

# Is the Tax Credit for SME in Chile an Effective Policy to Boost Investment?

Cristobal Marshall

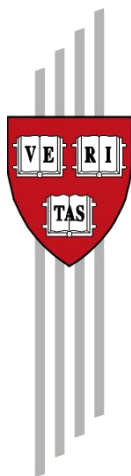
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## **Is the Tax Credit for SME in Chile an Effective Policy to Boost Investment?**

**ABSTRACT** This paper evaluates the effect of the investment tax credit on investment decisions of small and medium enterprises (SME) and recommends future steps to the Chilean Government. Although this instrument has existed since 1990 and is available to all firms, the investment tax credit rate has recently been temporarily increased from 6% to 8% exclusively for SME. Using a sharp discontinuity regression design and administrative data, we estimate that this policy increased investment among non credit constrained firms by 30%. Our estimates suggest that 14.7% of the additional investment was financed with fiscal resources. The analysis also shows that the investment tax credit is more effective in targeting resources towards SME than alternative policies such as a bonus depreciation allowance, a cash flow based system and a corporate tax reduction. Keywords: investment, tax incentives, tax credits, fiscal policy, regression discontinuity, small and medium enterprises, Chile JEL classification: E22, E62, H22, H25, H32, O16, O23, O54 Cristobal Marshall, MPA/ID 2010 cmarshall@mit.edu cristobal\_marshall@hks10.harvard.edu



# Is the Tax Credit for SME in Chile an Effective Policy to Boost

## Investment?

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**March 2010**

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**Towards the fulfillment of the requirements for the degree of Master of Public Administration in International Development**

**Harvard Kennedy School**

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**Executive Summary** This policy paper evaluates the effect of the investment tax credit on investment decisions of small and medium enterprises (SME) and recommends future steps to the Chilean Government. Although this instrument has existed since 1990 and is available to all firms, the investment tax credit rate has recently been temporarily increased from 6% to 8% exclusively for SME. Using a sharp discontinuity regression design and administrative data, we estimate that this policy increased investment among non creditconstrained firms by 30%. Our estimates suggest that 14.7% of the additional investment was financed with fiscal resources. We also identify three alternative policies that can potentially achieve the same goal as the investment tax credit: (a) a bonus depreciation allowance, (b) a cash flow based tax system, and (c) a corporate tax reduction. Along with their effect on investment decisions, we compare these policies in terms of their administrative feasibility and political support. The investment tax credit compares favorably on all three dimensions. It is more effective in targeting resources towards SME, it operates with almost no additional administration costs, and its current design ensures high political supportability. The relevance of this policy paper is threefold. First, it is one of the first steps towards formally evaluating current tax expenditures in Chile. Second, since the current increase in the investment tax credit is scheduled to expire in 2011, it can aid the Government in decisions about future steps. And third, this analysis can be useful for the newly elected Government in designing the recently announced temporary bonus depreciation. Based on our analysis, our policy recommendations are the following: 1. Given the low proportion of firms claiming the investment tax credit the Ministry of

Finance should be more active in promoting and explaining the policy. 2. The investment tax credit should be kept as a temporary policy to be used only in the context of low aggregate levels of investment. 3. If political support is required, the recently announced policy should be structured as a mixed policy where firms are given the choice between an investment tax credit and a bonus depreciation allowance.

<b>Table of Contents</b>	
<b>1. Introduction</b>	<b>1</b>
<b>2. Investment Tax Credit for SME: Policy and Institutional Setting</b>	<b>3</b>
2.1. Tax Expenditures as Policy Instrument	3
2.2. The importance of evaluating tax expenditure policies	4
2.3. Policy Description	5
<b>3. Analytical Framework</b>	<b>6</b>
3.1. Related Literature	6
3.2. Model	7
<b>4. Empirical Evidence</b>	<b>9</b>
4.1. Review of Empirical Evidence for Investment Subsidies	9
4.2. Review of Empirical Evidence from Chile	10
<b>5. Quantitative analysis</b>	<b>11</b>
5.1. Regression Discontinuity Approach	11
5.2. Data Description	12
5.3. Results	14
5.3.1. Graphical analysis	14
5.3.2. Regression Estimates	16
5.3.3. Specification Tests	23
5.3.4. Discussion	25
<b>6. Qualitative Analysis: Policy Comparison</b>	<b>27</b>
6.1. Effect on investment	28
6.2. Administrative feasibility	32
6.3. Political Support	34
<b>7. Conclusion and Recommendations</b>	<b>35</b>
<b>8. References</b>	<b>38</b>

**1. Introduction** Small and medium enterprises (SME) in Chile, as in most countries, are thought to face more difficult conditions in accessing credit, raising capital and complying with regulations and legal procedures. For those reasons SME are constantly the focus of political attention. Among a broad set of policies especially oriented to SME, tax expenditure policies in Chile are especially attractive for the Government. That makes them a commonly used instrument to target this particular group of firms. One of the most recently introduced policies to aid SME is a temporary increase in the tax credit for investment in fixed physical assets (from now on investment tax credit). The investment tax credit allows firms to deduct from corporate tax liabilities a given percentage of the cost of assets purchased new or constructed during the year. By including an investment tax credit on the framework of Jorgenson (1963) and Hall and Jorgenson (1967) we show a similar result to House and Shapiro (2008). This type of incentive can increase investment by reducing firms' user cost of capital. In other words, the investment tax credit raises the optimal level of capital which leads firms to increase investment until the new desired level of capital is achieved. In the case of a temporary incentive, firms reduce the capital stock to its initial equilibrium level after the incentive dies out. Even though this instrument has existed since 1990 and is available to all kinds of firms, the tax credit rate has recently been temporarily increased from 6% to 8% exclusively for SME. The particular policy design makes the 8% tax credit rate available only to firms with earnings below a particular threshold, creating a natural experiment uncommon among Chilean tax policies. Firms on the vicinity of the earning threshold are assumed to be on average equal in all characteristics except for the tax credit rate they receive. While firms with earnings just below the threshold receive an 8% tax credit rate, firms just above the threshold only receive a 6% tax credit rate. We exploit this sharp discontinuity on access to more favorable treatment to estimate the effect of the investment tax credit on the investment decisions of SME. Using a sharp discontinuity regression design and administrative data provided by the Chilean Internal Revenue Service (SII) we find that the policy increased on average

investment of eligible firms by 30%. We are cautious about these results. As will be discussed later the magnitude and significance of the estimated coefficients are sensitive to regression's specification and bandwidth selection. Since the goal of increasing investment among SME can be achieved with alternative policies, our analysis includes a policy comparison. We identify three tax expenditure policies that can achieve a similar outcome as the investment tax credit. These particular policies or similar versions are either already in place or have been presented to the Congress, facilitating the comparison. They are a bonus depreciation allowance, a cash flow based system and a corporate tax reduction. We compare them on three dimensions relevant to policy makers: (a) the effect on investment of SME, (b) their administrative feasibility, and (c) their political support. To analyze the impact of the alternative policies on investment we extend our analytical framework showing that an investment tax credit has the same effect on the user cost of capital as a bonus depreciation allowance and a cash flow based system. However, when introducing heterogeneity on asset's recovery period we show that the investment tax credit is more effective on focusing fiscal resources towards smaller firms. Regarding administrative feasibility we argue that all the policy alternatives are easily implementable. However, while the investment tax credit compares favorably in terms of administration costs and target capacity, it compares slightly less favorable in terms of controlling evasion. Finally, to analyze the political dimension we review the recent experience of tax expenditure bills presented to the Chilean Congress. The investment tax credit is more likely to receive support given its higher capacity to create a more generous incentive among smaller firms. Its appeal is diminished, however, by its lower visibility among taxpayers. We think this analysis is relevant for three main reasons. First, unlike most policies which are evaluated annually in the context of the discussion of the Budget Law, there is currently no formal process to evaluate tax expenditures. This policy paper is one of the first steps in the direction of formally evaluating whether current tax expenditures are complying with the goal for what they were created. Second, the current increase in the investment tax credit is scheduled to finish in 2011. The Government will have to decide to continue with the policy or to use it again on the future if specific economic

conditions hold. This policy paper is intended to provide guidelines for Government's future steps. Third, the recently elected Government has announced the implementation of a temporary bonus depreciation which in many dimensions is similar to an investment tax credit. The conclusion from this paper is also relevant for the future implementation of the announced policy. The policy paper is organized as follows. Section 2 presents the institutional setting of tax expenditures in Chile and describes in more detail the investment tax credit. Section 3 presents the analytical framework. Section 4 reviews the related empirical evidence. In Section 5 we perform the qualitative analysis. Section 6 presents the policy comparison analysis. Finally, we conclude and make our recommendations in section 7. **2. Investment Tax Credit for SME: Policy and Institutional Settings**

