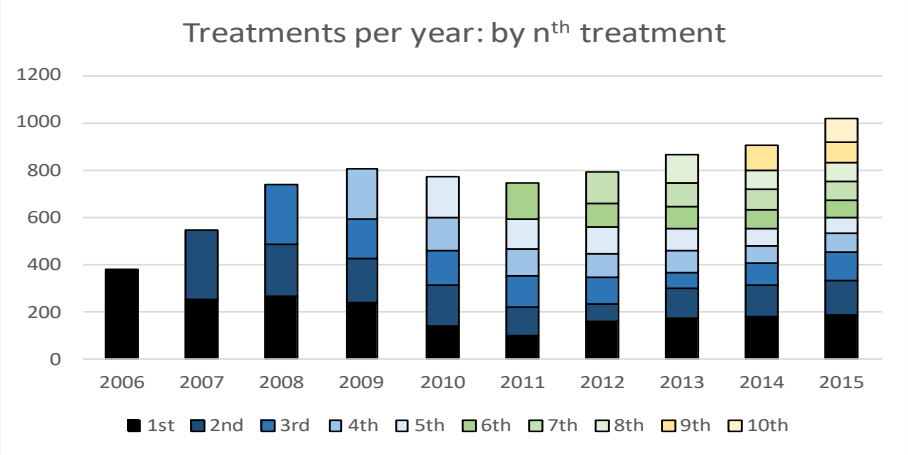


Figure 4.2: Number of projects approved by year and number of firms' programs



The representativeness of the ICT sector in SIFIDE has been decreasing since 2006, from 27% to 12.8% in 2015 (Figure 4.3).

SIFIDE has been progressively more used by firms with less experience in research and less prone to innovate. The number of firms accessing the programme with no investment in intangible assets or R&D projects in the two years before the programme has increased between 2006 and 2015 (Figure 4.4).

Figure 4.3: Representativeness of ICT firms among SIFIDE approved projects

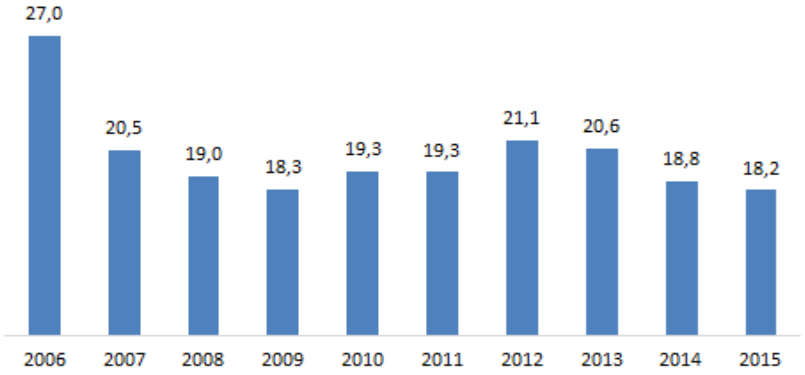
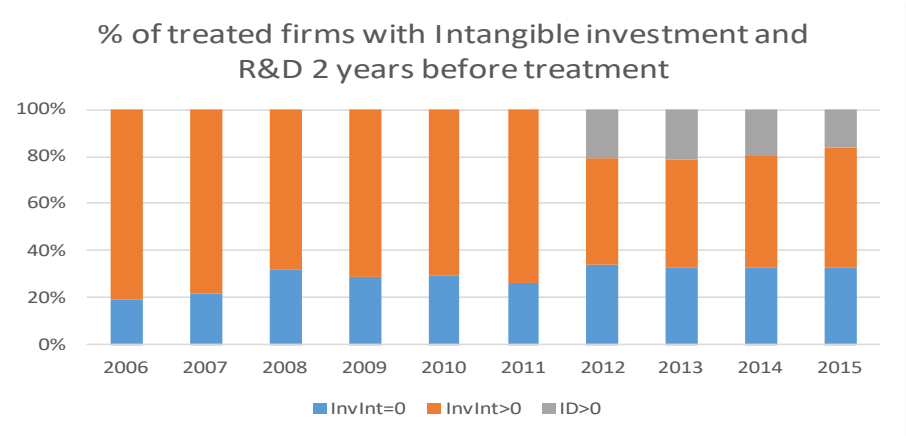


Figure 4.4: Firms displaying positive Intangible Investment and R&D projects[8] 2 years before the application



About 80% of companies with SIFIDE-supported projects are micro and SMEs (Figure 4.5). Between 2006 and 2015 the share of large companies has decreased, and the number of SMEs projects has tripled between 2006 and 2015.

Most firms with SIFIDE financed programmes are older firms (over 10 years old), although the share of younger firms has increased from around 5% to 20% during the period under analysis.

The size of the projects and tax credits became increasingly smaller, consistent with the large participation of SMEs.

[8] Variable available from 2010 onwards.

The percentage of treated firms with no positive profits has remained relatively stable over time. Since 2011, there was an increase in the proportion of firms with higher profit margins.

Figure 4.5: Characteristics of treated firms

Most of the costs financed by SIFIDE refer to R&D staff (42,58%) and operating costs (35,3%).

Table 4.3. SIFIDE Expenditures, by type

Supported expenditures	% of total
Fixed assets	13,27
R&D staff	42,58
R&D managers	0,03
Operating costs	35,3
Contracting external R&D	7,6
Participation in capital of R&D entities	0,94
Patent registry	0,15
Patent acquisition	0,05
Auditing activity	0,03
Demonstration activities	0,03
Total	**100,00**

As shown in Table 4.4, companies with investment projects supported by SIFIDE have, on average, very different characteristics from the remaining companies, with respect to investment (tangible and intangible), turnover, size, quality of human resources and other performance indicators. On average, SIFIDE supported firms invest more, have more qualified staff, export more and are more efficient and profitable than non-supported firms.

Table 4.4: Average characteristics of supported and unsupported companies

Variables	Treated Companies	Untreated Companies
Intangible investment (EUR 1,000)	682,79	5,60
Firms with Inv. intangible assets (%)	0,50	0,14
R&D employees	3,89	0,01
Employment	164,25	6,83
Turnover (EUR 1,000)	41300,00	651,30
FBCF (EUR 1,000)	2276,51	33,81
B&S exports (% sales)	32,18	5,43
Labour productivity (EUR 1,000)	75,26	20,07
Graduated Employees (% Employment)	32,72	12,64
Net Results on total assets	1,60	-123,28
Operating results	3483744,00	33.813,17

5. Methodology for assessing the impact of SIFIDE

As discussed, the impact of a policy is usually difficult to assess given that other factors might interfere with the results. This is particularly challenging when the scope of the policy is universal and firms self-select into the programme, as the criteria determining participation might not be obvious, making it difficult to understand why firms with viable project do not apply. Impact would be easier to assess if specific features of the policy produce incentives that are randomly more attractive to a particular group of firms, as other firms would naturally form a control group. However, aside from some policy changes discussed later, SIFIDE does not seem to have these features as its rules are essentially non-discriminatory.

As such, impact is analysed with the use of Matching (Propensity Score and Mahalanobis) and Difference in Difference methods which can, under some assumptions, produce unbiased results.

The Propensity Score Matching is performed in two distinct steps:

1. Identification of a control group consisting of firms with a similar a priori probability of being treated (propensity score), estimated with a probit model that controls for the variables that are likely to affect simultaneously both the probability of treatment and the outcome of the programme.
2. Comparison of results between the 'treated' firms and those of the control group, after the treatment. We use several matching methods for robustness of results.

The year of the treatment (application) corresponds to the year of the tax exercise, when the investment that qualifies for tax credit is implemented. Under the rules of SIFIDE, R&D expenditures incurred during the year of the tax exercise and during the first six months of the following year are eligible for tax credits under that programme. In this paper, only firms with approved projects are considered as treated and the analysis will focus on the impact of the programmes implemented between 2006 and 2015 [9].

Firms are matched, according to the specified control variables, two years before the treatment. Even though firms should be matched immediately before being subject to any effect of the treatment, we consider that in the year preceding treatment firms might be tempted to postpone investments in anticipation of next year's application, thereby affecting matching conditions.

Given that there are firms that benefit from several programmes, and in order to avoid contaminating the matching process with the effect of previous treatments, we initially restrict the analysis to the impact of the first treatment of firms. In addition, we also analyse the case of firms which were treated only once. This case is particularly interesting to assess whether the impact of the program is persistent, as the period following treatment is also unaffected by posterior programmes – we analyse effects one year and three years after the conclusion of the programme.

[9] Given that, according to SIFIDE rules, the investment made in R&D precedes the application and the obtaining of tax credit (thus the expectation of tax credit, and not the credit itself, which conditions the behavior of the company and the realization of the investment), it could also be justified to consider as 'treated' companies with unapproved applications since the investment would have been made. However, given that SIFIDE's eligibility criteria are particularly restrictive in terms of the characterization of the investment, it is likely that the non-approval of the credit swells from the fact that the investment made is not classified as an Investment in R&D, which justifies the exclusion of projects not approved for the characterization of the treatment.

The variables used as control as well as the rationale for their inclusion are described in Table 5.1. In general, they measure the firm's investment capacity, propensity to R&D size, quality of human capital (i.e. percentage of graduates among employees), the degree of indebtedness, performance and fixed effects associated with the sector or year of the programme (imposing the condition of coarsened exact matching to the sector and year of application), and are likely to affect both the likelihood of treatment (self-selection) and the results of the program.

Table 5.1: Description of control variables

Variable	Description	Rationale
DIntInv	Dummy variable =1 if Intangible investment >0, o otherwise	Captures persistence in intangible investment
DPropID	Dummy variable =1 if R&D>0 in any year analysed, 0 otherwise	Captures firms' propensity to R&D activities
Subs	Subsidies	Captures firms' activity and capacity in applying for public subsidies and grants.
Staff(log)	No of staff (in logs)	Capture the size of the firm
Univ%	Categorial variable measuring the % of staff with a university degree, = 1 if [0, 15]; = 2 if]15, 30], = 3 if > 30.	Determines firm capacity to R&D activities and form performance
Age	Categorial variable measuring the firm age in years, = 1 if [0, 5]; = 2 if]5, 10]; 3 if >10.	Controls for the effect that the firms' age might have on R&D activities and programme applications
GFCF(log)	Gross Fixed Capital Formation (in logs)	Determines the firms' investment capacity
Turnover(log)	Turnover (in logs)	Captures size in terms of productive capacity
FinAut	Capital in % of total assets: categorial variable = 1 if [0, 20]; = 2 if]20, 40], =3 if >40.	Captures the effect of financial autonomy on both R&D investments and programme applications
Profit	Net returns in % of total assets. categorial variable = 0 if <=0; 1 if]0, 15]; = 2 if]15, 30], =3 if >30.	Captures the effect of firms' profitability on both R&D investments and programme applications
i.NUTS	Dummy for regional classification	Controls for the regional impact
i.Sectors	Dummy for sector classification	Controls for the sectoral impact
i.Yr	Dummy for Year of application	Controls for temporal impact

According to the propensity score method, matching takes into account the similarities of the conditional probability of being treated (the advantage of the method lies precisely in condensing into a single variable – the propensity score – all the information relevant to the determination of a control group). In order to obtain results, however, firms can be compared with several methods which differ according to the weight attributed to non-treated observations. In the Nearest Neighbour method each firm is compared only with that with the closest propensity scores. The stratification method compares firms within each block of the distribution of the propensity score. The kernel method uses all firms of the control group and attributes a larger weight to untreated observation more "similar" to the treated ones.

I addition to the propensity score matching, a multivariate matching based on the Mahalanobis distance, was also used, according to which the weight attributed to each observation is based on the matrix of

correlation of covariates. The Mahalanobis was estimated using also the propensity score obtained with the probit model as a control variable.

For the difference-in differences method the following equation was estimated in four different specifications: with and without control variables, combined with and without fixed effects:

$$Y_{it} = \alpha_0 + \alpha_1 t + \alpha_2 T_i + \alpha_3 t^* T_i + \beta X_{it} + \varepsilon_{it}$$

The impact on R&D is analysed with respect to the investment in intangible assets (with different specifications of the variable). This variable was selected as, by including in-house R&D, external contracting of R&D and the acquisition of outputs of R&D performed by other entities, it measures more closely the type of investment that SIFIDE aims to incentivise. In addition, we also analyse the impact of SIFIDE in increasing R&D staff (also an expenditure eligible under SIFIDE) and in promoting firms' exports.

Furthermore, we analyse different scenarios according to different profiles of firm's investment in intangible assets and R&D. This allows greater similarity between treated and non-treated firms in the control group and to discriminate the impact of SIFIDE among these groups. As such, the impact of the programme is calculated under four scenarios: a) a general case including all firms; b) a subset of the sample consisting of firms with previous experience of investing in intangible assets (in either of the two years before treatment); c) a subset of firms with propensity to R&D (firms with in-house R&D projects in any period between 2012 and 2015[10]); d) the subset of firms with no previous experience on investing in intangible assets (in the two years before treatment).

Scenarios b) and c) analyse the impact of SIFIDE in firms already performing the type investments financed by the project. The later scenario analyses whether SIFIDE can incentivize firms with no previous experience in R&D or in investing in intangible assets to do so.

As shown in Tables A.I both the propensity score and the Mahalanobis ensure balances samples in all the covariate considered. As observed, matching considerably reduces the difference between 'treated' and 'untreated' observations as regards the variables used as control. The distribution of the propensity score is also similar among treated and non-treated variables in all scenarios considered.

Result for the probit model are shown in tables in annex A.II. The model selected 427 treated firms (for firms which have been treated only once) and 728246 observations of non-treated treated firms with balanced propensity scores and which formed the control group. When the case of first treatments (of all firms) was considered, selected firms were 1493 for treated and 755158 observations of non-treated.

[10] As this variable is only available from 2012 onwards.

6. Results obtained

6.1. On Intangible investment

As shown in tables in annex A.III, SIFIDE has a positive effect on intangible investment in all scenarios considered.

Several specifications of the variables were used: as a percentage of the total asset (IntInv), difference in intangible investment from the period of matching, in percentage of total assets in the period of matching (DifInvInt), and difference in logarithms (DInvInt(log)).

As shown in tables 6.1 and A.III.1.1, the results show a significant positive impact of the programme on 'treated' firms in the various specifications of the variables considered. These effects are relatively consistent along several matching methods used (e.g. the coefficient for the effect of the programme on 'Intangible investment on total assets' in the year of application varies between 0,84 and 1 in the general case).

Table 6.1: Impact on intangible investment (in % of total assets)

	PS (kernel)			Mahalanobis			PS (NN)			PS (Stratification)		
Variable	ATT		t	ATT		t	ATT		t	ATT		t
a) General model: all firms												
IntInv	0,88	***	6,16	0,95	***	6,61	0,84	***	4,96	1,00	***	6,86
b) Firms with positive Intangible Investment before treatment												
IntInv	1,11	***	5,04	1,30	***	5,83	1,15	***	4,33	1,16	***	5,25
c) Firms with no intangible investments before treatment												
IntInv	0,45	***	2,90	0,39	***	2,70	0,16		0,93	0,26	*	1,78
d) Firms with propensity to R&D												
IntInv	2,33	***	4,55	2,38	***	4,93	2,19	***	4,67	2,34	***	5,07

Results are more significant in the scenarios where firms had invested before in intangible assets and even more for firms with a propensity to R&D (coefficients range between 2,19 and 2,38 percent of total assets).

In the case of firms with no prior investment in the two preceding years, the impact is higher in the case where firms were treated only once (Table 6.2, and figure 6.1. AIII.2.1). In all remaining subsamples the impact of the first treatment is lower for firms treated only once.

A particularly important factor in the results presented has to do with the sustainability of the impact of the programme: 'treated' companies that applied to SIFIDE only once remain with higher Levels of R&D investment a few years after the programme is completed (Table 6.2 and AIII.2.2).

Table 6.2: Firms treated only once: persistence of impact

	PS (kernel)			Mahalanobis		
Variable	ATT		t	ATT		t
a) General model: all firms						
lntInv	1,03	***	3,70	1,07	***	4,16
lntInv+1	0,8015	***	3,22	0,78	***	3,39
lntInv+3	0,33	**	2,11	0,24		1,56
b) Firms with positive Intangible Investment before						
lntInv	1,15	***	2,66	1,28	***	3,14
lntInv+1	0,801	*	1,73	1,05	***	2,74
lntInv+3	-0,32		-1,62	-0,10		-0,81
c) Firms with no Intangible Investment before						
lntInv	0,72	***	2,11	0,65	**	2,02
lntInv+1	0,4561	*	1,92	0,30		1,33
lntInv+3	0,37		1,31	0,35		1,25
d) Firms with propensity to R&D						
lntInv	1,44	***	2,20	1,55	***	2,71
lntInv+1	2,2845	***	2,56	2,03	***	2,43
lntInv+3	-0,414		-1,07	-0,27		-1,25

When effects were calculated separately for each year (AIII. 1.6.), results show the impact to be higher in the first years of policy implementation. These effects are consistent with results in other studies and may be due to the fact that more active firms are more likely to apply to tax credits from the start of the programme.

6.2. Crowding-in vs crowding out

These results confirming the positive impact of SIFIDE on intangible investment allow us to reject the hypothesis of total crowding-out. However, this does not imply that the higher investment exceeds the amount of the tax credit.

The existence of an additional impact was tested by analysing the impact of SIFIDE using the matching method on a variable that measures privately financed intangible investment – i.e. excluding the amount of tax credit used to finance Intangible investment (total tax credit minus the amount related to staff costs and investment in tangible assets), all variables in percentage of total assets:

Additionality = Intangible investment – (total tax credit – credit on staff costs – credit on tangible investments).

As shown (Table 6.3), the positive and significant coefficients imply that the increase in intangible investment as a result of the programme exceed policy costs directly associated with it, thus confirming additionality.

Table 6.3: Additionality

	PS (kernel)			Mahalanobis		
	ATT		t	ATT		t
Addicionality	0,08	***	4,74	0,14	***	5,71

6.3. Differences in differences model

The impact of SIFIDE on intangible investment was also analysed with the differences-in-differences method, which estimates the differences between treated and untreated before and after treatment.

The model was estimated separately for each year comparing the results of firms treated that year with those never treated – companies treated in other years are excluded from the analysis in order not to contaminate the results with the effects of later treatments. For each year, four models were estimated, with and without controls and with and without firms' fixed effects. Estimating the model with fixed effects controls for any characteristic of firms that are invariant in time which may not have been considered by the control variables.

Tables A.III.3 show the results for the difference in difference estimations (table 6.4 shows results for the general case). As illustrated, the coefficient of interception between the variables post-treatment and treatment period (t*TRAT), i.e. the variable of interest, is significant for most years considered, thus confirming the conclusions obtained through the matching methods. As previously, differences in differences results also show higher and more significant effects in the initial years of the programme.

For the years between 2009 and 2011 the coefficients of the models with fixed effects (general case) are not significant. This can be explained by the fact that these are years of greater uncertainty (following the international financial crisis and during the euro area sovereign debt crisis) in which companies are less likely to make investments – this sentiment of risk aversion is better captured by firms' fixed effects than by the control variables. The coefficient of the variable measuring the temporal effect (t) is negative during that period, indicating the negative trend in investment. These results are consistent with Hud and Hussinger (2013) according to which companies would be more reluctant to make investments in times of crisis. As shown in Table 4.1, 2011 was also characterized by a relatively small number of applications to SIFIDE.

