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Environmental and Accounting Regulation: Lessons from The EU ETS

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Abstract
Environmental regulation potentially has a relevant role in reducing the negative effects of the firms' economic activities on the environment and thus in improving firms' environmental performance. However, environmental regulation can impose binding reduction targets of pollution, which can negatively affect firms' financial performance. Additionally, the institutional framework of the environmental regulation potentially affects the representation of firms' environmental perfomance in their financial statements. Against this background, the purpose of this paper is two-fold. First, it aims to investigate the effectiveness of the European Union Emissions Trading Scheme (EU ETS) in promoting companies' environmental and financial performance. Second, it aims to investigate how EU ETS affects the representation of environmental performance inside firms' financial statements. To reach our aim, we follow two main stages of analysis. First, with descriptive statistics and archival data analysis, we investigate the effects of the EU ETS institutional framework on firms' environmental and financial performance. Secondly, we develop a comparative analysis of the IAS/IFRS and Italian accounting standards concerning the recording of emission allowances. Our findings show that the EU ETS is a flexible regulation, which is effective at improving firms' environmental performance and at safeguarding firms' financial performance. Additionally, we find that under IAS/IFRS and Italian accounting standards, the environmental performance is included in the financial statements by recognizing the cost for polluting on an accrual basis.
Keywords: EU ETS, Environmental Regulation, Accounting Regulation, Environmental Performance, Policy Makers

Introduction

This paper investigates the influence of environmental regulation on firms' financial performance, and at the same time it studies how environmental regulation affects the representation of environmental performance in firms' financial statements.

Climate change is one of the most important environmental challenges human society is confronting. Companies have a relevant role in influencing the climate. Companies' economic activities increase the concentrations of greenhouse gases (GHG), leading to a growing greenhouse effect and global warming. The United Nations Framework Convention on Climate Change (UNFCCC) represents the international institutional answer to confronting climate change (United Nations 1992, 2015). The UNFCCC states the sustainable development principle, according to which policy makers should achieve a balance between pollution reduction targets and economic development. The Kyoto Protocol is the implementation tool of the UNFCCC. On the one hand, this protocol imposes emission reduction targets on countries. On the other hand, this protocol provides mechanisms to be applied for reducing emissions, the so-called Kyoto Mechanisms (United Nations 1998). Countries can apply these mechanisms to attain emission reduction targets and safeguard their economic development following the sustainable development principle (Barrett, 1998; Grubb et al., 1999; Springer, 2003).

The emissions trading scheme (ETS) is a Kyoto mechanism that can be established as a climate policy instrument at the national level to comply with the Kyoto Protocol targets (Brandt & Svendsen, 2011). The ETS strives to reduce companies' GHG emissions by translating them into costs for the companies. Emissions trading schemes are now valued at approximately €40 billion worldwide and represent 12% of global GHG emissions (Muûls et al., 2016). The European Union (EU) established the first ETS for GHG emissions in January 2005 (European Union, 2003), i.e. the European Union Emissions Trading Scheme (EU ETS), which is the largest ETS implemented in the world (Marin et al., 2018). The implementation of the EU ETS has covered three phases, i.e., the first phase (2005-2007), the second phase (2008-2012) and the third phase (2013-2020). The fourth phase of the EU ETS (2021-2030) is currently underway.

The EU ETS is a cap and trade system. On the one hand, the system strives to improve companies' environmental performance by discouraging companies from polluting. Companies can emit GHG emissions only if they own emission allowances. After each year, companies must surrender sufficient allowances to cover all of their GHG emissions; otherwise, penalties are imposed. Companies are required to buy allowances to pollute or alternatively to bear the costs for reducing emissions. A cap is set on the total amount of available emissions allowances, which corresponds to the maximum level of GHG that companies can emit. The cap is reduced over the phases such that total emissions decrease. On the other hand, the EU ETS provides mechanisms for safeguarding the financial performance of companies. Within the cap, companies freely receive an amount of allowances and can trade allowances with other companies. Therefore, companies can use the allowances allocated freely, or they can buy allowances to comply with the obligation of surrendering allowances. In brief, the institutional framework of the EU ETS reflects the intention of EU policy makers to improve companies' environmental performance while safeguarding companies' financial performance.