### **2.1. Tax Expenditures as Policy Instruments**

The attention given to SME is based on the idea that these firms face serious difficulties in getting access to credit, raising capital and complying with regulations and legal procedures. Even when they do get access to credit, they pay much higher interest rates, commissions and fees. For that reason a broad set of economic policies have been set up to assist that particular group. Among the policies more commonly used for that purpose are tax expenditures. Tax expenditure policies are special tax treatments that produce a forgone in government's revenue. They are used for two main purposes: transferring resources to specific taxpayers and creating economic incentives for certain activities, economic sectors, regions or specific groups of taxpayers. Among available policies tax expenditures on Chile are one of the Governments' preferred mechanisms to support SME. First, the Constitution grants the exclusive responsibility to the President to modify taxes or expenditure programs. That allows the

<sup>1</sup> The announcement is part of the "Government Plan" of Sebastian Piñera, the Chilean Elected President. See <http://pinera2010.cl/programa-de-gobierno/macroeconomia/>



<sup>2</sup>Government to retain full control on the design and cost of the policy while easily reaping the political benefit of supporting SME. Second, the Government has access to comprehensive and detailed information on taxes facilitating targeting and budget control of tax expenditure policies. Finally, tax expenditure policies are easily managed since most of the administrative capacity is already installed. Unlike other alternative policies the administrative cost of tax expenditures are in most cases close to zero. Given those arguments is not surprising the existence of a long list of tax expenditures for SME. Among the corporate income tax expenditure policies currently in place, ten are exclusively oriented to these types of firms. An example of a tax policy exclusively designed to benefit SME is the recent increase in the investment tax credit rate. The benefit has been limited to SME as a mechanism to boost investment among this particular group. As stated in the presentation of the bill to the Congress: the reduction in the cost of capital induced by this tax credit will lead to a higher level of investment and it will contribute to the development and growth of SME (History of Law 20.289).

## **2.2. The Importance of Evaluating Tax Expenditure Policies**

<sup>3</sup>In spite of the advantage of using tax expenditures as policy instruments, they also present problems. One of them is the lack of a formal evaluation process. Differently from other type of policies that are discussed yearly in the context of the Budget Law, tax expenditures do not need to prove their efficiency. Once approved by the Congress they remain in place until the Government with the support of the Parliament decides to remove them. According to Tokman et al (2006) there is a clear tendency to add new tax expenditures but not to eliminate them. In 2008 the estimated cost of tax expenditures was 3.96% of GDP. The lack of a formal process to evaluate tax expenditures has helped the creation of a broad variety of benefits. While some of them could be creating the right incentives, others could be failing in achieving the purpose for which they were created in the first place. Even if effective, the context in which tax expenditures were created could have

<sup>3</sup>

<sup>2</sup> See Informe de Finanzas Públicas (2009)

Idem.

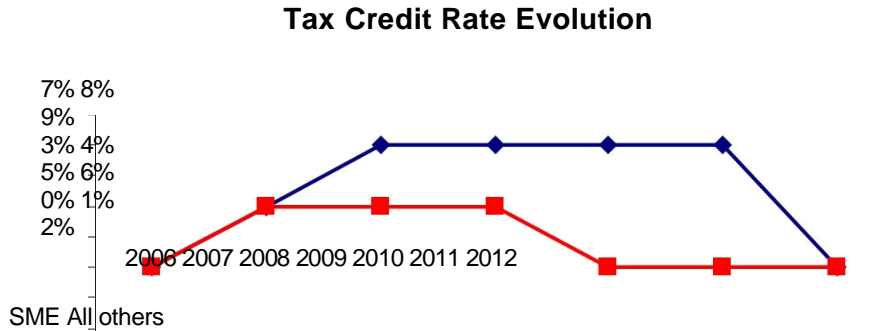
been changed making the current policy no longer necessary. If tax expenditures are properly evaluated, policy makers would have enough information to decide whether the policy has to be maintained, modified, expanded or eliminated. This situation creates a strong case to set up a formal mechanism to evaluate tax policies on a regular basis. In addition, and as a general rule, any tax expenditure proposed in Congress should be defined as temporary and extended only after a proper evaluation is performed. The goal of this policy paper follows precisely that idea. The evaluation of the investment tax credit will help policy makers to decide about the steps to be followed.

**4.2.3. Policy Description** The investment tax credit was introduced in 1990. It is equivalent to 4% of the investment in physical assets that are purchased new or constructed during the year the credit is exercised. The credit is deducted from corporate tax liabilities and cannot exceed 500 UTM (approximately US\$ 29,000 on December 2008). When the tax credit exceeds tax liabilities, the difference cannot be refunded. The credit is available to all firms that declare and pay corporate taxes under the regular taxation system. Special corporate tax systems for small firms are incompatible with the investment tax credit. The cost in terms of revenue forgone in 2006 was US\$ 37 millions. During 2006 the Law 20.171 increased the tax credit rate to 6%. The increase was designed as temporary starting January 1, 2007 until December 31, 2009. In addition to the increase in the tax credit rate the maximum amount to be credited was also temporarily raised from 500 UTM to 650 UTM. As shown in Section 5, approximately 6.9% of the firms in our sample are capped by this restriction. Finally, in 2007 the Government decided to further increase the incentive exclusively for SME. The Law 20.289 increased the tax credit rate to 8% for firms whose total earnings during the two previous years were below 100.000 UF (approximately US\$ 3.3

<sup>4</sup> UTM is unit of account adjusted monthly by inflation. On December 2008 one UTM was equivalent to \$37,652 Chilean pesos. The exchange rate on December 2008 was 650 \$/US\$.

5million on December 2008). The benefit was also defined as temporary starting on January 1, 2008 until December 31, 2011. The cost of the program in 2008 rose to US\$ 60 million. Figure 1 summarizes the tax credit rates schedule from 2006 until 2012.

Figure 1: Investment Tax Credit Rate: 20 06 to 2010



### 3. Analytical Framework

**3.1. Related Literature** The neoclassical models used to explain the effect of taxes on investment are the starting point to study the effect of investment subsidies on firms' investment decisions. Investment subsidies can be incorporated directly in the analysis as one of the elements that enters firms' profit function. One of the first and most important contributions to the study of the impact of corporate tax rates on investment was made by Jorgenson (1963) and Hall and Jorgenson (1967). In their framework, firms choose the optimal level of capital in order to maximize after tax profits. The optimal level of capital is determined by the user cost of capital which is an increasing function of the interest rate, the tax rate and the depreciation rate, among others. Capital also depends positively on tax subsidies such as depreciation allowances and tax credits. In another important contribution, Tobin (1969) shows that the incentive to add additional units of capital depends on the market value of capital relative to its replacement costs. Lower corporate

<sup>5</sup> The UF is a unit of account adjusted daily by inflation. At the 31<sup>st</sup> of December of 2008 one UF was equivalent to \$21,452.57 Chilean pesos.

tax rates as well as tax credits increase the market value of capital and therefore the incentives to invest. Since the empirical work has not fully corroborated the result of the neoclassical models, more realistic assumptions have been incorporated in the analysis such as productivity shocks and adjustment cost. Hasset and Hubbard (1996) present a literature review on tax policy and its effect on investment. In a more recent and influential paper, House and Shapiro (2008) analyze theoretically and empirically the effect of temporary tax incentives such as tax credits and depreciation allowances on investment. They find that the demand for investment is infinitely elastic in response to temporary tax changes. They specify a model with different types of capital goods that present different rates of economic depreciation. The model incorporates a demand and supply for capital and finds an equilibrium demand for investment that depends on the change and level of the tax benefit and the investment supply elasticity. The effectiveness of the policy depends on two elements. First, the policy is temporary. Second, the investment goods that received the benefits are long-lived.

**3.2. Model** In this section we include an investment tax credit into Hall and Jorgenson's (1967) model to analyze the effect of this policy on the optimal level of capital. In our very

simplified framework, firms produce output  $Y$  using capital  $K$  and labor  $L$ . For simplicity we assume there is single homogeneous capital good. The equation for the change on capital stock is the following:

$$\dot{K} = I - \delta K \quad (1)$$

Where the variable  $I$  represents investment and  $\delta$  represents the capital depreciation rate. Firms pay taxes  $t$  on their profits and receive a tax credit equal to a rate  $\gamma$  of investment  $I$ , where  $p$  is the price of capital. The problem of the firm is to maximize the following profit function subject to equation (1):



$$p r p Y d t ( ) 1 ( \gamma \& \& = ) 1 ( \rho \quad \Gamma \Gamma \Gamma$$

$$w Y =$$

(4)

Equations (3) and (4) define the equilibrium stock of capital and labor. The marginal productivity of capital equals the user cost of capital while the marginal productivity of labor equals wages. The tax credit reduces the cost of capital and increases the optimal amount of capital used for production. The exact opposite happens with the corporate tax rate. Also, as showed on Bustos et al (2003), in the special case that the corporate tax rate is equal to the investment tax credit rate, taxes produce no distortion in firms' investment decisions. Equation (3) also allows us to analyze the effect of a temporary increase on the investment tax credit. A temporary increase in the tax credit rate reduces the current user cost of capital with respect to future periods making current investment more attractive. To see more clearly the effect of the tax credit rate on investment we can obtain an expression for the optimal amount of capital. We will assume a Cob-Douglas  $LKY$ . Then, we can express the marginal product of capital as follows:

$$\frac{Y}{K} = \alpha K^{\alpha-1} L^\alpha = \quad (5)$$

From (3) and (5) we obtain the optimal level of capital as proportion of output as:

$$K = \frac{\gamma \beta \delta \tau}{\gamma \beta \delta \tau + 1} \frac{Y}{Y} \quad (6)$$

Taking logarithms we obtain:

$$\ln K = \ln \left( \frac{\gamma \beta \delta \tau}{\gamma \beta \delta \tau + 1} \right) + \ln Y \quad (7)$$

$$\ln K = \ln \left( \frac{\gamma \beta \delta \tau}{\gamma \beta \delta \tau + 1} \right) + \ln Y \quad (6)$$

$$\ln K = \ln \left( \frac{\gamma \beta \delta \tau}{\gamma \beta \delta \tau + 1} \right) + \ln Y \quad (7)$$

As we can see from equation (6) the optimal level of capital is a function of the investment tax credit rate (or an introduction of an investment tax credit) and the investment tax rate. When the investment tax credit rate is zero, the optimal level of capital is achieved when the investment tax rate is zero. When the investment tax rate is zero, the optimal level of capital has to return to the pre-perturbation level. When the investment tax credit rate is zero, the optimal level of capital has to return to the pre-perturbation level.

