Tax incentives and environmental protection: evidence from Sweden's taxpayers' level data

Thesis

Master in Economics

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Title: Tax incentives and environmental protection: evidence from Sweden's taxpayers' level data

Executive Summary

Tax incentives such as investment tax credit and taxable income deductions related to the environment and climate change are becoming more popular. Introducing tax incentives related to the environment and climate change helps meet the sustainability objectives of growth and development. Many countries worldwide are taking serious steps to counter the mounting challenges due to changing climatic conditions. To meet the sustainability goals, Sweden has set a goal to lower greenhouse gas emissions by 55% in 2030 compared to 1990. In this regard, it is imperative to reflect on the tax incentives provided by the Swedish government in terms of the investment tax credit. It is significant to investigate the beneficiaries of the Swedish government's tax incentives. We selected the top 100 listed companies on the Swedish stock market, Nasdaq Stockholm, to answer this question from 2017 to 2019. Our dependent variable is a dummy indicating 1 for firms who took advantage of the investment tax credit and 0 otherwise. We use ESG scores to construct our dependent variable. Because a higher ESG score reflects a more sustainable approach to production by firms. Therefore, we use dummy 1 for firms on the top of ESG ranking and 0 otherwise. We use different firm-level characteristics as the independent variables, such as age, size, investment, capital, assets, capacity, net capital, and net income. We use a longitudinal research design because sample observations vary across firms and over a short time. We conduct probit and logistic regression to identify the beneficiaries of the tax incentives. The study's findings show that different firm-level characteristics significantly impact the probability of being an ITC beneficiary. For instance, domestic enterprises are more likely to benefit from tax incentives than foreign enterprises, but the relationship is insignificant. In the same way, firms with a maximum number of employees and capital stock are more likely to benefit from the tax incentives than firms with lower capital stocks and limited employees. Our findings also show that firms with higher amounts of new investment in fixed assets are more likely to benefit from the tax incentives. Finally, we found a statistically significant coefficient for firm capacity, an indicator of total inventory. Specifically, the higher the capacity of a firm, the more it is likely to be an ITC beneficiary.

Keywords: Green tax incentives, green environment, theory of green tax, EGS, environmental protection

1.1 Introduction

Tax incentives such as investment tax credits and taxable income deductions related to the environment and climate change are frequently used tax incentives. Introducing tax incentives related to the environment and climate change helps meet the sustainability objectives of growth and development. Many countries worldwide are taking serious steps to counter the mounting challenges due to changing climatic conditions (Mao & Wang, 2016). To meet the sustainability goals, Sweden has set a goal to lower greenhouse gas emissions by 55% in 2030 compared to 1990 (Dahlberg & Wiklund, 2018). In this regard, it is imperative to reflect on the tax incentives provided by the Swedish government in terms of the investment tax credit. Investigating the beneficiaries of the Swedish government's tax incentives related to the environment is significant in many instances (Ferrell et al., 2016).

In the first place, the identification of beneficiaries allows relevant policymakers to reflect on the green tax incentives. Once it becomes clear that certain features of a firm are significant in determining the probability of being a beneficiary in the tax incentives program, then the obtained knowledge can be applied to fill the limitations of the existing tax incentives program. For instance, if foreign firms are more reluctant to avail the opportunities of green tax incentives than domestic firms, then policymakers must apply this knowledge and incentivize the program in favor of foreign firms. In the same way, if older firms are more reluctant than younger firms, there must be a redesign of green tax incentives, so that older firms must also engage themselves to avail the opportunities of green tax incentives Metcalf (2010).

A large amount of empirical literature has examined the relationship between Tax policy and direct regulation, but the results remain inconclusive (Murray et al., 2014). Many studies show a positive relationship (Bovenberg & Goulder, 1993, Goolsbee, 1998), while others show a negative (Duque-Grisales & Aguilera-Caracuel, 2019; Landi & Sciarelli, 2019) relationship. The Green tax theory opposes the views of these mixed results. The purpose of maximizing shareholder benefits in this perspective traditional view or shareholder theory argues that CSR governance with subsequent ESG activities poses a cost to the company against its (Ferrell et al., 2016). In contrast, if we consider the beneficiaries of firms who focus on maximizing value through CSR governance and ESG activities the good governance approach also known as a stakeholder theory promotes stakeholder-oriented management (Ferrell et al., 2016).

In this study, we explore the effect of Firm beneficiaries who took advantage of the green tax policy by analyzing the taxpayer data and the effects of these incentives on firms' activities. The former issue of the beneficiary is usually ignored by the literature, We first time pin down the factor of beneficiaries of firms' domestic and foreign effects on the green tax policy and protect the environment. As to their impacts, we regard capital accumulation, employment, energy consumption, and production.

The basic goal is to evaluate and investigate the beneficiaries of green tax policy in Sweden by relying on tax-payer-level observations. Therefore, this empirical investigation explores the implications of green tax policy and enlists the beneficiaries of green tax policy. Specifically, we select the top-listed 100 firms from Nasdaq Stockholm and investigate the beneficiaries of green tax policy by including different firm-specific variables. We construct our dependent variable by using ESG scores. Our dependent variable would be a dummy 1 for those

firms who secured ESG scores above 60; otherwise, 0. The ESG score is significant because it shows firms' attitudes toward green tax policy. We use different firm-level characteristics as the independent variables, such as age, size, investment, capital, assets, capacity, net capital, and net income. We use a longitudinal research design because sample observations vary across firms and over a short time. As an econometric technique, we conduct probit and logistic regression to identify the beneficiaries of the tax incentives.

1.2 Research Question

- Who are the beneficiaries of tax incentives on the environment in Sweden?