Environmental regulation potentially has a relevant role in reducing the negative effects of the firms' economic activities on the environment and thus in improving firms' environmental performance. However, environmental regulation can impose binding reduction targets of pollution, which can affect negatively the financial performance of firms. Additionally, the institutional framework of the environmental regulation potentially affects the representation of firms' environmental performance in their financial statements. Against this background, the purpose of this paper is two-fold. First, it aims to investigate the effectiveness of the EU ETS in promoting companies' environmental and financial performance at the same time. The scenario in which the environmental regulation succeeds in improving both financial and environmental performance is defined as the Porter hypothesis or the win-win hypothesis (Ambec & Barla, 2006; Ramanathan et al., 2017; Lazzini et al., 2021). From a theoretical and empirical perspective, fragmented and mixed literature focuses on the effectiveness of environmental regulation in promoting both firms' environmental and financial performance (Horváthová, 2010; Tuesta et al., 2021; Segura et al., 2018). This paper fills this literature gap by exploring the EU ETS environmental regulation and by analysing the effects of its institutional framework on firms' environmental and financial performance. The EU ETS is a recent environmental regulation with a flexible institutional design, and it represents a testing empirical basis for advancing research regarding how the institutional framework of environmental regulation potentially affects both environmental and financial performance.

Second, it aims to investigate how EU ETS affects the representation of environmental performance inside firms' financial statements. The institutional framework of EU ETS translates GHG emissions into emission allowances with market prices, and thus potentially permits the measurement of environmental performance and its inclusion into firms' financial statement through the accounting for emission allowances (Allini et al., 2018; de Aguiar, 2018; Gibson, 1996; Kim et al., 2023; Lehman, 1996; Milne, 1996; Rathee & Kapil, 2015; Stechemesser & Guenther, 2012; Wambsganss & Sanford, 1996). This study analyses the EU ETS emission allowances' accounting practices.

To reach our aim, we follow two main stages of analysis. First, we apply descriptive statistics to provide a deep understanding of the EU ETS institutional framework. The detailed description of the EU ETS allows us to investigate the effects of the EU ETS institutional framework on firms' environmental and financial performance, and to understand its accounting implications. In addition, we apply archival data analysis to find if and how EU ETS affects firms' financial performance, over the three phases. Secondly, we develop a comparative analysis of the IAS/IFRS and Italian accounting standards concerning the recording of emission allowances.

Our findings show that the EU ETS is a flexible regulation, which is effective at improving firms' environmental performance and at safeguarding firms' financial performance over the three phases. Additionally, the institutional framework of the EU ETS permits a reliable measure of firms' environmental performance and thus potentially offers the opportunity to include environmental performance in the financial statement. Overall under IAS/IFRS and Italian accounting standards, the environmental performance is included in the balance sheet by recognizing the cost for polluting on an accrual basis. However, significant limitations emerge in the accounting for emission allowances. The lack of an international accounting standard concerning emission allowances leads firms to implement different accounting practices at the expense of the comparability of financial statements.

This paper contributes to the extant literature by supporting the theoretical framework according to which environmental regulations with flexible design is a condition for meeting the Porter Hypothesis. Additionally, it contributes to deepening the study of environmental accounting (Milne, 1996), by providing evidence that EU ETS framework is suitable to permit the representation of environmental performance in the financial statement.

Finally, our findings have practical implications for Italian and European policy makers involved in the implementation of the EU ETS. By offering evidence regarding the effectiveness of the institutional change of the EU ETS, this research encourages policy makers to follow this direction to further increase the EU ETS effectiveness at promoting both firms' environmental and financial performance. Moreover, by highlighting the significant limitations of the accounting regulation concerning emission allowances, it encourages accounting standard setters to develop an international accounting standard suitable for EU ETS emission allowance accounting.

The remainder of this paper is organised as follows. Section 2 reviews the extant literature about environmental regulation and then focuses on the EU ETS environmental regulation. Section 3 presents the research design. Sections 4 and 5 provide the findings about the effects of EU ETS regulation on firms' environmental and economic performance. Section 6 develops a comparative analysis of the IAS/IFRS and Italian accounting standards concerning the recording of emission allowances. Finally, the seventh section concludes with research implications and future avenues.