When the investment tax credit rate is zero, we can express a relationship between the optimal level of capital and the investment tax credit rate as a function of the investment tax credit rate.

$$\ln K = \ln \left( \frac{\gamma \beta \delta \tau}{\gamma \beta \delta \tau + 1} \right) + \ln Y \quad (8)$$

Note that  $\beta$  is the parameter of interest elasticity of investment to the investment tax credit rate.

#### 4. Empirical Evidence:

##### 4.1. Review of Empirical Evidence on Investment Tax Subsidies

The related empirical literature on investment tax subsidies is extensive. A simple tax rate variation. A more

exogenous policy variation. Among them, particular attention has been given to the temporary bonus depreciation allowance of 2002-2003 in the US. One influential result is House and Shapiro (2008). They analyze empirically the effect of the temporary bonus depreciation, obtaining an estimation of the elasticity of investment supply. They find a large response of the quantity of investment to the temporary policy, especially for long-lived capital goods. In the other extreme, using a difference-in-difference specification, Cohen and Cummins (2006) conclude that bonus depreciation had no effect on firms' investment decisions.

#### **4.2. Review of Empirical Evidence from Chile**

The effect of tax credits or more generally investment subsidies has not been empirically studied in Chile yet. However, different approaches with mixed results have been used to estimate the impact of corporate taxes on investment. All these studies have in common the use of yearly variation in the corporate or individual tax rate to estimate the effect on investment. Hsieh and Park (2006) use aggregate data to show that the reduction of taxes on retained earnings between 1984 and 1986 increased investment by raising the availability of internal funds of credit-constrained firms. Vergara (2004) use variation in taxes in the period 1974-2003 to estimate that the tax reform of the eighties led to an increase of 3% in the aggregate level of investment. Additionally, using fixed effects and micro level data he estimates that lower taxes have a positive effect of on investment. Bustos et al (2004) use a panel of publicly held companies to show that taxes have no effect on the long run demand level of capital. They argue that taxes have almost no effect on the user cost of capital because tax depreciation allowance and interest deduction are almost similar in present value to the assets acquisition cost. In other words, firms would be close to the special case presented in section 3.3 where taxes have no effect on investment. Finally, Cerda and Larrain (2005) use a panel of manufacturing firms and a fixed effect and dynamic panel methodology to show that the level of response to taxes varies according to the size of firms. According to them, small and medium sized firms are more likely to be creditconstrained and therefore have a larger response to a change in taxes. Table 1 summarizes the methodology and findings of these studies.



Part of the difficulty of studying the effect of taxes in Chile is the lack of variations of tax rates or tax expenditures among different groups of taxpayers. Taxes in Chile are levied at the country level with no differences across regions or groups. The increase in the tax credit rate of SME is one of the only examples of this kind of variation in the Chilean legislation. The main contribution of this policy paper is precisely the use for the first time of this type of variation for empirical purposes. The increase in the investment tax credit rate that differs across firms produces a natural experiment that allows for estimations with much stronger internal validity than previous related studies. A regression discontinuity design has also never been used before in Chile in this field.

**Table 1: Literature Review: Taxes and Investment in Chile**

**Hsieh and Park Bustos, Engel and Galetovic Vergara Cerda and Larrain**

<b>Data Source</b>	Survey	Annual Reports	Annual Reports	Survey	<b>Sector</b>	Manufacturing				
<b>Firm Size</b>	All firms	Larger Firms	Larger Firms	All firms	<b>Period</b>	1982-1990	1985-1995	1980-2002	1981-1996	
<b>Estimation</b>	Panel	Weighted least Square	Panel	with Fixed Effects	Panel	with Fixed Effects	and	Dyna		
<b>Model</b>	Reduced form	Intertemporal Optimization	Reduced form	Reduced form						
<b>5. Quantitative analysis:</b>										
<b>5.1. Regression Discontinuity Approach</b>										
The change in the tax credit rate produces a natural experiment that can be used to evaluate the effect of the policy on the investment decisions of SME. The estimation strategy will rely on a regression discontinuity design (RD). This framework, introduced for the first time by Thistlewaite and Campbell (1960), is widely used to evaluate causal effects of interventions when the treatment is a discontinuous function of an underlying continuous variable. The basic idea of the RD design is that the assignment to the										
<b>Policy Change Analyzed</b>	Tax rate	Tax rate	Tax rate	Tax rate						
<b>Results</b>	Significant effect on liquidity - constrained firms	Small and positive effect in some years								

on SME Source: Based on Cerda and Larrain (2005).

Significant effect Significant effect

treatment is determined by the value of a predictor. For example, the assignment to the treatment depends on being above or below a certain cut-off point. Any discontinuity of the outcome as a function of this covariate at the cut-off value is interpreted as evidence of a causal effect of the treatment. One special case of RD that will be used in our estimations is a sharp regression discontinuity design (SRDS). SRDS are used when, as in our case, the assignment to the treatment is a deterministic function of a given variable (Imbens and Lemieux, 2007). For the purpose of our analysis the treatment, the increase in the investment tax credit, is a discontinuous function of firm's earnings ( $S$ ). Firms with total earnings below  $S$  will receive the treatment ( $T = 1$ ) while firms with total earnings above  $S$  will not receive the treatment ( $T = 0$ ). For firms with earnings around  $S$ , the treatment can be taken as randomly assigned. As a result, firms with very similar level of earning, and supposedly similar in all other characteristics, will be exposed to a different incentive to invest. The causal effect of the tax credit at the discontinuity point is given by:

$$u = \lim_{\Delta \rightarrow 0^+} (T = 1) - \lim_{\Delta \rightarrow 0^-} (T = 0)$$

A key assumption in the RD design is that the agents cannot affect the underlying variable. In our case the treatment is given by the earning levels of previous years so earnings cannot be affected by the new policy, at least in the first year of implementation. Further assumptions include that the conditional distribution of the outcome are continuous in the underlying variable. In our case we need investment to be a smooth function of earnings.

## 5.2. Data Description

The empirical part of this policy paper uses administrative data obtained from the firms' annual declaration of the corporate income tax (Form 22 of the SII). Annual data from 2006 to 2008 was collected for all the firms that declared the corporate tax rate under the general taxation system. Firms under special tax systems were not included in the analysis since they are not eligible for the investment tax credit. Given we are interested in the difference of investment between firms around the cut off level of 100,000 UF

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earnings, the sample was restricted to include only firms with earnings between 70,000 UF and 140,000 UF. The sample contains a total of 3,041 firms. To simplify the analysis all the variables were expressed in UF.

The eligibility variable  $I_{it}$  is a dummy variable that takes value one when firms had earnings below 100.000 UF in previous period and zero otherwise. Eligible firms in 2008 are those with earnings below 100.000 UF in 2006 and 2007. In order to obtain a sharp discontinuity in the treatment firms with earnings above 100.000 UF in 2006 were

not included in the sample. The key variable in our estimations, annual investment  $I_{it}$ , is not available in the tax declaration form. Thus, the variable was constructed dividing

the investment tax credit declaration by the corresponding investment tax credit rate, as follow:

$$I_{it} = \frac{\text{credittax}_{it}}{\text{credittax}_{it}} \cdot \left( \frac{\%6}{\%8} \right) \cdot I_{it}$$

For the initial data description we distinguish between three sample groups. First the full sample of 3,040 firms. Second, the 806 firms that had positive level of investment (positive investment tax credit) and profits larger than the declared investment tax credit. Third, a group of 751 firms that in addition of the restrictions imposed to the second sample group are not capped by the 650 UTM maximum that can be used as a tax credit. Table 2 shows a summary statistics of the investment variable for the full and restricted samples separated by eligible and non eligible firms. Three elements about the data are worthy of mention. First, the investment variable presents a high level of dispersion. While eligible firms in the third sample group have an average investment of 2,123 UF the standard deviation for the same group is 2,819 UF. Second, the distribution of the investment variable is right skewed with a median of 830 UF for the same sample group. Third, the data shows a low proportion of eligible firms declaring the investment tax credit. Among the firms with positive profits only 26.8% imputed the investment tax credit.