Table 6.4: Differences-in-differences models – general case

	Simple model		With control var.		Fixed effects		F.E. & Controls	
IntInv	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,10 ***	18,52	-0,01	-1,38	-0,14 ***	-30,74	-0,15 ***	-28,08
TRAT_2006	1,47 ***	10,06	1,30 ***	9,09	0,00			
tTRAT_2006	0,89 ***	4,97	0,79 ***	4,53	1,02 ***	3,38	0,79 ***	2,86
t	0,08 ***	14,09	-0,04 ***	-5,69	-0,21 ***	-44,23	-0,16 ***	-31,32
TRAT_2007	1,21 ***	6,35	0,97 ***	5,27				
tTRAT_2007	1,08 ***	4,62	0,96 ***	4,27	0,56 *	1,86	0,66 **	2,38
t	0,02 ***	4,14	-0,03 ***	-3,87	-0,24 ***	-49,60	-0,16 ***	-30,59
TRAT_2008	1,37 ***	7,26	0,88 ***	4,70				
tTRAT_2008	0,16	0,71	0,57 **	2,49	0,24	0,46	0,47	1,06
t	-0,10 ***	-20,85	-0,11 ***	-15,45	-0,29 ***	-60,49	-0,18 ***	-35,39
TRAT_2009	2,64 ***	13,44	1,94 ***	9,79				
tTRAT_2009	0,59 **	2,46	0,54 **	2,25	0,09	0,12	-0,37	-0,68
t	-0,18 ***	-36,96	-0,17 ***	-23,30	-0,29 ***	-64,63	-0,20 ***	-40,56
TRAT_2010	1,51 ***	6,00	0,88 ***	3,37				
tTRAT_2010	1,34 ***	4,35	1,16 ***	3,62	0,79	1,15	0,52	1,46
t	-0,17 ***	-37,41	-0,12 ***	-15,75	-0,25 ***	-60,93	-0,19 ***	-39,24
TRAT_2011	2,67 ***	9,11	0,93 ***	2,89				
tTRAT_2011	0,17	0,47	0,44	1,13	-0,36	-0,48	0,05	0,08
t	-0,15 ***	-32,30	-0,10 ***	-13,53	-0,21 ***	-52,11	-0,16 ***	-33,21
TRAT_2012	1,63 ***	7,21	0,52 **	2,09				
tTRAT_2012	1,49 ***	5,40	1,07 ***	3,55	1,19 *	1,68	0,62	0,90
t	-0,11 ***	-24,00	-0,08 ***	-10,02	-0,18 ***	-43,12	-0,12 ***	-26,14
TRAT_2013	1,25 ***	5,68	1,03 ***	4,09				
tTRAT_2013	1,20 ***	4,45	0,68 **	2,26	0,88 **	2,17	0,49	1,23
t	-0,10 ***	-22,09	-0,08 ***	-11,27	-0,16 ***	-41,70	-0,10 ***	-22,31
TRAT_2014	1,15 ***	5,37	0,77 ***	3,12				
tTRAT_2014	1,25 ***	4,77	0,64 **	2,17	0,62	0,95	0,15	0,28
t	-0,09 ***	-21,86	-0,11 ***	-15,51	-0,17 ***	-42,99	-0,10 ***	-23,07
TRAT_2015	1,55 ***	7,50	0,51 **	2,20	0,00		0,00	
tTRAT_2015	0,67 ***	2,63	0,52 *	1,83	0,21	0,28	-0,04	-0,09

6.4. Results by sectors and firms' size

The sectoral breakdown shows that the effects of the SIFIDE programme are much more significant in the business services sector (Group 6, corresponding to the aggregation of Sections J-N of NACE Rev. 2) than in the manufacturing industry (Group 3, corresponding to Section C of NACE Rev. 2). It should be noted that companies from these two sectors represent about 84% of the projects financed with SIFIDE. Firms in the ICT sector also perform particularly well.

The greater effect of the programme on the business services sector may result from the significant changes that have occurred in terms of digitalisation of the economy and which particularly affects the services sector.

These results are also confirmed by several other studies. This is particularly evident in the impact of SIFIDE on intangible investment as a percentage of assets (2.16 on services and 0.44 on industry in the general case). These differences are even more significant for firms with a propensity to R&D (4.4 to 4.62 for business and 1.05 to 1.36 for industry) – Tables 6.5 and AIII.1.2.

Table 6.5: Impact by sector

IntInv	PS (kernel)		Mahalanobis	
Sector	ATT	t	ATT	t
a) General model: all firms				
1 - Agric. for. & fishing	0,98	1,05	0,98	1,05
2 - Extr. Industries	--	--	--	--
3 - Manufacturing Ind.	0,44 ***	4,33	0,44 ***	5,39
4 - Utilities & constr.	0,80	1,42	0,87	1,63
5 - Trade & accom.	0,42	1,62	0,38	1,63
6 - Business services	2,16 ***	4,66	2,16 ***	4,8
7 - Other services	2,18 *	1,76	2,10 *	1,84
ICT_SECTOR	2,09 ***	3,4	2,36 ***	4,11
b) Firms with positive Intangible Investment before treatment				
3 - Manuf. Ind.	0,64 ***	3,33	1,02 ***	2,13
6-B. Services	2,59 ***	3,40	2,82 ***	3,93
c) Firms with no Intangible Investment before treatment				
3 - Manuf. Ind.	0,04	0,59	0,05	0,078
6-B. Services	1,27 **	2,22	1,24 **	2,39
d) Firms with propensity to R&D				
3 - Manuf. Ind.	1,05 ***	2,58	1,36 ***	4,31
6-B. Services	4,62 ***	3,41	4,40 ***	3,26

Concerning firms' size, the most significant impacts of SIFIDE on intangible investment are observed in micro and small enterprises in all scenarios considered– Tables 6.6 and AIII.1.3.

For large firms, only those with propensity to R&D show significant results from SIFIDE, although lower than smaller firms.

Table 6.6: Impact by firm size

InvInt	PS (kernel)		Mahalanobis	
Size	ATT	t	ATT	t
a) General model: all firms				
Micro	1,97 ***	2,42	2,37 ***	3,32
Small	0,90 ***	4,60	0,92 ***	3,80
Medium	0,44 **	2,54	0,52 ***	3,77
Large	0,18	1,32	0,26 *	1,65
b) Firms with positive Intangible Investment before treatment				
Micro	2,55 ***	2,7	2,36 ***	2,68
Small	1,67 ***	3,80	1,63 ***	3,17
Medium	0,72 ***	2,38	0,76 ***	3,04
Large	0,39	1,67	0,20	0,84
c) Firms with no Intangible Investment before treatment				
Micro	2,41 ***	2,47	2,28 **	2,37
Small	0,35 **	2,01	0,24	1,48
Medium	-0,03	-0,69	-0,06	-1,51
Large	0,00	-0,12	-0,24 ***	-4,04
d) Firms with propensity to R&D				
Micro	4,51 ***	2,93	4,09 ***	2,72
Small	3,60 ***	2,92	3,28 ***	2,69
Medium	1,04 ***	2,52	1,32 ***	3,45
Large	0,56 ***	2,57	0,34	1,65

6.5. Results of R&D staff and total export

Results also show the effectiveness of SIFIDE in incentivising the hiring of staff in R&D activities for most scenarios considered. Effects were measured in terms of the number of staff in R&D activities (StaffID) and in terms of this difference from the pre-treatment period (DStaffID).

Even though treated firms have more staff dedicated to R&D activities, only firms with previous intangible investment and propensity to R&D have higher more R&D staff as a result of the programme – tables 6.7 and AIII.

Table 6.7: Impact on R&D staff

	PS (kernel)		Mahalanobis	
Variable	ATT	t	ATT	t
a) General model: all firms				
StaffID	1,24 ***	6,03	1,23 ***	5,78
DStaffID	1,16 ***	2,86	0,92 ***	3,2
b) Firms with positive Intangible Investment before treatment				
StaffID	1,29 ***	5,10	1,22 ***	4,10
DStaffID	0,84 ***	2,30	1,08 ***	4,32
c) Firms with no Intangible Investment before treatment				
StaffID	0,85 ***	5,20	0,86 ***	5,47
DStaffID	0,29	0,68	0,30	0,8
d) Firms with propensity to R&D				
StaffID	1,59 ***	3,60	1,96 ***	4,40
DStaffID	1,24 ***	3,14	1,55 ***	3,36

Firms which benefit from SIFIDE also have higher export volumes (in % of total sales). Firms with propensity to R&D seem to have increase exports as a consequence of SIFIDE – tables 6.8 and AIII.

Table 6.8: Impact on Exports

	PS (kernel)		Mahalanobis	
Variable	ATT	t	ATT	t
a) General model: all firms				
ExpTot	9,24 ***	5,96	11,37 ***	7,99
DExpTot	2,40 ***	2,79	2,09 ***	2,59
b) Firms with positive Intangible Investment before treatment				
ExpTot	11,97 ***	4,99	12,44 ***	5,67
DExpTot	2,37	1,66	2,69 **	2,13
c) Firms with no Intangible Investment before treatment				
ExpTot	7,89 ***	3,36	9,43 ***	4,31
DExpTot	1,49	1,06	1,19	0,97
d) Firms with propensity to R&D				
ExpTot	21,45 ***	5,68	21,32 ***	6,14
DExpTot	4,37 *	1,72	4,94 *	1,92

6.6. Policy changes in SIFIDE

Policy changes are particularly important for policy evaluation as incentives to firms are likely to change in that period. These changes are particularly interesting when they affect firms differently.

There are two moments in SIFIDE when that seems to be the case: in 2009 when the limit for the incremental rate was increased from 750 000 euros to 1 500 000 euros [11], which benefits firms with large projects, and in 2014, when the carry forward option was increased from 6 to 8 years, which benefits firms with negative of no profits.

These effects were evaluated by re-estimating the differences in differences with additional dummies for these groups of firms on the variable of interest (t*TRAT).

However, results do not show a very significant impact from those changes. Large firms did neither increase their applications in 2014 nor their investments as a result of a change, and even though non-profitable firms continued to show significant effects, they were no higher than those before the policy change. This may due to the fact that previous limits were not binding and therefore incentives were not affected by policy changes. In fact very few projects have an overall tax credit of 750 thousand euros. In what concerns non-profitable firms, the previous possibility of carrying over the tax credit for 6 years was already a sufficient incentive for applying to SIFIDE and the extension to two more years added little in that regard.

Figure 6.1 Intangible investment (firms treated only once): all years and from 2006 to 2008

[11] Even though the base rate was also increase in that period, its impact is likely to be the same for all firms.

7. Conclusions

The capacity for innovation has been considered one of the main determinants of competitiveness and growth. The recent trend towards the digitisation of the economy allows anticipating an enormous potential, still to be explored, associated with these new technologies, in various areas of economic activity, especially in the services sector.

Despite these advantages, uncertainty, financing difficulties and the fact that the social return associated with innovation generally exceeds the private one limits the ability of firms to invest in R&D in the magnitude of the socially desirable. Thus, to address this market failure, several countries have been providing public support for this type of investment, with tax credit being the most common form.

The difficulty in providing effective incentives, which do not give rise to adverse behaviour by firms or to a mere replacement of private investment with public funding, reinforces the need to evaluate the efficacy of these policies.

This paper evaluates the impact of SIFIDE – a system of tax incentives for corporate R&D – with matching and differences-in-differences methods that allow minimizing the possible bias resulting from endogeneity between self-selection for the program and its impact. The relative consistency of the results obtained with various methods gives greater robustness to the analysis.

The results show the effectiveness of SIFIDE in promoting investment in R&D, both through the impact of the program on intangible investment and on R&D staff. An equally important factor concerns the persistence of the results. Indeed, the positive impact of the programme seems to remain for a few years after its completion, even in firms subject to a single approved project. It was also possible to conclude that SIFIDE encouraged additional private investment in an amount greater than the amount of the tax credit (crowding-in effect), after deducting for the parts related to costs with R&D staff and fixed tangible investments. This makes it possible to justify the relative generosity of SIFIDE when compared to tax credit rates in other European countries.

The breakdown of results by size or sector shows the higher impact of the programme on micro and small enterprises, in the services sector or in the ICT (information and communication technologies) sector. These results, largely consistent with those of studies on other countries, suggest that it may be advantageous to redesign the policy in order to differentiate support according to these characteristics of the company – contrary to the practice of most OECD countries, SIFIDE incentives do not differ much according to sector or the size of firms. However, the fact that R&D investment by large firms might result in higher technology spill-overs should also be considered.

It was also possible to note that SIFIDE is less effective at encouraging R&D in companies that did not register any intangible investment in the period prior to the programme, even though these companies can potentially benefit from a higher tax credit. This may justify some revision of the methodology for calculating the tax credit, concerning the value of the incremental rate.

Although there is less empirical evidence on the impact of R&D incentives on firms' performance, we also analysed the impact of the programme in promoting exports. Although treated firms showed a greater percentage of exports in total sales, evidence that this can be attributed to SIFIDE is more inconclusive.

Finally, we have also analysed whether recent policy changes with SIFIDE altered incentives for firms more likely to benefit from them: a) the increase in the limit applied to the incremental rate, more likely to benefit large firms and b) the extension of the carry forward option of the tax credit, more likely to affect firms with insufficient tax collections to benefit from SIFIDE. However, no significant changes in results were observed, which seems to suggest that limits under previous rules were mostly non-binding and questions the usefulness of these policy changes.

References:

Angrist, J. D., Pischke, J. S. (2008). 'Mostly Harmless Econometrics: An Empiricist's Companion', Princeton University Press.

Aghion, P.; Howitt, P. (1997), 'Endogenous growth theory'. The MIT Press, cambridge

Almus, M., Czarnitzki, D (2003), 'The effects of public R&D subsidies on firms' innovation activities: the case of East Germany', Journal of Business add Economic Statistics, 21

Aristei D., Sterlacchini, A.; Venturini, F. (2015), 'The effects of public support on business R&D: firm-level evidence across EU countries, MPRA

Arrow, K. (1962), 'Economic welfare and the allocation of resources for intervention. In Nelson, R., editor, *The rate and direction of inventive activity: economic and social factors*, Princeton University Press

Bravo-Biosca, A.; Criscuolo, C. Menon, C. 2013. "What Drives the Dynamics of Business Growth?," OECD Science, Technology and Industry Policy Papers 1, OECD Publishing

Carboni, O. A. (2011), 'R&D subsidies and private R&D expenditures: Evidence from Italian manufacturing data, International Review of Applied Economics, 25(4)

Card, David; Krueger, Alan B. (1994). "Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania"

Castellacci, F; Mee Lie, C, 2015), 'Do the effects of R&D tax credits vary across industries? A meta-regression analysis, Research Policy, 44(4)

Cerulli, G; Poti, B. (2012), 'Evaluating the robustness of the effect of public subsidies on firms' R&D: an application to Italy', Journal of Applied Economics,15(2)

Cin B. C., Kim Y. J. and Vonortas N. S. (2017). The Impact of Public R&D Subsidy on Small Firm Productivity: Evidence from Korean SMEs. Small Business Economics, 48, 345-360

Czarnitzki, D. Hanel, P., Rosa, J.M. (2011), 'Evaluating the impact ofR&D tax credits on innovation: a microeconometric study on Canadian firms', Research Policy 40(2)

Czarnitzki, D.; Delanote,J. (2015). 'R&D policies for young SMEs: input and output effects', Small Business Economics, 45(3)

Czarnitzki, D.; Hunermund, P. (2016), 'Estimating the local average treatment effect of R&D subsidies in a pan-European program, KU Leuven

Czarnitzki, D.; Licht, G. (2006), 'Additionality of public R&D grants in a transition economy: the case of Eastern Germany', Economics of Transition, 14(1)

David, P.A.; Hall, B.H.; Toole, A.A (2000), 'Is public R&D a complement or substitute for private R&D? a review of econometric evidence', Research Policy, 29 (4-5)

Duguet, E. (2004), Are R&D subsidies a substitute or a complement to privately funded R&D? Evidence from France using propensity score methods for non-experimental data', Revue d'Économie Politique, 122(3).

Einiö, E. (2014). 'R&D subsidies and company performance: Evidence from geographic variation in government funding based on the ERDF population-density rule,' Review of Economics and Statistics, 96 (4), 710–728.

Gonzalez, X; Pazó C. (2008), 'Do Public subsidies stimulate private R&D spending?', Research Policy, 37(3).

Hall, B.; Van Reenen, J. (2000), 'How effective are fiscal incentives for R&D? A review of the evidence', Research Policy, 29 (4-5)

Hud, M.; Hussinger, K. (2014), 'The impact of R&D subsidies during the crisis, ZEW Discussion Paper No 14-024

Lerner, J. (2013), ' The boulevard of broken dreams: innovation policy and entrepreneurship.' In Lerner, J., Stern, S., editors, *Innovation Policy and the Economy*, vol. 13. University of Chicago Press

Rosenbaum, P. R., and Rubin, D. B. (1983) "The central Role of Propensity Score in observational Studies for Causal Effects" Biometrika 70(1), 41-55

Simões, A. and Mamede, R. (2019). "SIFIDE Impact Assessment on Companies"

Wallsten, S. (2000), 'The Effects of Government-Industry R&D Programs on Private R&D: The Case of the Small Business Innovation Research Program', The Rand Journal of Economics, 31(1)

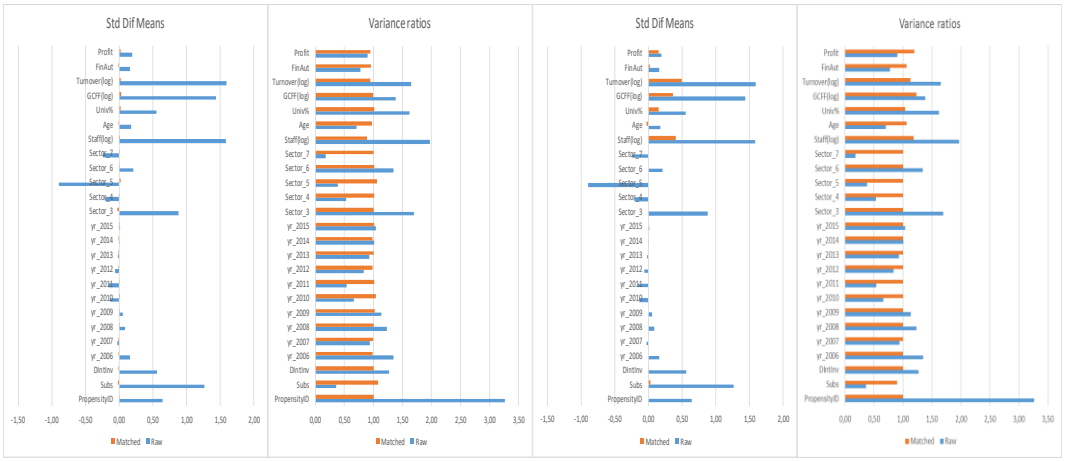
Zuniga-Vicente J.A.; Alonso-Borrego, C.; Forcadell, F.J.; Galàn, J.I. (2014), 'Assessing the effects of public subsidies on firm R&D investment: a survey', Journal of Economic Surveys, 28(1)