Literature Review

Environmental regulation potentially has a relevant role in reducing the negative effects of the firms' economic activities on the environment and thus in improving firms' environmental performance. However, environmental regulation can impose binding pollution reduction targets, which can negatively affect the economic performance of firms. The study of the relationship between environmental regulation and economic performance is challenging. Neoclassical researchers state that environmental regulation potentially negatively affects economic performance by imposing additional costs for firms (Horváthová, 2010; Palmer et al., 1995; Walley & Whitehead, 1994).

Porter (1991) and Porter & van der Linde (1995a, b) argue that environmental regulations can potentially positively affect the economic performance. Environmental regulation succeeds in improving both economic and environmental performance by promoting innovation; this scenario is defined as the Porter hypothesis or the win-win hypothesis. Environmental regulations can promote technology innovation, which can be exploited by firms to cover the costs of complying with environmental regulations and to increase their competitiveness, improving their economic performance (Ambec & Barla, 2006; Ramanathan et al., 2017).

Some studies depict an inverse U-shaped relationship between environmental regulation and economic performance (Wagner, 2001). That relationship is positive up to the level of environmental performance in which the economic performance is maximized. McWilliams & Siegel, 2001 find a neutral relationship between environmental regulation and economic performance. At the firm level, investments to reduce pollution lead to higher costs, which are recoverable because the customers of green firms are disposed to pay higher prices.

Ramanathan et al (2017) highlight that the design of environmental regulation plays a crucial role in determining the economic performance of firms. Environmental regulations can be categorized as flexible and inflexible regulations (Majumdar & Marcus, 2001). On the one hand, inflexible regulations impose binding reduction pollution targets and state how firms must attain them. To produce certain products, companies are required to apply certain techniques to reduce pollution. Therefore, companies experience increasing costs in applying the required technology and complying with the environmental regulations. On the other hand, flexible regulations establish only the desired target and offer companies discretion regarding how to achieve it. This type of regulation promotes innovation development inside companies, enhances companies' competitiveness and thus potentially improves companies' economic performance. A careful examination of prior literature reveals that environmental regulations with flexible design are a condition for meeting the Porter Hypothesis and promoting both environmental and economic performance (Ramanathan et al., 2017; Lazzini et al., 2021).

Several studies empirically test the relationship between firms' environmental and economic performance; however, fragmented and contrasting results emerge. Some researchers confirm the positive relationship between environmental performance and economic performance (King & Lenox, 2001; Konar & Cohen, 2001; López-Gamero et al., 2009; Russo & Fouts, 1997; Yang et al., 2011). In contrast, some scholars find a negative relationship (Jaggi & Freedman, 1992; Sarkis & Cordeiro, 2001; Stanwick & Stanwick, 1998), and others found no systematic relationship (Cohen et al., 1997; Earnhart & Lizal, 2007; Elsayed & Paton, 2005; Wagner, 2005).

Some scholars explain the contrasting results by highlighting the lack of a reliable measure of environmental performance (Cohen et al., 1997; Griffin & Mahon, 1997). Others explain contrasting results by stating the lack of a comprehensive study capable of considering all the variables that can potentially influence the firms' environmental and financial performance, such as the firm size, the firms' sector and the country location (Elsayed & Paton, 2005; Horváthová, 2010; Segura et al., 2018; Wagner, 2001).

Horváthová, 2010 attempts to explain the contrasting literature regarding the relationship between environmental and economic performance by performing a meta-analysis of the empirical studies. The researchers find that the empirical results regarding the relationship between environmental performance and financial performance are influenced by the type of environmental performance proxy. The positive link between environmental performance and economic performance is more frequent in empirical analyses, which apply qualitative environmental proxies. However, the qualitative environmental proxies are not completely informative about the actual impact of the firm on the environment.

In conclusion, from a theoretical and empirical perspective, fragmented and mixed literature focuses on the effectiveness of environmental regulation at promoting both firms' environmental and economic performance. This paper's objective is to fill this literature gap by exploring the EU ETS environmental regulation and analysing the effects of its institutional framework on firms' environmental and economic performance. The EU ETS is a recent environmental regulation with flexible institutional design, and it represents a testing empirical basis for advancing research regarding how the institutional framework of environmental regulation potentially affects both the environmental and economic performance of firms.

