

Are tax credits effective in developing countries? The recent Uruguayan experience^{*}

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Abstract

Investment promotion through tax incentives has been a key component of the growth strategies pursued in Uruguay by the last three administrations. A new regime was established, regulated by the Executive Decree 455, which caused the main channel for subsidizing investment to undergo a major overhaul. This regime immediately generated a battery of researchable questions about its effectiveness and efficiency. Using a big dataset, first put together for this study from firm-level administrative records kept by the tax collection and pensions institutes between 2005 and 2011, we test the hypotheses of significant and positive effects of obtaining a tax credit through the new regime on investment and employment outcomes. A matched differences-in-differences strategy confirms that the promotion regime introduced in 2008 had a statistically significant effect on the firms' rate of investment (around 11%); while effects on employment growth rate are more ambiguous. These findings are buttressed by several robustness tests. Further probing uncovers heterogeneity along the promotion timeline, with the greatest effect on the rate of investment occurring in the projects' first year.

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1. Introduction

Microeconomic evidence has tended to find that tax incentives do influence the investment decisions of firms (Agostini and Jorratt, 2013). Yet, the evidence cannot be considered conclusive; at least not in every dimension. First, it comes disproportionately from rich developed economies so we have only a very imprecise idea of how taxation affects investment in developing economies. Second, the scarce studies available on low and middle income countries tend to have partial coverage of the economy (by industries, geographic units, etc.). And, third, the bulk of the research on tax incentives focuses on policies mainly designed to attract *foreign* investments, which present an important but specific set of challenges vis-a-vis investments in general. These limitations are regrettable but are not necessarily the most serious. In fact, there is a greater paucity of studies based on research designs capable of sustaining credible *causal* inference.

Understanding the effects of tax incentives is key to all countries but crucial to emerging and developing ones. First, it is estimated that developing countries could be spending as much as \$139 billion per year in exemptions from corporate income taxes, much of it intended or justified as stimulus for investments, and a big share going to foreign companies (Action Aid, 2013). Second, large or small, tax incentives usually involve reallocation of resources that raises concerns about effectiveness, efficiency and fairness. In fact, if government subsidies cannot be linked to *additional* investments by the companies (that is, to projects that would have not gone forward without the public support), the public may become legitimately skeptic about the ethics of giving something for nothing.

It is not an exaggeration to say that Uruguay has suffered from chronic under-investment for about half a century. In Economics, tax incentives find their strongest justification as responses to market failures that make the social value of certain investments diverge from their private value. Private investment may be lower than socially desirable when, for example, there are positive spillovers from some firms' enlarged capital stock (or from the level of activity that comes with it). Yet, an extended investment deficit such as the one portrayed above would evoke other kinds of more massive coordination failures that can also justify policy interventions in a more Keynesian style. In fact, under-investment may

be the “bad outcome” of a coordination game where every investment project (or a sufficient number of them) needs a minimum of aggregate demand to be profitable, and the whole economy could be driven to good or bad outcomes depending on the existence and proper use of a switching factor (e.g., a positive fiscal shock, or a major public investment) that derives its importance from its power to align expectations.

Investment promotion through tax incentives has been a feature of industrial policies in Uruguay for a long time, and it has remained so in the last decade. Particularly, the left-wing administration that took office in 2005 sought to achieve several goals through a redesigned promotion scheme defined in detail by Executive Decree 455/007 (ED-455). The ED-455 translated to specific the general rules established in Law 16.906 of 1998 (“Investment Law”).

Within this legal framework, several important innovations were introduced with respect to recent past experience. First, the eligibility conditions and benefits were extended to all economic sectors, generating a major expansion of its scope since the previous regime was only available to the agriculture and industrial economic sectors. Second, the new regime allowed firms of varied legal status and size to enjoy the benefits, and especial measures were taken to ease the access of small and medium firms. Third, the regime of 2007 linked the size of the subsidies to projects’ contributions to the attainment of several pre-specified development objectives.

The resulting investment regime sought to influence some key economic variables, in forms that reflect the urgency to consolidate the incipient recovery from the devastating macroeconomic crisis of 2001-02. In particular, the generation of new jobs and growth of exports were explicit top priorities, while geographic decentralization, national value added, investments in R&D, and the introduction of clean production technologies were second order criteria that would nonetheless give opportunities to investors to increase the size of the earned benefits.¹

A complex public policy innovation such as the one associated with ED-455 always

¹All these objectives were maintained in the revision to the regime that took place in 2011, which mainly “raised the bar” for investors in terms of the size of development gains that were required for each unit of tax incentives claimed.

prompts questions about its effectiveness, efficiency and unintended effects. Those questions have been in the public domain since the regime was established, but the institutional coordination required to put together large databases from administrative records, and the political commitment to evaluating the policies, were not fully aligned until 2011.

Existing evaluations of the Uruguayan tax incentives regime are scarce and their results, though generally favorable, do not completely account for identification issues arising from the non-random assignment of firms into promotion. There are two previous studies that sought to assess the effects of the ED-455 regime. The first was carried out by Gervaz, Goday and Traiman (2011) and showed a positive effect of the regime on investment, exports and employment. However, the authors use aggregate data and cannot rule out the presence of unobservable confounders. The second study, by Artana and Templado (2012), is based on firms' microdata from tax collection records, with a sample that includes beneficiary and non-beneficiary firms before and after the ED-455. They find positive effects on investment. However, because of data constraints, they could not control for a common factor that would possibly affect both the probability of being a beneficiary and the level of investment.

This article tackles the three most basic questions from a policy point of view: (i) Does the new regime succeed in raising the investment rate of firms that receive the subsidy? (ii) Does the new regime have a positive and significant effect on employment levels of subsidized firms? and (iii) Are these positive outcomes achieved efficiently? Specifically, we perform a *matched difference in differences* estimation on a common support of firms. The common support is obtained through the propensity score estimator on a set of observable characteristics and trends of outcome variables before the implementation of the policy. We used the Hirano, Imbens and Ridder (2003) approach by weighting units in the control group according to the propensity score.

As mentioned, the growth of employment and exports were two key objectives for the program, almost at par with investment. We sought to evaluate both but the available data prevented us from looking at the effects on exports wearing the same methodological glasses used for investment and employment; the article includes then only a complete

evaluation of investment and employment effects of the tax regime.

The main empirical result is the outcome of the differences in differences regression, designed to compare firms that obtained the tax credit from the ED-455 (treatment) against a control group of firms that did not. To the best of our knowledge, this is the first article based on a nation-wide dataset of all the firms eligible to apply to the scheme, with enough prior and subsequent yearly observations usable for the evaluation. For this purpose, a panel database of taxpayers' firms in Uruguay based on the National Tax Agency and the Social Security administrative records with information before and after the implementation of the policy (2005 - 2011) was constructed. According to the results, ED-455 seems to be effective in the accomplishment of the main objective, i.e., positive effects on the investment rate. This result is robust to different specifications and differs by economic sectors. Furthermore, from exploring the heterogeneity of the potential effects (considering time and size dimensions) some policy implications may arise. First, the ED-455 has positive effects mainly in the first year after the project is "promoted". Second, the effect on the investment rate varies depending on the number of promoted investment projects and on their intensity (measured through the size of the project). On the other hand, the effect on the employment growth rate is positive but not robust to all specifications.

The rest of the article is organized as follows. In the next section, some of the more relevant features of the literature of tax incentives are reviewed. Following this presentation, in section 3 the investment promotion system and the subsequent changes introduced by the ED-455 are described. Section 4 develops the empirical strategy and explains the main characteristics of the database used in the estimations, which are presented in Section 5. Finally, Section 6 concludes.

2. Tax incentives: Foundations and applicability

About a decade ago, an international literature review (Zee, Stotsky and Ley, 2002) reported the extended use of fiscal subsidies to stimulate investment, opening the essay with a quote from Sir Nicholas Kaldor, who had observed the pattern a few decades earlier.

Since early times, those policies have been controversial. On one side of the equation, a national or sub-national government may feel that it is their duty to appeal to investors, to bring projects to shores that may not have been considered, had it not been for the tax incentives. On the other hand, even the best designed programs have leakage and information asymmetries that may prevent policymakers from seeing the redundancy and inefficiencies (on occasions, sheer corruption) surrounding the schemes. Within the expert community, benefits and costs are confronted, still inconclusively.