1.3 Research Objectives

We evaluate the implications of green tax policy for the 100 top-listed companies in the NASDAQ

Stockholm. Therefore, the objectives are,

- To identify the beneficiaries of green tax policy in Sweden between 2016-2020.
- To identify significant firm-level characteristics in taking advantage of green tax policy
- To provide practical policy recommendations

1.4 Research Hypothesis

According to the previous literature discussed above, the green tax theory is more dominant as the majority of studies show a positive relationship between a company's Beneficiary of green tax policy performance and protecting the environment. As described in the literature review, the green tax theory assumes superior to the beneficiaries of the companies that successfully integrate ESG activities into their firm-level operations. To test that assumption, the following hypotheses are formulated.Each ESG pillar is determined by a number of factors that can have a varying relation to and impact on the environment (Mao & Wang 2016). For this reason, it is important to examine the relationship between the individual ESG of the Firm, and independent variables, such as age, size, investment, capital, assets, capacity, net capital, and net income.

H1: The probability of being a beneficiary under the green tax incentives scheme is the same for domestic and foreign firms.

H2: The probability of being a beneficiary under the green tax incentives scheme is the same for older and younger firms.

H3: The probability of being a beneficiary under the green tax incentives scheme is the same for small and big firms.

H4: Firms with higher levels of new investment and fixed capital are more likely to benefit from the tax incentives than firms with lower levels of new and fixed capital.

H5: Firms with higher levels of profitability are more likely to benefit from tax incentives than firms with low profitability.

1.5 Research Scheme

The first chapter deals with the introduction, research question, objectives, and hypothesis. The second chapter presents a literature review by focusing on available empirical literature. The third chapters provide a theoretical discussion followed by research philosophy and design. In addition, data and econometric development are also presented in the third chapter. Chapter four presents results discussions followed by a conclusion and recommendations in the fifth chapter.

2. Literature Review

Tax policy is more prevalent than direct regulation, and there is a reason for that. Because tax policy allows consumers and firms to continue with their basic goals, such as utility and profit maximization. Thus, tax policy is more efficient than direct regulation (Tresch, 2015). To protect the environment, different countries have introduced various tax policies ranging from Pigovian taxes, investment tax credits, and taxable income deductions (Mao & Wang, 2016). However, there is no consensus among researchers regarding the effects of various environmental tax policies are concerned (Murray et al., 2014). In this section, we will review the available literature on tax incentives and particularly focus on available empirical literature.

The question of why firms respond to tax incentives has been answered by Hall & Jorgenson (1967). According to them, the user investment cost depends on many factors, including capital income tax. Therefore, tax incentives that cause a reduction in the user cost of investment will encourage firms to become the beneficiary of tax incentives. Regarding the efficiency of tax incentives, it is known that domestic public welfare can be increased more sustainably through investment tax credits than by cutting taxes on corporate income (Bovenberg & Goulder, 1993).

Because of the endowment effect[1], firms are more reluctant to accept the tax cut on corporate income than the tax credit on investments oriented to protect the environment. However, investment firms are far behind in capturing the benefit of an investment tax credit on the environment. It is found that increased demand for investment goods causes a price hike, and the suppliers of capital get a larger share of benefits than investing firms (Goolsbee, 1998). The investment tax credit can positively affect a firm value in terms of investment returns. For instance, there is a positive correlation between firm value and expected investment receipts tax credit (Lyon, 1989). A relatively higher return is expected on new investment than existing investment because only new investment can be applied for tax incentives. As a result, excess returns related to new investment increase firm value, but no relationship is found between change in existing assets and change in firm value. However, the effects of temporary and permanent tax incentives on the level of investment are not the same. For instance, a more short-term-oriented investment tax credit increases a firm's investment variability. Still, it has no short-run or long-run impact on a firm's investment (Altug et al., 2009). Investment tax credit on Research & Development has proved successful in Canada, especially for small firms. Alternatively, size can significantly explain the responsiveness of firms toward investment tax credits on Research & Development (Agrawal et al., 2014). The effects of an investment tax credit on private and regulated electricity markets are not the same. For instance, the responsiveness of the unregulated electricity market towards investment tax credits is relatively higher than that of the regulated electricity market (Huang, 2014).

The energy tax credit can explain the probability of a firm's investment level. The relationship between the two is positive and statistically significant. For instance, when there is an increase in

[1] Mullainathan, S., & Thaler, R. H. (2000). Behavioral economics.

an energy tax credit by ten percentage points, the percentage of claimants for energy tax credit will increase by 1.4 percent (Hassett and Metcalf, 1995). Emission taxes or carbon tax policy will only achieve the targeted goals if the respective government compensates those causing pollution. In other words, polluter firms must be compensated to achieve the targeted goals associated with Emission taxes or carbon tax policy (Bovenberg et al., 2008).

The literature on tax incentives related to energy conservation emphasizes the effects of tax incentives on investment and employment. There is a need to shift the focus to the effects of tax incentives on energy conservation. In this regard, Mao & Wang (2016) investigated the effects of two different tax incentives on energy conservation, i.e., investment tax credit and taxable income deduction. It has been found that many firm-specific characteristics can significantly impact the probability that a firm is likely to benefit from tax incentives. Specifically, they found a significant impact of age, size, and profitability on the probability of taking advantage of tax incentives. For instance, according to them, older firms are more likely to be reluctant to avail opportunities related to tax incentives. In addition, firms with a larger workforce and higher profitability are more likely to be beneficiaries of the tax incentives.

In this study, we evaluate the implications of the carbon tax policy for Sweden and contribute to the literature in two aspects. First, we evaluate the implications of the carbon tax policy for a developed country. It is important because Sweden introduced a carbon tax policy almost thirty years ago, and it is crucial to evaluate the implications of tax incentives. Second, we select the top-listed 100 firms from Nasdaq Stockholm and investigate the beneficiaries of the green tax policy by including different firm-specific variables.