EU ETS Institutional Framework

The European Union Emission Trading Scheme (EU ETS) is the European Union institutional regulation adopted to comply with the emission reduction commitments under the Kyoto Protocol (European Union, 2003, 2009, 2014). The EU ETS strives to improve companies' environmental performance with the intention of safeguarding their economic performance (Segura et al., 2018). European companies' installations in the energy and industrial sectors are the entities subject to the EU ETS, and they are responsible for approximately 50% of EU GHG emissions (European Union, 2015). The EU ETS implementation covers three phases: the first phase (2005-2007), the second phase (2008-2012) and the third phase (2013-2020).

The EU ETS is a cap-and-trade system. This system has set a cap on the amount of GHG emissions that installations can produce. GHG emissions are converted into emission allowances, so-called European Union Allowances (EUAs). An EUA indicates the right to emit an amount of GHGs equivalent to one tonne of CO2. Therefore, the cap on GHGs corresponds to a maximum amount of EUAs. The cap is distributed over the various stages so that GHG emissions decrease. Within the cap, trading of EUAs between companies is allowed.

EU ETS participants can only pollute if they have EUAs. EUAs can be allocated to EU ETS participants in two ways: free allocation and by auction. Free allocation means that an installation receives the allowances for free. Free allocation is the EU ETS's instrument to reduce the risk that the rising costs of complying with the EU ETS regulation will lead companies to relocate production to other countries where anti-pollution measures are less stringent, i.e. the so-called carbon leakage risk. The auction-based allocation method means that participants buy allowances at a market price. In addition, participants can purchase EUAs from other installations through private transactions.

By 30 April of each year, EU ETS participants must surrender an amount of EUAs equal to their emissions in the previous year; otherwise, heavy penalties apply. Below is a calculation of the total amount of EUAs held by installations:

EUAs allocated free of charge
+
EUAs allocated by auctioning
+
EUAs acquired through private transactions
–
EUAs sold through private transactions.

Three scenarios of compliance to the obligation of surrendering EUAs equal to emissions produced emerge: (1) surplus, (2) deficit and (3) break even.

(1) Surplus: the total sum of EUAs owned by EU ETS participants is superior to the amount of emissions produced. Thus, participants can sell the surplus EUAs through private transactions.

(2) Deficit: the total sum of EUAs owned by EU ETS participants is lower than the amount of emissions produced. Thus, participants must acquire EUAs by the auctioning method or by private transactions to comply with the obligation of surrendering an amount of EUAs equal to the emissions produced.

(3) Break-even: the total sum of EUAs owned by EU ETS participants is equal to the amount of emissions produced.

The reliability of the amount of EUAs owned by the companies is guaranteed by a transparent, accurate and consistent EU registry of GHG emissions, i.e., the Union Registry. The Union Registry ensures an accurate monitoring and reporting of EUAs (European Union, 2015, 2018).

Overall, the institutional framework of EU ETS regulation is structured to ensure the improvement of firms environmental performance without causing negative effects on their economic performance. First, the framework discourages firms from polluting, by imposing costs on them for emitting GHGs. Companies should acquire EUAs to emit an amount of GHGs superior to the level of GHGs permitted, which corresponds to the level of EUAs allocated freely. Alternatively, companies should invest in green technologies to reduce their GHG emissions, such that the amount of EUAs freely allocated covers their emissions. The price of EUAs acquisition should deter installations from excessive GHG emissions and promote installations' decisions regarding investing in technology for reducing GHG emissions. Second, the EU ETS regulation targets safeguarding firms' economic performance; thus, it establishes mechanisms to help companies in fulfilling their commitments in a cost-efficient manner, i.e., EUAs' free allocation and the possibility to trade the surplus of EUAs between firms (Occhipinti & Verona, 2020).

The institutional framework of the EU ETS has evolved over the three phases in relation to the scope of EU ETS and to the allocation of EUAs.

The scope of EU ETS has increased over the three phases in terms of geography, sectors and type of GHG considered to increase the effectiveness of the EU ETS in reducing the GHG emissions. Currently, the EU ETS is actually covering the 28 EU member states, Norway, Iceland and Liechtenstein. The number of sectors covered by the EU ETS has expanded over the three phases. In the first phase, the EU ETS covered emissions from the intensive energy and manufacturing industry; specifically, it involved the following sectors: "power stations and other combustion plants ≥20 MW, oil refineries, coke ovens, iron and steel plants, cement clinker, glass, lime, bricks, ceramics, pulp, paper and board" (European Union, 2003). In the second phase, the aviation sector was added to the sectors covered by the EU ETS. Finally, in the third phase, the sectoral scope has been expanded to also cover the following sectors: "production of aluminium; petrochemicals; ammonia; nitric acid; adipic and glyoxylic, acid production; CO2 capture, transport in pipelines and geological storage of CO2" (European Union, 2015). The types of GHGs included in the EU ETS have increased over the phases. In the first phase, only CO2 emissions were included in the EU ETS; then, in the second phase, N2O emissions could be voluntarily included. Finally, in the third phase, N2O and PFC from the production of aluminium have been included.