As a working definition, fiscal incentives are reductions of the tax burden, to stimulate certain firms and projects the government wants to promote (adapted from Zee et al., 2002 p. 1498). The definition makes clear that incentives represent a positive discrimination towards desirable investments. However, as long as the benefits are available to a broad set of firms regardless of industry or other characteristics, the policy can be classified as “horizontal”, in the language of recent industrial policy (e.g., Hausmann, Rodrik, and Velasco, 2005), and it does not entail picking winners. Far from assuming that it is not relevant, to the extent that additions to the capital stock are the mechanism through which many technological innovations take place, a fiscal incentives regime is a potentially valuable tool in the industrial policy toolbox.

From an economic point of view, tax incentives can be justified in more than one way. Incentives can be justified (i) to respond to some of the forms of market failure, or (ii) as the need to choose the best available policy in a second best world. The existence of externalities, public goods, liquidity constraints, and coordination failures may determine that the free market policy carries out inefficient underinvestment, and therefore provides a rationale for subsidizing investment.

The economic justification for tax incentives becomes more questionable when it is based on the objective of leveling the playing field, or using tax policy to try to compensate for other distorting but hard-to-avoid policies. The existence of justified deviations from tax neutrality does not mean that they have to be used. Once a market failure is identified, the analysis should demonstrate that a tax benefit would fix or mitigate the problem that caused it in the first place. In other words, the policy must be effective.

Agostini and Jorratt (2013) provide a careful and timely review of the recent international experience and literature. For the purposes of the present study, it is worth highlighting that:

(i) There is a variety of tax incentives to promote investment, with varying strengths and weaknesses. Roughly, there is a tradeoff between administrative simplicity and effective targeting. Investment credits—the mechanism that resembles the most Uruguay’s investment promotion regime—are somewhere between the extremes of administration costs and economic efficiency.

(ii) While developed countries (OECD members) use mainly subsidized credit, accelerated depreciation, investment-oriented tax credits, and the reduction in local taxes, developing countries rely more often on tax exemptions for imports of capital goods, tax holidays, and tax credits.

(iii) The effectiveness of investment promotion regimes has been assessed with different empirical strategies. Broadly speaking, estimations tend to converge on an average investment elasticity to tax rate of 0.6; in other words, a 10% reduction in the tax rate on corporate benefits yields additions of 6% to the capital stock. It is noteworthy that the majority of available studies reflect the circumstances of developed economies. The few available studies for developing countries show similar results but there are not enough studies to assume that it is a robust empirical regularity.

(iv) The effects of the policy vary widely between the short and the long run. The duration of the incentive, its design (i.e., whether it promotes longer term investments) and the supply of capital goods, are determinants of the impacts that can be observed over different time horizons.

(v) The evidence seems to confirm that incentives to promote geographic decentralization and employment dynamism in depressed regions tend to result in re-localization of some firms, without substantial net additions of economic activity to the whole country.

Among the mechanisms to deliver the tax incentive, investment tax credits are among the most widely used in different contexts. They consist in authorizing the deduction of a

percentage of investments in capital goods directly from the tax bill. The advantages over other regimes include the fact that it is delivered only once the investment has occurred, and the support to projects can be varied according to policy priorities. Tax holidays, on the contrary, tend to benefit mostly big investments that normally are among the most profitable, and therefore the most likely to have occurred regardless the incentives. Compared to deductions for investments, that authorize to expense a fraction greater than the regular depreciation, tax credits for investments are not biased towards shorter duration investments. Accelerated depreciation, in turn, has mainly a financing effect, while it has targeting advantages and is less prone to abuses.

3. Policy description

The Executive Decree 455/007 approved in December 2007 is a regulatory act of the so called “Investment Law” of 1998. This law declared of national interest the promotion and protection of investments made by domestic and foreign investors in the country, and its aim was not only to attract foreign investment but also increase reinvestment by domestic firms. The 1998 regulation of the investment law established manufacturing, mining and agricultural firms as potential beneficiaries. Promoted investment included machinery and equipment directly affected to production, equipment for electronic data processing, industrial and agricultural fixed investment, certain intangible assets and investment incorporating technological innovation.² The established benefits were the exemption from the net wealth tax by the presence of promoted goods, value-added tax (VAT) and excise tax exemptions on imported goods that are part of promoted investment and the VAT rebates on domestic purchases of these goods. The law also empowered the government to grant an accelerated depreciation regime for promoted investment, which has mainly a financing effect and affects corporate income tax payments.³ The Application Commission

² Articles 6 and 7, Law 16.906

³ Articles 8 and 9, Law 16.906

(COMAP for the Spanish acronym) was created as advisor to the Ministry of Finance for implementing the promotion scheme.⁴

The ED-455 of December 2007 regulated with innovations the 1998 Investment Law. The specific objectives explicitly prioritized were to increase investment, employment and exports, and on a second level contribute to economic decentralization, promote investment in less developed areas, encourage the use of clean technologies, promote investment in R+D+i and contribute to Gross Domestic Product (GDP) growth and the generation of domestic value added.

Several innovations were introduced with respect to the previous regime. First, the eligibility conditions and benefits were extended to all economic sectors, generating a major expansion of its scope. Second, the new regime allowed firms of varied legal status and size to enjoy the benefits, and special measures were taken to ease the access of small and medium firms. Third, the size of the tax credit was linked to the projects' contributions to the attainment of the previously mentioned objectives. Fourth, the tax incentive was modified, the main benefit now being reductions in the corporate income tax (IRAE, for the Spanish acronym). Fifth, the concept of "promotable investment" was broadly expanded, including all investment directly linked to the firms' activity.

In order to apply for the tax benefits, firms must submit an investment project to the COMAP, along with an engagement letter in which the applicant agrees to comply with the conditions that lead to the granting of the benefits. The COMAP then evaluates the project in coordination with the relevant ministries. If the project gets the promotion, the beneficiary firm must annually submit to the COMAP its balance sheets and any additional required information for the analysis of compliance with the goals that justify the received benefits. In case of failure to meet the targets, the COMAP can impose the revocation of the granted benefits. Two key features of the *investment credit* make it appealing as a mechanism to reduce the cost of capital and expand genuine investments: first, the State reduces the income tax bill by an amount that is known and has a known phase out from the

⁴ The COMAP is currently integrated by delegates of the Ministries of Finance, Agriculture, Industry; Work and Social Security, Tourism and the Office of Planning and Budgeting.

beginning; and, second, the State only incurs in a loss (forsaken taxes) if the firms actually generate rents, since otherwise there will be no rent nor IRAE to collect.

Projects are classified by size into six groups, from projects of less than 4 hundred thousand dollars investment amount ("small" projects) to those that anticipate more than 8.13 hundred million dollars of investment. For each group, there are different maximum percentage exemptions of the corporate income tax, and different deadlines for the implementation of the investment and the application of the benefit. Each group has also a specific evaluation matrix with explicit weights and scores for each objective or goal.

The amount of the exemption on the corporate income tax is established as a percentage of actual investment by the firm. The total exemption can range from 60% of investment in the case of "small" projects, gradually rising to a maximum of 100% of investment for the largest projects (see Table 1).

Table 1. Maximum exemption rates of corporate income tax and maximum period for the benefit, by group. ED-455.