Liu et al (2022) analyze the effect of the implementation of China's environmental tax in 2018 on firms' environmental investments. The findings of this study indicate a significant increase in firms' environmental investments after the implementation of the tax. However, Shabbir et al (2020) examined the relationship between CSR activities and firm performance through a non-linear and disaggregate approach. Moreover, Shabbir and Wisdom (2020) investigated the causal association between CSR and firm performance in the manufacturing sector. The results of both studies indicate a positive and significant impact on firm performance. Arslan et al (2021) described the mediating role of green creativity and the moderating role of green mindfulness in the relationship between a clean environment, clean production, and sustainable growth. They took primary data sets from the top seven fertilizer companies listed in Pakistan. The results indicate that green creativity and green mindfulness have a positive effect on a clean environment. Cao et al (2022) explain the relationship among financial development, energy consumption, and sustainable environmental economic growth through sustainable environmental agenda in the era of globalization. Whereas, Ge et al (2022) examine the causal effect of foreign private investment on a clean industrial environment through CO2 emissions, energy consumption, trade openness, and sustainable economic growth.

Liu et al (2022) investigate the impact of green environmental innovation really matter for carbonfree economy through green technological innovation, green international trade, and green power generation. The findings of their study show a positive and significant effect of green environmental innovation on a carbon-free economy. Sadiq et al (2022) explain the dynamic role of globalization toward energy consumption, economic growth, and carbon dioxide emissions through sustainable environmental agenda. Liu et al (2022) investigate the impact of China’s

new Environmental Protection Law on the green innovation behavior of listed companies in high-polluting industries. Khurshid et al (2022) examined the role of environmental policy, energy consumption, environmental taxes, urbanization, and economic growth on the environment.

3. Methodology

3.1 Theoretical Discussion

Green tax theory incorporates the sustainability aspect of the capitalist production process. In greening the tax code, governments aim to achieve environmental goals by harnessing their fiscal structure (Milne, 2007). There are two dimensions of green tax theory which are worth considering here. First, the green tax theory allows the government to increase taxes on activities or commodities causing environmental damage. And second, it allows governments to decrease taxes on sustainable activities that are beneficial in environmental terms (Milne, 2003). Apart from equity, economic, and administrative tax principles, the Green Tax theory adds sustainability principles to internalize the costs associated with the private activities of the production process (Milne, 2007).

In particular, the green tax reflects and captures the environmental cost of the private activities of different firms and ensures the inclusion of environmental costs into their cost structure. For instance, Pigou (1920) introduced the idea that we can measure the cost of private activities causing environmental damage by imposing taxes on such activities. In this way, the imposition of taxes on the private activities of a firm implies widening its cost structure. Corresponding to taxes, the government also introduces various subsidy programs to assist with

pollution control measures. However, the polluter pays principle stands against such subsidies as they are causing issues related to fiscal structure (De Sadeleer, 2014). Apart from taxes and polluter pays principle, the least-abatement cost is another measure to control the aggregate pollution level.

One of the advantages of the least-abatement cost is that it allows the polluter firm to decide on an optimal reduction in aggregate pollution (Kesicki & Strachan, 2011).

In addition, the idea of a double dividend related to green tax theory is also worth considering here. According to this concept, the green tax code first allows a government to reap environmental benefits termed environmental dividends. The second stage allows for reaping the economic benefits termed an economic dividend. However, as it is extremely difficult to capture the exact amount of external cost related to private activities, the green tax increase implementation is largely executed inefficiently (Freire-González, 2018).

On the other hand, the green tax decrease is more efficient when the exact external cost is unknown and difficult to measure. A green tax decrease can encourage firms to choose environmentally friendly activities by subsidizing these activities. For example, investment tax credits, deductions, and exemptions are various forms of green tax decrease. A green tax decrease is also a tax expenditure because it reduces the government's revenue. But at the same time, the green tax decrease is more attractive because the green tax increase is politically unpopular (Milne, 2007).

Green tax instruments are a means to achieve the end of reduction in greenhouse gas emissions (Gago, Labandeira, & López-Otero, 2014). However, it is still an important question to ask when and how to use one of the two sides of green taxes, I.e., green tax increase and green tax decrease or expenditure. In this regard, two points are worthy of being mentioned here. First, green tax increases will likely cooperate when environmental goals are such that they require

long-term structural and attitudinal changes. In the same way, if environmental goals are such that it requires the polluter pays principle to be followed, then a green tax increase would be the best option. On the other hand, green tax expenditure as a tax instrument will likely cooperate if environmental goals are short-term oriented and require society to be the external cost of private activities (Milne, 2003).

Green tax practices are significantly related to several political and policy issues. As a result, the actual green tax practices are far from the ideal position stated in the Green Tax theory (Dahlberg & Wiklund, 2018). For instance, an ideally pure Carbon tax model contradicts certain political stakeholders' interests. Therefore, a green tax on the carbon content of fossil fuels is difficult to introduce, primarily due to political and policy issues (Stern & Stern, 2007).

In 1992, the green tax policy introduced by the European Commission imposed taxes on both carbon content and energy value. The European Commission extended the green tax to include non-carbon fuel resources to protect the competitive position of different member states (European Commission, 1992). In 1993, the US designed a green tax policy by merely targeting the energy content. Because it was believed that a carbon tax on coal would create economic and policy issues in the country(US Treasury, 1993). As a result, it can be said that the environmental principle remains far behind the policy principle primarily due to the expected short-run economic consequences of pure carbon taxes.

However, Nordic countries were the first to introduce carbon taxes in the early 1990s. Sweden's carbon tax was introduced in 1991 to mitigate the changing climatic conditions worldwide and within the country. This specific green tax policy aimed to reduce greenhouse emissions cost-effectively and promote the environment by developing and deploying clean technologies (Jagers & Hammar, 2009). Pricing carbon emissions is the manifestation of the green tax increase. Sweden's government derived the carbon tax model from the polluter pays

principle, which says that the external cost of pollution must not be borne by society but by those who are causing it. The carbon tax policy in Sweden has proved more successful in achieving its stated objectives, such as a decline in energy consumption, a rise in the efficiency of energy usage, and greater availability and use of more and more renewable energy alternatives (Andersson, 2019). In 2017, Nasdaq Stockholm introduced sustainable bonds and became the first stock exchange to launch a market for sustainable bonds, making it mandatory for companies to include sustainability efforts in their annual reports (Erhart, 2018).