The EU ETS has evolved in relation to the allocation method of EUAs, with the aim of increasing transparency and harmonisation in the allocation of EUAs, improving the effectiveness of the EU ETS in reducing GHG emissions and safeguarding the economic performance of companies. Graph 1 shows the amount of total allowances allocated over the years for all countries covered by the EU ETS and details the amount of freely allocated and auctioned allowances; it also provides the amount of verified emissions.

[INSERT GRAPH 1 ABOUT HERE]

In the first and second phases, the EUAs were primarily provided to installations for free; the amount of free EUAs is based on historical GHG emissions. Each Member State establishes the amount of free allocations through National Allocations Plans (NAPs), which are required to be assessed by the European Commission.

However, since 2009, in the EU ETS, an imbalance between the supply and demand of EUAs emerged. The economic crisis of 2008 entailed a decrease in firms' production, leading to a decrease in firms' GHG emissions. Firms experience a surplus of EUAs; in other words, they own an amount of EUAs superior to the amount necessary to cover their effective emissions. The surplus of EUAs weakens the functioning of the EU ETS, since it decreases the EUAs' price; thus, it may deter participants from investing in technology for abating pollution.

Solutions to the EUAs surplus are the increase in the demand of EUAs and the reduction of the supply of EUAs. On the one hand, from the third phase, auctioning becomes the default method of allocation. The amount of EUAs freely allocated has been reduced to increase the firms' demand for EUAs (Graph 1). Free allocation is maintained mainly in the industry and heating sectors, subject to the risk of carbon leakage. From 2013, the power generation sector will receive no EUAs for free, since the experience of the previous years shows that power generation installations can pass the opportunity costs of having used freely allocated EUAs to customers instead of selling them (European Union, 2015). Additionally, from the third phase, the free allocation of EUAs is determined by product-related GHG emissions benchmarks, which are set at " the average emission level of the 10% most efficient installations within each sector" (European Union, 2015). Thus, highly efficient installations receive nearly all the EUAs necessary to comply with EU ETS obligations.

On the other hand, the total EUAs cap has been reduced to decrease the EUAs supply (Graph 1). During the third phase, the total EUAs cap decreases each year by a linear reduction factor of 1.74% of the average total amount of EUAs issued annually in 2008-2012. From the third phase (2013-2020), the maximum cap of EUAs is set centrally, guaranteeing transparency and harmonization for all market sectors.

Additional solutions to reduce the supply of EUAs and solve the EUAs surplus are the back loading and the market stability reserve. Back loading is a short-term solution to the EUAs surplus; it consists of deferring the auctioning of 900 million EUAs from the 2014-2016 period until 2019-2020. Back loading has contributed to creating a balance between the EUAs supply and demand and to reducing the volatility of EUAs' prices (Graph 1).

The market stability reserve represents a long-term solution to the EUAs surplus, and it will be active from January 2019. The reserve is a mechanism that regulates the auction volumes and maintains the surplus of EUAs under a certain level by removing EUAs. EUAs can be moved from the market to the reserve to reduce the surplus. In contrast, EUAs can be added from the reserve to the market when the EUA surplus is under certain levels (European Union, 2015, 2018).

To summarize, the EU ETS's institutional framework works with the objective of improving the environmental performance of firms and safeguarding their economic performance. Additionally, the framework has evolved during the three phases to minimize EU ETS functioning inefficiencies, to increase its effectiveness at achieving the emission reductions goals, and finally to increase its transparency and reliability.

Firms' environmental and economic performance under EU ETS: state of the literature

Limited and inconclusive studies have analysed the effectiveness of the EU ETS at promoting both firms' environmental and economic performance. Certain scholars analyse the impact of the EU ETS on companies' environmental performance (Abrell et al., 2011; Anderson & Di Maria, 2011; Egenhofer et al., 2011; Ellerman & Buchner, 2007, 2008; Kettner, Kletzan-Slamanig, & Köppl, 2015; Klemetsen et al., 2016; Petrick & Wagner, 2014). These studies measured the environmental performance through the emission reductions and find that the EU ETS has contributed to reducing GHG emissions in the participating firms.