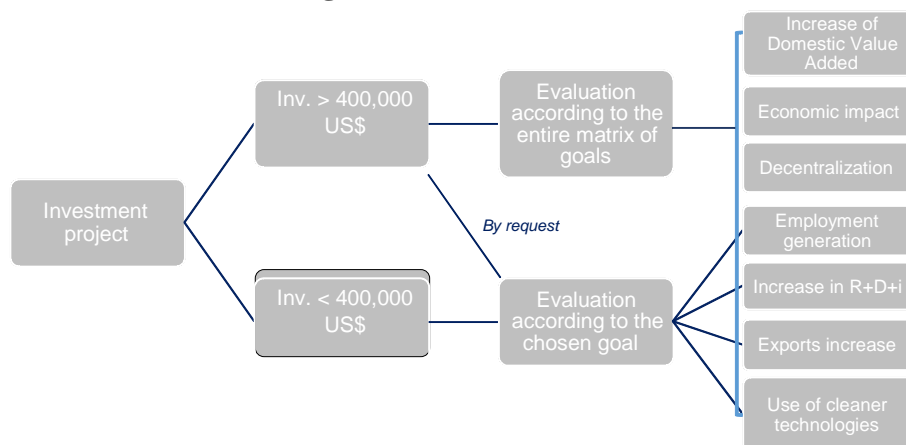
Groups	Investment (in US\$)	Maximum percentage of exemption of corporate income tax	Maximum Period (in years)
Small	Inv. <400,000	51% - 60 %	3 to 5
Medium - 1	400,000 ≤ Inv. < 1,626,345	70%	15
Medium - 2	1,625,345 ≤ Inv. <8,131,725	80%	20
Large – 1	8,131,725 ≤ Inv. <16,623,480	90%	25
Large – 2	16,623,480 ≤ Inv. < 58,083,750	90%	25
Large – 3	58,083,750 ≤ Inv. <813,172,495	100%	25
Very Large	Inv. ≥ 813,172,495	100%	25

Source: Private sector supporting agency (UNASEP, for the Spanish acronym)

Note: investment amounts are in US Dollars of 2011.

The effective rate of exemption on the corporate income tax is determined by an explicit rule that links the maximum potential exemption (second column, in %, Table 1) with the score of the project arising from the evaluation matrix. A simplified regime for small projects was established; these being evaluated by a single goal, selected by the firm (see Figure 1). Medium and large projects are evaluated through the entire matrix of goals, although they can request to be evaluated for one. In that case, the maximum exemption is of 60% of investment, the same as small projects.

Figure 1: Evaluation criteria



The period in which tax exemptions can be applied can range from five years for small projects to up to 25 years for larger projects. The period runs from the first year in which a positive taxable corporate income is generated by the firm. A decreasing maximum application rate for tax exemption was established. The firm can deduct up to 90% of corporate income tax for the first half of the period for which the project was promoted, 80% for subsequent years corresponding to 10% of the period, 60% for the next 10%, 40%, 20% and 10% by the end of the promotion period. For example, in the case of a project promoted with a term of 10 years, during the first five years the firm could bring down the corporate income tax by 90%, 80% in year 6, 60% in year 7, 40% in year 8, 20% in year 9 and 10% in the last year of promotion.

The investment promotion regime regulated by ED- 455 coexists with another tax incentive mechanism, the Exemption for Investment dating back to 1987.⁵ This scheme establishes a 40% rebate on the purchase of capital goods such as machinery, industrial and agricultural facilities and equipment for data processing. The regime also includes investments made by hotels and entertainment services. The rebate is set at 20% for construction and expansion of buildings for industrial activities or hotels. Since 2006, more items were added to the list of goods that can get the rebate, and the expiration date of the rebate was extended to two

⁵Article 447, Law 15.903, November 1987.

years. The Exemption for Investment has been in force since 1987, without entering into conflict with the ED- 455 that had been established twenty years early.

One main difference between both mechanisms is that the ED-455 requires firms to submit a specific project, which is then evaluated and rated with the aid of an evaluation matrix; while the Exemption for Investment is automatically granted to the firms that buy capital goods in a given year. Another main difference relates to the amount of the benefit: while the ED-455 allows for exemptions between 60-100% of the total cost of the investment, the Exemption for Investment establishes only a deduction between 20-40% of the cost of capital goods.

Between 2008 and 2011, 2,018 projects submitted by 1,454 firms were promoted under ED-455. Firms could submit one or more investment projects. 46% of total promoted investment was granted to the industrial sector, and 36% to commerce and services. The latter tended to submit smaller size investment projects, as they account for 58% of total projects (see Table 2).

Table 2. Number of promoted projects and firms, by sector. 2008-2011

Sectors	Number of promoted projects	Number of promoted firms	% Promoted investment
Agriculture	165	134	7%
Industry	581	421	46%
Commerce and Services	1,167	810	36%
Tourism	105	89	12%
Total	2,018	1,454	100%

Source: Own calculations from DGI, COMAP-MEF, MGAP and MIEM data.

Finally, Uruguay holds one of the higher ratios of total tax expenditure in relation to the GDP (5.8% in 2011) compared to the rest of the countries of the Latin American region, being above Argentina, Brazil and Chile. The tax expenditure related to the IRAE represented around 1.74% of the GDP in 2010 (Olmos and Peláez, 2012). Similarly, in 2011 tax exemptions of the IRAE throughout the ED-455 were 18.1% of total IRAE revenues, resulting in 0.4% of the GDP (DGI, 2012).

4. Empirical Approach and Data

There is a growing literature that empirically examines the effect of incentives to promote investment and exports for developing countries using different impact evaluation methodologies. In particular, recent literature uses impact evaluation techniques to explore the effect of exports promotion in developing countries (Volpe and Carballo, 2010a, 2010b; Volpe, Carballo and García, 2012), the impact of tax incentives on innovation and performance (Benavente, Crespi and Maffioli, 2007; Castillo, Maffioli, Rojo and Stucchi, 2011) and the effect of fiscal incentives on investment in research and development (Bérubé and Mohnen, 2007; Carboni, 2008; Bronzini and Iachini, 2011).

In general, according to the empirical literature, difference-in-difference and matching techniques are frequently used. If there are differences *a priori* between the treatment and control groups, impact evaluation analysis is complemented with matching techniques for robustness. Also, some empirical studies combine both techniques and use the matching differences-in-difference estimator, comparing the change in the outcome variable before and after the policy, between firms that participated and the paired ones that did not participate in the program.

4.1 Empirical Strategy

In order to assess the effectiveness of incentives to promote investment, the essential problem is that we do not observe the outcomes for beneficiary firms, have they not participated in the promotion. Therefore, it is possible to approximate this result constructing an appropriate counterfactual reflecting how participants (firms under treatment by the investment promotion law regulated by ED-455) would have performed under no treatment.

A way to compute the impact of the program is combining Difference-in-Difference (DID) with Propensity Score Matching (PSM) techniques (Volpe and Carballo, 2008; Castillo, Maffioli, Rojo and Stucchi, 2011). The DID method consists in comparing results between beneficiary firms (treatment group) and non-beneficiary ones (control group) before and after policy implementation. The main idea is to use repeated observations of firms to

control for unobserved and time invariant characteristics correlated both with participation in investment promotion benefits and investment performance (Angrist and Krueger, 1999). The key identifying assumption of the DID method is that investment trends would be the same for both groups in the absence of treatment. In turn, the PSM is used to select a control group of firms similar to the treatment group on the basis of their observable characteristics.

4.1.1 Econometric Modeling

Formally, let D_{it} be a binary variable that gives information about treatment by ED-455. Since ED-455 changes the rules of investment decisions, firms' behavior could have been modified since they obtained the investment promotion. In this sense, an accurate definition of D_{it} is that D takes value 1 for each beneficiary firm since the year they were actually granted by the policy to the end of the period under analysis, and 0 otherwise. Under this specification, the associated coefficient estimates the overall impact of the regime on the entire period that was in force (see equations (3) and (4) below). We then modified the treatment specification accounting for different effects of the policy over time (see section 4.1.2).

We considered 2008 as the year of implementation of the regime. Even though it was approved in December 2007, all projects got their promotion in 2008 or afterwards. Therefore the year 2007 was not considered as a "treatment year".

Finally, since one of the main objectives of the investment promotion policy was to improve capital investment and employment of firms, the effects over both the rate of investment and the employment growth rate were explored.