In this study, we evaluate Sweden's green tax policy's implications. The basic goal is to evaluate and investigate the beneficiaries of green tax policy in Sweden by relying on tax-payer level observations. Therefore, this empirical investigation explores the implications of green tax policy and enlists the beneficiaries of green tax policy. Specifically, we select the top-listed 100 firms from Nasdaq Stockholm and investigate the beneficiaries of green tax policy by including different firm-specific variables. We construct our dependent variable by using ESG scores. Our dependent variable would be a dummy 1 for those firms who secured ESG scores above 60, otherwise, 0. The use of the ESG score is significant because it shows firms' attitudes toward green tax policy. We choose different firm and region-specific characteristics as our independent variables and are enlisted in table 1. In the next section, we provide a detailed discussion of the research methodology of this study.

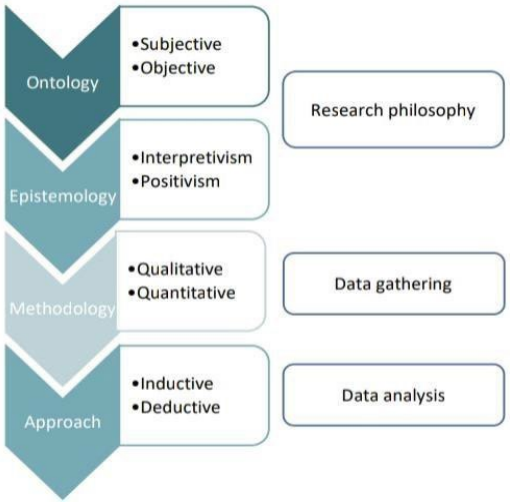
3.2 Research Process and Methods

In this section, we present our research philosophy, design & methodology, and approach and provide justifications for all these basic elements of scientific research.

3.2.1 Research philosophy

Research philosophy refers to a research study's ontological and epistemological assumptions. It contemplates the very nature and philosophical development of knowledge. It consists of beliefs and assumptions that have paramount implications for the construction and interpretation of research findings. Such beliefs and assumptions about the knowledge and nature of reality can be translated into two different paradigms, ontological position, and epistemological position. In the first paradigm, the point of concern is the nature and perception of reality, while epistemology studies the theory of knowledge (Goertz, & Mahoney, 2012).

Figure 1. Overview of the research process and methods



. Ontology sees the nature of reality from objective and subjective lenses. It asks a basic question about the nature of reality, whether objective or subjective. Because the objective reality is always independent of the construction and interpretation of social actors, on other hand, subjective realities can be constructed based on the perceptions and actions of the social actors. Specifically, ontology deals with reality from two different perspectives. In the first place, objectivism considers reality as physical objects that can be measured and tested. However, constructionism sees reality from a subjective perspective and cannot measure and test reality

(Goertz & Mahoney, 2012). Since this study is interested in identifying the beneficiaries of green tax arrangements in Sweden, we can measure and empirically test the reality. Therefore, objectivism as a perspective to see reality is the best ontological position for this study.

The validity and acceptability of knowledge in any discipline is the subject matter of epistemology. Fundamentally, two different sources of knowledge are much needed to be discussed here. The first is a positivist approach that believes knowledge must come from facts and objective evidence, and also the knowledge must be observable and measurable. More specifically, a positivist approach requires hypothesis formulation to make a causal linkage between occurrences by using a large set of samples. On the other hand, interpretivism focuses on meanings instead of facts, and knowledge comes from subjective evidence instead of objective and measurable reality (Roots, 2007). To sum it up, a positivist approach requires a quantitative methodology to answer research questions, while the interpretivism approach requires a qualitative methodology.

Since this study is interested in identifying the beneficiaries of green tax arrangements in Sweden, we largely rely on facts and observable data to answer the research questions. Therefore, we chose interpretivist approach as the epistemological position for this study.

3.2.2 Research design

Research design is a depiction of various steps that have to be taken out by the researcher in a bid to translate the research questions into data analysis and research findings. It is a kind of design in which all the various stages of research are connected in a more consistent way (Salkind, 2010). Broadly, three different types of research design are widely used by researchers. Exploratory research design, as the name indicates, largely answers unexplored research

questions. This kind of design is suitable when no previous studies are conducted around the research questions.

Second, a descriptive research design is widely used to describe various characteristics of an existing phenomenon. It is suitable to use descriptive research only when the research questions require a description of certain characteristics. It goes more deeply into an issue than exploratory research does. However, some issues need to be explained Instead of just being explored or described. If exploratory research design is used to formulate a hypothesis, then explanatory research design is about testing the hypothesis. Using an analytical method, an explanatory research design tries to explain the phenomenon in detail (Skinner & Dancis, 2020). Based on these categorizations of research design, it can be said that the explanatory research design is more suitable for this study. Because our basic purpose is testing hypotheses, not formulating them, therefore we are using an explanatory research design.

3.2.3 Research Approach

A research approach tells us the relationship between theory and research. The two broader approaches to research are inductive and deductive. In the former approach, the theory is the outcome of the research. While the deductive approach as the name indicates deduces a hypothesis from a grounded theory and either accepts or rejects the formulated hypothesis. In other words, the deductive approach moves from theory to findings with the help of data collection and data analysis (Gregory, & Muntermann, 2011). For all these reasons, the deductive approach is more suitable for this study.

As far as the choice of methodology is concerned, we know that our research problem is quantifiable, and we can measure the problem in numeric form. Consistent with this research's ontological and epistemological position, we are using quantitative methodology. As we have

chosen objectivism and positivism as ontological and epistemological positions, the only quantitative methodology will be suitable for this study.