Others analyse the effects of the EU ETS on companies' economic performance; however, heterogeneity emerged across research and outcomes (Martin et al., 2016; Tuesta et al., 2021). Martin et al (2016) reviewed and systematized the literature regarding the impact of the EU ETS on economic performance. In sum, the researchers find that the negative effects of the EU ETS on the economic performance are limited, although companies must support the cost of acquiring EUAs to emit an amount of GHGs superior to the level permitted (Laing et al., 2014). Marin et al (2018) analyse how, in the first phase and in the second phase, the EU ETS affects firms' economic performance; they found that the EU ETS does not negatively impact firms' economic performance.

Recently, Segura et al., 2018 analysed the relationship between environmental and economic performance in Spanish companies involved in the EU ETS, for the 2005-2015 period. Overall, the researchers do not find a strong relationship between environmental performance and economic performance. However, this analysis reveals limited information regarding the effectiveness of the EU ETS institutional framework at promoting both firms' environmental and economic performance.

Against this background, this paper strives to investigate the EU ETS environmental regulation and analyse the effectiveness of its institutional framework at promoting the environmental performance and the economic performance of firms. To achieve this objective, we focus on the Italian context, and we implement archival data analysis to explore the effects of the EU ETS institutional framework on firms' environmental and economic performance.

Research Design

Our research follows two main stages of analysis.

First stage. We apply archival data analysis to find if and how the EU ETS affects the environmental and economic performance of firms over the three phases. We first investigate the effectiveness of EU ETS institutional changes at improving firms' environmental performance. The EU ETS discourages firms from polluting, by imposing costs for emitting GHGs. Then, we analyse how firms' environmental performance affects their economic performance under the EU ETS. Since firms must acquire EUAs if their emissions are higher than the EUAs freely allocated, the amount of companies' emissions potentially impacts the cost production function (Segura et al., 2018). However, the institutional framework of EU ETS regulation is structured to safeguard firms' economic performance; in fact, it establishes mechanisms to help companies in fulfilling their commitments in a cost-efficient manner, i.e., EUAs' free allocation and the possibility of trading the surplus EUAs between firms (European Union, 2015).

We focus on the Italian firms subject to the EU ETS and cover the three EU ETS phases, specifically the period from 2005 to 2016. The European Union Transaction Log contains the lists of installations participating in the EU ETS. In sum, until May 2018, 1608 Italian installations are recorded on the European Union Transaction Log, and they correspond to 1031 Italian companies. We exclude from our analysis the aviation sector, which is covered by a specific EU ETS institutional framework; thus, the sample is reduced to 946 companies. Overall, due to data availability, we focus our analysis on 815 Italian companies, which represent more than the 86% of the total.

Indicators for the economic performance are obtained from the AIDA database, and indicators for environmental performance are obtained from the European Union Transaction Log. In the following, we summarize the indicators used in our research[1] (Table 1).

[INSERT TABLE 1 ABOUT HERE]

In relation to environmental performance indicators, several indicators have been used in the literature; these can be grouped into qualitative proxies, which primarily valuate the firms' environmental engagement, such us policies, procedure and rating (Thomas, 2001; White, 1996; Yamashita et al., 1999), and quantitative proxies that measure the effective pollution of companies (Capece et al., 2017; Hart & Ahuja, 1996; Hughes, 2000; King & Lenox, 2001; Segura et al., 2018). However, scholars highlight that the contrasting findings regarding the

[1] The related descriptive statistics are shown in the Appendix.

relationship between environmental and financial performance are due to the unreliable measure of the environmental performance (Cohen et al., 1997; Griffin & Mahon, 1997; Segura et al., 2018). Horváthová (2010) highlights that the qualitative environmental proxies are not completely informative of the actual impact of the firm on the environment. Therefore, in this research, we apply a quantitative measure of the environmental performance; specifically, we choose the verified emissions (VER) recorded in the EU ETS Union Registry. Verified emissions are the GHG emissions effectively produced by firms and covered by the EU ETS. These emissions' reliability is guaranteed by the transparent and accurate EU registry of GHG emissions, i.e., the Union Registry (European Union, 2015, 2018; Segura et al., 2018).