Assuming that unobserved heterogeneity is constant over time, some types of potential selection biases can be mitigated using a fixed effects model. More precisely, we start from the following specification:

$$Y_i = X_{it}\theta + \beta D_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (1)$$

where Y_{it} are the investment rate and employment growth rate variables approximated respectively, by the difference (in logs) of fixed assets (capital stock growth) at constant prices⁶ and the difference (in logs) of aggregate employment for each firm.⁷ Coefficient β is the parameter of interest and would provide an unbiased estimate of the overall effect of the tax incentive regime if D_{it} is not correlated with the error term ε_{it} , that is, if there are no omitted variables that are correlated with both the treatment variable and the dependent variable. Coefficient α_i reflects unobservable fixed firm effects; γ_t controls by year common effects (e.g., annual macroeconomic effects). Finally, a set of covariates X_{it} controls by firms' observable characteristics before the policy implementation. Control variables such as interactions between sectors of activity and years were included.

Under the assumption that unobservable heterogeneity of firms is time invariant, the fixed effects model in equation (1) gives a consistent estimate of the effect of the policy. Nonetheless bias could exist if the constant unobservable heterogeneity assumption does not hold, i.e., beneficiary and non-beneficiary firms might be highly heterogeneous and could differ in unobservable time-variant components. Moreover, introducing linearity in covariates could lead to a misspecification of the model (see Blundell, Dearden and Sianesi, 2004; Imbens and Wooldridge, 2008).

The matching difference-in-differences method allows reducing the above mentioned problem, estimating fixed effects on a common support. Thereby, treated and not treated firms are similar in their observable characteristics and in the trend of the outcome variable before policy implementation. The common support is obtained through the propensity score matching estimator $P(X_i) = P(D_i = 1|X_i)$.⁸ It indicates the propensity for a firm to be declared promoted by ED - 455 according to a set of observable characteristics before the implementation of the policy. These are: fixed assets (in logs); total employment (in

⁶Fixed assets correspond to those declared by firms to the tax authority every year. The assets reported are revalued and net to accumulated depreciation. For estimations at constant prices we use the Producer's Prices of National Products Index, the same index the tax authority uses to perform their calculations of real assets.

⁷Although exports promotion was an explicit objective of the ED-455, it was not possible to perform the impact evaluation over this variable. In the database, only the amount of exports in intervals was available, not allowing to identify the potential effects for each firm .

⁸Common support condition implies that only non beneficiary firms with similar participation probability $P(X)$ respect to beneficiary firms were considered.

logs); productivity (in logs); variation of fixed assets, employment and productivity between 2006 and 2007; and a dummy reflecting whether the firm is an exporter before the policy. The Hirano, Imbens and Ridder (2003) approach was considered, by weighting units in the control group according to a propensity score (with weights defined as 1 for the treated firms and $\frac{\hat{P}(X)}{1 - \hat{P}(X)}$ for control group firms).

The matching difference-in-differences method generates consistent estimates of the impact of the policy under the assumption that there do not remain unobservable time-varying effects both affecting the selection into treatment and the outcome variable (see Blundell and Costa Dias, 2002). Formally, the equation is given by:

$$Y_{it} = \beta D_{it} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (2)$$

Equation (2) is estimated on the common support performed in a previous step, with a weighted sample as proposed by Hirano, Imbens and Ridder (2003).

An additional specification was estimated attempting to measure the dynamics of impacts. While through ED-455 all firms were enabled to submit an investment project for promotion, in practice, firms with submitted projects were declared promoted in different years of the period of analysis. The above specifications captured an overall effect, but do not take into account that there might be different effects of the policy over time.⁹

The following additional equation was specified for the fixed effects model using the investment rate and employment growth rate as outcome variables:

$$Y_{it} = \sum_{j=1}^k \beta_j D_{it}^j + \alpha_i + \gamma_i + \varepsilon_{it} \quad (3)$$

where D_{it}^j takes value 1 for the j-th year of effective promotion. For instance, D_{it}^1 takes value 1 in the first year that a firm had a declared promoted project; D_{it}^2 takes value 1 in the second year and so forth, each one representing the total effect of each year.

⁹ The estimated impacts are mainly short-term since only 4 years after the ED - 455 were considered.

We assume that, as we analyze a four-year period after the policy was put in place, actually most of the firms continue to be in their “promotion timeline”, and the changing in signs or values of the time dummies for different periods will essentially capture changes in investment decisions of firms still receiving the treatment. Although unfortunately, we do not have the information of the exact timeline of each project, we do know that two thirds of promoted firms have a timeline of more than five years, and the other third presented projects that have a three to five year period of implementation. Of this third, the majority (according to interviews to policy implementers) has a five year period of promotion. Additionally, only 30% of the overall potential tax exemption was effectively used between 2008-2011.

The fixed effects model was estimated for the overall economy and disaggregated into three activity sectors: Services, Commerce and Manufacturing.¹⁰

4.1.2 Some additional modeling extensions and robustness tests

A first concern is about the self-selection of firms that obtained the tax credit. Unfortunately, we do not have information on firms that applied but did not receive the promotion (fact that besides did not happen frequently) in order to restrict the sample to firms that applied to the program. So the set of estimations described above compare firms who *received* the tax credit against a “comparable” set of firms who *did not*; using the matched difference-in-difference approach. In order to check for self selection of firms in submitting to tax credits, we performed another set of estimations restricting the sample to firms that self-select in any of the existing mechanisms of promotion, either the ED-455 or the Exemption for Investment. In this way, we built a counterfactual considering only firms that may have had a certain “propensity to invest”, as at least they obtained one of the existing mechanisms of investment promotion (see section 5.3.2).

A second concern is that the impact of the ED-455 may vary depending on the size of the investment promotion project. As shown in Table 1, projects could amount from less than 400 thousand US dollars (small projects) to more than 800 million US dollars (very large),

¹⁰There is aggregate information for the following economic sectors: Agriculture, Manufacturing, Commerce, Services and Tourism. Only three were selected for analyzing considering that each one of these sectors has a considerable sample size: Manufacturing, Commerce and Services.

so potentially heterogeneous effects may arise. In order to assess this source of heterogeneity, the treatment variable was modified considering the size of the project.

Lastly, beneficiary firms could have a strategic behavior by slowing their investment in the years before they get their investment promotion. If this strategic behavior takes place, the chosen specification could overestimate the true impact. This fact was tested by running a falsification test -which considers that the promotion takes place in a previous year than the actual one- and no significant effect was found. The falsification tests were also performed to assess validity of the results under the assumption of no selection on observables from the standard specification of the equation (2).

4.2 Data and Descriptive Statistics

Our dataset consists of two databases that to our knowledge are novel in Uruguay and in the region: first, an administrative database with sworn statements of taxpayer firms of the corporate income tax (IRAE) to the National Tax Agency (DGI for its Spanish acronym) during 2005 to 2011.¹¹ Second, administrative data of a set of firms from the Social Security Bank (BPS for its Spanish acronym) on employment and remunerations at firm level were used to perform the PSM. Both databases were merged at firm-level for the same period (2005-2011).¹²

Only firms with information of the years before the policy implementation and that had records in both databases in all years were considered. It should be mentioned that new firms (those created after 2007) were not included.

Table 3 presents the matching estimation results of the period before the policy implementation (years 2006 and 2007). It shows results for variables used in the propensity

¹¹ It contains annual information at firm level about revenues, costs, accounting and fiscal results, fixed and total assets, taxes, sector of activity, year(s) in which the firm was promoted according to ED - 455 regime, benefit effectively applied for promotion and other benefits to investment, among others.