Table 2: Investment (UF) in 2008 for Eligible and Non Eligible Firm			
Sample size	Mean	Median	S.d.
Eligible Firms	575	0	2,125
Non-eligible Firms	831	0	2,555
Eligible Firms	806	0	2,650
Non-eligible Firms	4,128	2,994	1,035
Eligible Firms	1,746	750	2,218
Non-eligible Firms	2,123	830	2,819

5

3

Results

The results from the empirical analysis have been organized in the following way. The first part presents the graphic analysis. The second part shows the regression estimates. The

third part presents the results from specification tests. Finally, we conclude with a discussion of our results including the main strengths and limitations of our approach.

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We begin the analysis by checking whether there is a discontinuity in the number of firms at the 100.000 UF earning cut-off level. A regression discontinuity assumes that firms cannot

manipulate the level of earnings in order to be eligible for the 8% tax credit rate. If firms bunch at the cut-off level we could interpret that they are manipulating their earnings in order to gain the 8% tax credit rate. As already mentioned, the design of the benefit eliminates the possibility of manipulation at least for the first year of implementation. The policy was presented in Congress and approved during 2008 giving firms no room to reduce earnings in order to obtain the higher tax credit rate. To see graphically if the data confirms this statement, Graph 1 plots the number of firms by earning levels. To facilitate the analysis 40 bins of earnings were constructed, twenty at each side of the cut-off level. Then, the number of firms in each bin was calculated. As

expected, we  
can clearly see  
from the graph  
that there is no  
bunching at  
14

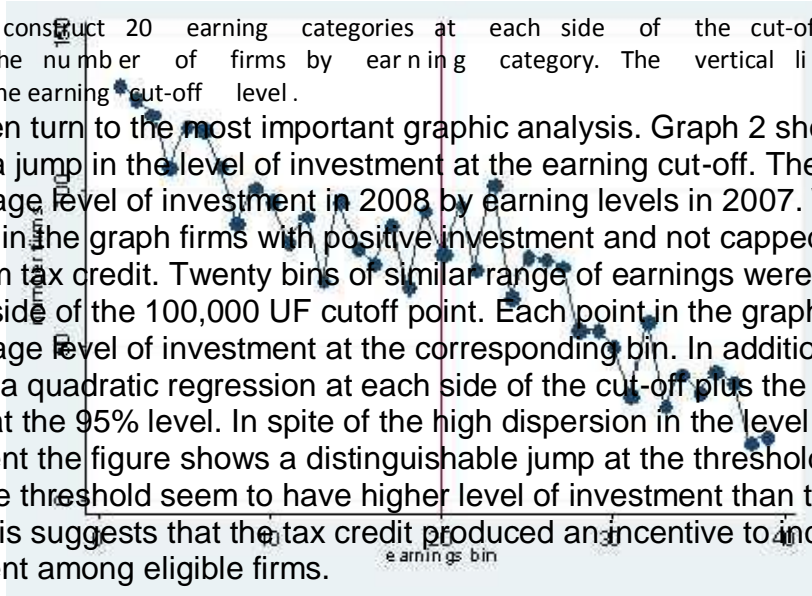
the cut-off level. This suggests that firms are nearly randomized to the 6% or 8% tax credit rate validating a key assumption of the regression discontinuity design.

### Graph 1: Frequency of firms by earning levels

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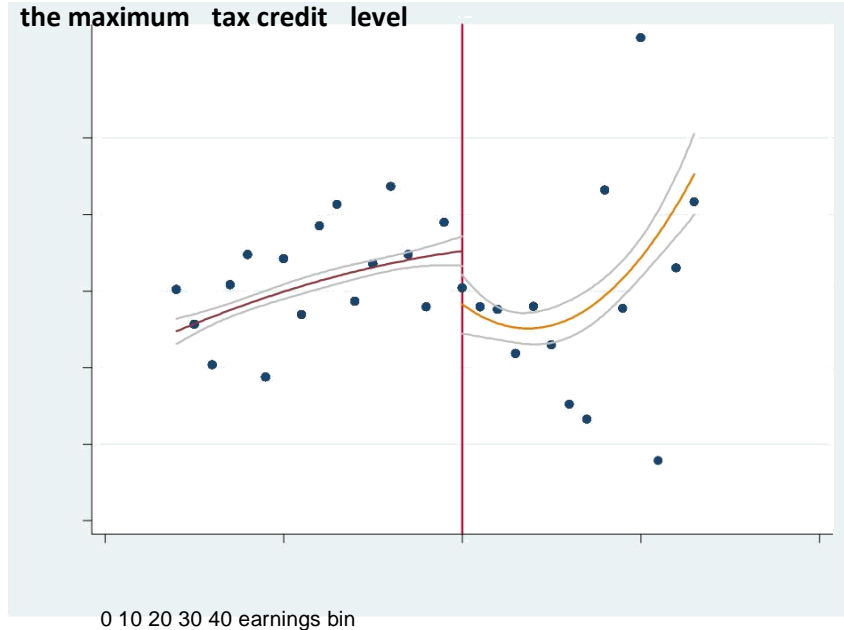
NOTE: We construct 20 earning categories at each side of the cut-off level. The figure plots the number of firms by earning category. The vertical line denotes the earning cut-off level.

We then turn to the most important graphic analysis. Graph 2 shows whether there is a jump in the level of investment at the earning cut-off. The graph plots the average level of investment in 2008 by earning levels in 2007. We only included in the graph firms with positive investment and not capped by the maximum tax credit. Twenty bins of similar range of earnings were constructed at each side of the 100,000 UF cutoff point. Each point in the graph represents the average level of investment at the corresponding bin. In addition, the graph includes a quadratic regression at each side of the cut-off plus the confidence interval at the 95% level. In spite of the high dispersion in the level of investment the figure shows a distinguishable jump at the threshold level. Firms below the threshold seem to have higher level of investment than the rest of the firms. This suggests that the tax credit produced an incentive to increase investment among eligible firms.





**Graph 2: Effect of the increase in the tax credit rate on investment Firms with positive investment and not capped by the maximum tax credit level**



NOTE: The figure plots the average investment in each earning category. We only include firms with positive level of investment and not capped by the maximum level of tax credit. The vertical line denotes the cut-off level.

$$I_i = \beta_0 + \beta_1 S_i + \beta_2 T_i + \beta_3 X_i + \beta_4 RD_i + \beta_5 (S_i - S_c)^2 + \beta_6 (S_i - S_c) + \epsilon_i \quad (9)$$

$I_i$  is investment,

$S_i$  is firm's earning levels,

$RD$

$T$  is a dummy variable that takes value one when the firms are eligible for the 8% tax credit rate and zero otherwise,  $S_c$  is the 100,000 UF cut-off level that determines the eligibility to the benefit and  $X$  is a vector of control variables. The coefficient of interest  $\beta_4$  represents the estimated average difference in investment between eligible and non-eligible firms at the cut-off level. For estimation purpose we use observations within a distance of 25,000 UF from

both sides of the cut-off. Later in this section, we repeat the estimations for different values of  $h$ . Since the investment variable was constructed dividing the investment tax credit by the corresponding investment tax credit rate, the resulting variable is censored at two different points. For eligible firms the investment variable is censored at 8,125 UTM (650 UTM over 8%) and for non eligible firms investment is censored at 10,833.360 UTM (650 UTM over 6%). To avoid our estimates are mechanically affected by having one censoring just below the cut-off and a different censoring just above the eligibility cut-off, we will assume investment is censored at 8,125 UTM irrespective of whether firms are eligible or not for the benefit. We first estimate a Tobit regression for the whole sample of firms with profits larger than the declared tax credit. Specification 1 to 3 varies only in the control variables included. The control variables are the previous year profits, the initial level of assets and the interest expenses as a proxy for the firm's initial financial position. In specification 4 to 6 we repeat the estimation only for firms with positive levels of investment so we only include firms that are already taking advantage of the benefit. Table 3 summarizes the main results. The estimated effect of the increase in the investment tax credit rate on investment is presented along with the standard errors on parenthesis. The coefficients of interest for specifications 1 to 3 are small and statistically not significant. Part of the reason for this result is that many of the firms that are not investing are non productive firms used as an instrument to delaying tax payments at the individual level. These firms are created to manage financial instruments and rarely invest in physical assets. An increase in the investment tax credit is likely to produce no effect on these types of firms. The coefficients of interest for specifications 4 to 6 are comparatively larger but still statistically not significant. Although we have excluded from the sample firms with no investment we still have firms capped by the maximum level investment tax credit. Those firms face no incentive to increase investment even if they are eligible for the 8% tax credit rate. Any additional investment made by those firms receives no tax benefit at all.

**Table 3. Effect of the increase in the tax credit rate on investment**

Tobit Regression: All firms Tobit Regression: Firms with positive investment Depend	Tobit Regression: All firms		Tobit Regression: Firms with positive investment		Dependent Variable	
	1	2	3	4	5	6
Investment	0.94	0.94	0.94	0.94	0.94	0.94
Eligibility						
Sample size	1,788	1,788	1,788	1,788	1,788	1,788
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\* Significant  
 ant at 5% level, \*\* Significant at  
 10% level.  
 Note: All specifications report estima  
 tes of the Tobit Regression for in  
 vestment as dependent variable. Inv  
 estment is censored at 8,125 UTM.