VER's descriptive statistics reveal a decrease in firms' GHG emissions over the years, highlighting the increasing effectiveness of the EU ETS at decreasing the GHG emissions produced by firms (Graph 2).

[INSERT GRAPH 2 ABOUT HERE]

The strong reduction of the VER in 2013 compared to the previous years emphasizes the institutional change of the third phase, i.e., the reduction of the total EUAs' cap and the centralization of decisions regarding the amount of the total EUAs' cap (European Union, 2015).

In addition, we apply the SURPLUS indicator as an indicator of firms' environmental performance and as a proxy of the EU ETS policy. SURPLUS means that free allowances are superior to the amount of verified emissions. In the first phase (2005-2007) and in the second phase (2008-2012), nearly all EUAs are allocated freely to firms, and the EU ETS lacks effectiveness; several firms produce an amount of emissions inferior to the EUAs that are freely allocated, experiencing a SURPLUS situation. SURPLUS descriptive statistics show that the percentage of firms with SURPLUS is more than 40% in the first phase. This percentage increases in the second phase, achieving more than 70% due to the economic crisis, which negatively affects the firms' production and thus the related GHG emissions (Graph 3).

[INSERT GRAPH 3 ABOUT HERE]

From the third phase, the percentage of firms with SURPLUS decreases progressively, emphasizing the effectiveness of the EU ETS institutional changes. In the third phase, solutions to the EUAs surplus are implemented. Auctioning becomes the default method of allocation. The amount of EUAs freely allocated has been reduced, and the back loading has been implemented.

In relation to the economic performance, consistent with prior literature (Capece et al., 2017; Marin et al., 2018; Segura et al., 2018), we apply the following indicators:

-Asset Turnover (AT, i.e., total revenues/total assets), which is an indicator of firms' productivity.

-Return on Assets (ROA, i.e., Operating Income/Total Assets), which measures firms' profitability.

-Debt/equity ratio (RISK), which measures the risk of a company.

AT measures the productivity of the firms, and it is strictly related to the company's production level. AT's descriptive statistics reveal a decrease in AT from 2008, reflecting the negative effects of the 2008 economic crisis on the production level (Graph 4).

[INSERT GRAPH 4 ABOUT HERE]

ROA measures the profitability of firms. It is related to the firms' production level. ROA's descriptive statistics depict a decrease in ROA in 2009, which is related to the negative effects of the 2008 economic crisis on the production level. In the third phase of the EU ETS, ROA tends to increase; therefore, the EU ETS third phase institutional changes potentially do not negatively impact firms' profitability (Graph 5).

[INSERT GRAPH 5 ABOUT HERE]

Finally, RISK measures the debt level compared to equity and is thus an indicator of the risk of the companies. The descrpitive statistics of the RISK reveal an increase in the risk level from 2009, in accordance with the economic downturn (Graph 6).

[INSERT GRAPH 6 ABOUT HERE]

We include in our analysis, as control variables, firms' sectors, which can affect the relation between economic and environmental performance. We group the Italian firms into five sectors on the basis of the NAICS 2017 code: (1) Agriculture, Forestry, Fishing and Hunting; (2) Mining, chemical and mineral processing industry; (3) Energy; (4) Manufacturing industries (food, textile, footwear, leather and clothing, paper, rubber, wood); and (5) Rest of the sectors (building, transportation, communications, trade, restaurants, financial institutions and other services, and waste management).

Overall, environmental and economic indicators' descriptive statistics from Italian companies confirm that EU ETS institutional changes are effective at improving the environmental performance of firms and do not negatively impact firms' economic performance.

Second Stage. Our research develops a comparative analysis of the IAS/IFRS and Italian accounting standards related to the recording of emission allowances.

The following sections depict the results of the first and second stage of research.

The EU ETS and firms' environmental performance: results' analysis and discussion

In this section, our objective is to estimate if the EU ETS is effective at promoting firms' environmental performance. The EU ETS institutional framework strives to discourage firms from polluting, by assigning them a cost for polluting more than the amount permitted.