3.3 Data

There are two sources of data collection such as primary and secondary sources of data. Primary data contain first-hand information from the respondents, whereas secondary data is not first-hand information but rather has already been collected by different private and public organizations. One way to differentiate primary versus secondary data is to identify whether any statistical methods have been applied to the data or not (Hox, & Boeije, 2005). For example, companies' annual reports will be considered secondary sources of data. In this study, we also use annual reports of 100 top-listed companies in NASDAQ Stockholm. Therefore, our data source is secondary.

Other data categorizations, such as cross-sectional, time-series, and Panel data, are also important to be discussed here. When observations change only across different sections or units, we can call it cross-sectional data. It does not take into account the time-varying aspects of observations. On the other hand, time-series data allows observations to change over time, but unlike cross-sectional data, it does not allow observations to change across different sections. However, the panel data set allows observations to change across different sections and over time. This study uses short panel data because the cross-sectional elements are greater than the periods. Specifically, we are using secondary data from 2016-2020 for 100 companies.

3.4 Econometric Specification

Ordinary Least square assumes normal distribution to estimate parameters. However, the distribution is no more normal, characterized by 0 mean and 1 standard deviation. Instead,

dichotomous dependent variables assume Bernoulli distribution to estimate parameters. In other words, using OLS will likely produce inefficient parameters, especially when the experiment is drawn from the Bernoulli distribution. A random variable is said to have a Bernoulli distribution if it assumes only two values: 0 with probability 1-p and 1 with probability p, where $0 \leq p \leq 1$. Random variables of this category can be generated from a population whose outcomes can assume two values, i.e., yes or no. The binomial distribution is the generalization of the Bernoulli distribution, where the former draws outcomes from repetition.

Binary response models such as logit and probit assume mutually exclusive binary outcomes and focus on the occurrence of one outcome with the probability p. It implies that binary response models do not focus on the alternative outcome that occurs with a probability of 1-p.

Suppose that the outcome variable Y assumes one of the two values:

$$\mathbf{Y = 1 \text{ with probability } p}$$

$$\mathbf{Y = 0 \text{ with probability } 1\text{-}p}$$

In this stage, we must differentiate the observed binary outcome Y and the unobserved continuous Y*, which is often termed as a latent variable. For instance, the probability density function for the observed binary outcome Y is given by

$$\mathbf{P^{Y} (1-p)^{1-Y}}$$

$$\mathbf{With\ E(Y) = P \qquad and\ Var(Y) = P(1-P)}$$

The basic model of the single-index form is given by,

$$\mathbf{Pi = Pr(Yi = 1/X) = F(\hat{X}\ i\ \beta)} \qquad \mathbf{(Exp.\ 1)}$$

$$\mathbf{Where\ f(Yi/Xi) = Pi^{Y} (1-Pi)^{1-Yi}}$$

To satisfy the necessary condition of $0 \leq p \leq 1$, f (Yi/Xi) must be a cumulative distributive function.

Assume that the latent variable Y* satisfies the single index model,

$$Y^* = \hat{X}_i \beta + u \qquad \textbf{(Exp. 2)}$$

Although we cannot observe Y*, we can observe

$$Y = 1 \text{ If } Y^* > 0$$

$$Y = 0 \text{ If } Y^* < 0$$

Thus we can transform Expression 1 into Expression 3.

$$\Pr (Yi = 1/X) = \Pr (Y^* > 0) \qquad \textbf{(Exp. 3)}$$

Applying some mathematical operations on expression 2 and expression 3, we can have,

$$\Pr (Yi = 1/X) = \Pr (\hat{X}_i \beta + u > 0) \qquad \textbf{(Exp. 4)}$$

$$\Pr (Yi = 1/X) = \Pr (-u < \hat{X}_i \beta) \qquad \textbf{(Exp. 5)}$$

$$\Pr (Yi = 1/X) = F (\hat{X}_i \beta) \qquad \textbf{(Exp. 6)}$$

In expression 5, the F(.) equals the cumulative distribution of -u. In addition, expression 6 has different implications for the selection of a proper binary response model. For instance, if the U is standard normally distributed, we must use the probit model; otherwise, we must use the logit model.

3.5 Variables of the Study

Table 1. Dependent and Independent variables

Variables	Definitions Variables Definitions

Dependent Variable	Dummy indicates 1 for firms who took advantage of Green Tax incentives, otherwise 0.
SOE	1 for State-owned, 0 for private c
Foreign	1 for Foreign, 0 for domestic import Importing cost
Age	Age of birth/foundation date
size	Total number of employees
investment	Newly increased fixed assets/output
capital	Net value of fixed assets/output
capacity	Inventory/output
net capital	1-period weighted growth of net investment
Net income	1-period weighted growth of real output

4. Results and Discussion

4.1 Overview

To identify the beneficiaries of tax incentives provided by the Swedish government, we conduct a probit regression analysis. Our dependent variable is a dummy indicating 1 for firms who took advantage of the investment tax credit and 0 otherwise. We use ESG scores to construct our dependent variable. Because a higher ESG score reflects a more sustainable approach to production by firms. Therefore, we use dummy 1 for firms who are on the top of ESG ranking and 0 otherwise. As far as explanatory variables are concerned, we use different firm-level characteristics such as age, size, investment, capital, assets, capacity, net capital, and net income. The use of the probit model especially with dummy dependent allows us to identify different firm-level characteristics that have significant impacts on the probability of being an ITC beneficiary. Analysis of the secondary data starts from descriptive statistics. Various statistical properties of the data set would be highlighted, such as mean, standard deviations, and range of the observations. The basic aim of providing descriptive statistics is to check the stationarity of the data set. After that, the correlation matrix is presented to check multicollinearity in the model. A highly correlated variable with other explanatory variables causes multicollinearity in the model. Using Person correlation as a yardstick, we will discuss the degree of correlation among explanatory variables. In the next step, we provide the regression output of probit

regression analysis both with default and robust standard errors. In addition, we present a marginal effect analysis of the explanatory variables.