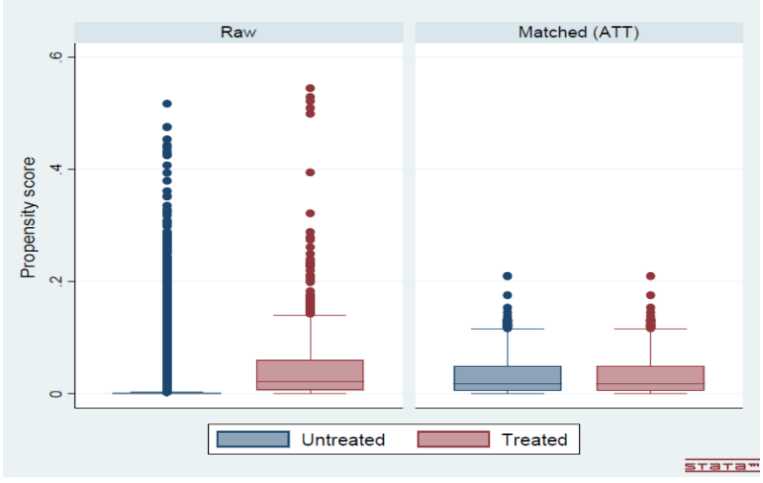
– ANNEXES –

Tables A.I – Matching quality: 1st treatments (TRAT)

a) General model – Matching with all firms

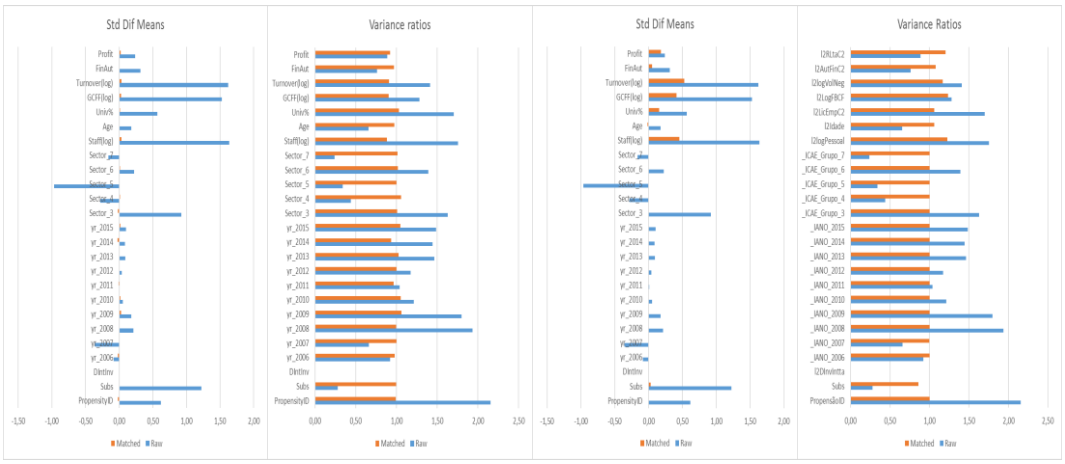
	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID	0,65	0,01	3,26	1,01	0,65	0,00	3,26	1,00
Subs	1,27	-0,02	0,36	1,08	1,27	0,03	0,36	0,90
DIntInv	0,56	-0,01	1,27	1,00	0,56	0,00	1,27	1,00
yr_2006	0,16	-0,01	1,35	0,98	0,16	0,00	1,35	1,00
yr_2007	-0,03	0,00	0,94	1,00	-0,03	0,00	0,94	1,00
yr_2008	0,09	0,00	1,24	1,00	0,09	0,00	1,24	1,00
yr_2009	0,05	0,01	1,14	1,02	0,05	0,00	1,14	1,00
yr_2010	-0,13	0,01	0,66	1,04	-0,13	0,00	0,66	1,00
yr_2011	-0,16	0,00	0,54	1,02	-0,16	0,00	0,54	1,00
yr_2012	-0,06	-0,01	0,84	0,98	-0,06	0,00	0,84	1,00
yr_2013	-0,02	0,00	0,93	1,00	-0,02	0,00	0,93	1,00
yr_2014	0,00	0,00	1,01	0,99	0,00	0,00	1,01	1,00
yr_2015	0,01	0,00	1,04	1,01	0,01	0,00	1,04	1,00
Sector_3	0,88	-0,03	1,69	1,01	0,88	0,00	1,69	1,00
Sector_4	-0,21	0,00	0,53	1,01	-0,21	0,00	0,53	1,00
Sector_5	-0,90	0,02	0,38	1,06	-0,90	0,00	0,38	1,00
Sector_6	0,21	0,01	1,34	1,01	0,21	0,00	1,34	1,00
Sector_7	-0,24	0,00	0,18	1,00	-0,24	0,00	0,18	1,00
Staff(log)	1,58	0,02	1,97	0,89	1,58	0,41	1,97	1,18
Age	0,18	0,00	0,70	0,98	0,18	-0,03	0,70	1,06
Univ%	0,55	0,02	1,62	1,02	0,55	0,15	1,62	1,04
GCFF(log)	1,43	0,03	1,38	0,99	1,43	0,36	1,38	1,23
Turnover(log)	1,60	0,03	1,65	0,95	1,60	0,50	1,65	1,13
FinAut	0,16	-0,01	0,78	0,96	0,16	0,02	0,78	1,06
Profit	0,20	0,02	0,90	0,95	0,20	0,15	0,90	1,20

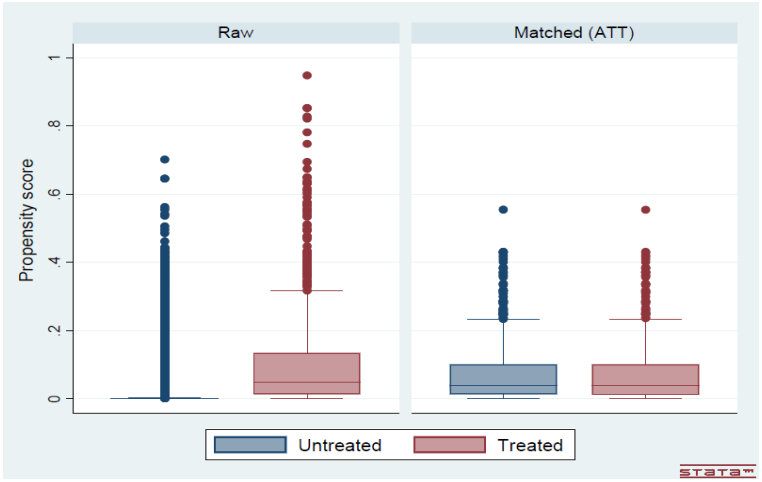




b) Firms with positive intangible Investment in the pre-treatment period

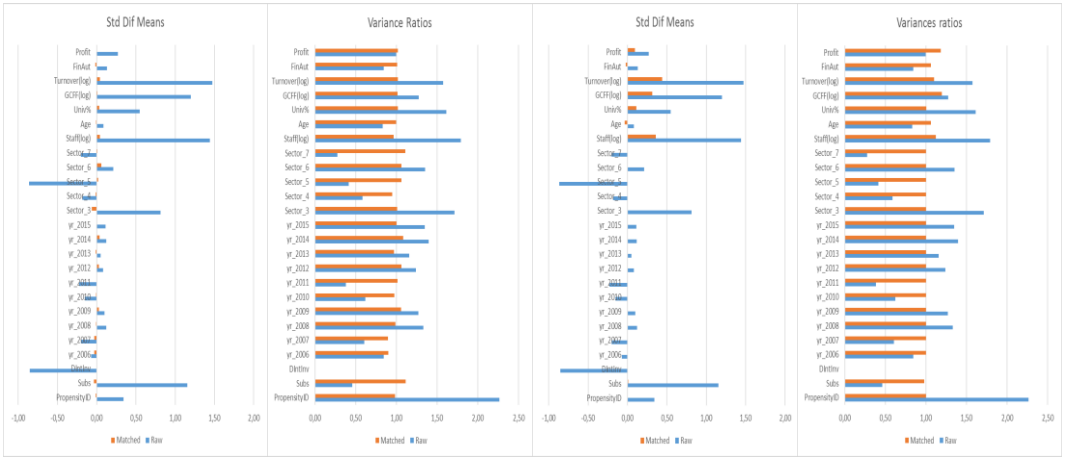
	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID	0,62	-0,02	2,16	0,99	0,62	0,00	2,16	1,00
Subs	1,22	0,00	0,28	0,99	1,22	0,03	0,28	0,86
DIntInv								
yr_2006	-0,08	-0,02	0,92	0,98	-0,08	0,00	0,92	1,00
yr_2007	-0,36	0,00	0,66	1,00	-0,36	0,00	0,66	1,00
yr_2008	0,21	0,00	1,94	1,00	0,21	0,00	1,94	1,00
yr_2009	0,18	0,03	1,80	1,06	0,18	0,00	1,80	1,00
yr_2010	0,05	0,02	1,21	1,05	0,05	0,00	1,21	1,00
yr_2011	0,01	-0,01	1,04	0,97	0,01	0,00	1,04	1,00
yr_2012	0,04	0,00	1,17	1,00	0,04	0,00	1,17	1,00
yr_2013	0,09	0,01	1,46	1,03	0,09	0,00	1,46	1,00
yr_2014	0,09	-0,02	1,44	0,93	0,09	0,00	1,44	1,00
yr_2015	0,10	0,02	1,49	1,05	0,10	0,00	1,49	1,00
Sector_3	0,92	-0,02	1,63	1,01	0,92	0,00	1,63	1,00
Sector_4	-0,28	0,01	0,44	1,05	-0,28	0,00	0,44	1,00
Sector_5	-0,97	0,00	0,34	1,00	-0,97	0,00	0,34	1,00
Sector_6	0,22	0,01	1,39	1,02	0,22	0,00	1,39	1,00
Sector_7	-0,16	0,00	0,24	1,01	-0,16	0,00	0,24	1,00
Staff(log)	1,64	0,03	1,76	0,88	1,64	0,45	1,76	1,22
Age	0,18	0,00	0,65	0,97	0,18	-0,02	0,65	1,06
Univ%	0,57	0,01	1,70	1,03	0,57	0,16	1,70	1,06
GCFF(log)	1,53	0,03	1,28	0,90	1,53	0,41	1,28	1,24
Turnover(log)	1,62	0,03	1,41	0,91	1,62	0,53	1,41	1,17
FinAut	0,31	0,00	0,76	0,97	0,31	0,05	0,76	1,08
Profit	0,24	0,02	0,89	0,92	0,24	0,18	0,89	1,20

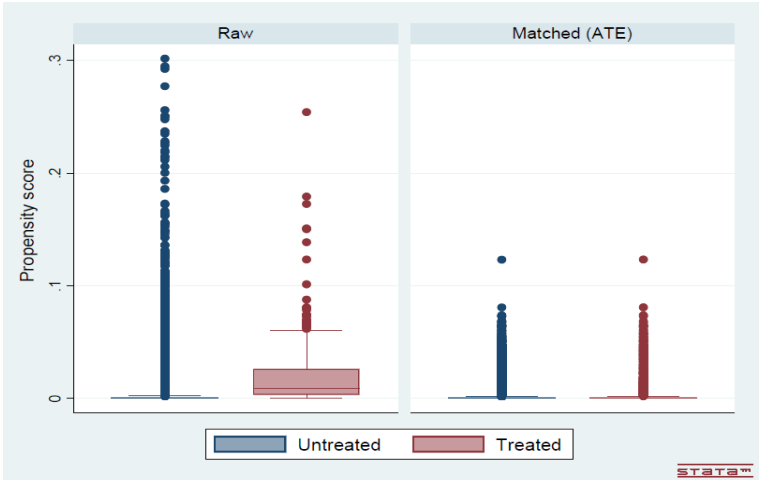




c) Firms without Intangible Investment in the two years before treatment

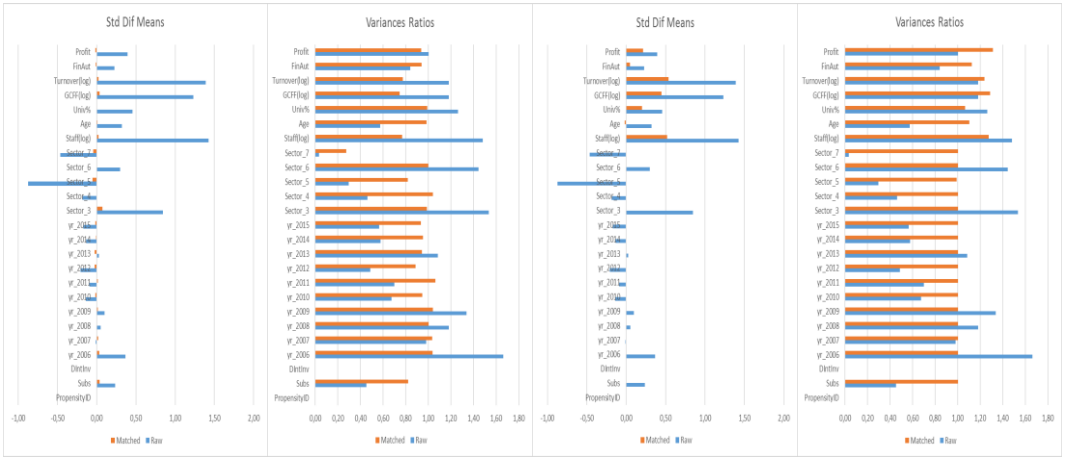
	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
Subs	1,15	-0,04	0,46	1,12	1,15	0,01	0,46	0,98
DIntInv	-0,85	0,00	0,00		-0,85	0,00	0,00	
yr_2006	-0,07	-0,03	0,85	0,90	-0,07	0,00	0,85	1,00
yr_2007	-0,20	-0,03	0,60	0,90	-0,20	0,00	0,60	1,00
yr_2008	0,12	-0,01	1,33	0,99	0,12	0,00	1,33	1,00
yr_2009	0,10	0,03	1,27	1,06	0,10	0,00	1,27	1,00
yr_2010	-0,15	-0,01	0,62	0,97	-0,15	0,00	0,62	1,00
yr_2011	-0,23	0,00	0,38	1,01	-0,23	0,00	0,38	1,00
yr_2012	0,08	0,03	1,24	1,06	0,08	0,00	1,24	1,00
yr_2013	0,05	-0,01	1,16	0,97	0,05	0,00	1,16	1,00
yr_2014	0,12	0,03	1,40	1,08	0,12	0,00	1,40	1,00
yr_2015	0,11	0,00	1,35	1,00	0,11	0,00	1,35	1,00
Sector_3	0,81	-0,06	1,71	1,01	0,81	0,00	1,71	1,00
Sector_4	-0,19	-0,01	0,59	0,95	-0,19	0,00	0,59	1,00
Sector_5	-0,86	0,02	0,41	1,06	-0,86	0,00	0,41	1,00
Sector_6	0,21	0,06	1,35	1,06	0,21	0,00	1,35	1,00
Sector_7	-0,20	0,01	0,28	1,11	-0,20	0,00	0,28	1,00
Staff(log)	1,44	0,04	1,79	0,97	1,44	0,36	1,79	1,12
Age	0,08	-0,01	0,83	1,00	0,08	-0,03	0,83	1,06
Univ%	0,55	0,03	1,61	1,02	0,55	0,11	1,61	1,01
GCFF(log)	1,20	0,01	1,28	1,01	1,20	0,31	1,28	1,20
Turnover(log)	1,47	0,04	1,58	1,02	1,47	0,44	1,58	1,10
FinAut	0,13	-0,02	0,84	1,01	0,13	-0,02	0,84	1,06
Profit	0,27	0,01	1,00	1,02	0,27	0,10	1,00	1,18

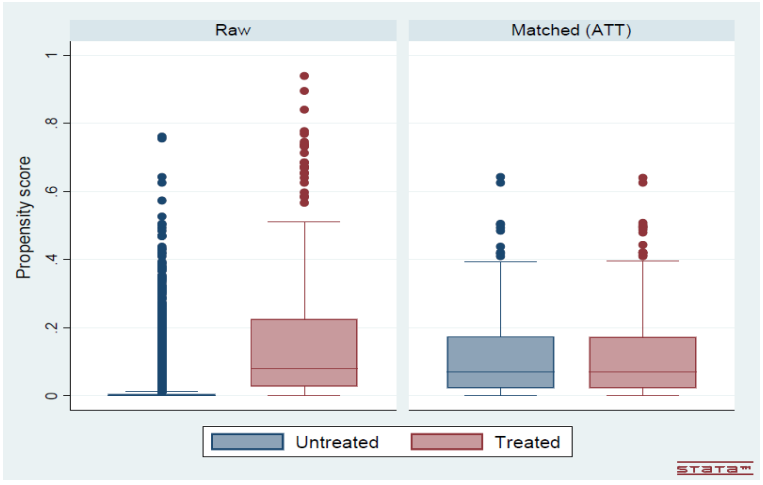




d) Firms with propensity to R&D

	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID								
Subs	0,24	0,04	0,45	0,82	0,24	0,00	0,45	1,00
DIntInv								
yr_2006	0,36	0,03	1,66	1,04	0,36	0,00	1,66	1,00
yr_2007	-0,01	0,02	0,98	1,03	-0,01	0,00	0,98	1,00
yr_2008	0,05	0,00	1,18	1,00	0,05	0,00	1,18	1,00
yr_2009	0,10	0,02	1,34	1,04	0,10	0,00	1,34	1,00
yr_2010	-0,14	-0,02	0,68	0,95	-0,14	0,00	0,68	1,00
yr_2011	-0,09	0,01	0,70	1,06	-0,09	0,00	0,70	1,00
yr_2012	-0,21	-0,03	0,49	0,89	-0,21	0,00	0,49	1,00
yr_2013	0,03	-0,03	1,08	0,94	0,03	0,00	1,08	1,00
yr_2014	-0,14	-0,01	0,58	0,95	-0,14	0,00	0,58	1,00
yr_2015	-0,17	-0,02	0,57	0,94	-0,17	0,00	0,57	1,00
Sector_3	0,84	0,07	1,54	0,99	0,84	0,00	1,54	1,00
Sector_4	-0,19	0,01	0,46	1,04	-0,19	0,00	0,46	1,00
Sector_5	-0,87	-0,06	0,30	0,82	-0,87	0,00	0,30	0,99
Sector_6	0,30	0,00	1,45	1,00	0,30	0,00	1,45	1,00
Sector_7	-0,46	-0,04	0,03	0,28	-0,46	0,00	0,03	1,00
Staff(log)	1,43	0,02	1,48	0,77	1,43	0,52	1,48	1,27
Age	0,32	0,01	0,57	0,99	0,32	-0,02	0,57	1,10
Univ%	0,46	0,00	1,26	0,99	0,46	0,20	1,26	1,07
GCFF(log)	1,23	0,04	1,18	0,75	1,23	0,45	1,18	1,29
Turnover(log)	1,39	0,02	1,18	0,77	1,39	0,54	1,18	1,24
FinAut	0,23	-0,01	0,84	0,94	0,23	0,05	0,84	1,13
Profit	0,39	-0,02	1,00	0,94	0,39	0,22	1,00	1,31