The coefficient estimates can be int  
 erpreted as the estimate  
 d average difference in investmen  
 t between eligible and non  
 -eligible firms at the earn  
 ing cut-off level. Specification 1,  
 2 and 3 are estimated on the  
 whole sample of firms with profit  
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 ation 4, 5 an  
 d 6 restrict the sample to firms w  
 ith positive investment. Specification  
 2 and 5 include initial profits

as a control variable while Specification 3 and 6 include initial profits, initial debt and initial assets as control variables. Standard errors are shown in parentheses.

The next step is to repeat the estimations on firms not capped by the maximum investment tax credit level. We estimate an OLS regression only on firms with investment below 8,125 UTM as an alternative method to avoid the potential effects of different censoring above and below the cut-off level. Results are shown in Table 4. Specifications 1 to 3 show that the coefficients of interest are positive and significant at the 5% level. According to our estimates the increased investment among eligible firms goes from 1,196 UF to 1,500 UF. The results show a large impact of the policy. Investment in 2008 was estimated to be on average between 30% and 36% higher for eligible firms. The estimated from specification 1, 2 and 3 also confirm one of the characteristic of the regression discontinuity design. That is, adding control variables should produce little or no changes on estimated coefficients. The inclusion of control variables is however important in order to increase the precision of the estimates.

**Table 4: Effect of the increase in the investment tax credit rate on investment on firms not capped by the maximum tax credit**

OLS Regression:	Excluding capped firms	Dependent Variable: Investment	Sample size	431	431	317	1	8	0	*	1	,	2	4
							x							

In addition to quantifying the effects of the policy on investment we investigate whether the increased in the investment tax credit for SME increased the likelihood of investing. We test this hypothesis by estimating a Probit regression on the whole sample of firms with positive profits. The regression has the following form:

$$L_i = \alpha + \beta_1 X_i + \beta_2 S_i + \beta_3 T_i + \beta_4 A_i + \beta_5 C_i + \epsilon_i \quad (10)$$

Where  $L_i$  is a dummy variable that takes value one if investment is positive and zero otherwise. Table 5 shows the main results of the estimations. The increase in the investment tax credit produced no effect on the likelihood of investing. For the 3 specifications shown in Table 5 the coefficient of interest is not significant at the 5% significance level.

**Table 5: Effect of the 8% tax credit rate on likelihood of investing: Probit Regression**

				Probit Regression			Dependent Variable			
Independent Variable:				1	2	3	Sample size	1,788	1,761	1,028
Dummy=1 if investment is positive							8			
Likelihood of investing										
Credit rate				0.074						
Control variables										
Initial investment										
Initial profits										
Initial debt										
Initial assets										
Initial taxes										

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The coefficients of interest are now  $\beta$  and  $\beta_{rdC}$ . The first coefficient is the average difference in investment between eligible and non eligible non credit-constrained firms at the cut-off level. The sum of the two coefficients is the average difference in investment between eligible and non eligible credit-constrained firms at the cut-off level.

**Table 6: Effect of the increase in the investment tax credit rate on investment: Tobit regression with credit constrained interaction**

Tobit Regression: Interaction Effect Dependent Variable: Investment 1 2 3  
i n i t  
s s e t

21

	* Significant at 5% level, ** Significant at 10% level.		
Note:	All specifications	report estimates	of a Tobit regression for investment
	dependent variable on	the restricted sample of	firms with positive
	nt. All specifications include	a credit constrained dummy	and an interaction
	variable between the	credit constrained dummy	and the
	eligibility variable.	Investment is censored	at 8,125 UTM. Specific
	ation 2 include initial	profits as a control variable	while Specification
	lude initial profits and	initial assets as control	variable
	s. Standard errors are	shown in parentheses.	
	Table 6 shows the results of the estimation of (11) using a Tobit regression. The coefficients for specification 3 are only significant at 10% level. Eligible firms. Although the latter result shows a negative effect of the policy, the estimation		

zero at 5% level. This suggests that the investment tax credit had no effect on the investment decision of credit-constrained firms. Similar results are found for specification 2 and 3.

### Sensitivity to Bandwidth Selection

As already argued our goal is to estimate the increase in the investment tax credit rate at the vicinity of the earning cut-off. When selecting a bandwidth we only include in our estimations observations within a distance  $h$  to either side of the discontinuity point. The selection of  $h$  is important as it can potentially affect our estimates. The following step is to check the sensitivity of our results to different bandwidths. We repeat the estimation shown in Table 3 and Table 4 for three values of  $h$ : 30,000 UF, 25,000 and 20,000 UF. Table 7 presents the results. We can see that different bandwidth produces different results. Although the estimates when  $h$  is equal to 25,000 and 20,000 UF are similar, the estimates when  $h$  is equal to 30,000 UF are smaller and not significant at 5% level.

**Table 7: Sensitivity of Estimates to Different Bandwidths**

OLS Regression:	Excluding capped firms	Tobit Regression:	Interaction	Effect	Dependent Variable:	
Sample size	1	2	3	4	5	6
524	431	334	577	474	334	
<b>Variables</b>						Eligibility to
8% tax credit	787	1,180*	1,328*	1,196	1,721*	1,880
	(498)	(565)	(671)	(819)	(807)	(1,004)
credit constrained interaction	-2,295*	-2,915*	(970)	(1,042)	(1,158)	
Restrictions	investment > 0	x	x	x	x	x
Tax credit < 650	UTM	x	x	x		

h	Bandwidth		w i t				
	70,000	00	< e a r n				
ing s < 100	x	30	, 0				
ing s < 100	x	75	, 00	0 < e a r n	x		
ing s < 100	x	25	, 0			x	
ing s < 100	x	0 < e a r n	120	, 0	x		

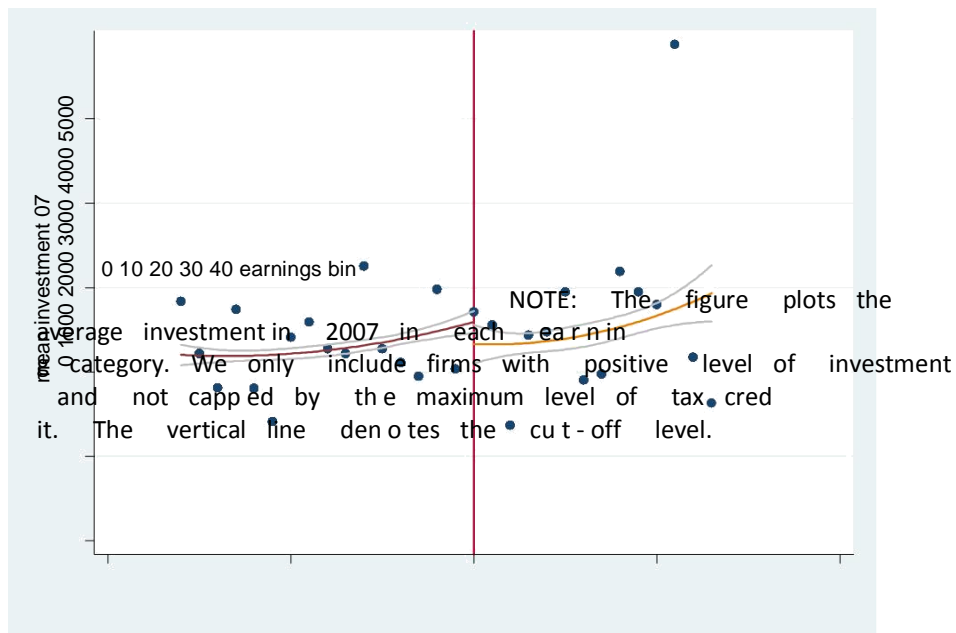
\* Significant at 5% level, \*\* Significant at 10% level.  
 Note: Specifications 1, 2 and 3 report estimates of an OLS regression for the restricted sample of firms with positive investment and not capped by the maximum tax credit level. Specification 4, 5 and 6 report estimates of a Tobit regression for firms with positive investment. Specification 1 and 4 only include firms with earnings between 70,00

0 and 130,000. Specification 2 and 4 only include firms with earnings between 75,000 and 125,000. Specification 3 and 6 only include firms with earnings between 80,000 and 120,000.

22

**5.3.3 Specification Tests:** To evaluate the identification assumptions of our methodology we start by performing a placebo test. It consists on comparing the investment decision of eligible and non eligible firms at the same cut-off level in 2007, when the policy was still not in place. In the absence of the policy, any jump in investment at the cut-off level would suggest there is something different from the investment tax credit that creates a difference in investment between eligible and non eligible firms. If we cannot reject the hypothesis of zero jumps at the cut-off we would be unable to attribute the discontinuity on investment as a causal effect of the investment tax credit. We repeat the analysis showed in Graph 2. We plot the average level of investment in 2007 for different bins of earnings. Clearly, there is no jump at the cut-off level. The result suggests that there is no effect previous to the increase in the investment tax credit rate that affected the level of investment at the cut-off level.