4.2 Descriptive Statistics

The average Dependent variable for the current data set is 0.537 with a standard deviation of 0.498. It implies that 53% of the observations in the dependent variables contain a value of 1 while 47% of observations contain a value of 0. Alternatively, 53% of the top-listed companies secure an ESG score greater than 60 for the period 2016-2020. However, 47% of the top-listed companies secure an ESG score of less than 60. Our first explanatory variable is also a dummy indicating whether a company is a domestic or foreign firm and assumes value 1 for a foreign company. Its average value is 0.467 which implies that 46% of the top-listed companies are foreign-based while 54% are domestic companies. Age of company is our second explanatory variable which measures how long a company is operating. The mean age of the top-listed companies is 82 which implies the average age of the selected companies. For instance, the maximum age of a company in this data set is 147 and the minimum age is 7.

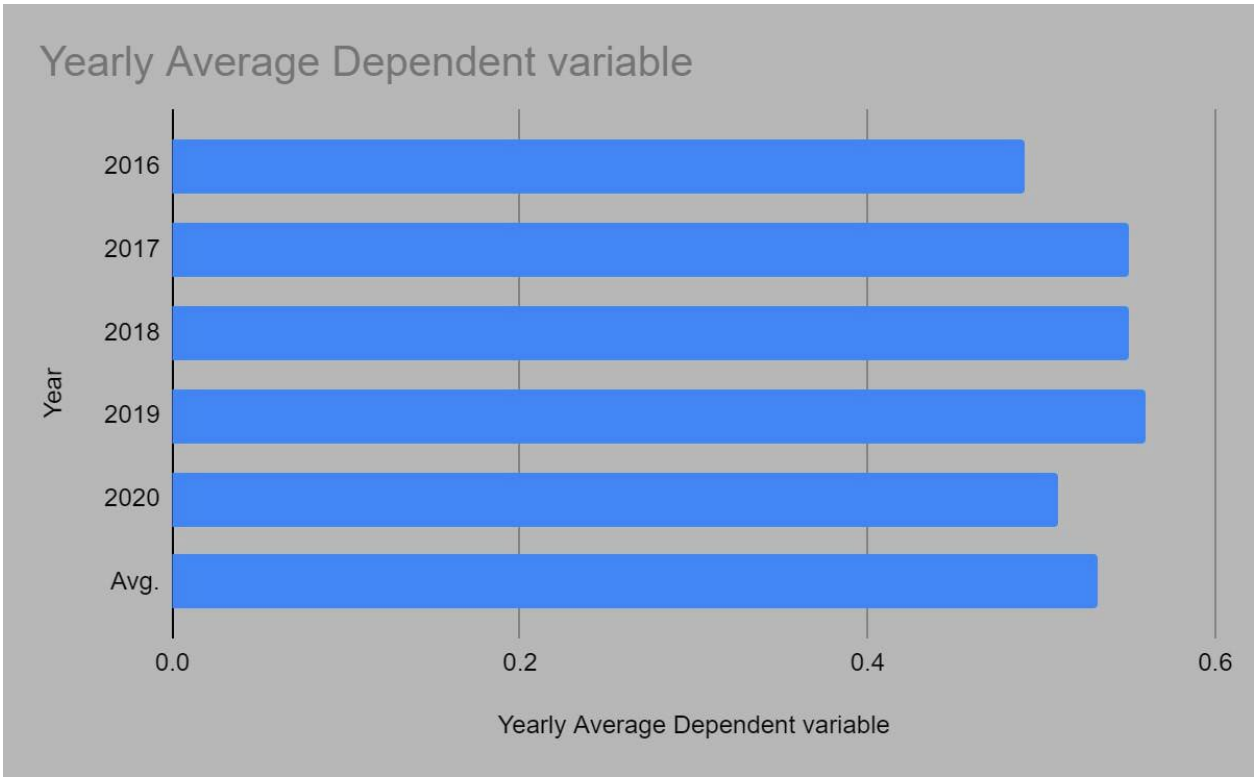
Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Dep. Var	403	0.5372208	0.4986092	0	1
foreign	404	0.4678218	0.4995822	0	1
age	404	82.50495	107.2939	7	147
size	404	17731.24	35689.35	1	345000
investment	404	4145.491	8133.748	-25351	52483
capital	404	67494.5	114699.7	65	927960
assets	404	66.1645	512.0224	-59	4917

capacity	404	4875.559	8966.647	0	63916
netincome	404	3496.461	8484.113	-35206	101226
id	404	50.34653	30.83823	1	100

Our third explanatory variable is Size which measures total number of employees. The mean of size is 17731 which is the average number of employees for the selected companies for the period 2016-2020. However, its standard deviation is quite large indicating a higher gap between the minimum and maximum value. It can be said that the distribution of the Size variable is lacking the normality assumption.

Bar Chart: Yearly Average Dependent variable



In the Bar chart, we present the yearly average of our dependent variable. In 2016 the average dependent variable was 0.49 and in 2020 it is 0.51. It shows the early evolution of sustainable practices of the selected companies. For instance, only 49 % of the selected companies were

engaged in sustainable activities in 2016 but the percentage increased to 56% in 2019. The average dependent variable shows that 53% of the companies secured ESG scores above 60. To sum it up,

4% of companies have incorporated and prioritized sustainable activities in their daily operations.

4.3 Multicollinearity

The most crucial econometric issue in multiple linear regressions is to account for the degree of correlation among the explanatory variables. If one or more explanatory variables are correlated with another explanatory variable, we can have the issue of multicollinearity in the model.