II – Firms treated only once

a) General model – Matching with all firms

	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID	0,51	0,06	2,88	1,07	0,51	0,00	2,88	1,00
Subs	1,10	-0,02	0,51	1,05	1,10	0,10	0,51	0,81
DIntInv	0,42	0,02	1,27	1,01	0,42	0,08	1,27	1,02
Yr_2006	-0,22	-0,01	0,55	0,96	-0,22	0,00	0,55	1,00
yr_2007	-0,25	-0,01	0,52	0,95	-0,25	0,00	0,52	1,00
yr_2008	0,01	0,01	1,02	1,04	0,01	0,00	1,02	1,00
yr_2009	-0,05	0,01	0,87	1,03	-0,05	0,00	0,87	1,00
yr_2010	-0,25	0,00	0,40	0,98	-0,25	0,00	0,40	1,00
yr_2011	-0,07	0,03	0,78	1,13	-0,07	0,00	0,78	1,00
yr_2012	-0,01	-0,01	0,97	0,98	-0,01	0,00	0,97	1,00
yr_2013	-0,01	0,03	0,97	1,12	-0,01	0,00	0,97	1,00
yr_2014	0,06	-0,02	1,21	0,96	0,06	0,00	1,21	1,00
yr_2015	0,59	-0,02	2,78	0,98	0,59	0,00	2,78	1,00
Sector_3	0,73	-0,04	1,72	1,00	0,73	0,03	1,72	1,00
Sector_4	-0,17	-0,01	0,62	0,97	-0,17	0,00	0,62	1,01
Sector_5	-0,82	0,03	0,46	1,07	-0,82	-0,05	0,46	0,89
Sector_6	0,23	0,03	1,39	1,03	0,23	0,02	1,39	1,02
Sector_7	-0,19	0,00	0,31	0,99	-0,19	0,00	0,31	1,00
_INUTS_simp_2	-0,11	0,01	0,31	1,16	-0,11	0,00	0,31	1,00
Staff(log)	1,34	0,01	1,74	0,92	1,34	0,33	1,74	0,96
Age	-0,01	-0,01	0,93	1,00	-0,01	-0,09	0,93	1,19
Univ%	0,62	0,02	1,69	1,04	0,62	0,10	1,69	1,06
GCFF(log)	1,24	0,01	1,23	1,00	1,24	0,29	1,23	0,93
Turnover(log)	1,39	0,02	1,51	0,99	1,39	0,40	1,51	0,88
FinAut	0,06	-0,02	0,82	0,97	0,06	-0,02	0,82	1,04
Profit	0,14	-0,02	0,92	0,94	0,14	0,11	0,92	1,22
ps	0,88	0,00	44,08	1,21	0,88	0,12	44,08	0,97

b) Firms with positive intangible investment before treatment

	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID	0,45	0,09	1,95	1,07	0,45	0,02	1,95	1,02
Subs	1,10	-0,02	0,39	1,07	1,10	0,09	0,39	0,77
DIntInv								
Yr_2006	-0,51	-0,02	0,43	0,94	-0,51	0,00	0,43	1,02
yr_2007	-0,61	-0,02	0,38	0,95	-0,61	0,00	0,38	0,99
yr_2008	0,20	0,01	1,90	1,04	0,20	0,00	1,90	1,01
yr_2009	0,13	-0,05	1,56	0,90	0,13	0,00	1,56	1,01
yr_2010	-0,07	0,01	0,75	1,05	-0,07	0,00	0,75	1,01
yr_2011	0,16	0,00	1,96	1,01	0,16	0,00	1,96	1,01
yr_2012	0,11	0,01	1,52	1,04	0,11	0,00	1,52	1,01
yr_2013	0,13	0,02	1,71	1,07	0,13	0,00	1,71	1,01
yr_2014	0,16	0,00	1,87	1,00	0,16	0,00	1,87	1,01
yr_2015	0,67	0,03	4,65	1,04	0,67	0,00	4,65	1,01
Sector_3	0,80	-0,03	1,68	1,01	0,80	0,06	1,68	1,00
Sector_4	-0,24	-0,04	0,52	0,88	-0,24	0,02	0,52	1,08
Sector_5	-0,85	-0,02	0,44	0,95	-0,85	-0,10	0,44	0,79
Sector_6	0,22	0,08	1,40	1,09	0,22	0,03	1,40	1,04
Sector_7	-0,12	0,01	0,38	1,19	-0,12	0,00	0,38	1,01
Staff(log)	1,37	-0,01	1,63	0,86	1,37	0,32	1,63	1,04
Age	-0,01	0,01	0,89	0,97	-0,01	-0,08	0,89	1,17
Univ%	0,67	0,01	1,77	1,03	0,67	0,12	1,77	1,10
GCFF(log)	1,34	-0,03	1,16	0,92	1,34	0,28	1,16	0,97
Turnover(log)	1,43	-0,01	1,29	0,95	1,43	0,38	1,29	0,88
FinAut	0,17	0,05	0,84	1,02	0,17	-0,02	0,84	1,06
Profit	0,15	0,05	0,87	0,97	0,15	0,13	0,87	1,17
ps	0,98	0,03	28,18	1,58	0,98	0,15	28,18	0,95

c) Firms with no Intangible investment before treatment

	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID	0,29	0,01	2,07	1,03	0,29	0,00	2,07	1,01
Subs	1,01	-0,04	0,59	1,10	1,01	0,08	0,59	0,88
DIntInv	-0,86	0,00	0,00		-0,86	-0,08	0,00	0,00
Yr_2006	-0,38	-0,01	0,26	0,93	-0,38	0,00	0,26	1,01
yr_2007	-0,34	0,00	0,37	1,01	-0,34	0,00	0,37	1,01
yr_2008	-0,07	0,02	0,84	1,07	-0,07	0,00	0,84	1,01
yr_2009	-0,02	0,01	0,96	1,04	-0,02	0,00	0,96	1,01
yr_2010	-0,23	0,01	0,45	1,05	-0,23	0,00	0,45	1,01
yr_2011	-0,19	0,00	0,48	1,03	-0,19	0,00	0,48	1,01
yr_2012	0,07	0,01	1,22	1,04	0,07	0,00	1,22	1,01
yr_2013	-0,01	-0,01	0,96	0,97	-0,01	0,00	0,96	1,01
yr_2014	0,16	-0,03	1,55	0,95	0,16	0,00	1,55	1,01
yr_2015	0,67	0,00	2,95	1,00	0,67	0,00	2,95	1,01
Sector_3	0,63	0,01	1,72	1,01	0,63	0,01	1,72	1,01
Sector_4	-0,18	-0,01	0,59	0,95	-0,18	0,00	0,59	1,01
Sector_5	-0,79	0,03	0,48	1,08	-0,79	-0,01	0,48	0,98
Sector_6	0,28	0,02	1,46	1,02	0,28	0,00	1,46	1,01
Sector_7	-0,16	-0,01	0,40	0,94	-0,16	0,00	0,40	1,01
Staff(log)	1,22	0,03	1,63	0,83	1,22	0,32	1,63	0,91
Age	-0,12	0,01	1,08	0,98	-0,12	-0,09	1,08	1,12
Univ%	0,61	0,03	1,69	1,01	0,61	0,09	1,69	1,02
GCFF(log)	1,06	0,01	1,12	0,88	1,06	0,29	1,12	0,96
Turnover(log)	1,21	0,02	1,69	1,03	1,21	0,36	1,69	0,96
FinAut	0,05	-0,01	0,85	0,96	0,05	-0,04	0,85	1,04
Profit	0,28	0,00	1,07	1,04	0,28	0,09	1,07	1,23
ps	0,86	0,05	38,64	1,77	0,86	0,10	38,64	0,98

d) Firms with propensity to R&D

	Propensity score				Mahalanobis			
	StdDif Means		Ratio Variances		StdDif Means		Ratio Variances	
	Raw	Matched	Raw	Matched	Raw	Matched	Raw	Matched
PropensityID								
Subs	0,30	-0,01	0,33	1,12	0,30	-0,02	0,33	1,21
DIntInv								
Yr_2006	-0,27	0,02	0,49	1,09	-0,27	0,00	0,49	1,03
yr_2007	-0,34	0,01	0,43	1,08	-0,34	0,00	0,43	1,01
yr_2008	-0,01	0,03	0,98	1,11	-0,01	0,00	0,98	1,02
yr_2009	0,03	0,08	1,12	1,30	0,03	0,00	1,12	1,02
yr_2010	-0,32	-0,03	0,31	0,87	-0,32	0,00	0,31	1,01
yr_2011	0,17	0,03	1,65	1,07	0,17	0,00	1,65	1,02
yr_2012	-0,06	0,00	0,85	1,01	-0,06	0,00	0,85	1,02
yr_2013	0,24	-0,08	1,81	0,90	0,24	0,00	1,81	1,02
yr_2014	-0,02	0,02	0,95	1,10	-0,02	0,00	0,95	1,02
yr_2015	0,44	-0,04	2,24	0,96	0,44	0,00	2,24	1,02
Sector_3	0,83	-0,01	1,56	1,02	0,83	0,18	1,56	0,99
Sector_4	-0,10	-0,04	0,69	0,81	-0,10	0,00	0,69	1,02
Sector_5	-0,80	-0,01	0,37	1,00	-0,80	-0,32	0,37	0,52
Sector_6	0,20	0,03	1,33	1,05	0,20	0,12	1,33	1,17
Sector_7	-0,38	0,01	0,17	1,24	-0,38	0,00	0,17	1,02
Staff(log)	1,24	0,17	1,02	0,87	1,24	0,45	1,02	0,92
Age	0,16	0,01	0,70	1,00	0,16	-0,10	0,70	1,26
Univ%	0,58	-0,10	1,38	1,12	0,58	0,30	1,38	1,22
GCFF(log)	0,99	0,09	0,92	0,71	0,99	0,37	0,92	0,89
Turnover(log)	1,23	0,10	0,83	0,91	1,23	0,42	0,83	0,87
FinAut	0,01	-0,01	0,94	1,07	0,01	-0,02	0,94	1,17
Profit	0,15	0,05	0,94	1,19	0,15	0,12	0,94	1,38
ps	0,99	-0,02	16,81	0,90	0,99	0,25	16,81	1,00

Tables A.II. Probit models

General case – Firms treated only once

Probit regression	Number of obs	832479
	LR chi2(23)	1794.98
	Prob > chi2	0.0000
	Pseudo R2	0.2451
	Log likelihood	-2764.0889

TRT1	Coef.		z	P>z
PropensityID	0,23	***	5,68	0,00
Subs	0,14	***	3,84	0,00
DIntInv	0,35	***	8,04	0,00
Yr_2006	-0,14	*	-1,73	0,08
yr_2007	-0,18	**	-2,27	0,02
yr_2008	0,00		0,03	0,97
yr_2009	-0,07		-0,90	0,37
yr_2010	-0,34	***	-3,64	0,00
yr_2011	-0,17	**	-2,08	0,04
yr_2012	-0,06		-0,77	0,44
yr_2013	-0,08		-1,09	0,27
yr_2015	0,34	***	5,52	0,00
Sector_3	0,22	*	1,63	0,10
Sector_4	-0,19		-1,29	0,20
Sector_5	-0,46	***	-3,36	0,00
Sector_6	-0,04		-0,29	0,77
Sector_7	-0,63	***	-3,56	0,00
Staff(log)	0,08	***	3,95	0,00
Age	0,29	***	11,84	0,00
Univ%	0,05	***	4,74	0,00
GCFF(log)	0,14	***	8,01	0,00
Turnover(log)	-0,01		-0,35	0,73
FinAut	0,06	***	3,08	0,00
Profit	-6,53	***	-28,29	0,00

The final number of blocks is 12
The region of common support is [1.414e-06, .17807266]

Inferior limit of ps score	TRT1=0	TRT1=1	Total
1,41E-06	460680	13	460693
0,0000977	74157	9	74166
0,0001953	63401	10	63411
0,0003906	51766	27	51793
0,0007813	37834	42	37876
0,0015625	25825	49	25874
0,003125	1563	88	1651
0,00625	8153	80	8233
0,0125	3426	60	3486
0,025	1166	36	1202
0,05	252	12	264
0,1	26	1	27
Total	728249	427	728676

Firms with positive intangible investment before treatment

Probit regression — Number of obs = 222817
LR chi2(22) = 808.13
Prob > chi2 = 0.0000
Log likelihood = -1184.9649 — Pseudo R2 = 0.2543

TRT1	Coef.	Std. Err.	z	P>z
PropensãoID	0,15	0,06	2,51	0,01
Subs	0,40	0,08	5,24	0,00
_IANO_2006	-0,09	0,12	-0,72	0,47
_IANO_2007	-0,18	0,12	-1,48	0,14
_IANO_2008	0,15	0,12	1,25	0,21
_IANO_2009	0,05	0,13	0,38	0,71
_IANO_2010	-0,22	0,15	-1,51	0,13
_IANO_2011	0,02	0,13	0,17	0,87
_IANO_2012	-0,06	0,13	-0,46	0,65
_IANO_2013	-0,05	0,13	-0,39	0,70
_IANO_2015	0,41	0,11	3,88	0,00
_ICAE_Grup~3	0,45	0,35	1,28	0,20
_ICAE_Grup~4	0,00	0,36	0,00	1,00
_ICAE_Grup~5	-0,28	0,36	-0,79	0,43
_ICAE_Grup~6	0,14	0,36	0,38	0,70
_ICAE_Grup~7	-0,60	0,41	-1,46	0,15
l2logPessoal	0,08	0,03	2,38	0,02
l2LicEmpC2	0,31	0,04	8,05	0,00
l2LogFBCF	0,05	0,02	2,85	0,00
l2logVolNeg	0,12	0,03	4,71	0,00
l2AutFinC2	0,00	0,03	0,02	0,99
l2RLtaC2	0,06	0,03	1,86	0,06
_cons	-6,52	0,47	-14,01	0,00

The region of common support is [.00002421, .17302968]

The final number of blocks is 10

	TRT1		
PS	0	1	Total
0,000024	78255	8	78263
0,000391	14423	9	14432
0,000781	12031	11	12042
0,001563	9561	22	9583
0,003125	6793	30	6823
0,006250	4291	47	4338
0,012500	2071	34	2105
0,025000	744	28	772
0,050000	174	8	182
0,100000	19	1	20
Total	128362	198	12856

First treatment – firms treated several times

Number of obs	833551
LR chi2(23)	7525,46
Prob > chi2	0,00
Pseudo R2	0,34
Log likelihood	-7209,94

TRAT	Coef.		z	P>z
PropensityID	0,37		17,98	0,32
DIntInv	0,14	***	6,32	0,00
Subs	0,55	***	17,49	0,00
Yr_2006	0,55	***	9,83	0,00
yr_2007	0,38	***	6,70	0,00
yr_2008	0,46	***	8,14	0,00
yr_2009	0,38	***	6,66	0,00
yr_2010	0,13	**	2,10	0,04
yr_2011	0,22	***	3,60	0,00
yr_2012	0,22	***	3,64	0,00
yr_2013	0,26	***	4,37	0,00
yr_2015	0,24	***	4,01	0,00
Sector_3	0,30	**	2,37	0,02
Sector_4	-0,27	**	-2,03	0,04
Sector_5	-0,58	***	-4,45	0,00
Sector_6	-0,05		-0,42	0,67
Sector_7	-0,77	***	-4,92	0,00
Staff(log)	0,12	***	9,04	0,00
Univ%	0,39	***	23,61	0,00
GCFF(log)	0,06	***	9,06	0,00
Turnover(log)	0,18	***	15,43	0,00
FinAut	0,05	***	3,53	0,00
Profit	0,09	***	6,98	0,00
_cons	-7,90	***	-42,12	0,00

Inferior limit of ps score	TRT1=0	TRT1=1	Total
0,0000	430167	18	430185
0,0001	61632	13	61645
0,0002	56858	17	56875
0,0004	51922	23	51945
0,0008	44966	44	45010
0,0016	36956	81	37037
0,0031	27822	126	27948
0,0063	19707	180	19887
0,0125	8393	116	8509
0,0188	4629	101	4730
0,0250	4957	136	5093
0,0375	2495	103	2598
0,0500	2367	166	2533
0,0750	1060	101	1161
0,1000	1050	166	1216
0,2000	170	86	256
0,4000	7	16	23
TOTAL	755158	1493	756651

Tables AIII. – Results

AIII.1 First Treatments – all firms

1.1. Impact on intangible investment – overall

	Propensity score (Kernel)					Mahalanobis (Kernel)					Propensity score (NN)					Propensity score (Stratification)				
Variable	T	NT	ATT		t	T	NT	ATT		t	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms																				
IntInv	1368	830066	0,88	***	6,16	1475	207105	0,95	***	6,61	1406	1386	0,84	***	4,96	1406	516878	1,00	***	6,86
DifIntInv	1368	830066	1,98	***	3,24	1475	207105	1,99	***	3,42	1406	1386	2,77	***	3,77	1406	516878	2,73	***	3,91
DInvInt(log)	510	44274	0,45	***	3,70	544	16594	0,46	***	4,08	1406	344	0,84	***	6,20	1406	516878	0,75		
b) Firms with positive Intangible Investment before treatment																				
IntInv	727	222304	1,11	***	5,04	787	62155	1,30	***	5,83	800	733	1,15	***	4,33	793	153844	1,16	***	5,25
DifIntInv	727	222304	1,46	***	3,09	787	62155	1,78	***	3,61	800	733	1,20	*	1,79	793	153844	1,66	***	3,29
DInvInt(log)	510	44274	0,45	***	3,70	544	16594	0,45	***	4,08	800	396	0,51	***	3,38	793	153844	0,62	***	6,64
c) Firms with no intangible investments before treatment																				
IntInv	499	602473	0,45	***	2,90	477	89892	0,39	***	2,70	486	483	0,16		0,93	486	517559	0,26	*	1,78
d) Firms with propensity to R&D																				
IntInv	281	27887	2,33	***	4,55	299	10263	2,38	***	4,93	306	296	2,19	***	4,67	304	23485	2,34	***	5,07
DifIntInv	281	27887	2,65	**	2,01	299	10263	3,19	***	2,84	306	296	3,77	***	3,30	304	23485	-0,62		-0,15
DInvInt(log)	239	14200	0,75	***	3,88	248	5455	0,60	***	3,80	306	176	0,53	***	2,63	304	23485	0,75	***	5,62

Additionality

	Propensity score (Kernel)					Mahalanobis (Kernel)				
	T	NT	ATT		t	T	NT	ATT		t
Addicionality	739	85018	0,08	***	4,74	694	68680	0,14	***	5,71

1.2. Impact on intangible investment, by sector

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Sector	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
1 - Agric. for. & fishing	8	5130	0,98		1,05	8	3542	0,98		1,05
2 - Extr. Industries	--					--				
3 - Manufacturing Ind.	783	146439	0,44	***	4,33	837	92452	0,44	***	5,39
4 - Utilities & constr.	81	99169	0,80		1,42	87	47922	0,87		1,63
5 - Trade & accom.	148	395864	0,42		1,62	160	71721	0,38		1,63
6 - Business services	349	140103	2,16	***	4,66	371	106812	2,16	***	4,8
7 - Other services	11	17038	2,18	*	1,76	12	3602	2,10	*	1,84
b) Firms with positive Intangible Investment before treatment										
3 - Manuf. Ind.	435	40419	0,64	***	3,33	106	20528	1,02	***	2,13
6-B. Services	187	35951	2,59	***	3,40	195	13616	2,82	***	3,93
c) Firms with no Intangible Investment before treatment										
3 - Manuf. Ind.	241	104889	0,04		0,59	259	44881	0,05		0,078
6-B. Services	113	44641	1,27	**	2,22	125	14661	1,24	**	2,39
d) Firms with propensity to R&D										
3 - Manuf. Ind.	163	5546	1,05	***	2,58	175	4368	1,36	***	4,31
6-B. Services	88	5023	4,62	***	3,41	90	2586	4,40	***	3,26

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Sector_ICT	T	NT	ATT		t	T	NT	ATT		t
IntInv	232	18690	2,09	***	3,4	252	15096	2,36	***	4,11
StaffID	78	3975	2,19	**	2,17	83	5899	1,51		1,31