¹² We assume that the selection bias that may arise by considering firms that are both taxpayers and pay social security to the BPS systems should not be important. The great majority of taxpaying firms also pay social security to the BPS. The only exceptions are financial services and independent professionals, which contribute to other security systems. But these type of firms are not the ones that obtained benefits from for the ED-455. Mostly firms from manufacturing, commerce, tourism and other services sectors obtained the promotion and all these type of firms contribute to the BPS system.

score and balance indicators between promoted and not promoted firms. As it is shown, the matched sample is balanced considering a set of relevant observable characteristics.¹³

Table 3. Balance indicators before and after performing matching at the baseline

Variable		Mean		% bias	% bias reduction	t-test	
		Treatment	Control			t	p> t
Fixed assets	Unmatched	16.71	13.67	144.20		52.01	0.00
	Matched	16.71	16.76	-2.80	98.10	-0.73	0.47
Employment	Unmatched	3.89	2.13	143.20		56.20	0.00
	Matched	3.89	3.87	1.50	99.00	0.37	0.71
Productivity	Unmatched	11.63	11.08	90.80		32.15	0.00
	Matched	11.63	11.63	0.20	99.80	0.05	0.96
Fixed assets growth	Unmatched	0.05	-0.01	16.00		5.47	0.00
	Matched	0.05	0.04	1.90	88.40	0.53	0.60
Employment growth	Unmatched	0.14	0.09	16.90		5.87	0.00
	Matched	0.14	0.14	-1.70	90.10	-0.41	0.69
Productivity growth	Unmatched	0.23	0.26	-11.10		-3.94	0.00
	Matched	0.23	0.22	1.60	85.70	0.44	0.66
Export	Unmatched	0.51	0.15	83.00		34.99	0.00
	Matched	0.51	0.50	3.20	96.10	0.77	0.44

Notes: Fixed assets, total employment and productivity are expressed in logarithms. The growth estimates are calculated with the variables in logarithms. The data corresponds to the period before the policy (2006 and 2007).

Source: Own calculations from DGI-BPS data.

The final database included 8,801 firms, of which 705 were promoted. Table 4 shows firms characteristics in terms of key variables for the total sample and by three economic sectors (Services, Commerce and Manufacturing), for treated and control groups considering the matched sample. As observed, after performing the matching, there are not substantial mean differences of key variables between treated and control firms in the total sample and by sector of activity (Table 4).

¹³ See also the summarized indicators of balanced testing in the Appendix.

Table 4. Descriptive Statistics for the overall firms and by economic sectors.**Matched sample**

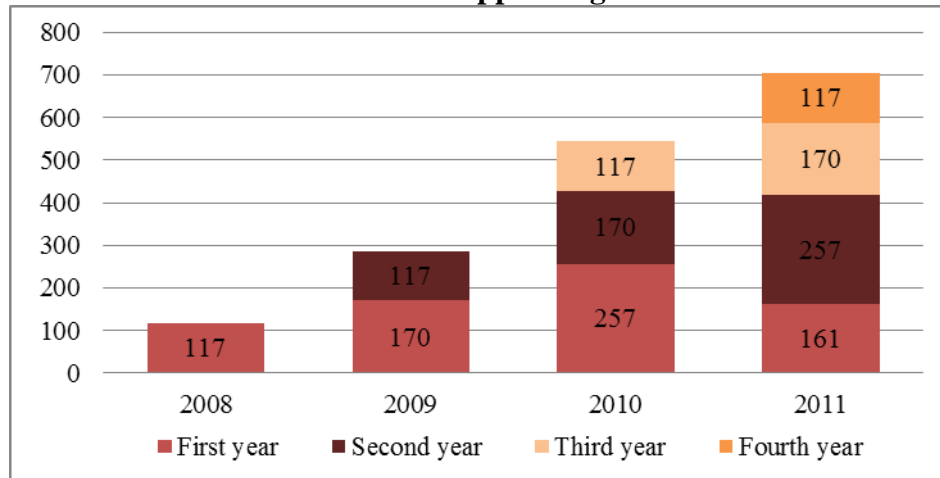
Variable	Total		Manufacturing		Commerce		Services	
	Treatment	Control	Treatment	Control	Treatment	Control	Treatment	Control
Fixed assets	16.71	16.76	17.40	17.37	15.81	15.58	16.76	17.27
Total employment	3.89	3.87	4.33	4.30	3.52	3.32	3.73	3.98
Productivity	11.63	11.63	11.70	11.67	11.55	11.41	11.70	11.68
Fixed assets growth	0.05	0.04	0.05	0.03	0.06	0.04	0.03	0.07
Employment growth	0.14	0.14	0.14	0.15	0.14	0.12	0.15	0.17
Productivity growth	0.23	0.22	0.21	0.21	0.25	0.24	0.21	0.23
Exports	0.51	0.50	0.76	0.75	0.46	0.36	0.20	0.25
Firms	705	8,096	281	1,879	237	3,817	151	1,402

Notes: Fixed assets, total employment and productivity are expressed in logarithms. The growth estimates are calculated with the variables in logarithms. The data corresponds to the period before the policy (2006 and 2007).

Source: Own calculations from DGI-BPS data.

Figure 2 illustrates the composition of promoted firms by year and time since they were granted with the investment promotion benefits (considering observations in the common support). It shows that a total of 117 firms had promoted investment in 2008 (first year of implementation of the ED-455) and total promoted firms increase gradually along the period, reaching a total of 705 firms in 2011. In particular, for the last year considered there were 22.8% of firms in their first year of promotion (161 firms), 36.5% in the second year, 24.1% in the third year and 16.6% in the fourth year (117 firms).

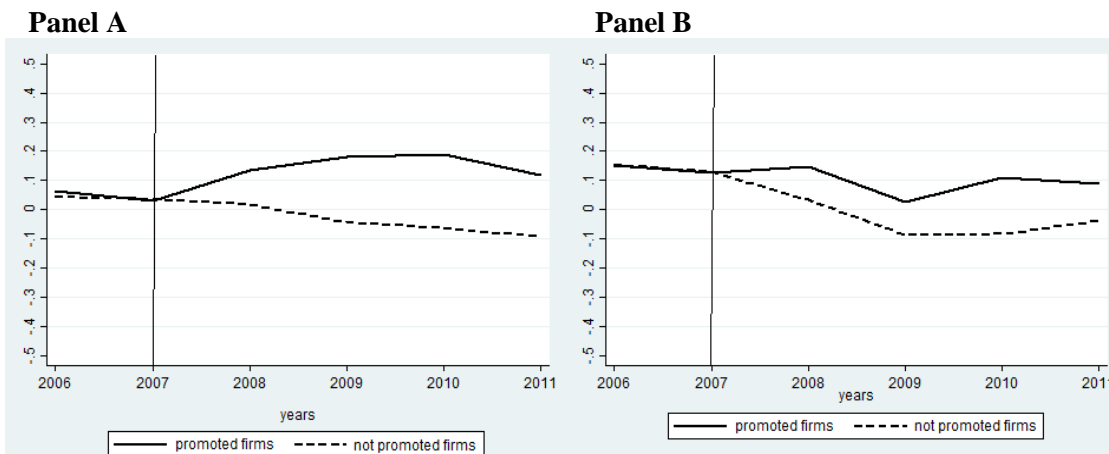
**Figure 2. Number of promoted firms by year since they obtained the promotion.
Common support region**



Source: Own calculations from DGI-BPS data.

Figure 3 displays the investment rate (Panel A) and the employment growth rate (Panel B) for promoted and control groups of firms (considering the total sample and common support's firms weighted to guarantee an accurate balance in observable characteristics). As observed, both the gap in the investment rate and in the employment growth rate between both groups expanded after policy implementation.

Figure 3. Investment rate (panel A) and employment growth rate (panel B) for promoted and not promoted firms. Common Support



Note: Not promoted firms were re-weighted by $[p(x)/1-p(x)]$
Source: Own calculations from DGI-BPS data.

5. Main Results

In this section, results of the estimated impact of the ED-455 on investment rate and employment growth rate are presented, both the effect for all promoted firms and the sectoral effects within the main sectors (i.e., Manufacturing, Commerce and Services). While ED-455 does not select economic sectors of activity ex-ante, it does select them ex-post based on the goals set to obtain the benefit. Since sectors have different intensities in the activities awarded, this could lead to an ex-post selective policy. This section is divided into three sub-sections. First, we present the overall results on investment and employment (5.1). Second, we present differential impacts related to the elapsed time since the promotion (5.2). Finally, in section 5.3 we present some extensions and robustness checks of the results.