Table 3. Correlation Matrix

	Dep.Var	foreign	age	size	invest~t	capital	assets	capacity	netinc~e
Dep. Var	1								
foreign	0.1052	1							
age	0.0339	0.0221	1						
size	0.0474	0.0494	0.2144	1					
investment	0.0676	0.0972	0.0949	0.2698	1				
capital	0.0782	0.069	0.113	0.3	0.8092	1			
assets	0.1247	0.1075	0.0609	0.0576	0.0103	0.0609	1		
capacity	0.2459	0.3387	0.2446	0.314	0.5641	0.4789	0.0513	1	
netincome	0.0262	0.156	0.0777	0.1378	0.666	0.6864	0.0352	0.3815	1

In table 1, we present the correlation matrix of the selected variables. Pearson correlation coefficient can take a value between 0-1, and we can categorize three different levels of correlation coefficients. For instance, a correlation coefficient between 0.1-0.30 indicates a weak

degree of correlation. A correlation coefficient between 0.30-0.60 would imply a moderate correlation between the variables. And finally, a correlation coefficient above 0.60 indicates a strong correlation between variables (Chok, 2010).

We can find three correlation coefficients that indicate a strong level of correlation between variables. For instance, the correlation coefficient between investment and capital is 0.80 which shows a strong correlation between the two variables. In the same way, the correlation coefficient between net income and capital is 0.68 which shows a strong correlation between these variables. And finally, the correlation coefficient between net income and investment is 0.66 which again shows a strong correlation between the two variables. However, all the remaining correlation coefficients do not exhibit a strong correlation between variables.

4.3 Probit regression results

The basic argument is that different firm-level characteristics play a significant role in determining the probability of being a beneficiary in a green tax incentives scheme. We hypothesize this idea and investigate the impact of different firm-level characteristics on the probability of being a beneficiary in a green tax incentives scheme. The results of hypothesis testing are presented in table 4.

Table 4. Probit regression (Default standard errors)

	3	Number of obs	366		
LR chi2(8)	71.19	Prob > chi2	0.0000		
Log likelihood	-217.17424	Pseudo R2	0.1408		
	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
foreign	-0.0205285	0.1726666	-0.12	0.905	-.3589489 .3178918
age	-0.0012014	0.0007648	-1.57	0.116	-.0027004 .0002976

size	0.1237845	0.0475502	2.6	0.009	0305878 .2169813 .
investment	0.0000213	0.0000134	1.59	0.111	.0000475 . 000936
capital	0.1288844	0.071947	1.79	0.073	.0121291 .269898
assets	0.0294692	0.0071592	4.12	0.0000	.0154374 .043501
capacity	0.0001001	0.0000217	4.6	0.000	.0000575 .0001427
_cons	0.3738198	0.5830442	0.64	0.521	-.7689257 1.516565

In the first column of table 4, we enlisted the variables with their coefficients in the second column.

For instance, the coefficient is negative for foreign-based companies indicating the fact that foreign-based firms are less likely to benefit from the green tax incentives. However, this coefficient is statistically insignificant at the standard 5% significance level. For instance, its associated probability value is almost 90%. Another way to look at the statistical significance of explanatory variables is to check whether the Z statistics is above 2 or not. In this case, it is far lower than the critical region of 2. It can be said that though domestic companies are more likely to benefit from the green tax incentive scheme than foreign-based firms, this probability lacks its statistical validity (see, e.g., Greenstone and Hanna 2014). Because this variable remained statistically insignificant in our specification too. For instance, in table 5, we changed the mode of standard errors from Stata default mood to Robust mood, but still, the coefficient appeared to be insignificant. In addition, the marginal effect of Foreign-dummy presented in table 6 tells the same story. Alternatively, the foreign dummy appears statistically insignificant in all three different specifications and is consistent with a negative insignificant coefficient for foreign-based firms in Mao & Wang (2016). Therefore, regarding our first hypothesis, it can be

concluded that a foreign dummy has no significant impact on the probability of being a beneficiary under the green tax incentives scheme (see, e.g., Greenstone and Hanna 2014).

Table 5. Probit regression (Robust standard errors)

Number of obs	366	Prob > chi2	0		
Wald chi2(8)	49.48	Pseudo R2	0.1408		
Log pseudolikelihood	-217.17424	-			
	Coef.	Std. Err.	z	P>z	[95% Conf. Interval]
foreign	-0.0205285	0.1739272	-0.12	0.906	-.3614195 .3203624
age	-0.0012014	0.0005706	-2.11	0.035	-.0023198 -.0000831
size	0.1237845	0.0466592	2.65	0.008	.0323342 .2152348
investment	0.2164103	0.1200538	1.75	0.096	.004764 0.3178426
capital	0.1288844	0.0715838	1.81	0.072	.0114172 .269186
assets	0.0294692	0.0075724	3.89	0.000	0146276 .0443108 .
capacity	0.0001001	0.0000182	5.5	0.000	.0000644 .0001358
_cons	-0.3738198	0.1420854	-2.64	0.0041	-.1278474 1.475487

Our second explanatory variable in table 4 is age. A positive coefficient for age would imply that older firms are more likely to benefit from the tax incentives than younger firms. However, the coefficient of age is negative and indicates that older firms are less likely to benefit from the green tax incentives scheme than younger firms. Though this coefficient is statistically insignificant in table 4 because the probability value is 11%, it appears statistically significant under robust standard error regression in table 5. In the same way, the marginal effect of age on the probability of being a beneficiary in the green tax incentive scheme is also statistically significant. Consistent with the literature, the coefficient for size also appears negative and

significant in Mao & Wang (2016). Therefore, we reject our second hypothesis that older and younger firms have the same impact on the probability of being beneficiaries under the tax incentives scheme and conclude that younger firms are more engaged in sustainable activities than older firms (Xu C 2011).