1.3. Impact on intangible investment, by firm size

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Size	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
Micro	144	509818	1,97	***	2,42	151	35685	2,37	***	3,32
Small	529	162027	0,90	***	4,60	572	105160	0,92	***	3,80
Medium	520	26831	0,44	**	2,54	559	20809	0,52	***	3,77
Large	189	3623	0,18		1,32	204	3161	0,26	*	1,65
b) Firms with positive Intangible Investment before treatment										
Micro	62	73387	2,55	***	2,7	67	10070	2,36	***	2,68
Small	249	41510	1,67	***	3,80	267	27854	1,63	***	3,17
Medium	299	8866	0,72	***	2,38	324	7787	0,76	***	3,04
Large	131	1591	0,39		1,67	137	1411	0,20		0,84
c) Firms with no Intangible Investment before treatment										
Micro	55	185906	2,41	***	2,47	59	13899	2,28	**	2,37
Small	197	28259	0,35	**	2,01	211	56621	0,24		1,48
Medium	155	12681	-0,03		-0,69	165	13401	-0,06		-1,51
Large	42	1761	0,00		-0,12	44	1659	-0,24	***	-4,04
d) Firms with propensity to R&D										
Micro	33	10384	4,51	***	2,93	34	1633	4,09	***	2,72
Small	98	6834	3,60	***	2,92	105	3345	3,28	***	2,69
Medium	111	1764	1,04	***	2,52	122	1372	1,32	***	3,45
Large	42	153	0,56	***	2,57	44	204	0,34		1,65

1.4. Impact on other R&D staff

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Variable	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
StaffID	494	265101	1,24	***	6,03	529	81061	1,23	***	5,78
DStaffID	338	172815	1,16	***	2,86	355	58472	0,92	***	3,2
b) Firms with positive Intangible Investment before treatment										
StaffID	204	26833	1,29	***	5,10	219	12361	1,22	***	4,10
DStaffID	137	25837	0,84	***	2,30	147	8324	1,08	***	4,32
c) Firms with no Intangible Investment before treatment										
StaffID	214	231753	0,85	***	5,20	225	49513	0,86	***	5,47
DStaffID	146	124514	0,2912		0,68	155	43332	0,3025		0,8
d) Firms with propensity to R&D										
StaffID	78	6534	1,59	***	3,60	83	3083	1,96	***	4,40
DStaffID	52	5219	1,24	***	3,14	55	1805	1,55	***	3,36

1.5. Impact on exports

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Variable	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
ExpTot	586	345876	9,24	***	5,96	624	89515	11,37	***	7,99
DExpTot	438	201503	2,40	***	2,79	467	67408	2,09	***	2,59
b) Firms with positive Intangible Investment before treatment										
ExpTot	255	32594	11,97	***	4,99	272	13819	12,44	***	5,67
DExpTot	178	29997	2,37		1,66	190	10892	2,69	**	2,13
c) Firms with no Intangible Investment before treatment										
ExpTot	237	27268	7,8874	***	3,36	253	57513	9,426	***	4,31
DExpTot	200	214243	1,4863		1,06	212	45658	1,1874		0,97
d) Firms with propensity to R&D										
ExpTot	98	12848	21,45	***	5,68	106	3844	21,32	***	6,14
DExpTot	64	6255	4,37	*	1,72	69	2579	4,94	*	1,92

1.6. Impact on Intangible investment, by year

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Year of treatm.	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
2006	273	110258	1,66	***	4,17	286	69648	1,83	***	4,68
2007	188	121761	0,99		1,58	202	50937	1,36	***	2,81
2008	183	85456	0,86	**	2,06	195	16987	0,71	**	2,27
2009	162	81976	0,65		1,25	175	27592	0,71		1,46
2010	89	82915	0,80		1,31	94	9460	0,82		1,43
2011	57	60895	0,23		0,70	62	8428	0,18		0,59
2012	102	29216	0,48	**	2,11	112	8919	0,29		1,33
2013	106	62530	1,10	*	1,90	111	17819	1,05	*	1,75
2014	108	48755	0,34	*	1,95	115	18382	0,28	*	1,72
2015	120	66808	0,34		1,05	129	19871	0,47	*	1,76
b) Firms with positive Intangible Investment before treatment										
2006	198	66805	2,28	***	4,10	205	30508	2,45	***	4,75
2007	131	73585	1,91	***	2,72	140	28636	1,76	***	2,63
2008	86	11683	0,90		1,30	91	3045	1,20	*	1,81
2009	73	11785	0,25		0,48	81	3968	0,49		1,00
2010	51	11950	0,68		0,87	53	1675	0,66		0,87
2011	28	2732	-0,11		-0,20	29	1524	0,06		0,13
2012	41	3442	0,11		0,23	42	1605	0,27		0,71
2013	44	5212	1,58		1,42	47	2465	1,54		1,48
2014	42	7497	0,23		0,75	44	1965	0,21		0,72
2015	52	8225	0,29		0,89	56	3985	0,42		1,41
c) Firms with no Intangible Investment before treatment										
2006	49	43437	0,19		0,42	53	8435	0,19		0,47
2007	37	44623	0,10		0,98	40	26872	0,02		0,23
2008	64	73669	0,21		0,96	69	10587	0,19		0,91
2009	60	41547	0,32		0,80	65	9132	0,20		0,53
2010	28	1526	1,43		1,11	29	3213	1,33		1,07
2011	13	969	0,62		0,72	14	700	0,72		0,93
2012	53	43625	0,28		0,89	57	7097	0,23		0,77
2013	44	58630	0,90		1,41	46	6569	0,79		1,24
2014	53	54631	0,24		1,32	53	14971	0,19		1,03
2015	53	56144	0,77		1,37	56	13964	0,68		1,27
d) Firms with propensity to R&D										
2006	85	4125	3,86	***	3,49	89	2822	3,99	***	3,78
2007	49	4871	3,97	***	2,36	49	2127	4,09	***	4,46
2008	24	1712	2,22		1,65	25	938	2,32	*	1,81
2009	28	1882	0,94		0,84	31	824	0,92		0,78
2010	22	3073	1,76		1,02	23	425	1,87		1,13
2011	13	553	-0,63		-1,26	14	484	-0,43		-0,85
2012	14	2133	1,25		1,52	13	364	0,39		0,37
2013	26	1284	0,27		0,34	28	838	0,84		1,03
2014	11	371	1,09	*	1,69	11	363	0,43		0,64
2015	15	1854	0,21		0,44	16	519	0,04		0,08

2. Firms treated only once

2.1. Impact on intangible investment

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Variable	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
IntInv	399	678473	1,03	***	3,70	417	349418	1,07	***	4,16
DifIntInv	399	668352	1,97	**	2,29	417	352392	1,77	**	2,24
DIntInv(log)	117	31718	0,72	***	2,65	124	24257	0,63	***	2,53
b) Firms with positive Intangible Investment before treatment										
IntInv	184	101241	1,15	***	2,66	193	104302	1,28	***	3,14
DifIntInv	184	101241	1,07		1,03	193	104302	0,90		0,93
DInvInt(log)	117	35523	0,56	**	2,06	124	23262	0,62	***	2,50
c) Firms with no Intangible Investment before treatment										
IntInv	152	499503	0,72	***	2,11	161	157273	0,65	**	2,02
d) Firms with propensity to R&D										
IntInv	55	21676	1,44	***	2,20	59	15301	1,55	***	2,71
DifIntInv	55	21676	0,47		0,29	59	15301	1,50		0,45
DInvInt(log)	49	9572	0,38	***	2,65	50	6606	1,12	***	3,06

2.2. Lagged effects, 1 and 3 years after treatment

	Propensity score (Kernel)					Mahalanobis (Kernel)				
Variable	T	NT	ATT		t	T	NT	ATT		t
a) General model: all firms										
IntInv1	364	515486	0,8015	***	3,22	389	271369	0,78	***	3,39
IntInv3	226	230837	0,33	**	2,11	234	177911	0,24		1,56
b) Firms with positive Intangible Investment before treatment										
IntInv1	170	130986	0,801	*	1,73	178	71997	1,05	***	2,74
IntInv3	102	30551	-0,32		-1,62	106	43441	-0,10		-0,81
c) Firms with no Intangible Investment before treatment										
IntInv1	142	293850	0,4561	*	1,92	149	131475	0,30		1,33
IntInv3	88	88230	0,37		1,31	87	41253	0,35		1,25
d) Firms with propensity to R&D										
IntInv1	52	11338	2,2845	***	2,56	56	11193	2,03	***	2,43
IntInv3	33	9269	-0,414		-1,07	36	6243	-0,27		-1,25

3. – Differences in Differences

a) General model

	ANO 2006						ANO 2007						ANO 2008					
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,10 ***	18,52	-0,01	-1,38	-0,14 ***	-30,74	-0,15 ***	-28,08	0,08 ***	14,09	-0,04 ***	-5,69	-0,21 ***	-44,23	-0,16 ***	-31,32	0,02 ***	4,14
TRAT_yr	1,47 ***	10,06	1,30 ***	9,09	0,00				1,21 ***	6,35	0,97 ***	5,27					1,37 ***	7,26
tTRAT_yr	0,89 ***	4,97	0,79 ***	4,53	1,02 ***	3,38	0,79 ***	2,86	1,08 ***	4,62	0,96 ***	4,27	0,56 *	1,86	0,66 **	2,38	0,16	0,71
Sector_2			0,16 **	2,43							0,20 **	3,24						
Sector_3			0,25 ***	9,81							0,29 ***	12,07						
Sector_4			0,23 ***	9,17							0,26 ***	11,06						
Sector_5			0,58 ***	23,66							0,62 ***	27,21						
Sector_6			0,42 ***	16,14							0,46 ***	19,14						
Sector_7			0,17 ***	6,24							0,22 ***	8,67						
Staff(log)			0,05 ***	9,24			0,09 ***	6,92			0,06 ***	13,34			0,09 ***	7,03		
Univ%			0,00 ***	25,27			0,00	-0,52			0,00 ***	28,88			0,00	-1,11		
Age			-0,30 ***	-53,98							-0,31 ***	-62,68						
GFCF			0,24 ***	107,66							0,24 ***	117,91						
Turnover(log)			-0,23 ***	-63,37			-0,09 ***	-8,41			-0,25 ***	-71,48			-0,13 ***	-13,08		
FinAut			0,00 **	2,46			0,00 ***	-2,51			0,00 ***	2,50			0,00 *	-1,79		
Profit			0,00 ***	-4,90			0,00 **	-2,08			0,00 ***	-6,00			0,00 *	-1,97		
_cons	0,31 ***	77,86	1,42 ***	31,14	0,43 ***	191,58	1,32 ***	10,92	0,34 ***	100,18	1,57 ***	36,50	0,46 ***	241,16	1,79 ***	15,65	0,36 ***	119,14
Number of obs	1001338		573 274		1001338		673573		1256815		697277		1256815		849240		1505542	
F	326,38		1262,69		476,72		154,53		180,29		1565,17		978,71		166,83		67,67	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,001		0,034		0,0014		0,0024		0,0004		0,0347		0,0024		0,0027		0,0001	
Adj R-squared	0,001		0,034						0,0004		0,0346						0,0001	
Root MSE	2,7928		2,636						2,9544		2,7701						3,023	

	ANO 2008						ANO 2009						ANO 2010					
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,03 ***	-3,87	-0,24 ***	-49,60	-0,16 ***	-30,59	-0,10 ***	-20,85	-0,11 ***	-15,45	-0,29 ***	-60,49	-0,18 ***	-35,39	-0,18 ***	-36,96	-0,17 ***	-23,30
TRAT_yr	0,88 ***	4,70					2,64 ***	13,44	1,94 ***	9,79					1,51 ***	6,00	0,88 ***	3,37
tTRAT_yr	0,57 **	2,49	0,24	0,46	0,47	1,06	0,59 **	2,46	0,54 **	2,25	0,09	0,12	-0,37	-0,68	1,34 ***	4,35	1,16 ***	3,62
Sector_2	0,20 ***	3,39							0,21 ***	3,84							0,22 ***	4,22
Sector_3	0,31 ***	13,68							0,30 ***	14,65							0,31 ***	15,98
Sector_4	0,28 ***	12,61							0,28 ***	13,45							0,28 ***	14,47
Sector_5	0,65 ***	30,07							0,63 ***	31,99							0,62 ***	33,79
Sector_6	0,49 ***	21,55							0,50 ***	24,00							0,51 ***	26,44
Sector_7	0,23 ***	9,77							0,23 ***	10,70							0,24 ***	11,61
Staff(log)	0,07 ***	14,76			0,08 ***	6,98			0,07 ***	16,77			0,06 ***	6,15			0,07 ***	17,24
Univ%	0,01 ***	31,81			0,00	-1,54			0,01 ***	34,94			0,00 **	-2,14			0,01 ***	37,10
Age	-0,30 ***	-65,55							-0,29 ***	-67,68							-0,27 ***	-68,99
GFCF	0,24 ***	127,60							0,23 ***	131,53							0,23 ***	136,56
Turnover(log)	-0,25 ***	-76,41			-0,16 ***	-18,63			-0,25 ***	-79,01			-0,18 ***	-21,81			-0,24 ***	-80,48
FinAut	0,00	1,88			0,00 *	-1,87			0,00 *	1,80			0,00 *	-1,98			0,00	1,20
Profit	0,00 ***	-6,01			0,00	-0,14			0,00 ***	-6,40			0,00	-0,65			0,00 ***	-6,19
_cons	1,54 ***	37,55	0,45	274,41	2,25 ***	21,75	0,37 ***	140,87	1,48 ***	38,93	0,43 ***	311,32	2,49 ***	25,54	0,37 ***	154,78	1,39 ***	38,65
Number of obs	810448		1505542		1019454		1762778		914909		1762778		1176566		2009908		1004697	
F	1813,45		1229,87		167,59		378,45		1976,46		1829,00		217,95		544,83		2102,01	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0346		0,0025		0,0027		0,00006		0,0334		0,0031		0,0031		0,0008		0,0324	
Adj R-squared	0,0345						0,0006		0,0334						0,0008		0,0324	
Root MSE	2,8689						2,985		2,8444						2,9116		2,8369	

	ANO 2010						ANO 2011						ANO 2012					
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,29 ***	-64,63	-0,20 ***	-40,56	-0,17 ***	-37,41	-0,12 ***	-15,75	-0,25 ***	-60,93	-0,19 ***	-39,24	-0,15 ***	-32,30	-0,10 ***	-13,53	-0,21 ***	-52,11
TRAT_yr					2,67 ***	9,11	0,93 ***	2,89					1,63 ***	7,21	0,52 **	2,09		
tTRAT_yr	0,79	1,15	0,52	1,46	0,17	0,47	0,44	1,13	-0,36	-0,48	0,05	0,08	1,49 ***	5,40	1,07 ***	3,55	1,19 *	1,68
Sector_2	0,23 ***	4,67					0,23 ***	4,67					0,24 ***	5,06				
Sector_3	0,32 ***	17,50					0,32 ***	17,50					0,33 ***	19,18				
Sector_4	0,29 ***	15,82					0,29 ***	15,82					0,30 ***	17,46				
Sector_5	0,62 ***	36,09					0,62 ***	36,09					0,63 ***	38,71				
Sector_6	0,53 ***	29,05					0,53 ***	29,05					0,55 ***	31,70				
Sector_7	0,25 ***	12,83					0,25 ***	12,83					0,27 ***	14,97				
Staff(log)	0,07 ***	18,07			0,04 ***	4,80							0,07 ***	18,82				
Univ%	0,01 ***	38,68			0,00 ***	-3,11							0,01 ***	41,08				
Age	-0,26 ***	-68,18											-0,24 ***	-67,80				
GFCF	0,22 ***	140,07											0,22 ***	144,46				
Turnover(log)	-0,23 ***	-82,75			-0,17 ***	-23,73							-0,23 ***	-85,02				
FinAut	0,00	0,39			0,00 ***	-3,89							0,00	-0,26				
Profit	0,00 ***	-6,23			0,00	0,02							0,00 ***	-6,32				
_cons	1,32 ***	38,36	0,36 ***	409,13	2,30 ***	28,27	0,34 ***	159,84	1,32 ***	38,36	0,36 ***	409,13	2,30 ***	28,27	0,32 ***	162,28	1,25 ***	38,02
Number of obs	1328592		2244253		1468,934		2244253		1,083139		2244253		1468,934		2482383		1165785	
F	267,10		553,77		250,91		1856,70		2192,47		1856,70		250,91		482,73		2318,66	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0031		0,0007		0,0026		0,0019		0,0314		0,0019		0,0026		0,0006		0,0308	
Adj R-squared			0,0007						0,0314						0,0006		0,0308	
Root MSE			2,8529						2,8188						2,8251		2,8142	

	ANO 2012						ANO 2013						ANO 2014					
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,21 ***	-33,21	-0,11 ***	-24,00	-0,08 ***	-10,02	-0,18 ***	-43,12	-0,12 ***	-26,14	-0,10 ***	-22,09	-0,08 ***	-11,27	-0,16 ***	-41,70	-0,10 ***	-22,31
TRAT_yr			1,25 ***	5,68	1,03 ***	4,09					1,15 ***	5,37	0,77 ***	3,12				
tTRAT_yr	0,62	0,90	1,20 ***	4,45	0,68 **	2,26	0,88 **	2,17	0,49	1,23	1,25 ***	4,77	0,64 **	2,17	0,62	0,95	0,15	0,28
Sector_2					0,25 ***	5,47							0,26 ***	5,67				
Sector_3					0,35 ***	21,13							0,35 ***	22,42				
Sector_4					0,32 ***	19,38							0,32 ***	20,54				
Sector_5					0,65 ***	41,68							0,65 ***	44,01				
Sector_6					0,57 ***	34,46							0,58 ***	36,85				
Sector_7					0,30 ***	17,45							0,31 ***	19,06				
Staff(log)	0,04 ***	4,64			0,07 ***	19,96			0,04 ***	5,15			0,08 ***	21,84			0,04 ***	5,62
Univ%	0,00 ***	-3,49			0,01 ***	44,76			0,00 ***	-3,61			0,01 ***	46,92			0,00 ***	-4,06
Age					-0,24 ***	-68,21							-0,23 ***	-68,62				
GFCF					0,22 ***	149,84							0,22 ***	154,05				
Turnover(log)	-0,15 ***	-23,32			-0,24 ***	-88,86			-0,14 ***	-22,72			-0,24 ***	-91,81			-0,13 ***	-22,89
FinAut	0,00 ***	-4,84			0,00	-0,56			0,00 ***	-5,19			0,00	-1,17			0,00 ***	-6,20
Profit	0,00	-0,06			0,00 ***	-6,03			0,00	0,10			0,00 ***	-6,14			0,00	0,00
_cons	2,14 ***	28,06	0,31 ***	163,47	1,24 ***	38,89	0,32 ***	440,35	1,96 ***	27,53	0,30 ***	166,81	1,22 ***	39,60	0,31 ***	466,64	1,88 ***	27,87
Number of obs	1611697		2725027		1251036		2725027		1758135		2,976531		1339715		2976531		1909202	
F	195,91		281,81		2489,10		931,33		150,43		253,57		2622,71		869,82		143,19	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0021		0,0003		0,0309		0,0008		0,0016		0,003		0,0304		0,0006		0,0014	
Adj R-squared			0,0003		0,0308						0,003		0,0304					
Root MSE			2,8066		2,8411						2,7892		2,819					