**Graph 3: Effect of the increase in the investment tax credit rate in 2007: Placebo Test**



We then formally test this hypothesis by repeating the estimation of the effect of the increase in the investment tax credit rate on investment. We use investment in 2007 as a dependent variable instead of investment in 2008 to repeat two estimations: the OLS regression that exclude capped firms and the Tobit regression that included the credit constrained interaction. Table 8 summarizes the results of the placebo tests. As expected the coefficients of interest are small and statistically not significant at 5% level. The only exception is the estimate of the interaction coefficient of the Tobit Regression that turn out to be significant at the 10% level.

**Table 8: Effect of the increase in the investment tax credit rate: Placebo Tests**

Dependent Variable:	Investment in 2007	Sample size	OLS Regression: Excluding capped firms	502	Tobit Regression: Interaction Effect	542	Variable
Investment in 2007	3.60	699	(5.85)		(8.43)		8% Credit
Interaction	(9.83)						-1.724**
Restriction	investment > 0				x		x
Tax credit	6.50				U		T
							M

\* Significant at 5% level, \*\* Significant at 10% level.

Note: Both specifications report estimates of regressions on investment in 2007 as dependent variable. The first specifications report an OLS regression on firms with positive investment and not capped by the maximum tax credit level. The second specification report a Tobit regression on firms with positive investment including a credit constrained dummy and an interaction variable between the credit constrained dummy and the eligibility variable. Standard errors are shown in parenthesis. In addition,

and following Imbens and Lemieux (2007) we include two additional tests for jumps at non discontinuous point. Instead of estimating investment differences at the 100.000 UF levels we repeat the calculation at two different cut-off levels where no discontinuity in treatment is present. The new cut-offs were chosen adding and subtracting 15,000 UF to the original cut-off level. Table 9 summarizes the results. For the two tests the estimations of the coefficients are not significant at the 5% level. Thus, we cannot reject the hypothesis of zero jumps at the respective cut-offs.

**Table 9: Effect of the increase in the investment tax credit rate on investment: Non discontinuous cut-off test**

Dependent Variable: Investment	OLS Regression: Excluding capped firms	Tobit Regression: Interaction Effect	1	2	3	4
Sample size	431	431	4	3	1	4 / 4
Investment	-90	-92.6	204	-88.6		(684)
credit constrained	(1,042)	(1,007)		(1,274)		Cre
Interaction						-80
Restriction			(1,040)			(1,829)
Investment >						
credit <						
Cut-off						85,000
UF						

**5.3.4 Discussion** \* Significant

Significant at 5% level, \*\* Significant at 10% level. Note: Both specifications report estimates of regressions on investment in 2007 as dependent variable. Specifications 1 and 2 report an OLS regression on the restricted sample of firms with positive investment and not capped by the maximum tax credit level. Specification 3 and 4 report a Tobit regression on firms with positive investment including a credit constrained dummy and an interaction variable between the credit constrained dummy and the eligibility variable. The cut-off level on specification 1 and 3 is equal to 85,000 UF while for specification 2 and 4 is 125,000 UF. Standard errors are shown in parenthesis.

According to our results, the increase in the investment tax credit is an effective policy to increase investment among SME that are already taking advantage of the benefit and are not capped by the maximum amount that can be used as a tax credit. Moreover, when we control for the access to credit we found the effect of the policy is positive and statistically significant only among firms that face no constrain in the access to credit. For a number of reasons we view these results with caution. First, our investment variable was calculated from firms' declaration of the investment tax credit. Since only a small proportion of firms declared the credit, our sample was shrunk, thereby reducing the significance of our estimates. Second, the small proportion of firms declaring the tax credit suggests that many firms might not be aware of the benefit. If that were the case, the average response to the increase

in the investment tax credit would be diminished by  
25



the inability of firms to identify the additional benefit. Following this idea, Knittel (2006) shows surprising evidence that around 45% of firms in the USA did not claim the depreciation allowance of 2002-2003 even though they qualified for it. Replicating this estimation for Chilean investment tax credit would be an interesting extension to this study. Third, the results are sensitive to bandwidth selection. The choice of the bandwidth not only affects the magnitude of the effect but also the statistical significance of the results. Finally, the investment variable shows a very high level of dispersion making more difficult to distinguish a clear jump at the discontinuous point. In spite of the mentioned weakness, our methodology also has some significant strength. The design of the policy creates a clean natural experiment that favors a clear identification of the problem. First, the assignment to the treatment is a sharp discontinuous function of the earning levels. Second, the assignment to the treatment, at least for 2008, is based on a variable that cannot be manipulated. Third, the 50% increase in the investment tax rate creates a meaningful incentive for firms to increase the stock of capital or to anticipate the replacement of capital. One of the difficulties created by the design of the policy in the identification of our problem is the presence of the 650 UTM maximum tax credit. In effect, the incentive is totally ineffective for firms close to the cap since any additional investment receives no benefit. Although most SME should not be constrained by the limit, the restriction is more likely to be an issue for firms at the cut-off level. Finally, the timing of the policy poses some challenges to our analysis. The bill that proposed the tax credit increase was announced and introduced in Congress at the beginning of 2008. Although the benefit was explicit in granting the higher tax credit rate to all purchases of assets made during 2008, the bill was only approved on September 2008. If concerned about the future of the bill, firms could have waited until its approval to make any investment decision. If that were case, eligible firms had only a few months to purchase new assets making less likely to observe a sizable increase on investment.

## **6. Qualitative Analysis: Policy Comparison**

In this section we will compare the investment tax credit with other alternative policies that can also affect the investment decisions of SME. These alternative policies were identified under the following criteria. First, they are all tax expenditure policies. Second, even if not their primary goal, they have to produce an effect on investment among SME. Third, these policies or similar versions have already been introduced in Chile so we can assess their potential support. Along with their effect on investment decisions, we compare these policies in terms of their administrative feasibility and political support. The policy alternatives are the following:

### **a. Bonus Depreciation Allowances for SME:**

In a standard depreciation method firms are allowed to make a sequence of deductions equivalent to a proportion of the cost of the assets purchased. Deductions depend on the recovery period of the assets and the depreciation method. The recovery period specifies how long it takes to write off the investment goods and is typically defined according to the lifespan of the assets. The depreciation method defines the percentage of the cost that is deducted each year. In Chile firms are allowed to use the accelerated depreciation method. For that purpose the SII defines the recovery period of each type of assets and firms deducts linearly the cost of the investment in the equivalent to one third of the recovery period.

A bonus depreciation allowance provides an additional incentive to the general depreciation method. It allows firms to deduct a usually higher percentage of the cost of investment during the same year the asset is purchased. The remaining percentage of the cost is deducted according to the general rules during the following years. As an example, in 2002 the US introduced a bonus depreciation allowance equivalent to a deduction of 30% of the cost of asset during the first year. The percentage was then increased to 50% in 2003. In Chile a similar bonus depreciation bill was presented to the Congress in 2006 but shortly after rejected by the Senate. A special case of bonus depreciation is an instantaneous bonus depreciation allowance. It allows firms to deduct as depreciation the total cost of the asset during the same year

the assets were purchased. A bonus depreciation exclusive for SME could be used as an alternative incentive to boost investment among this group of firms.

**b. Corporate Tax Rate Reduction for SME:**

As demonstrated in section 3 taxes increase the user cost of capital and reduce the stock of capital. An alternative policy to increase investment among SME consists in reducing the corporate tax rate for firms with total earnings below certain level. **c.**

**Extension of the Current Cash Flow Based System to all SME:**

The cash flow based system is an alternative taxation system. Instead of levying taxes on annual taxable income it levies taxes on annual cash flows. Under this scheme all sales are treated as income and all purchases are treated as expenses and deducted from total income. As every purchase is recognized as an expense, any acquisition of assets is immediately deducted from taxes. Thus, the cash flow system provides an instantaneous bonus depreciation allowance. A simplified taxation system that levies taxes on annual cash flows was introduced in Chile in 2006. Currently only micro and small firms in Chile are given the choice to declare taxes under this system or the general taxation system. An alternative policy to the investment tax credit consists in extending this choice to all SME.