5.1 The overall effect of the ED-455 on the investment rate and employment growth rate

This section shows the estimates for the impact of the ED-455 on investment and employment based on the specified models in the equation (2). We are interested in those outcomes in particular because they include the very purpose of the project (to prop up investment), and the second leading goal (to create jobs). Third level objectives explain the shape of the projects' merit assessment. For all the estimations, a sample of promotion beneficiaries confronts a control group meant to provide a comparable group of untreated firms (firms that did not receive benefits from the ED-455 regime). Table 5 presents the effects of the ED-455 considering the fixed effects model for both the investment rate and the employment growth rate for the overall economy and for the Manufacturing, Commerce and Services sectors. The first two columns show the estimates for the overall economy considering two alternative specifications: time dummies (column (1)) and interactions accounting for different timing effects within the economic sectors (column (2)); columns (3), (4) and (5) show results for Manufacturing, Commerce and Services sectors, respectively.¹⁴

¹⁴Interactions between time dummies γ_t and dummies for each sector (Agriculture, Manufacturing Industries, Commerce and Services, and Tourism) were considered.

The overall effect of the policy on the investment rate is significant and positive in the whole period, and does not differ significantly between both specifications considered (columns (1) and (2)). Getting the investment promotion by ED-455 is associated with an investment rate increase of 11.5%. In other words, the ED-455 increased capital accumulation by around 11.5% on average in the five years after the policy was implemented.

The overall estimated effect of the policy on investment rate is also positive and significant within each of the main sectors (manufacturing, commerce and services). The estimated effect on the commerce and services firms is higher than the global effect, around 14.7% for the former and 16.2% for the latter. The lowest estimated impact, however, is in the manufacturing sector with an increase of around 8.6%.

Additionally, the impact of the ED-455 on the employment growth rate is also positive and significant (see Table 5). In fact, the investment promotion policy increases employment growth rate by 5.3% in the period. Differences are noticeable when disaggregating this effect by the economic sectors. The manufacturing sector experienced the highest increase, around 7.2% in employment growth rate, while no significant impact is found in the service sector.

Table 5. Investment and employment impact estimates: total and by sectors.**Dependent variable: investment rate and employment growth rate**

	General effects				
	Total		Manufacturing	Commerce	Services
	FE (1)	FE (2)	FE (1)	FE (1)	FE (1)
Dependent variable: Investment rate					
DID	0.115*** (0.025)	0.115*** (0.025)	0.086*** (0.030)	0.147*** (0.046)	0.162*** (0.055)
Total observations	44,005	44,005	10,800	20,270	7,765
Dependent variable: Employment growth rate					
DID	0.053* (0.028)	0.053* (0.028)	0.072** (0.033)	0.044* (0.024)	0.057 (0.087)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	No	No
Total observations	43,982	43,982	10,793	20,266	7,759

Notes: "FE" represents a Fix effects model. Columns (1) and (2) distinguish models with or without an interaction of sector and time dummies.

* Coefficients are statistically significant at the 10% level, ** at the 5% level, *** at the 1% level of significance; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets.

Source: Own calculations from DGI-BPS data.

Regarding the effect on employment outcomes, it must be noted that the positive effect may include formalization of employers, and not only net employment growth. That is, if prior to applying for the ED-455 firms had part of their working force in an informal status, they would have an incentive to formalize their workers so they can accomplish the “employment growth” objective. If this was case, the effect of the policy would be more improving the quality of employment (i.e., creating more formal jobs) and not so much creating “new” jobs. Unfortunately, we do not have additional information to account for these effects separately.

5.2 The timing of the effect

In this section we analyze if there is a differential effect of the policy over time, since it could be expected that the impact immediately after obtaining the benefit could be different from the effect four years later. In this sense, given the heterogeneity in the duration of the treatment within the promoted firms in these years, this analysis becomes relevant to approach the longer-term impacts.

The results shown in Table 6 indicate that the effect on the investment rate is positive and decreases progressively over time. In particular, it is positive for the first two years and null (not statistically significant) in the third and fourth years for the whole sample of promoted firms. The annual effect is substantially higher in the first year, implying around 15% increase of the investment rate due to the policy, but it decreases by more than half the effect in the second year. The analysis by economic sectors shows that only in the services sector the ED-455 has significant positive impacts on the investment rate for both the first and the second year after the promotion (an increase of 19.2% and 11.4%, respectively), while in the manufacturing and commerce sectors the positive effect is totally captured in the first year.

The ED-455 seems to have a similar temporal pattern on the employment outcome. In fact, Table 6 shows that there is a significant positive effect on the employment growth rate mainly in the first year after getting the promotion. The impact is positive, both for all firms and by sectors separately. In the first and second year, the increase in the employment rate is around 5.3% (column (2)) and zero onwards. The commerce sector has a similar increase (5.6% in the first year), being the manufacturing sector the one that shows the largest estimated effect (8% in the first year). No significant effects on the employment growth rate of the services sector were found.

The results showing positive impacts mainly in the first year, and no effects afterwards on the investment rate and the employment growth are expected given the policy design, and imply a permanent shock in both capital stocks and firms' formal employment level.

Table 6. Investment and employment impact estimates: total and by sectors.
Dependent variable: investment rate and employment growth rate

	Effects by years				
	Total		Manufacturing	Commerce	Services
	FE (1)	FE (2)	FE (1)	FE (1)	FE (1)
Dependent variable: Investment rate					
DID 1 th year	0.151*** (0.027)	0.151*** (0.027)	0.117*** (0.030)	0.195*** (0.051)	0.192*** (0.058)
DID 2 th year	0.060** (0.030)	0.059** (0.030)	0.048 (0.041)	0.057 (0.050)	0.114* (0.069)
DID 3 th year	0,000 (0.036)	0,000 (0.035)	0.005 (0.045)	-0.040 (0.066)	0,086 (0.088)
DID 4 th year	-0.032 (0.043)	-0.030 (0.043)	-0.019 (0.059)	-0.067 (0.071)	0.032 (0.109)
Total observations	44,005	44,005	10,800	20,270	7,765
Dependent variable: Employment growth rate					
DID 1 th year	0.054* (0.029)	0.053* (0.029)	0.080*** (0.031)	0.056** (0.028)	0,020 (0.095)
DID 2 th year	0,051 (0.032)	0.053* (0.032)	0,058 (0.039)	0.016 (0.026)	0.121 (0.099)
DID 3 th year	0.045 (0.044)	0.047 (0.042)	0.063 (0.052)	0.025 (0.031)	0.101 (0.131)
DID 4 th year	-0.005 (0.050)	-0.003 (0.050)	0.039 (0.067)	-0.055 (0.042)	0.004 (0.153)
Total observations	43,982	43,982	10,793	20,266	7,759
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	No	No

Notes: "FE" represents a Fix effects model. Columns (1) and (2) distinguish models with or without an interaction of sector and time dummies.

* Coefficients are statistically significant at the 10% level, ** at the 5% level, *** at the 1% level of significance; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets. Tests for the significance differences for the coefficients are in the Table A2 of the Appendix.

Source: Own calculations from DGI-BPS data.

5.3 Robustness checks and Extensions

A set of robustness checks for the estimates presented in the previous section were performed to assess the reliability of the results.

5.3.1 Falsification test

The purpose of the false intervention test (placebo) is to reinforce the graphical of the change in investment performance between promoted and non-promoted firms before and

after the policy. Placebo tests were used considering the intervention takes place in a previous year than the one when the firm gets the promotion for the following groups: i) treated in 2008; ii) treated in 2008 and 2009; and iii) treated sometime in the period 2008 - 2011. The falsification test was performed for the investment rate and employment growth rate as dependent variables.

As shown in Table 7, the coefficient associated with the dummy that identifies treated firms before the policy implementation for the different placebo specifications is not statically significant, neither for investment nor for employment outcomes. This means that matched treated and control groups did not differ on the investment rate or on employment growth rates before the ED-455.

Table 7. Placebo test. General effects. Dependent variable: Investment rate and Employment growth rate

	General effects					
	Placebo (1)		Placebo (2)		Placebo (3)	
	FE (1)	FE (2)	FE (1)	FE (2)	FE (1)	FE (2)
Dependent variable: Investment rate						
DID	-0.023 (0.050)	-0.024 (0.050)	-0.019 (0.032)	-0.019 (0.032)	-0.023 (0.029)	-0.024 (0.029)
Total observations	17,425	17,425	17,425	17,425	17,425	17,425
Dependent variable: Employment growth rate						
DID	0.031 (0.039)	0.037 (0.038)	0.037 (0.036)	0.045 (0.034)	-0.002 (0.043)	-0.005 (0.043)
Total observations	17,598	17,598	17,598	17,598	17,598	17,598
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	Yes	No	Yes

Notes: "FE" represents a Fix effects model. Placebo (1) defines as promoted firms in 2007 those firms promoted in 2008. Placebo (2) defines as promoted firms in 2007 those firms promoted in 2008 and 2009. Placebo (3) defines as promoted firms in 2007 those firms promoted at some year in the period.