	ANO 2015							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,09 ***	-21,86	-0,11 ***	-15,51	-0,17 ***	-42,99	-0,10 ***	-23,07
TRAT_yr	1,55 ***	7,50	0,51 **	2,20	0,00		0,00	
tTRAT_yr	0,67 ***	2,63	0,52 *	1,83	0,21	0,28	-0,04	-0,09
Sector_2			0,27 ***	6,06				
Sector_3			0,35 ***	23,18				
Sector_4			0,32 ***	21,28				
Sector_5			0,65 ***	45,82				
Sector_6			0,58 ***	38,67				
Sector_7			0,31 ***	19,55				
Staff(log)			0,08 ***	23,78			0,04 ***	5,66
Univ%			0,01 ***	49,86			0,00 ***	-3,73
Age			-0,23 ***	-70,08				
GFCF			0,22 ***	158,16				
Turnover(log)			-0,24 ***	-94,51			-0,13 ***	-22,36
FinAut			0,00	-1,53			0,00 ***	-6,97
Profit			0,00 ***	-6,36			0,00	0,32
_cons	0,29 ***	170,45	1,22 ***	40,76	0,30 ***	485,06	1,78 ***	27,39
Number of obs	3237772		1431527		3237772		2065963	
F	249,94		2771,93		923,87		153,85	
Prob > F	0,000		0,000		0,0000		0,0000	
R-squared	0,0002		0,0301		0,0006		0,0013	
Adj R-squared	0,0002		0,03					
Root MSE	2,783		2,8759					

b) With positive intangible investment before treatment

	Year 2006								2007								2008							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,25 ***	37,82	0,04 ***	4,82	-0,25 ***	-39,68	-0,26 ***	-35,12	0,36 ***	48,08	0,04 ***	4,39	-0,41 ***	-45,53	-0,31 ***	-32,01	0,52 ***	56,90	0,13 ***	9,75	-0,82 ***	-46,25	-0,54 ***	-27,98
TRAT_yr	1,93 ***	10,92	1,72 ***	10,15					1,69 ***	6,74	1,33 ***	5,65					1,69 ***	5,52	0,97 ***	3,32				
tTRAT_yr	1,15 ***	5,24	1,10 ***	5,28	1,36 ***	3,41	1,05 ***	2,84	1,43 ***	4,59	1,39 ***	4,78	0,76 *	1,80	0,89 **	2,33	0,00	0,00	0,90 **	2,48	0,85	0,89	1,45 *	1,79
Sector_2	0,31 ***	73,92	0,16 **	2,22					0,37 ***	91,88	0,23 ***	3,15							0,26 ***	3,42				
Sector_3			0,27 ***	9,22							0,34 ***	11,18							0,39 ***	12,76				
Sector_4			0,27 ***	9,02							0,33 ***	10,86							0,38 ***	12,41				
Sector_5			0,63 ***	22,14							0,73 ***	24,80							0,80 ***	27,02				
Sector_6			0,46 ***	15,35							0,55 ***	17,90							0,62 ***	19,99				
Sector_7			0,18 ***	5,78							0,25 ***	7,67							0,27 ***	8,39				
Staff(log)			0,05 ***	8,20			0,14 ***	7,45			0,06 ***	11,04			0,12 ***	6,24			0,07 ***	11,54			0,10 ***	5,31
Univ%			0,00 ***	23,63			0,00 ***	-2,61			0,01 ***	26,33			0,00 ***	-3,07			0,01 ***	27,83			0,00 ***	-3,51
Age			-0,31 ***	-50,06							-0,33 ***	-54,11							-0,31 ***	-52,22				
GFCF			0,26 ***	104,23							0,28 ***	110,70							0,30 ***	116,54				
Turnover(log)			-0,25 ***	-62,18			-0,11 ***	-8,68			-0,29 ***	-68,57			-0,20 ***	-13,81			-0,30 ***	-71,91			-0,27 ***	-19,16
FinAut			0,00 ***	2,72			0,00	-0,42			0,00 ***	2,86			0,00	-0,39			0,00 ***	2,63			0,00	-0,46
Profit			0,00 ***	-4,69			0,00 *	-1,84			0,00 ***	-5,45			0,00 *	-1,79			0,00 ***	-5,29			0,00	0,18
_cons			1,43 ***	28,15	0,51 ***	198,35	1,61 ***	10,66			1,61 ***	30,70	0,59	233,07	2,76 ***	16,17	0,41 ***	107,67	1,57 ***	29,64	0,64 ***	209,43	3,72 ***	22,16
Number of obs	841,156		495,46		841156		558745		930,49		536,968		930490		612434		1,015,800		575,038		1015800		664190	
F	718,78		1207,19		791,08		220,64		894,38		1402,59		1036,95		167,31		1116,73		1549,57		1369,73		143,69	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0026		0,0375		0,0034		0,0051		0,0029		0,0401		0,0054		0,0058		0,0033		0,0413		0,008		0,0072	
Adj R-squared	0,0026		0,0375						0,0029		0,0401						0,0033		0,0413					
Root MSE	2,9419		2,7164						3,2829		2,9719						3,4812		3,1378					

	2009								2010								2011							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,17	18,13	-0,07 ***	-5,20	-0,93 ***	-53,05	-0,57 ***	-30,58	-0,05 ***	-5,27	-0,18 ***	-12,44	-0,83 ***	-50,39	-0,52 ***	-29,62	-0,08 ***	-8,17	-0,10 ***	-6,74	-0,65 ***	-41,40	-0,46 ***	-26,19
TRAT_yr	4,45	13,68	3,53 ***	11,29					2,12 ***	5,19	1,13 ***	2,82					4,45 ***	8,66	1,04 ***	1,93				
tTRAT_yr	0,24	0,60	-0,03	-0,09	-0,14	-0,10	-1,61 *	-1,75	2,14 ***	4,13	1,49 ***	2,95	1,37	1,06	0,81	1,54	0,68	1,06	1,11 ***	1,65	-0,71	-0,54	0,20	0,35
Sector_2			0,27 ***	3,62							0,28 ***	3,75							0,30 ***	4,10				
Sector_3			0,40 ***	13,32							0,42 ***	14,12							0,44 ***	15,26				
Sector_4			0,39 ***	13,05							0,41 ***	13,73							0,43 ***	14,88				
Sector_5			0,81 ***	28,18							0,83 ***	29,25							0,85 ***	30,80				
Sector_6			0,66 ***	21,79							0,69 ***	23,28							0,73 ***	25,12				
Sector_7			0,29 ***	9,15							0,30 ***	9,62							0,32 ***	10,56				
Staff(log)			0,07 ***	12,71			0,08 ***	4,61			0,08 ***	12,92			0,07 ***	4,10			0,08 ***	13,45			0,07 ***	3,97
Univ%			0,01 ***	30,24			0,00 ***	-3,65			0,01 ***	32,13			0,00 ***	-3,92			0,01 ***	33,17			0,00 ***	-4,20
Age			-0,31 ***	-55,94							-0,31 ***	-56,89							-0,29 ***	-54,52				
GFCF			0,30 ***	119,47							0,31 ***	122,49							0,31 ***	124,12				
Turnover(log)			-0,30 ***	-73,17			-0,32 ***	-22,31			-0,31 ***	-73,86			-0,33 ***	-23,83			-0,31 ***	-75,08			-0,33 ***	-24,93
FinAut			0,00 ***	2,63			0,00	-0,50			0,00 **	2,30			0,00	-0,95			0,00 ***	2,21			0,00 **	-2,00
Profit			0,00 ***	-5,49			0,00	0,17			0,00 ***	-5,19			0,00	1,05			0,00 ***	-5,29			0,00	1,32
_cons	0,47	127,76	1,56 ***	29,90	0,64 ***	235,84	4,31 ***	25,75	0,50 ***	140,39	1,49 ***	29,00	0,61 ***	264,50	4,40 ***	27,55	0,50 ***	144,92	1,41 ***	27,89	0,56 ***	308,80	4,46 ***	28,80
Number of obs	1100803		608394		1100803		709339		1179080		636682		1179080		751996		1245300		659134		1245300		786433	
F	306,04		1618,71		1407,46		183,44		76,13		1666,32		1269,76		180,47		104,73		1700,61		857,47		164,96	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0008		0,0408		0,0088		0,0081		0,0002		0,0402		0,0064		0,0069		0,0003		0,0396		0,0032		0,0058	
Adj R-squared	0,0008		0,0408						0,0002		0,0402						0,0002		0,0396					
Root MSE	3,5493		3,1993						3,5787		3,2537						3,539		3,282					

	2012								2013								2014							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,04 ***	-4,23	-0,09 ***	-5,56	-0,55 ***	-31,74	-0,39 ***	-19,36	0,01	1,06	-0,01	-0,54	-0,44 *	-24,92	-0,25 *	-12,90	-0,01	-0,96	-0,01	-0,96	-0,39 ***	-24,14	-0,19 ***	-10,70
TRAT_yr	2,08 ***	4,72	0,60	1,32					1,01 **	2,31	0,84 *	1,89					1,49 ***	3,54	0,78 *	1,69				
tTRAT_yr	2,80 ***	5,01	1,14 **	2,02	2,46 *	2,00	1,02	1,02	1,72 ***	3,23	1,25 **	2,34	1,11	1,66	0,64	1,03	1,46 **	2,83	0,67	1,20	0,39	0,33	0,00	0,00
Sector_2			0,32 ***	4,39							0,35 ***	4,76							0,35 ***	4,86				
Sector_3			0,46 ***	16,23							0,49 ***	17,67							0,50 ***	18,45				
Sector_4			0,45 ***	16,02							0,49 ***	17,57							0,50 ***	18,32				
Sector_5			0,87 ***	32,45							0,91 ***	34,51							0,93 ***	35,83				
Sector_6			0,76 ***	26,87							0,81 ***	28,91							0,83 ***	30,44				
Sector_7			0,37 ***	12,30							0,43 ***	14,49							0,45 ***	15,79				
Staff(log)			0,08 ***	13,92			0,06 ***	3,91			0,08 ***	14,57			0,06 ***	4,12			0,09 ***	15,56			0,06 ***	4,03
Univ%			0,01 ***	35,27			0,00 ***	-3,91			0,01 ***	38,46			0,00 ***	-3,88			0,01 ***	40,12			0,00 ***	-3,80
Age			-0,27 ***	-52,52							-0,26 ***	-50,52							-0,25 ***	-49,24				
GFCF			0,31 ***	126,38							0,32 ***	129,69							0,32 ***	132,15				
Turnover(log)			-0,31 ***	-76,37			-0,33 ***	-24,80			-0,32 ***	-79,08			-0,32 ***	-24,62			-0,32 ***	-80,78			-0,31 ***	-25,28
FinAut			0,00 **	2,15			0,00 **	-2,36			0,00 **	2,49			0,00	-1,61			0,00 **	2,39			0,00 *	-1,93
Profit			0,00 ***	-5,37			0,00	0,77			0,00 ***	-5,16			0,00	0,85			0,00 ***	-5,21			0,00	0,64
_cons	0,49	147,16	1,34 ***	26,91	0,54	306,30	4,39 ***	28,81	0,49 ***	148,45	1,32 ***	26,60	0,53 ***	295,07	4,23 ***	28,68	0,49 ***	151,48	1,28 ***	26,26	0,53 ***	314,94	4,19 ***	29,59
Number of obs	1312548		683527		1312548		822002		1387082		710989		1387082		862595		1464994		739046		1464994		904314	
F	79,09		1754,80		505,07		321959,00		28,98		1851,92		310,91		113,33		36,94		1913,92		291,32		118,30	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0002		0,0395		0,0019		0,0048		0,0001		0,04		0,0011		0,004		0,0001		0,0398		0,0009		0,0038	
Adj R-squared	0,0002		0,0394						0,0001		0,04						0,0001		0,0398					
Root MSE	3,6272		3,3187						3,6602		3,3882						3,6838		3,4316					

	2015							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,04 ***	-3,63	-0,08 ***	-4,89	-0,46 ***	-29,08	-0,27 ***	-15,61
TRAT_yr	2,62 ***	6,68	0,71 *	1,76				
tTRAT_yr	1,38 ***	2,79	1,01 **	2,01	0,20	0,13	-0,49	-0,54
Sector_2			0,35 ***	4,77				
Sector_3			0,50 ***	18,67				
Sector_4			0,51 ***	18,70				
Sector_5			0,94 ***	36,77				
Sector_6			0,85 ***	31,45				
Sector_7			0,44 ***	15,61				
Staff(log)			0,10 ***	17,19			0,06 ***	4,12
Univ%			0,01 ***	42,81			0,00 ***	-3,17
Age			-0,25 ***	-49,55				
GFCF			0,33 ***	134,35				
Turnover(log)			-0,33 ***	-82,70			-0,30 ***	-24,72
FinAut			0,00 **	2,45			0,00 *	-1,97
Profit			0,00 ***	-5,34			0,00	1,15
_cons	0,49 ***	154,49	1,31 ***	26,92	0,53	328,61	4,04 ***	29,01
Number of obs	1545117		767002		1545117		946290	
F	77,20		1990,94		422,96		130,36	
Prob > F	0,000		0,000		0,0000		0,0000	
R-squared	0,0001		0,0399		0,0011		0,0039	
Adj R-squared	0,0001		0,0399					
Root MSE	3,7203		3,4972					

c) With no intangible investment before treatment

	ANO 2006								ANO 2007								ANO 2008							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,10 ***	18,57	-0,01	-1,36	-0,14 ***	-30,74	-0,15 ***	-28,05	0,08 ***	14,12	-0,04 ***	-5,67	-0,21 ***	-44,23	-0,16 ***	-31,31	0,02 ***	4,14	-0,03	-3,84	-0,24 ***	-49,60	-0,16 ***	-30,56
TRAT_yr	-0,31	-0,86	-0,33	-0,95					-0,34	-0,79	-0,26	-0,63					-0,36	-1,10	-0,48	-1,46				
tTRAT_yr	0,45	1,02	0,47	1,11	0,68 **	2,18	0,70 **	2,20	0,14	0,26	0,06	0,11	0,42 ***	5,38	0,39 ***	5,01	0,42	1,02	0,51	1,26	0,66 ***	4,51	0,61 ***	3,98
Sector_2			0,16 **	2,45							0,20 ***	3,29							0,20	3,45				
Sector_3			0,25 ***	9,88							0,29 ***	12,14							0,31	13,74				
Sector_4			0,23 ***	9,08							0,26 ***	10,94							0,28	12,58				
Sector_5			0,58 ***	23,64							0,62 ***	27,18							0,65	30,06				
Sector_6			0,41 ***	15,96							0,46 ***	19,07							0,49	21,51				
Sector_7			0,17 ***	6,36							0,22 ***	8,72							0,23	9,83				
Staff(log)			0,05 ***	9,46			0,09 ***	6,77			0,06 ***	13,36			0,09 ***	7,01			0,07	14,76			0,08 ***	6,88
Univ%			0,00 ***	24,51			0,00	-0,56			0,00 ***	28,42			0,00	-1,17			0,00	31,40			0,00	-1,64
Age			-0,30 ***	-54,12							-0,31 ***	-62,73							-0,30	-65,56				
GFCF			0,23 ***	107,26							0,24 ***	117,67							0,24	127,47				
Turnover(log)			-0,23 ***	-62,75			-0,08 ***	-8,37			-0,25 ***	-71,15			-0,13 ***	-3,62			-0,25	-76,20			-0,16 ***	-18,68
FinAut			0,00 ***	2,52			0,00 ***	-2,63			0,00 ***	2,55			0,00 *	-1,81			0,00	1,86			0,00 *	-1,99
Profit			0,00 ***	-4,93			0,00 **	-2,09			0,00 ***	-6,03			0,00 *	-1,97			0,00	-6,01			0,00	-0,14
_cons	0,31 ***	78,09	1,40 ***	30,79	0,43 ***	191,57	1,31 ***	10,92	0,34 ***	100,33	1,56 ***	36,33	0,46 ***	240,99	1,79 ***	15,63	0,36 ***	119,28	1,53	37,43	0,45 ***	275,42	2,25 ***	21,85
Number of obs	1000425		572 413		100425		672703		1256219		696707		1256219		848,663		1505020		809955		1505020		1018952	
F	115,46		1210,47		473,96		154,25		66,75		1537,20		981,70		167,50		6,17		1795,06		1234,00		168,58	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0003		0,0000		0,0000		0,0000	
R-squared	0,0003		0,0327		0,0014		0,0024		0,0002		0,0341		0,0024		0,0027		0		0,0342		0,0094		0	
Adj R-squared	0,0003		0,0327						0,0002		0,0341						0		0,0342					
Root MSE	2,7847		2,6238						2,9499		2,7632						3,0195		2,8635					

	ANO 2009								ANO 2010								ANO 2011							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,10 ***	-20,90	-0,11 ***	-15,42	-0,29 ***	-60,49	-0,18 ***	-35,39	-0,18 ***	-36,99	-0,17 ***	-23,31	-0,29 ***	-64,63	-0,20 ***	-40,56	-0,17 ***	-37,43	-0,12 ***	-15,75	-0,25 ***	-60,93	-0,19 ***	-39,24
TRAT_yr	-0,37	-1,06	-0,45	-1,31					-0,37	-0,82	-0,43	-0,95					-0,34	-0,60	-0,48	-0,72				
tTRAT_yr	0,62	1,42	0,63	1,48	0,79 **	2,27	0,71 *	1,95	1,19 **	2,15	1,27 **	2,25	1,28 ***	2,49	1,28 **	2,32	0,64	0,92	0,65	0,81	0,72 ***	2,87	0,78 **	2,48
Sector_2			0,21 ***	3,83							0,22 ***	4,20							0,23 ***	4,66				
Sector_3			0,31 ***	14,82							0,31 ***	16,00							0,32 ***	17,53				
Sector_4			0,28 ***	13,45							0,28 ***	14,41							0,29 ***	15,81				
Sector_5			0,63 ***	31,97							0,62 ***	33,77							0,62 ***	36,08				
Sector_6			0,50 ***	23,91							0,51 ***	26,38							0,53 ***	29,02				
Sector_7			0,24 ***	10,85							0,24 ***	11,62							0,25 ***	12,85				
Staff(log)			0,07 ***	16,53			0,06 ***	6,15			0,07 ***	17,31			0,05 ***	5,13			0,07 ***	18,07			0,04 ***	4,79
Univ%			0,00 ***	34,04			0,00 **	-2,11			0,01 ***	36,89			0,00 ***	-2,56			0,01 ***	38,54			0,00 ***	-3,13
Age			-0,29 ***	-67,60							-0,27 ***	-68,98							-0,26 ***	-68,14				
GFCF			0,23 ***	131,47							0,23 ***	136,43							0,22 ***	139,99				
Turnover(log)			-0,24 ***	-78,29			-0,18 ***	-21,87			-0,24 ***	-80,33			-0,17 ***	-22,68			-0,23 ***	-82,64			-0,17 ***	-23,73
FinAut			0,00 *	1,79			0,00 **	-2,07			0,00	1,18			0,00 ***	-2,72			0,00	0,40			0,00 ***	-3,89
Profit			0,00 ***	-6,41			0,00	-0,66			0,00 ***	-6,20			0,00	-0,39			0,00 ***	-6,23			0,00	0,02
_cons	0,37 ***	141,23	1,45 ***	38,31	0,43 ***	313,15	2,49 ***	25,63	0,37 ***	154,92	1,39 ***	38,56	0,40 ***	352,94	2,38 ***	26,91	0,34 ***	159,93	1,32 ***	38,28	0,36 ***	409,81	2,30 ***	28,27
Number of obs	1762302		914473		1762302		1176124		2009632		1004454		2009632		1328339		2244036		1082955		2244036		1468745	
F	146,06		1930,33		1830,72		218,43		457,80		2087,02		2090,47		267,63		467,23		2184,28		1858,14		251,36	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0002		0,0327		0,0031		0,0031		0,0007		0,0322		0,0029		0,0031		0,0006		0,0313		0,0019		0,0026	
Adj R-squared	0,0002		0,0327						0,0007		0,0322						0,0006		0,0313					
Root MSE	2,9609		2,8342						2,9088		2,8341						2,8513		2,818					