**6.1 Effect on investment**

In this section we show that both a bonus depreciation allowance and an investment tax credit reduce the after tax cost of capital. As a result, both policies produce the same effects on the investment decisions of firms. We can extend the framework presented in

Section 3 to include a depreciation allowance  $z$  equivalent to the present value of an annual deduction  $\frac{tst}{pf}$  over the recovery period of the capital goods  $s$ . Where  $s$  is the proportion of the cost of the assets deducted at year  $s$ . When including a depreciation

allowance, the profit function to be maximized is now the following:

$$\int_0^8 \dots [ \dots ] \dots d \ t \ z \ l \ p \ w \ L \ L \ K \ Y \ e \dots (1), (2)$$

Now we can replace the investment tax credit  $\mu/pz$  with a bonus depreciation allowance. This is equivalent to a fraction of the cost  $\mu$  that is deducted immediately in the first period and the remaining percentage  $(1 - \mu)$  that is deducted according to the usual depreciation method. The total depreciation deduction  $z$  including the bonus depreciation allowance can be represented by:

$$\int_{st}^* \dots = f \mu \mu (1 - \dots) \dots (13)$$

29

In the case of instantaneous bonus depreciation note that  $z = \mu$ . As we can see from equation (14), when including this type of bonus depreciation the firm is back in the

same maximization problem that solved when receiving an investment tax credit. The solution to the problem is similar to the solution when the investment tax credit was available, showing that the effect of both policies on the optimal amount of capital is the same.

$$\int_0^8 \dots$$

is clearly independent of the recovery period of the asset. In the case of a bonus depreciation allowance the total tax reduction is equivalent to the corporate tax rate times the difference in the present value of the total depreciation allowance with and without the bonus  $(z - t)$ . The marginal effect of the bonus depreciation depends not only in the fraction of the cost that can be deducted in the first year but also in the recovery period of the asset and the discount rate. As a conclusion, a bonus depreciation allowance produces high incentives to invest in long-lived assets. The incentives to invest in short-lived assets are, at the other hand, negligible. Table 10 shows the equivalence between an investment tax credit and bonus depreciation allowance for different recovery periods and discount rates. It is assumed that the bonus depreciation is introduced in addition to the current standard accelerated depreciation method and that the corporate tax rate is 17%. At one extreme a bonus depreciation allowance is equivalent to an investment tax credit of zero for assets with recovery period of six years. At the other extreme the same bonus depreciation allowance is equivalent to an investment tax credit of 5.2% for assets with recovery period of 25 years and discount rate of 20%.

**Table 10 : Equivalence between Tax Credit and a 50 % Bonus Depreciation :**

Discount Rate %	Recovery Period (years)				5%				10%				15%				20%							
	6	9	15	20	6	9	15	20	6	9	15	20	6	9	15	20	6	9	15	20				
0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.3%	0.5%	0.6%	1.0%	1.3%	1.5%	1.8%	1.4%	1.8%	2.2%	2.8%	1.9%	2.5%	3.1%	4.1%	2.6%	3.4%	4.2%	5.6%
1.0%	1.3%	1.5%	1.8%	2.2%	2.7%	3.9%	4.5%	4.7%	3.2%	4.4%	5.0%	5.2%	3.6%	4.8%	5.4%	6.8%	4.3%	5.1%	5.7%	7.1%	5.0%	5.8%	6.4%	7.8%
2.0%	2.7%	3.1%	3.9%	4.7%	3.4%	4.9%	5.6%	5.8%	4.0%	5.4%	6.1%	6.3%	4.4%	5.8%	6.5%	8.0%	5.1%	5.9%	6.6%	8.1%	5.8%	6.6%	7.2%	8.6%
3.0%	3.9%	4.5%	5.4%	6.4%	3.6%	5.1%	5.8%	6.0%	4.2%	5.6%	6.3%	6.5%	4.6%	6.0%	6.7%	8.2%	5.3%	6.1%	6.8%	8.3%	6.0%	6.8%	7.4%	8.8%
4.0%	5.1%	5.9%	6.9%	8.0%	3.8%	5.3%	6.0%	6.2%	4.4%	5.8%	6.5%	6.7%	4.8%	6.2%	6.9%	8.4%	5.5%	6.3%	7.0%	8.5%	6.2%	7.0%	7.6%	9.0%
5.0%	6.3%	7.2%	8.3%	9.5%	4.0%	5.5%	6.2%	6.4%	4.6%	6.0%	6.7%	6.9%	5.0%	6.4%	7.1%	8.6%	5.7%	6.5%	7.2%	8.7%	6.4%	7.2%	7.8%	9.2%
6.0%	7.5%	8.5%	9.7%	11.0%	4.2%	5.7%	6.4%	6.6%	4.8%	6.2%	6.9%	7.1%	5.2%	6.6%	7.3%	8.8%	5.9%	6.7%	7.4%	8.9%	6.6%	7.4%	8.0%	9.4%
7.0%	8.7%	9.8%	11.1%	12.5%	4.4%	5.9%	6.6%	6.8%	5.0%	6.4%	7.1%	7.3%	5.4%	6.8%	7.5%	9.0%	6.1%	6.9%	7.6%	9.1%	6.8%	7.6%	8.2%	9.6%
8.0%	9.9%	11.1%	12.5%	14.0%	4.6%	6.1%	6.8%	7.0%	5.2%	6.6%	7.3%	7.5%	5.6%	7.0%	7.7%	9.2%	6.3%	7.1%	7.8%	9.3%	7.0%	7.8%	8.4%	9.8%
9.0%	11.1%	12.4%	13.9%	15.5%	4.8%	6.3%	7.0%	7.2%	5.4%	6.8%	7.5%	7.7%	5.8%	7.2%	7.9%	9.4%	6.5%	7.3%	8.0%	9.5%	7.2%	8.0%	8.6%	10.0%
10.0%	12.3%	13.7%	15.3%	17.0%	5.0%	6.5%	7.2%	7.4%	5.6%	7.0%	7.7%	7.9%	6.0%	7.4%	8.1%	9.6%	6.7%	7.5%	8.2%	9.7%	7.4%	8.2%	8.8%	10.2%

We can clearly link the intensity of incentive created by a bonus depreciation allowance with the size of the firms that receive the benefit. Micro and small firms invest mainly in assets with low recovery period gaining almost no additional benefit. The opposite happens with larger firms. As a result, for a given level of tax forgone an investment tax credit is more favorable for micro and small firms. If the goal of the policy is to increase investment among SME a tax credit is clearly more efficient than a bonus depreciation allowance.

We can extend this same analysis to assess the effect of the cash flow based system on investment. As already showed, a cash flow based system is equivalent to an instantaneous bonus depreciation allowance. Table 11 shows the equivalence between an investment tax credit and a cash flow based system for different recovery periods and discount rates. It is assumed that firms receive this benefit on addition of the standard accelerated depreciation method. It also assumes the corporate tax rate is 17%. A cash flow based system produces the same incentives to invest as a tax credit of 1.2% for assets with recovery period of 6 years and a discount rate of 5%. At the same time it produces the same effect as a tax credit of 13.6% for asset with recovery period of 75 years and a discount rate of 20%.

**Table 11 : Equivalence between Tax Credit and a 100 % Bonus Depreciation :**

Discount Rate	Recovery Period (years)	5%	10%	15%	20%
6	1.2%	2.2%	3.2%	4.0%	9
9	1.6%	2.9%	4.1%	5.1%	15
15	2.3%	4.1%	5.6%	6.8%	30
30	3.9%	6.6%	8.5%	9.9%	45
45	5.2%	8.4%	10.4%	11.7%	60
60	6.4%	9.8%	11.7%	12.9%	75
75	7.4%	10.8%	12.6%	13.6%	

Finally, we discuss the effect of our last policy alternative on firms' investment decisions. Although a reduction in the corporate tax rate reduces the user cost of capital and increases investment it also produces additional undesirable effects. A corporate tax reduction produces an unnecessary reduction in tax revenue by reducing the tax liabilities of firms that are not investing. If the goal of the policy is to increase investment among SME a corporate tax rate reduction is less efficient than a direct investment subsidy. In summary, an investment tax credit is a more efficient on incentivizing SME. First, differently from a bonus depreciation and a cash flow based system it reduces the after tax user cost of capital irrespective of the recovery period of the asset purchased. Given micro and small firms tend to be more intensive in short-lived assets the investment tax credit is more efficient in targeting resources towards these types of firms. Second,

differently from a tax rate reduction the investment tax credit reduces taxes only for firms that effectively increase their stock of capital.

## **6.2 Administrative feasibility**

Both the investment tax credit and the alternative policies can easily be implemented in Chile. All of them have been in place or are a natural extension of existing policies. The investment tax credit has existed since 1990. The cash flow based system was introduced in 2006. The bonus depreciation is only a slightly different version of the current depreciation allowance. The corporate tax reduction for SME requires additional controls but its implementation is straightforward. Although all these policies can be easily implemented they differ on other dimensions that are relevant for policy makers. A lower cost of administration, a better capacity to control evasion and a better scope for targeting benefits are some of the attributes that make one policy more desirable than others.

**Administrative Cost:** Both the investment tax credit and the alternative policies are implementable at a very low additional cost. The investment tax credit and the depreciation allowance are items already included in the annual tax declaration form. The control mechanisms required by these policies are part of the general procedures meaning almost no additional administration cost is required. The cash flow based system offers taxpayers a proposal for declaration available through the SII webpage. Extending this service to more firms will involve comparatively higher costs.

**Control of evasion:** The investment tax credit and the alternative policies require no additional mechanisms to control evasion. The tax credit and the bonus depreciation are reported by the taxpayer based on the purchased of new fixed assets. This information is already declared by taxpayers in the depreciation allowance section. Thus, the creation or extension of any of these benefits creates no difference in the mechanism to control evasion. However, the existence of a higher investment tax credit rate or a bonus depreciation allowance could potentially increase the incentive to overstate the amount of assets purchased.

Unlike the tax credit and the bonus depreciation the design of the cash flow based system and the tax corporate reduction produces lower risk of evasion. First, the SII provides a proposed declaration widely used by the taxpayers of the cash flow based system. This declaration is based on the information of the VAT, that as shown by See Barra and Jorrat (1999) presents lower evasion rates than the income tax. Second, a reduction in the corporate tax credit decreases tax liabilities independently on the amount invested, producing no additional incentives to evade.