* Coefficient is statistically significant at the 10% level, ** at the 5% level, *** at the 1% level; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets.

Source: Own calculations from DGI-BPS data.

5.3.2 Some additional extensions: The treatment effect within firms which received any incentive to investment

In this section we show the results of a set of estimations where we restrict the sample to firms that received any of the two most important mechanisms of tax incentives: the benefits from the ED-455 and / or the Exemption for Investment described in section 3.

Even though the two programs are very different, we could be confronted with a case of common confounder (perhaps an unobservable tendency among some firms to seek for any tax benefit available), since firms that participate frequently in any of the variety of promotion programs are generally characterized by high investment and employment growth. For these reasons, we undertake additional estimations to assess robustness of our main findings.

In order to perform this additional set of estimations, we restricted the sample to firms that received benefits from any tax benefit available. Treated firms are again defined as firms who received benefits from the ED-455, whereas a comparable control group within firms who received benefits from the Exemption for Investment was re- built by obtaining a new common support through the propensity score matching estimator.

The results can be read as the effect on the investment rate and on the employment growth rate of receiving a benefit from the ED- 455 among firms that have revealed a high propensity to invest. Table 8 and 9 show the results of these estimations for the investment rate and the employment growth rate, respectively. The point estimated impact of the ED-455 on investment rate is slightly lower than our baseline estimations (10.5%), and it is also totally captured in the first two years, mostly in the first year of promotion.

The fact that our impact estimates on the investment rate are very similar to our baseline estimation (only one percentage point lower considering the point estimate when we restrict the comparison to firms that obtained benefits from the Exemption for Investment) reinforces the positive impact of ED-455 on the investment rate, taking into account the possible self- selection bias of firms who are benefit-seekers when deciding to invest. These results do not allow us to draw valid conclusions about the effectiveness of the Exemption

for Investment, which would require a series of additional estimations that would drive us away from our main focus.

Table 8. Investment impact estimates. Restricted sample of firms that received any tax benefit available. Dependent variable: investment rate

	General effect		Effects by years	
	FE (1)	FE (2)	FE (1)	FE (2)
DID	0.105*** (0.025)	0.106*** (0.025)		
DID 1 th year			0.139*** (0.026)	0.142*** (0.027)
DID 2 th year			0.053* (0.030)	0.052* (0.030)
DID 3 th year			-0.009 (0.036)	-0.008 (0.035)
DID 4 th year			-0.043 (0.043)	-0.041 (0.043)
Total observations	12,515	12,510	12,515	12,510
Firm fixed effects	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	Yes

Notes: "FE" represents a Fix effects model. (1) and (2) distinguish models with or without an interaction of sector and time dummies. * Coefficient is statistically significant at the 10% level, ** at the 5% level, *** at the 1% level; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets. Source: Own calculations from DGI-BPS data.

On the other hand, the overall effect of the policy on the employment growth rate is still positive but not statistically significant (see Table 9). So the evidence does not allow us to conclude that there is a positive effect on the employment growth rate of the ED-455 in this subsample. This result introduces some ambiguity on the effectiveness of the ED-455 regarding employment outcomes, one of its main goals besides investment, and makes desirable to inspect the design elements of the policy that may be inducing this behavior.

Table 9. Employment impact estimates. Restricted sample of firms that received any tax benefit available. Dependent variable: employment growth rate.

	General effects		Effects by years	
	FE (1)	FE (2)	FE (1)	FE (2)
DID	0.0373 (0.0274)	0.0381 (0.0279)		
DID 1 th year			0.0413 (0.0281)	0.0421 (0.0293)
DID 2 th year			0.0296 (0.0316)	0.0306 (0.0311)
DID 3 th year			0.0217 (0.0425)	0.0210 (0.0414)
DID 4 th year			-0.0283 (0.0490)	-0.0281 (0.0479)
Total observations	12,515	12,510	12,515	12,510
Firm fixed effects	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	Yes

Notes: "FE" represents a Fix effects model. (1) and (2) distinguish models with or without an interaction of sector and time dummies. * Coefficient is statistically significant at the 10% level, ** at the 5% level, *** at the 1% level; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets.

Source: Own calculations from DGI-BPS data.

5.3.3 Some additional extensions: differential effects considering the number of promoted projects and their size.

One additional fact to take into account is related with the potentially different impacts of the ED-455 on the investment rate depending on the size of the promoted project, or in other words, depending on the intensity of the treatment. In this sense, Table 10 presents the results considering three alternative definitions of the project size for the treatment variable: i) one that considers the number of promoted projects for each firm (panel A); ii) one representing the average size of all the promoted projects by firm (panel B).

On Panel A, estimates show positive significant effects of the policy for firms that got either one, two or three promoted investment projects, and the effect does not differ significantly between categories.¹⁵ Estimates on Panel B show that the ED-455 has positive effects for small and medium size projects, with a significant larger effect for medium size

¹⁵ The correspondent tests were performed considering the confidence intervals.

projects. However, we do not find significant effects for large projects, even though they could receive higher benefits (i.e., the investment exemption is higher). This result may be related to the fact that large projects usually have a longer timeline for their execution, and our focus is on the first four years of implementation of the policy. A longer term analysis could be required for fully assessing the impact of the policy in large and long –term investment projects.

Table 10. Intensity of the Treatment: number of promoted projects (A) and investment project size (B). Dependent variable: investment rate

	General effects			
	(A)		(B)	
	FE (1)	FE (2)	FE (1)	FE (2)
Promoted projects				
One	0.118*** (0.0306)	0.119*** (0.0307)		
Two	0.0888*** (0.0323)	0.0891*** (0.0325)		
Three or four	0.151*** (0.0446)	0.143*** (0.0450)		
Five or more	0.0868 (0.0768)	0.0737 (0.0783)		
Projects size				
DID (Small)			0.090** (0.039)	0.088** (0.039)
DID (Medium)			0.172*** (0.031)	0.172*** (0.031)
DID (Large)			0.033 (0.039)	0.039 (0.039)
Total observations	44,005	43,955	44,002	44,002
Firm fixed effects	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes
Sector*time dummies	No	Yes	No	Yes

Notes: "FE" represents a Fix effects model. (1) and (2) distinguish models with or without an interaction of sector and time dummies. A and B measure the intensity of the treatment. In (A) the treatment variable is a categorical variable that counts the amount of promoted projects. In (B) the treatment variable is a categorical variable of the size of the projects (small, medium, large). * Coefficient is statistically significant at the 10% level, ** at the 5% level, *** at the 1% level; no asterisk means that the coefficient is not different from zero with statistical significance. Robust standard errors in brackets.

Source: Own calculations from DGI-BPS data.

5.4 Evidence about the efficiency of the policy

Although the focus of the article is on the tax credit's *effectiveness* (that is, whether the mechanism has been capable of expanding investment), the *efficiency* of the policy must also be considered before deciding on its continuity or dismissal. In fact, if the subsidies

granted through the tax credit tool are greater than the *additional* investments induced, or there are less expensive ways of delivering a similar subsidy to a similar group of beneficiaries, there would be net losses to the society requiring further justification, the policies' reformulation or their abandonment.

As it was shown, the average effect of the treatment on the treated represents an increase in investment rate of around 10.5% - 11.5%. Keeping in mind that the situation before and after the treatment involves a reduction of the tax burden on the corporate income tax of about 21% (as estimated by Olmos and Peláez, 2012), the elasticity of investment rate to changes in the tax burden would be about -0.6.