	ANO 2012								ANO 2013								ANO 2014							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,15 ***	-32,35	-0,10 ***	-13,53	-0,21 ***	-52,11	-0,16 ***	-33,22	-0,11 ***	-24,01	-0,08 ***	-10,01	-0,18 ***	-43,12	-0,12 ***	-26,13	-0,10 ***	-22,11	-0,08 ***	-11,25	-0,16 ***	-41,70	-0,10 ***	-22,30
TRAT_yr	-0,32	-0,97	-0,56	-1,57					-0,31	-0,87	-0,49	-1,20					-0,30	-0,90	-0,52	-1,36				
tTRAT_yr	1,05 ***	2,56	0,92 **	2,10	1,10 ***	3,58	0,95 ***	3,48	1,16 ***	2,68	1,06 **	2,14	1,21 ***	2,58	1,17 **	2,18	1,45 ***	3,57	1,43 ***	3,11	1,49 ***	2,96	1,29 ***	2,49
Sector_2			0,24 ***	5,08							0,25 ***	5,47							0,26 ***	5,67				
Sector_3			0,33 ***	19,25							0,35 ***	21,14							0,35 ***	22,42				
Sector_4			0,30 ***	17,46							0,32 ***	19,36							0,32 ***	20,50				
Sector_5			0,63 ***	38,70							0,64 ***	41,66							0,65 ***	43,96				
Sector_6			0,55 ***	31,66							0,57 ***	34,42							0,58 ***	36,81				
Sector_7			0,27 ***	15,00							0,30 ***	17,49							0,31 ***	19,07				
Staff(log)			0,07 ***	18,73			0,04 ***	4,66			0,07 ***	19,98			0,04 ***	5,12			0,08 ***	21,84			0,04 ***	5,61
Univ%			0,01 ***	40,95			0,00 ***	-3,49			0,01 ***	44,52			0,00 ***	-3,64			0,01 ***	46,74			0,00 ***	-4,11
Age			-0,24 ***	-67,74							-0,24 ***	-68,19							-0,23 ***	-68,55				
GFCF			0,22 ***	144,43							0,22 ***	149,75							0,22 ***	153,99				
Turnover(log)			-0,23 ***	-84,83			-0,15 ***	-23,36			-0,23 ***	-88,70			-0,14 ***	-22,68			-0,24 ***	-91,66			-0,13 ***	-22,88
FinAut			0,00	-0,24			0,00 ***	-4,81			0,00	-0,56			0,00 ***	-5,22			0,00	-1,17			0,00 ***	-6,20
Profit			0,00 ***	-6,32			0,00	-0,06			0,00 ***	-6,04			0,00	0,10			0,00 ***	-6,15			0,00	0,00
_cons	0,32	162,50	1,25 ***	37,84	0,34	435,81	2,15 ***	28,09	0,31 ***	163,55	1,24 ***	38,78	0,32 ***	440,75	1,96 ***	27,49	0,30 ***	166,91	1,22 ***	39,49	0,31 ***	469,01	1,88 ***	27,86
Number of obs	2482125		1165566		2482425		1611471		2724718		1250768		2724718		1757854		2976222		1339460		2976222		1908930	
F	351,19		2306,18		1362,06		197,00		195,42		2472,51		932,25		150,73		169,94		2610,79		873,04		143,99	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0004		0,0307		0,0012		0,0021		0,0002		0,0307		0,0008		0,0016		0,0002		0,0302		0,0006		0,0014	
Adj R-squared	0,0004		0,0307						0,0002		0,0306						0,0002		0,0302					
Root MSE	2,8212		2,8113						2,8053		2,8393						2,7875		2,8502					

	ANO 2015							
lnvIntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,09 ***	-21,88	-0,11 ***	-15,51	-0,17 ***	-42,99	-0,10 ***	-23,08
TRAT_yr	-0,29	-0,87	-0,50	-1,35				
tTRAT_yr	1,01 ***	2,49	1,07 **	2,37	1,07 ***	2,51	1,13 **	2,43
Sector_2			0,27 ***	6,05				
Sector_3			0,35 ***	23,17				
Sector_4			0,32 ***	21,25				
Sector_5			0,65 ***	45,77				
Sector_6			0,58 ***	38,60				
Sector_7			0,31 ***	19,55				
Staff(log)			0,08 ***	23,64			0,04 ***	5,64
Univ%			0,01 ***	49,71			0,00 ***	-3,71
Age			-0,23 ***	-70,06				
GFCF			0,22 ***	158,05				
Turnover(log)			-0,24 ***	-94,20			-0,13 ***	-22,34
FinAut			0,00	-1,53			0,00 ***	-6,96
Profit			0,00 ***	-6,35			0,00	0,31
_cons	0,29 ***	170,60	1,21 ***	40,54	0,30 ***	488,76	1,78 ***	27,37
Number of obs	3237435		1431,236		3237435		2065661	
F	162,25		2761,19		926,12		154,37	
Prob > F	0,000		0,000		0,0000		0,0000	
R-squared	0,0002		0,0299		0,0006		0,0014	
Adj R-squared	0,0002		0,0299					
Root MSE	2,7806		2,8746					

d) With propensity to R&D

	Year 2006						2007						2008					
lnvlntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,37 ***	11,08	0,11 ***	2,82	-0,10 ***	-3,46	-0,13 ***	-4,14	0,45 ***	12,57	0,17 ***	4,14	-0,23 ***	-6,05	-0,18 ***	-4,39	0,54 ***	14,44
TRAT_yr	3,25 ***	9,75	2,78 ***	8,71					3,20 ***	6,28	2,31 ***	4,70					2,78 ***	4,03
tTRAT_yr	1,55 ***	3,77	1,24 ***	3,19	1,70 **	2,20	1,01	1,52	1,79 ***	2,88	1,25 **	2,12	1,33	1,35	2,07 **	2,31	-0,84	-0,98
Sector_2			0,19	0,68							0,58 **	2,03						
Sector_3			0,35 ***	3,22							0,50 ***	4,57						
Sector_4			0,45 ***	3,99							0,59 ***	5,20						
Sector_5			0,80 ***	7,74							0,96 ***	9,24						
Sector_6			0,87 ***	7,82							1,10 ***	9,88						
Sector_7			-0,14	-1,19							-0,03	-0,30						
Staff(log)			-0,01	-0,26			0,29 ***	4,11			0,02	0,64			0,28 ***	4,04		
Univ%			0,01 ***	9,66			0,00	-0,38			0,01 ***	10,12			-0,20	0,18		
Age			-0,27 ***	-9,96							-0,27 ***	-10,52						
GFCF			0,39 ***	32,85							0,44 ***	36,69						
Turnover(log)			-0,31 ***	-17,06			-0,14 ***	-2,86			-0,36 ***	-19,58			-0,20 ***	-4,73		
FinAut			0,00	1,28			0,00	-1,61			0,00 **	2,42			0,00	-1,35		
Profit			0,00	-0,14			0,00 **	-2,32			0,00	-0,31			0,00	-0,76		
_cons	0,38 ***	16,78	0,82 ***	3,78	0,62 ***	45,77	2,01 ***	3,33	0,49 ***	22,78	0,77 ***	3,58	0,74 ***	53,00	2,68 ***	5,27	0,56 ***	28,45
Number of obs	46453		32 397		46453		35473		54562		37410		54562		41377		63132	
F	213,44		139,06		8,13		6,16		137,73		147,05		18,91		7,51		81,15	
Prob > F	0,0000		0,0000		0,0003		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0136		0,0643		0,0048		0,0016		0,0075		0,0592						0,0038	
Adj R-squared	0,0135		0,0638		f.e.		f.e		0,0075		0,0588		f.e		f.e		0,0038	
Root MSE	3,5626		3,2814						3,9806		3,5823						4,1918	

	2008						2009						2010					
lnvlntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,24 ***	5,50	-0,45 ***	-8,65	-0,303 ***	-5,71	0,34 ***	9,33	0,12 ***	2,78	-0,53	-11,42	-0,33 ***	-6,51	0,37 ***	9,92	0,24 ***	5,09
TRAT_yr	0,47	0,74					9,35 ***	15,03	7,13	12,07					4,39 ***	5,41	1,94 ***	2,55
tTRAT_yr	1,15	1,44	-0,11	-0,01	1,9431 *	1,75	-1,16	-1,50	-1,49 **	-2,05	-1,97	-0,65	-4,42 **	-2,11	2,01 *	1,93	2,50 ***	2,58
Sector_2	0,67 **	2,36							0,68 **	2,45							0,81 **	2,90
Sector_3	0,64 ***	6,01							0,76 ***	7,32							0,85 ***	8,43
Sector_4	0,69 ***	6,22							0,83 ***	7,61							0,95 ***	8,93
Sector_5	1,08 ***	10,74							1,21 ***	12,35							1,32 ***	13,95
Sector_6	1,24 ***								1,48 ***	14,16							1,71 ***	16,90
Sector_7	-0,04	-0,36							0,04	0,38							0,14	1,33
Staff(log)	0,03	1,15			0,21 ***	3,20			0,06 **	2,38			0,16 ***	2,69			0,05 **	2,11
Univ%	0,01 ***	12,48			0,00	0,02			0,01 ***	14,89			0,00	-0,18			0,01 ***	15,24
Age	-0,28 ***	-11,70							-0,33 ***	-14,38							-0,33 ***	-14,82
GFCF	0,47 ***	40,41							0,52 ***	44,61							0,56 ***	48,63
Turnover(log)	-0,40 ***	-22,20			-1,92 ***	-5,01			-0,47 ***	-26,95			0,28 ***	-6,02			-0,50 ***	-29,04
FinAut	0,00 ***	2,77			0,00	-0,93			0,00 ***	3,30			0,00	0,57			0,00 ***	3,56
Profit	0,00	-0,30			3E-06	0,3			0,00	-0,34			0,00	0,23			0,00	-0,26
_cons	0,83 ***	4,01	0,83 ***	58,55	2,754 ***	5,94	0,65 ***	33,93	1,29 ***	6,42	0,91	67,60	3,89 ***	7,26	0,70 ***	38,39	1,16 ***	5,94
Number of obs	42709		63132		47693		75445		47858		75445		53184		82447		51787	
F	37,42		8,73				217,92		244,95		65,50		11,07		77,52		265,29	
Prob > F	0,0000		0,0000				0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	0,0602						0,0086		0,0757						0,0028		0,0758	
Adj R-squared	0,0598		f.e		f.e		0,0086		0,0754		f.e.		f.e.		0,0028		0,0755	
Root MSE	3,7497						4,4437		3,907						4,5868		4,0115	

	2010						2011						2012					
lnvlntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,48 ***	-10,29	0,23 ***	-4,22	0,47 ***	10,95	0,43 ***	8,15	-0,48 ***	-9,32	-0,32 ***	-5,62	0,65 ***	14,20	0,58 ***	10,08	-0,36 ***	-6,35
TRAT_yr					8,22 ***	8,39	1,97 *	1,98					1,83 *	1,80	1,64 *	1,63		
tTRAT_yr	2,32	0,75	1,39	1,26	-3,51 ***	-2,88	-0,24	-0,20	-3,18	-1,38	-0,71	-0,73	3,80 ***	2,97	2,14 *	1,74	6,33 *	1,94
Sector_2							0,92 ***	3,32							0,98 ***	3,52		
Sector_3							0,98 ***	10,04							1,07 ***	11,09		
Sector_4							1,06 ***	10,22							1,17 ***	11,31		
Sector_5							1,43 ***	15,61							1,54 ***	17,09		
Sector_6							1,91 ***	19,53							2,08 ***	21,49		
Sector_7							0,23 **	2,33							0,41 ***	4,21		
Staff(log)			0,1325 **	2,18			0,05 **	2,08			0,11 *	1,93			0,03	1,32		
Univ%			0,0004	0,18			0,01 ***	16,53			0,00	0,58			0,01 ***	18,12		
Age							-0,34 ***	-15,48							-0,36 ***	-15,91		
GFCF							0,58 ***	50,86							0,61 ***	53,25		
Turnover(log)			-0,263 ***	-5,74			-0,52 ***	-30,73			-0,27 ***	-6,29			-0,55 ***	-32,22		
FinAut			0,0021	0,99			0,00 ***	3,43			0,00	1,22			0,00 ***	3,72		
Profit			5E-07	0,04			0,00	-0,32			0,00	0,12			0,00	-0,21		
_cons	0,91 ***	81,11	3,67	6,96	0,74 ***	43,27	1,19 ***	6,23	0,90 ***	109,72	3,84 ***	7,69	0,79 ***	46,32	1,21 ***	6,31	0,93 ***	116,60
Number of obs	82447		57670		89385		54926		89385		61838		95827		5831		95827	
F	53,14		6,54		79,54		297,94		44,71		9,73		89,58		337,68		21,86	
Prob > F	0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000		0,0000	
R-squared	f.e.		f.e.		0,0027		0,0799						0,0028		0,0848			
Adj R-squared					0,0026		0,0796						0,0028		0,0846			
Root MSE					4,6949		4,0905						4,8898		4,2634			

	2012						2013						2014					
lnvlntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	-0,12	-1,81	1,08 ***	22,99	0,71 ***	12,81	0,02	0,27	0,24 ***	3,58	0,91 ***	19,56	0,47 ***	8,90	-0,01	-0,09	0,14 **	2,23
TRAT_yr			1,76 **	2,01	1,41 *	1,78					0,14 ***	0,11	0,19	0,16				
tTRAT_yr	1,74 *	0,60	-0,10	-0,10	-0,08	-0,09	-0,34	-0,83	-0,51	-1,27	5,07 ***	3,52	2,24	1,58	2,46	0,92	-0,55	-1,25
Sector_2					1,10 ***	3,93							1,11 **	4,04				
Sector_3					1,24 ***	13,07							1,24 ***	13,68				
Sector_4					1,34 ***	13,12							1,34 ***	13,55				
Sector_5					1,74 ***	19,69							1,75 ***	20,62				
Sector_6					2,27 ***	23,86							2,30 ***	25,15				
Sector_7					0,61 ***	6,41							0,68 ***	7,40				
Staff(log)	0,07	1,17			0,04	1,55			0,08	1,35			0,04 **	1,90			0,09	1,55
Univ%	0,00	0,94			0,02 ***	21,02			0,00 *	1,76			0,02 ***	23,35			0,00 **	2,21
Age					-0,37 ***	-16,45							-0,37 ***	-17,08				
GFCF					0,64 ***	56,83							0,65 ***	58,98				
Turnover(log)	-0,28 ***	-6,06			-0,60 ***	-35,04			-0,30 ***	-6,71			-0,60 ***	-36,57			-0,34 ***	-8,00
FinAut	0,00 **	2,11			0,00 ***	5,10			0,01 ***	4,74			0,00 ***	6,07			0,01 ***	5,70
Profit	0,00	-0,37			0,00	-0,10			0,00	-0,03			0,00	-0,22			0,00	-0,07
_cons	3,96 ***	7,48	0,81 ***	47,65	1,20 ***	6,34	0,96 ***	114,97	4,08 ***	7,84	0,88 ***	52,19	1,23 ***	6,67	1,00 ***	129,03	4,55 ***	9,27
Number of obs	65916		103083		62602		103083		70816		110336		66798		110336		75691	
F	6,13		183,37		398,87		0,35		17,24		146,02		428,65		0,43		16,9	
Prob > F	0,0000		0,0000		0,0000		0,7035		0,0000		0,0000		0,0000		0,6508		0,0000	
R-squared			0,0053		0,0925						0,004		0,0931					
Adj R-squared			0,0053		0,0923						0,0039		0,0929					
Root MSE			5,1088		4,4189						5,2163		4,4554					

	2015							
lnvlntta	Coef.	t	Coef.	t	Coef.	t	Coef.	t
t	0,66 ***	13,43	0,23 ***	4,05	0,49 ***	-8,58	-0,33 ***	-5,99
TRAT2006	8,31 ***	7,97	2,08 **	2,17				
tTRAT2006	-1,69	-1,31	0,97	0,82	-2,04	-0,44	-1,98	-0,69
_ICAE_Grupo_2			1,07 ***	3,90				
_ICAE_Grupo_3			1,21 ***	13,45				
_ICAE_Grupo_4			1,32 ***	13,43				
_ICAE_Grupo_5			1,73 ***	20,72				
_ICAE_Grupo_6			2,33 ***	25,82				
_ICAE_Grupo_7			0,55 ***	6,07				
logPessoal			0,06 ***	2,69				
LicEmp			0,02 ***	25,97			0,08	1,57
Idade			-0,41 ***	-18,98			0,00 **	2,65
LogFBCF			0,67 ***	60,51				
logVolNeg			-0,64 ***	-38,47			-0,32 ***	-7,71
AutFin			0,00 ***	5,85			0,01 ***	6,36
RLta			0,00	-0,25			0,00	0,60
_cons	0,96 ***	56,74	1,59 ***	8,68	1,10 ***	157,50	4,35 ***	9,06
Number of obs	11684		70546		116840		80137	
F	110,39		463,42		36,92		17,39	
Prob > F	0,0000		0,0000		0,0000		0,0000	
R-squared	0,0028		0,0951					
Adj R-squared	0,0028		0,0949					
Root MSE	5,4161		4,5936					

GEE Papers

1: Evolução do Comércio Externo Português de Exportação (1995-2004)
João Ferreira do Amaral

2: Nowcasting an Economic Aggregate with Disaggregate Dynamic Factors: An Application to Portuguese GDP
Antonio Morgado | Luis Nunes | Susana Salvado

3: Are the Dynamics of Knowledge-Based Industries Any Different?
Ricardo Mamede | Daniel Mota | Manuel Godinho

4: Competitiveness and convergence in Portugal
Jorge Braga de Macedo

5: Produtividade, Competitividade e Quotas de Exportação
Jorge Santos

6: Export Diversification and Technological Improvement: Recent Trends in the Portuguese Economy
Manuel Cabral

7: Election Results and Opportunistic Policies: An Integrated Approach
Toke Aidt | Francisco Veiga | Linda Veiga

8: Behavioural Determinants of Foreign Direct Investment
Ricardo Pinheiro-Alves

9: Structural Transformation and the role of Foreign Direct Investment in Portugal: a descriptive analysis for the period 1990-2005
Miguel de Freitas | Ricardo Mamede

10: Productive experience and specialization opportunities for Portugal: an empirical assessment
Miguel de Freitas | Susana Salvado | Luis Nunes | Rui Costa Neves

11: The Portuguese Active Labour Market Policy during the period 1998-2003 - A Comprehensive Conditional Difference-In-Differences Application
Alcina Nunes | Paulino Teixeira

12: Fiscal Policy in a Monetary Union: Gains from Changing Institutions
Susana Salvado

13: Coordination and Stabilization Gains of Fiscal Policy in a Monetary Union
Susana Salvado

14: The Relevance of Productive Experience in the Process of Economic Growth: an Empirical Study
Diana Vieira