**Targeting Capacity:** The investment tax credit and the alternatives policies can be designed to exclusively benefit SME. For that purpose SME have to be defined according to some criteria, typically earning levels. However, earnings are not necessarily a good proxy to distinguish the type of firms that require a policy intervention. As an example, since withholding profits in Chile are exempted from individual income taxes, most high income taxpayers create investment firms with the unique purpose of delaying the amount of taxes paid at the individual level. Given the main activities of these firms is to invest in financial assets they end up with low level of earnings. As a result, the firms become eligible for SME benefits although there is no justification to extend the benefits to them. In the case of a direct investment subsidy, this problem is minimized since these type firms have very low level of investment in physical assets. This is not the case of a corporate tax rate reduction, which benefits firms even if they do not invest. Table 12 summarizes the performance of the tax credit and the policy alternatives in terms of their administration cost, control of evasion and targeting capacity. The investment tax credit compares favorably in terms of administration cost and targeting capacity. Regarding control of evasion, an investment tax credit is overcome by a cash flow based system and a corporate tax reduction.

**Table 12**  
**: Administrative Feasibility Evaluation**

	Administration Cost	Control of Evasion	Targeting
Tax credit	Very low or zero	Good	Very good
Bonus depreciation allowance	Very low or zero	Good	Very good
Corporate tax reduction	Very low or zero	Very good	Medium
Cash flow based system	Medium or low	Very good	Very good




### **6.3 Political Support**

Since any introduction, elimination or modification of taxes in Chile must be proposed by the Government and approved by the Congress, our political support analysis will be focused on policies' capacity to gain support from the National Congress. The recent experience of bills proposing tax expenditure shows that policies are more likely to gain political support when the benefits are limited to SME. Tax expenditures available across the board are usually criticized for being regressive as most part of the benefits is captured by large firms. One clear example is the rejection of the bill that proposed a bonus depreciation allowance in 2006. The bill was presented in the context of a low level of aggregate investment and it was approved on every but its final proceeding including the Budget Committee of the Senate. However, it ended up losing all political support and was finally rejected. The most common argument used by the Senate Members to reject the bill was that most of the benefits would be captured by large firms that needed no support (Historia de la Ley N° 20.289). A second source of political support relates to the level of generosity and visibility of the benefits. In order to gain political support tax expenditure policies need to offer a generous and visible benefit to taxpayers. The bonus depreciation bill of 2006 was rejected in part because it offered a very small benefit to micro and small firms. Regarding visibility among taxpayers, the investment tax credit and the bonus depreciation are more complex and difficult to understand than a tax reduction. Even if aware of the benefits taxpayers need the capacity to calculate and declare the tax deduction. This is less of a problem for large firms that hire accountants or external assistance but is likely to be a problem for smaller firms. On the contrary, a tax rate reduction is highly visible, straightforward and easy to understand and declare. Finally, a cash flow system is not commonly viewed as an incentive to investment. The instantaneous depreciation provided by the cash flow based system is only an indirect effect of a system aimed at simplifying tax declaration. In summary, tax expenditure policies aimed to increase investment among SME are more likely to gain political support if they are design to: (i) target the benefits to intended beneficiaries (ii) produce a visible benefit among taxpayers (iii) produce a

generous benefit. Table 13 summarizes the performance of the proposed policies in these dimensions.

**Table 13 : Political Support Evaluation**

Capacity to Target SME	Visibility of the benefits	Generosity of the benefit	Tax credit	High	Medium
dium High Bonus deprec ia					
tion allowance High Med	um Low for micro	and small firms	Corporate tax reduction		Medium
High High Cash flow based system	High Low Low for micro	and small firms			

## 7. Conclusions and Recommendations

As demonstrated by our analytical framework, investment subsidies such as the investment tax credit introduced in Chile reduce the user cost of capital, leading firms to invest in order to increase the stock of capital. Once the stimulus is withdrawn, firms reduce the stock of capital to initial optimal levels. We find that the increase in the investment tax credit from 6% to 8% had a positive and statistically significant effect on the investment decisions of non credit-constrained SME. The policy increased investment by 30% among eligible firms with earnings in the vicinity of 100,000 UF while producing no effect on credit-constrained firms. In terms of the fiscal cost of the policy our estimates imply that 14.7% of additional annual investments made by these firms were financed with fiscal resources. This number is higher than the 8% tax credit rate, because the benefit applies to purchases of all assets and not only to additional investments. Regarding the robustness of our estimates, we are cautious on interpreting our results as strong evidence. These estimates are sensitive to changes in the regression’s specifications and bandwidth selection, not only in terms of the magnitude of the coefficients but also in terms of their statistical significance. Since we are cautious about the effect of the policy on investment, we should consider what the main consequences of implementing an ineffective policy are. If the policy produces no additional investment, the tax credit would be a simple transfer of resources to SME. More precisely, given the investment tax credit is non refundable the policy would be

equivalent to a tax rate reduction for SME, conditional on having taxable profits. It is also important to note that the tax rate reduction implied by the ineffective policy is not uniform across firms: it provides greater benefits to those firms that regularly invest more. Our methodology is also subject to strengths and the traditional weaknesses plaguing this kind of regression techniques. One of the advantages is the presence of a clean natural experiment that favors estimation via a sharp regression discontinuity design. A second advantage is the availability of administrative data from the population of firms with earnings around the discontinuity point. The main drawback is that we only estimate the effect of the policy at the earning cut-off level, which according to the standard Chilean classification corresponds to medium-sized firms. Thus, we cannot directly conclude that these results also apply to smaller firms. Since smaller firms tend to have less access to credit, we suspect that the effect of the policy on this type of firms could be much smaller or even negligible. This paper also identifies three tax expenditure policies that can achieve the same goal as the investment tax credit: (a) a bonus depreciation allowance, (b) a cash flow based tax system, and (c) a corporate tax reduction. Our analysis suggests that the investment tax credit stands favorably compared to the three alternative policies. First, unlike the bonus depreciation allowance and the cash flow based system, the investment tax credit produces additional incentives to invest, irrespective of the recovery period of the assets. Since SME tend to be more intensive on short-lived assets, an investment tax credit is comparatively more efficient on increasing investment among smaller firms. Second, although all the policy alternatives are easily implementable, the investment tax credit compares favorably in terms of administration costs and targeting capacity. Third, the analysis also suggests that an investment tax credit for SME is more likely to receive political support than the alternatives. Based on our analysis our recommendations are the following: 1. The low proportion of firms declaring the investment tax credit suggests that the

benefits are not broadly known or understood among taxpayers. The Ministry of Finance and the SII should be more active in promoting the benefits, especially

given its temporary dimension. The SII has already been promoting the use of the simplified taxation system and electronic invoices among SME. For that purpose, it has created a section especially dedicated to SME on its webpage. The SII should take advantage of this tool to further promote and explain the investment tax credit. Further, through its regional offices the SII should provide more information and training sections to accountants, who play a critical role in transmitting information and advice to taxpayers.

2. The investment tax credit should only be continued (or extended beyond 2011) in

the context of low level of investment, especially among SME. Thus, we recommend keeping the temporary nature of the policy. This is because investment subsidies should be temporary in order to produce meaningful impact on current investment. A permanent benefit increases the optimal level of capital but provides no additional benefit to anticipate the purchase of new assets. In addition, there is also an administrative reason for not supporting a permanent benefit for SME. A permanent tax benefit for SME provides larger firms with more incentives to circumvent the eligibility requirement by splitting into smaller firms.

3. The recently elected Government has announced the introduction of a temporary

bonus depreciation allowance. If the main objective of the policy is to incentivize large investment plans, a bonus depreciation allowance would be more effective than an investment tax credit. This is because a bonus depreciation allowance produces more benefits for purchases of long-lived assets. However, under this design, the benefit for SME would be small or even zero. This could raise serious concerns about the fairness of the instrument and significantly reduce the political support. A more effective benefit would be a mixed policy, in which firms are given a choice between a bonus depreciation allowance and an investment tax credit. This would allow firms to choose the alternative that provides the highest expected benefit.

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**Appendix** The Hamiltonian for the firm's maximization problem [s ] { } ) ( the following:

Where  $p_t$  is the after investment tax credit price of investment or  $p_t(1 - \tau_t)$

conditions are the followings:

$$\frac{\partial H}{\partial L} = 0 \quad (2)$$

$$\frac{\partial H}{\partial K} = 0 \quad (3)$$

From (3), (4) and (5)

$$\frac{\partial H}{\partial \lambda} = 0 \quad (4)$$

Differentiating FOC (3) and dividing the result by  $\lambda$ , we obtain:

$$(5) \quad p_t(1 - \tau_t)$$

$$p_t(1 - \tau_t) \gamma_t = r_t \quad (6)$$

$$\frac{\partial H}{\partial Y_t} = 0 \quad (7)$$

$$\frac{\partial H}{\partial Y_t} = 0 \quad (8)$$

$$\frac{\partial H}{\partial Y_t} = 0 \quad (9)$$

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