Those estimates speak of a medium to low effectiveness (elasticities below 1.0 in absolute value tend to be considered "low"). The estimated elasticities amount to saying that investment responds sluggishly to changes in the tax burden on corporate income. The economic justification for investment incentives should also take into account the *costs* of the policy. James (2009) proposes a simple accounting tool to detect and quantify the efficiency or inefficiencies of the tax credit scheme. There will be absolute efficiency if the additional tax revenue from the greater economic activity that results from the subsidized investments (REV) and the direct social benefits from the additional investment (SOCBENEF) are greater than the fiscal loss from redundant subsidies (REDUND) plus the enforcement, evasion and management costs of the regime (ADMIN). Synthetically, the efficiency criterion is such that $REV + SOCBENEF > REDUND + ADMIN$. The terms in the left hand side of the inequality are notoriously difficult to estimate, and involve controversial assumptions about parameters. Instead, the comparison between the direct benefits from additional investments and the direct administrative costs is more feasible and provides an assessment of the efficiencies of interest that does not stride too far away from the scope of this article. ADMIN should include the costs of managing the regime, possible losses related to evasion and avoidance and the application and reporting costs incurred by firms interested in participating. Although we did not have estimates of those three items, it would seem that they have been comparatively low, given the overall design of the mechanism, and the socio-economic and political context in which it was implement.

Table 11 presents estimates of the lost tax revenue compared to the *added* investment, confirming that the policy as implemented in Uruguay meets a first very fundamental efficiency criterion consisting in ensuring that the benefits distributed (among investing firms) are not lower than the costs of implementing (key elements of) the policy.

Table 11. Some evidence of the efficiency of the policy

Tax expenditure in Investment Promotion Regime (2008-11)	US\$ 611 millions
Credit used to payback Corporate Income Tax (2008-11)	US\$ 647millions
“Additional” investment (counterfactual), 2008-11	US\$ 1,848 millions
Tax expenditure / additional investment	33%
Credit used to pay CIT / additional investment	35%

Source: Own calculations from DGI-BPS data, and DGI (2012).

6. Concluding Remarks

In this article we investigated the causal effect on investment and employment of the promotion regime laid out by ED-455. For this purposes, a novel large dataset of administrative records from the National Tax Agency (individual tax returns of firms eligible to get incentive) and the Social Security Bank (firms’ payroll records) for the 2005-2011 period was constructed.

We estimated the global impact of the promotion regime on the investment rate for the whole period, as well as the specific effect according to the time the firm stayed in the program, applying several robustness checks and additional extensions. Based on the results we can conclude that ED-455 has indeed increased the investments of the beneficiary firms on average, in comparison to what they would have invested in the absence of the regime. Specifically, we find that the regime has had a positive impact on investment rate of around 10.5% - 11.5%. Effects on employment growth rate are more ambiguous, as our estimations find positive effects (around 3.7%- 5.3% on average in the four years after the implementation of the policy); but not significant when we restrict the sample to firms with a high propensity to participate in investment promotion programs. In addition, we must consider that part of the positive effect on employment may include formalization of jobs, and not only net creation of new jobs.

The positive effects on investment are temporary, at most for the first two years after getting the promotion. The fact that the effects on investment are not permanent was predictable given that benefits are assigned to projects that have decreasing schedules of investment. These projects represent a shock on the stock variable, the fixed assets. The finding that the effects on investment are predominantly short term is in line with similar findings, for example short term effects of other promotion mechanisms such as grants and loans on innovation investments (Crespi, Maffioli and Meléndez, 2015).

The effects on the investment rate differ by sector, with a larger effect in the service sector by comparison with manufacturing and commerce. Nevertheless, positive impacts in all sectors suggest that firms of different specialization could take advantage of the incentive.

It is necessary to acknowledge some limitations to the analysis. First, there is no information about firms that submitted a promotion project but did not get it, in order to consider restricting the analysis only to firms that applied for the tax credit. We intended to solve this limitation by running certain robustness checks, and they reinforced the results of our baseline estimations. Second, the relatively small number of observations “before” the policy intervention. With a larger sample, it would be possible to have a better assessment of the common trends assumption before the policy implementation. Third, another limitation is the exclusion of “new” firms; that is, those created after the implementation of the ED-455. The applied methodology that compares beneficiary versus non beneficiary firms before and after the policy forces us to exclude those firms from the analysis.

In brief, the investment promotion regime introduced by the ED-455 can be seen as an appropriate tool to stimulate the accumulation of fixed assets in Uruguay. First, it has serious economic justifications; second, it seems to have the power to modify the speed of capital accumulation in the desired direction. On the other hand, the effects focus mostly on the first year of promotion, and we could not find robust effects on employment growth. It would be desirable to inspect the design elements of the policy that induce this behavior. Another research line could inform policies by focusing on the specificities of market and coordination failures justifying the government subsidies.

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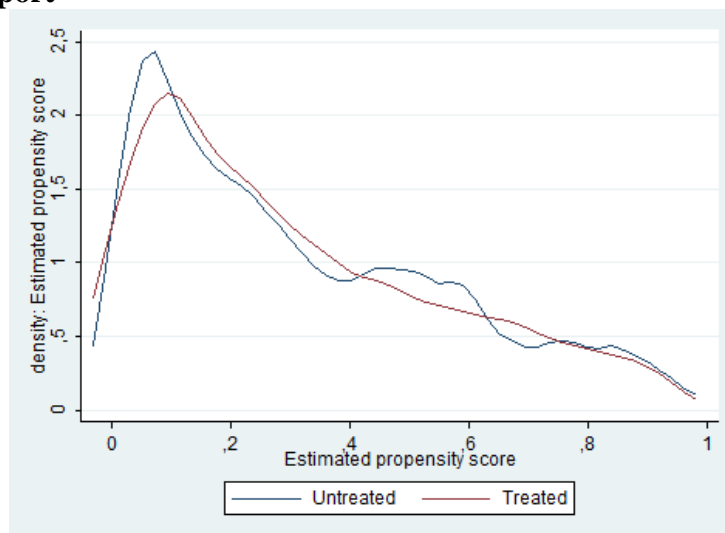
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8. Appendix

**Figure A1. Kernel density of propensity score after reweighting at the baseline.
Common Support**



Source: Own calculations from DGI-BPS data.

Table A1. Summarized indicators before and after performing matching at the baseline

Sample	Pseudo R2	LR chi2	p>chi2	MeanBias	MedBias
Raw	0.307	3036.24	0.000	72.1	83.0
Matched	0.001	4.20	0.756	1.8	1.7

Source: Own calculations from DGI-BPS data.

Table A2. Tests for the significance of coefficients

a) Total sample. Treated: promoted firms.

Dependent variable: Investment rate	Dependent variable: Employment growth rate.
FE (1) Model	FE (1) Model
test DID 1 st year = DID 2 nd year	test DID 1 st year = DID 2 nd year
F(1, 8800) = 12.15 Prob > F = 0.0005	F(1, 8800) = 0.02 Prob > F = 0.8988
FE (2) Model	FE (2) Model
test DID 1 st year = DID 2 nd year	test DID 1 st year = DID 2 nd year
F(1, 8790) = 13.06 Prob> F = 0.0003	F(1, 8790) = 0.00 Prob> F = 0.9997

b) Manufacturing sample. Treated: promoted firms.

Dependent variable: Investment rate	Dependent variable: Employment growth rate.
FE (1) Model	FE (1) Model
test DID 1 st year = DID 2 nd year	test DID 1 st year = DID 2 nd year
F(1, 2159) = 3.94 Prob > F = 0.0474	F(1, 2159) = 0.92 Prob > F = 0.3364

c) Commerce sample. Treated: promoted firms.

Dependent variable: Investment rate	Dependent variable: Employment growth rate.
FE (1) Model	FE (1) Model
test DID 1 st year = DID 2 nd year	test DID 1 st year = DID 2 nd year
F(1, 4053) = 8.65 Prob > F = 0.0033	F(1, 4053) = 2.33 Prob > F = 0.1271

d) Service sample. Treated: promoted firms.

Dependent variable: Investment rate	Dependent variable: Employment growth rate.
FE (1) Model	FE (1) Model
test DID 1 st year = DID 2 nd year	test DID 1 st year = DID 2 nd year
F(1, 1552) = 1.81 Prob > F = 0.1786	F(1, 1552) = 1.24 Prob > F = 0.2658