Our third explanatory variable is the size which measures the total number of employees. The third hypothesis is that size does not significantly impact the probability of being a beneficiary. However, we reject this hypothesis at a 5% significance level in all three specifications. Specifically, a positive and significant coefficient for size indicates that there is a significant difference between big and small firms as far as the probability of being a beneficiary is concerned. The positive and significant coefficient for size indicates that firms with a larger workforce are more likely to benefit from the tax incentives and these findings are consistent with Mao & Wang (2016), and Agrawal et al.(2014). Therefore, we reject our third hypothesis and conclude that firms with a larger workforce are more likely to benefit from the tax incentives than firms with a smaller workforce (see, e.g., Agrawal et al. 2014).

Table 6. Marginal effects

	dy/dx	Std. Err.	z	P>z	[95% Conf.	Interval]
foreign	-0.0069509	0.0588727	-0.12	0.906	-0.1223392	0.1084375
age	-0.0004068	0.0001901	-2.14	0.032	-0.0007793	-0.0000343
size	0.0419129	0.0152576	2.75	0.006	0.0120085	0.0718174

investment	0.2164103	0.1200538	1.75	0.096	.00476416	0.3178426
capital	0.0436397	0.0238021	1.83	0.067	-0.0030115	0.090291
assets	0.0099781	0.0023756	4.2	0.000	0.005322	0.0146342
capacity	0.0001001	0.0000182	5.5	0.000	0.0000229	0.0000449

Our second last hypothesis assumes that firms with higher levels of new investment and fixed capital are more likely to benefit from the tax incentives than firms with lower levels of new investment and fixed capital. In this regard, the coefficients for investment and capital are critical to be considered. It appears that both coefficients are positive and statistically significant at 9 and 6 % significance levels. For instance, in table 5, we can see that the probability values of investment and capital are 0.09 and 0.07. The magnitude of the coefficient of capital is relatively higher and almost double than what it was in Mao & Wang (2016) and (see Young 2000; Xu 2011). However, the capital coefficient was significant at a 1 % significance level in Mao & Wang (2016). Regarding our second last hypothesis, therefore, it is concluded that firms with higher existing and new investments are more likely to benefit from the tax incentives than firms otherwise (see Young 2000; Xu 2011).

Finally, our last hypothesis assumes that the level of profitability and capacity of a firm have an insignificant impact on the probability of being a beneficiary under the tax incentives. We use both return on assets and the capacity of a firm as its profitability indicators. We found positive and significant coefficients for both assets and capacity. However, the magnitude of the asset coefficient is almost double what it was in Mao & Wang (2016). It implies that firms with stronger profitability in Sweden are more likely to benefit from the tax incentives than firms with

stronger profitability in China. Therefore, we again reject our last hypothesis and conclude that firms with higher returns on assets are more likely to benefit from the tax incentives than firms with lower returns on assets.

Table 6. Goodness-of-fit tes

Probit model for dependent variable,	goodness-of-fit
number of observations =	403
number of covariate patterns =	403
Pearson chi2(392) =	373
Prob > chi2 =	0.7473

It is imperative to conduct goodness of fit test after presenting initial regression results. The null hypothesis of the goodness of fit test is such that there is no significant difference between the observed and the expected value. Rejection of this hypothesis would imply a significant difference between the observed and the expected value. However, we are unable to reject the null hypothesis at a 5% significance level because the probability of Chi2 is 74%. Therefore, it can be concluded that the model is well-fitted as there is no significant difference between the observed and expected value.

5. Conclusion and Recommendations

5.1 Conclusion

This study aimed to investigate the impact of different firm-specific characteristics on the probability of being a beneficiary in the green tax incentives scheme introduced by the Swedish

government. Green tax incentives are becoming popular to enhance the sustainability aspect of a firm's production process. For instance, different green tax incentives in terms of investment tax credits and taxable income deductions are prevalent across the globe. In this regard, this study investigates and identifies the beneficiaries of the green tax incentives program introduced by the Swedish government.

We have collected data on firm-specific characteristics by evaluating annual reports of the top listed 100 firms on the Nasdaq Stockholm stock exchange for the year 2016-2020. We estimated probit regression estimators to investigate the probability of being a beneficiary in the green tax incentives program. Because the dependent variable of this study is derived from ESG scores, we converted them into binary outcomes of 0 and 1. Specifically, firms with ESG score above 60 was considered dummy 1, and firms with ESG score below 60 was considered dummy 0. We used a foreign dummy as an explanatory variable indicating whether the owner of the firm is domestic or foreign-based. Dummy 1 indicates foreign ownership and 0 for domestic ownership. Apart from that, the firm's size, age, investment, capital, return on assets, and capacity of a firm have been used as explanatory variables in this study.

The findings of the study suggest that only two firm-specific variables secure negative coefficients

i.e., foreign dummy and age, while all the rest of the coefficients are indicating a positive and significant impact on the probability of being a beneficiary under the green tax incentives program.

For instance, the coefficients are negative and significant for both foreign dummy and age variables. But the coefficients are positive and significant for size, investment, capital, asset return, and capacity. Based on the findings, it can be concluded that different firm-specific

characteristics are critical in determining their probability of being beneficiaries in the green tax incentives program.

5.2 Policy recommendations.

Based on the study findings, we recommend the following policy recommendations.

- Regarding our first hypothesis, we confirmed that foreign firms took less advantage of the green tax incentives scheme, therefore, it is imperative to redesign the green tax incentives programs in an attempt to attract foreign-based firms.
- We found in this study that younger firms are engaged in more sustainable activities than older firms and took greater advantage of the tax incentives scheme than older firms. Based on this finding, it is suggested that upcoming green tax packages must include incentives for older firms.
- This recommendation must be extended to the size factor. That is, the upcoming green tax packages must include incentives for large-size firms. Because findings of this study suggest that firms with relatively higher numbers of employees took less advantage of the green tax incentives in Sweden.
- In addition, findings suggest that firms with greater capacity and capital accumulation took relatively greater advantage of the green tax system. Therefore, it is suggested that upcoming green tax packages must also include smaller firms' concerns regarding capacity and capital.

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