15: Employment and Exchange rates: the Role of Openness and Technology
Fernando Alexandre | Pedro Bação | João Cerejeira | Miguel Portela

16: Aggregate and sector-specific exchange rate indexes for the Portuguese economy
Fernando Alexandre | Pedro Bação | João Cerejeira | Miguel Portela

17: The Macroeconomic Determinants of Cross Border Mergers and Acquisitions and Greenfield Investments
Paula Neto | Antonio Brandao | António Cerqueira

18: Does the location of manufacturing determine service sectors' location choices? Evidence from Portugal
Nuno Crespo | Maria Paula Fontoura

19: A hipótese do Investment Development Path: Uma Abordagem por Dados em Painel. Os casos de Portugal e Espanha
Miguel Fonseca | António Mendonça | José Passos

20: Outward FDI Effects on the Portuguese Trade Balance, 1996-2007
Miguel Fonseca | António Mendonça | José Passos

21: Sectoral and regional impacts of the European Carbon Market in Portugal
Margarita Robaina Alves | Miguel Rodriguez | Catarina Roseta-Palma

22: Business Demography Dynamics in Portugal: A Non-Parametric Survival Analysis
Alcina Nunes | Elsa Sarmento

23: Business Demography Dynamics in Portugal: A Semi-parametric Survival Analysis
Alcina Nunes | Elsa Sarmento

24: Digging Out the PPP Hypothesis: an Integrated Empirical Coverage
Miguel de Carvalho | Paulo Júlio

25: Regulação de Mercados por Licenciamento
Patrícia Cerqueira | Ricardo Pinheiro Alves

26: Which Portuguese Manufacturing Firms Learn by Exporting?
Armando Silva | Óscar Afonso | Ana Paula Africano

27: Building Bridges: Heterogeneous Jurisdictions, Endogenous Spillovers, and the Benefits of Decentralization
Paulo Júlio | Susana Peralta

28: Análise comparativa de sobrevivência empresarial: o caso da região Norte de Portugal
Elsa Sarmento | Alcina Nunes

29: Business creation in Portugal: Comparison between the World Bank data and Quadros de Pessoal
Elsa Sarmento | Alcina Nunes

30: The Ease of Doing Business Index as a tool for Investment location decisions
João Zambujal Oliveira | Ricardo Pinheiro Alves

31: The Politics of Growth: Can Lobbying Raise Growth and Welfare?
Paulo Júlio

32: The choice of transport technology in the presence of exports and FDI
José Pedro Ponte | Armando Garcia Pires

33: Tax Competition in an Expanding European Union
Ronald Davies | Johannes Voget

34: The usefulness of State trade missions for the internationalization of firms: an econometric analysis
Ana Paula Africano | Aurora Teixeira | André Caiado

35: The role of subsidies for exports: Evidence from Portuguese manufacturing firms
Armando Silva

36: Criação de empresas em Portugal e Espanha: análise comparativa com base nos dados do Banco Mundial
Elsa Sarmento | Alcina Nunes

37: Economic performance and international trade engagement: the case of Portuguese manufacturing firms
Armando Silva | Oscar Afonso | Ana Paula Africano

38: The importance of Intermediaries organizations in international R&D cooperation: an empirical multivariate study across Europe
Aurora Teixeira | Margarida Catarino

39: Financial constraints, exports and monetary integration - Financial constraints and exports: An analysis of Portuguese firms during the European monetary integration
Filipe Silva | Carlos Carreira

40: FDI and institutional reform in Portugal
Paulo Júlio | Ricardo Pinheiro-Alves | José Tavares

41: Evaluating the forecast quality of GDP components
Paulo Júlio | Pedro Esperança | João C. Fonseca

42: Assessing the Endogeneity of OCA conditions in EMU
Carlos Vieira | Isabel Vieira

43: Labor Adjustment Dynamics: An Application of System GMM
Pedro Esperança

44: Corporate taxes and the location of FDI in Europe using firm-level data
Tomás Silva | Sergio Lagoa

45: Public Debt Stabilization: Redistributive Delays versus Preemptive Anticipations
Paulo Júlio

46: Organizational Characteristics and Performance of Export Promotion Agencies: Portugal and Ireland compared
Inês Ferreira | Aurora Teixeira

47: Evaluating the forecast quality of GDP components: An application to G7
Paulo Júlio | Pedro Esperança

48: The influence of Doing Business' institutional variables in Foreign Direct Investment
Andreia Olival

49: Regional and Sectoral Foreign Direct Investment in Portugal since Joining the EU: A Dynamic Portrait
Irina Melo | Alexandra Lopes

50: Institutions and Firm Formation: an Empirical Analysis of Portuguese Municipalities
Simão Arouca

51: Youth Unemployment in Southern Europe
João Leão | Guida Nogueira

52: Financiamento da Economia Portuguesa: um Obstáculo ao Crescimento?
João Leão | Ana Martins | João Gonçalves

53: O Acordo de Parceria Transatlântica entre a UE e os EUA constitui uma ameaça ou uma oportunidade para a Economia Portuguesa?
João Leão | Guida Nogueira

54: Prescription Patterns of Pharmaceuticals
Ana Gonçalves

55: Economic Growth and the High Skilled: the Role of Scale Eects and of Barriers to Entry into the High Tech
Pedro Gil | Oscar Afonso | Paulo Brito

56: Finanças Públicas Portuguesas Sustentáveis no Estado Novo (1933-1974)?
Ricardo Ferraz

57: What Determines Firm-level Export Capacity? Evidence from Portuguese firms
Ana Gouveia | Ana Luisa Correia

58: The effect of developing countries' competition on regional labour markets in Portugal
Tiago Pereira

59: Fiscal Multipliers in the 21st century
Pedro Brinca | Hans Holter | Per Krusell | Laurence Malafry

60: Reallocation of Resources between Tradable and Non-Tradable Sectors in Portugal: Developing a new Identification Strategy for the Tradable Sector
Ana Fontoura Gouveia | Filipa Canas

61: Is the ECB unconventional monetary policy effective?
Inês Pereira

62: The Determinants of TFP Growth in the Portuguese Manufacturing Sector
Daniel Gonçalves | Ana Martins

63: Practical contribution for the assessment and monitoring of product market competition in the Portuguese Economy – estimation of price cost margins
Luis Folque

64: The impact of structural reforms of the judicial system: a survey
Ana Gouveia | Silvia Santos | Corinna Herber

65: The short-term impact of structural reforms on productivity growth: beyond direct effects
Ana Gouveia | Silvia Santos | Inês Gonçalves

66: Assessing the Competitiveness of the Portuguese Footwear Sector
Fábio Batista | José Matos | Miguel Matos

67: The empirics of agglomeration economies: the link with productivity
Ana Gouveia | Silvia Santos | Marli Fernandes

68: Determinants of the Portuguese GDP stagnation during the 2001-2014 period: an empirical investigation
Carlos Figueira

69: Short-run effects of product markets' deregulation: a more productive, more efficient and more resilient economy?
Ana Gouveia | Silvia Santos | Gustavo Monteiro

70: Portugal: a Paradox in Productivity
Ricardo Pinheiro Alves

71: Infrastructure Investment, Labor Productivity, and International Competitiveness: The Case of Portugal
Alfredo Pereira | Rui Pereira

72: Boom, Slump, Sudden stops, Recovery, and Policy Options. Portugal and the Euro
Olivier Blanchard | Pedro Portugal

73: Case Study: DBRS Sovereign Rating of Portugal. Analysis of Rating Methodology and Rating Decisions
Annika Luisa Hofmann | Miguel Ferreira | João Lampreia

74: For Whom the Bell Tolls: Road Safety Effects of Tolls on Uncongested SCUT Highways in Portugal
Alfredo Pereira | Rui Pereira | João Pereira dos Santos

75: Is All Infrastructure Investment Created Equal? The Case of Portugal
Alfredo Pereira | Rui Pereira

76: Why Virtuous Supply-Side Effects and Irrelevant Keynesian Effects are not Foregone Conclusions: What we Learn from an Industry-Level Analysis of Infrastructure Investments in Portugal
Alfredo Pereira | Rui Pereira

77: The Role of Gravity Models in Estimating the Economic Impact of Brexit
Graham Gudgin | Ken Coutts | Neil Gibson | Jordan Buchanan

78: Infrastructure Investment in Portugal and the Traded/Non-Traded Industry Mix
Alfredo Pereira | Rui Pereira

79: Goods and Factor Market Integration: A Quantitative Assessment of the EU Enlargement
Lorenzo Caliendo | Fernando Parro | Luca David Opromolla | Alessandro Sforza

80: Understanding productivity dynamics:a task taxonomy approach
Tiago Fonseca | Francisco Lima | Sonia C. Pereira

81: On the Effects of Infrastructure Investments on Industrial CO2 Emissions in Portugal
Alfredo Pereira | Rui Pereira

82: Assessing Competition With the Panzar-Rosse Model: An empirical analysis of European Union banking industry
Suzana Cristina Silva Andrade

83: Health Care Investments and Economic Performance in Portugal: An Industry Level Analysis
Alfredo Pereira | Rui Pereira | Pedro G. Rodrigues

84: Is deregulation of product and labour markets promoting employment and productivity? A difference-in-differences approach
Hugo Correia | Ana Fontoura Gouveia

85: Foreign acquisition and internal organization
Paulo Bastos | Natália P. Monteiro | Odd Rune Straume

86: Learning, Prices, and Firm Dynamics
Paulo Bastos | Daniel A. Dias | Olga A. Timoshenko

87: The Diffusion of Knowledge via Managers' Mobility
Giordano Mion | Luca David Opromolla | Alessandro Sforza

88: Empresas Zombie em Portugal - Os sectores não transacionáveis da Construção e dos Serviços
Gabriel Osório de Barros | Filipe Bento Caires | Dora Xarepe Pereira

89: Collective bargaining through the magnifying glass: A comparison between the Netherlands and Portugal
Alexander Hijzen | Pedro Martins | Jante Parlevliet

90: A Lower VAT Rate on Electricity in Portugal: Towards a Cleaner Environment, Better Economic Performance, and Less Inequality
Alfredo Pereira | Rui Manuel Pereira

91: Who Seeks Re-Election: Local Fiscal Restraints and Political Selection
Susana Peralta | João Pereira dos Santos

92: Assessing the Competitiveness of the Metalworking Sector
João Marinho | Pedro Carvalho

93: The efficiency of Portuguese Technology Transfer Offices and the importance of university characteristics
Aurora Teixeira | André Monteiro

94: Persistence in innovation and innovative behavior in unstable environments
Joana Costa | Anabela Botelho | Aurora Teixeira

95: The effect of entrepreneurial origin on firms' performance - The case of Portuguese academic spinoffs
Natália Barbosa | Ana Paula Faria

96: Absorptive Capacity and Firms' Generation of Innovation - Revisiting Zahra and George's Model
Dina Pereira | João Leitão

97: Innovations in digital government as business facilitators: implications for Portugal
João Martins | Linda Veiga

98: Innovation and the economic downturn: Insights from Portuguese firms
Hugo Pinto | Tiago Santos Pereira | Elvira Uyarra

99: European Funds and Firm Dynamics: Estimating Spillovers from Increased Access
João Pereira dos Santos | José Tavares

100: Corporate Leverage and Investment in Portugal
Ana Martins | José Henrique Gonçalves | João Mário Ferreira Duque

101: The effects of official and unofficial information on tax compliance
Filomena Garcia | Luca David Opromolla | Andrea Vezzulli | Rafael Marques

102: Competition effect on innovation and productivity - The Portuguese case
Anabela Santos | Michele Cincera | Paulo Neto | Maria Manuel Serrano

103: Measuring the Welfare of Intermediation in Vertical Markets
Javier D. Donna | Pedro Pereira | Tiago Pires | Andre Trindade

104: Of course Collusion Should be Prosecuted. But Maybe... Or (The case for international antitrust agreements)
Filomena Garcia | Jose Manuel Paz y Miñõ | Gustavo Torrens

105: Product market competition and gender discrimination
Dudley Cooke | Ana P. Fernandes | Priscila Ferreira

106: Integration of Small Technology-Based Firms in Aeronautics
Anabela Reis | Joana Mendonça | Ligia Urbina

107: The Effects of Highway Tolls on Private Business Activity – Results from a Natural Experiment
João Pereira dos Santos | David B. Audretsch | Dirk Dohse

108: Competition and Firm Productivity: Evidence from Portugal
Pedro Carvalho

109: Do Exchange Traded Funds (ETFs) Outperform the Market? Evidence from the Portuguese Stock Index
Carlos Manuel Pinheiro | Hugo Hilário Varela

110: Assessing the Competitiveness of the Portuguese Chemical Sector
Ana Rita Marques | Cátia Silva

111: A General Equilibrium Theory of Occupational Choice under Optimistic Beliefs about Entrepreneurial Ability
Michele Dell'Era | Luca David Opromolla | Luis Santos-Pinto

112: O Mercado Segurador em Portugal: O Papel dos Gestores na Constituição de Provisões
Soraia de Sousa Bornett | Carlos Manuel Pinheiro

113: Exploring the implications of di erent loan-to-value macroprudential policy designs
Rita Basto | Sandra Gomes | Diana Lima

114: The Determinants of TFP Growth in the Portuguese Service Sector
Ana Martins | Tiago Domingues | Catarina Branco

115: Agglomeration and Industry Spillover Effects in the Aftermath of a Credit Shock
José Jorge | Joana Rocha

116: Entrepreneurial Human Capital and Firm Dynamics
Francisco Queiró

117: Global Value Chains and Vertical Specialization: The case of Portuguese Textiles and Shoes exports
Tiago Domingues

118: Firm heterogeneity and exports in Portugal: Identifying export potential
Frederico Oliveira Torres

119: Vantagens Comparativas Reveladas e suas determinantes: Uma Aplicação à Economia Portuguesa
Guida Nogueira | António Portugal Duarte

120: A Look at the main channels of Potential Impact of Brexit on the Portuguese Economy
Guida Nogueira | Paulo Inácio

121: How internationalization and competitiveness contribute to get public support to innovation? The Portuguese case
Anabela Santos, Michele Cincera, Paulo Neto | Maria Manuel Serrano

122: Grande Guerra e Guerra Colonial: Quanto Custaram aos Cofres Portugueses?
Ricardo Ferraz

123: Financing a Renewable Energy Feed-in Tariff with a Tax on Carbon Dioxide Emissions: A Dynamic Multi-Sector General Equilibrium Analysis for Portugal
Rui M. Pereira | Alfredo M. Pereira

124: Brown Sugar, how come you taste so good? The impact of a soda tax on prices and consumption
Judite Gonçalves | João Pereira dos Santos

125: ARFIMA Reference Forecasts for Worldwide CO2 Emissions and the National Dimension of the Policy Efforts to Meet IPCC Targets
José Beirute | Alfredo M. Pereira

126: Reference Forecasts for CO2 Emissions from Fossil-Fuel Combustion and Cement Production in Portugal
José M. Belbute | Alfredo M. Pereira

127: Regulated Early Closures of Coal-Fired Power Plants and Tougher Energy Taxation on Electricity Production: Synergy or Rivalry?
Alfredo Marvão Pereira | Rui Manuel Pereira

128: Picking Our Environmental Battles: Removal of Harmful Subsidies or Carbon Taxation?
Alfredo Marvão Pereira | Rui Marvão Pereira

129: Financing Future Feed-in Tariffs from Currently Installed RES-E Generating Capacity
Alfredo Marvão Pereira | Rui Marvão Pereira

130: Foreign Direct Investment, Income Inequality and Poverty in Portugal, 1973-2014: What does cointegration analysis tell us?
Aurora Teixeira | Ana Sofia Loureiro

131: On the Spillover Effects of CO2 Taxation on the Emissions of other Air Pollutants
Alfredo Marvão Pereira | Rui Marvão Pereira

132: On the Macroeconomic and Distributional Effects of the Regulated Closure of Coal-Operated Power Plants
Alfredo Marvão Pereira | Rui Manuel Pereira

133: The China Shock and Employment in Portuguese Firms
Lee Branstetter | Brian Kovak | Jacqueline Mauro | Ana Venâncio

134: Energy Taxation Reform with an Environmental Focus
Alfredo Marvão Pereira | Rui Manuel Pereira

135: ARFIMA Reference Forecasts for Worldwide CO2 Emissions and the Need for Large and Frontloaded Decarbonization Policies
José M. Belbute | Alfredo M. Pereira

136: Exporter Firms Behaviour, Evidence From Portuguese Firms Using Microdata
Luís Pedro Manso Machado

137: Collateral Value and Entrepreneurship: Evidence from a Property Tax Reform
Miguel Ferreira | João Pereira dos Santos | Ana Venâncio

138: The Financial Channels of Labor Rigidities: Evidence from Portugal
Edoardo M. Acabbi | Ettore Panetti | Alessandro Sforza

139: Can a small leak sink a great ship? A comprehensive analysis of the Portuguese household savings
Tiago Domingues | Margarida Castro Rego

140: Corporate taxes and high-quality entrepreneurship: evidence from a tax reform
Ana Venâncio | Victor Barros | Clara Raposo

141: Built Like a House of Cards? - Corporate Indebtedness and Productivity Growth in the Portuguese Construction Sector1
José Santos | Nuno Tavares | Gabriel Osório de Barros

142: Effectiveness of Simplex: The Case of Portuguese Social Security
António Alberto Nifrário de Pinho Tavares

143: Digital innovation in higher education: A questionnaire to Portuguese universities and polytechnic institutes
Paulo Nuno Vicente |Margarida Lucas | Vânia Carlos

144: Portugal in the Global Innovation Index: A panel data analysis
Marcelo P. Duarte | Fernando M. P. O. Carvalho

145: Intangible investments and productivity performance
Michele Cincera | Julie Delanote | Pierre Mohnen | Anabela Santos | Christoph Weiss

146: Digitalization in Two-sided Platform Competition
Filomena Garcia | Muxin Li

147: Collusion between two-sided platforms
Joana Pinho | Yassine Lefouili

148: Da confluência entre Big Data e Direito da Concorrência: As concentrações digitais - O caso Facebook/WhatsApp
Ana Rodrigues Bidarra

149: The Determinants of Total Factor Productivity in the Portuguese Quaternary Sector
Paulo Matos | Pedro Neves

150: Os modelos Input-Output, a estrutura setorial das economias e o impacto da crise da COVID 19
Pedro N. Ramos | João Ferreira | Luís Cruz | Eduardo Barata

151: Public Expenditure and private firm performance: using religious denominations for causal inference
Henrique Alpalhão | Marta Lopes | João Santos| José Tavares

152: Employee Training and Firm Performance: Quasi-experimental evidence from the European Social Fund
Pedro S. Martins

153: Dream Jobs
Luca David Opromolla | Giordano Mion | Gianmarco I.P. Ottaviano

154: Minimum wage and financially distressed firms: another one bites the dust
F. Alexandre | P. Bação | J. Cerejeira | H. Costa | M. Portela

155: Do short-term rentals increase housing prices? Quasi-experimental evidence from Lisbon
Duarte Gonçalves | Susana Peralta | João Pereira dos Santos

156: Economic and social policies under EMU
Ricardo Pinheiro Alves

157: International Sourcing in Portuguese Companies: Evidence from Portuguese Micro Data
Ana Martins | Guida Nogueira | Eva Pereira

158: The Impact of R&D tax incentives in Portugal
Rita Bessone Basto | Ana Martins | Guida Nogueira

Gabinete de Estratégia e Estudos