To achieve our objective, we implement a logistic regression of SURPLUS on AT.

$$\text{Logit}[\,P(\text{SURPLUS}_i=1)]= b_0 + b_1\text{AT}_i+b_2\text{RISK}_i+b_{3j}\text{Sector}_{ji}+u_i$$

i=1, …n number of observations
j= 1…k-1; k= number of Sectors

SURPLUS is the dependent variable, and it is dichotomous; in other words, it has a value of 1 if a firm is in a SURPLUS situation, and otherwise, it has a value of 0. AT is an independent variable. We include the RISK and the four sectors as dummies. We apply this regression for each year, from 2005 to 2016.

The probability that firms are in a SURPLUS situation increases or decreases if the regression coefficients are positive or negative, everything else being equal. AT's regression coefficients are statistically significant for most of the years (Table 2 and Graph 7). These coefficients are negative; therefore, it means that, when AT increases, the probability of finding firms with SURPLUS decreases, everything else being equal. In fact, the increasing of productivity (AT) implies an increase in emissions' production, and therefore, it is less probable to find a firm with verified emissions inferior to free EUAs (SURPLUS).

[INSERT TABLE 2 ABOUT HERE]

[INSERT GRAPH 7 ABOUT HERE]

The downtrend in absolute values of AT coefficients, over the EU ETS third phase, is associated with a decreasing probability of finding firms with SURPLUS, in accordance with the descriptive statistics of SURPLUS (Graph 3). In fact, from the third phase, solutions to the EUAs surplus are implemented; consequently, the percentage of firms with SURPLUS decreases progressively, emphasizing the effectiveness of the EU ETS institutional changes at improving firms' environmental performance.

The EU ETS and firms' economic performance: results' analysis and discussion

In this section, we explore the effects of firms' environmental performance on their economic performance under the EU ETS.

We first set up the problem in terms of robust multiple linear regression of ROA on VER:

$ROA_i = b_0 + b_1VER_i + b_2RISK_i + b_{3j}Sector_{ji} + u_i$

i=1, …n number of observations
j= 1…k-1; k= number of Sectors

The economic performance is measured through ROA and is the dependent variable. The environmental performance is measured through VER and is the independent variable. The EU ETS imposes firms to acquire EUAs to emit more than the EUAs freely allocated; therefore, our objective is to explore if the increasing amount of verified emissions negatively impacts the economic performance. We maintain the RISK as a control variable and the four sectors as dummies. We apply this regression for each year, from 2005 to 2016.

The regression coefficients of VER are not significant; therefore, it emerges that the amount of firms' verified emissions does not impact the firms' profitability. The EU ETS does not appear to affect firms' profitability (Table 4).

[INSERT TABLE 3 ABOUT HERE]

To deepen the results of the regression of ROA on VER, we set up the problem in terms of robust multiple linear regression of ROA on SURPLUS:

$ROA_i = b_0 + b_1SURPLUS_i + b_2RISK_i + b_{3j}Sector_{ji} + u_i$
i=1, …n number of observations
j= 1…k-1; k= number of Sectors

The economic performance is measured through ROA and is the dependent variable. SURPLUS is the independent variable, and it is dichotomous; in other words, it has a value of 1 if a firm is in a SURPLUS situation, and a value of 0 otherwise. We maintain the RISK as a control variable and the four sectors as dummies. We apply this regression for each year, from 2005 to 2016.

The regression coefficient of the SURPLUS measures the difference between the ROA mean when SURPLUS=1 and the ROA mean when SURPLUS=0, everything else being equal.

The regression coefficients of SURPLUS are statistically significant for most of the years (Table 4).

[INSERT TABLE 4 ABOUT HERE]

Although firms with SURPLUS do not need to acquire EUAs to comply with the EU ETS system, from the regression analysis, the result is that the SURPLUS situation has negative effects on firms' economic performance (ROA). This empirical evidence can be explained by considering the results of the logistic regression of SURPLUS on AT. The AT's negative coefficients (Graph 7) mean that when AT increases, the probability of finding firms with SURPLUS decreases, everything else being equal. Of course, AT influences ROA, and a rise in AT potentially increases ROA. Therefore, when AT increases, ROA increases and the probability of finding firms with SURPLUS decreases. In fact, the increasing of productive (AT) and profitability (ROA) implies an increase in emissions' production; therefore, it is less probable to find a firm with verified emissions inferior to free EUAs (SURPLUS).

Against this background, the EU ETS institutional framework potentially does not affect the economic performance of firms. The ROA's downturn/increase is potentially due to production's downturn/increase and not to the EU ETS institutional framework.

Comparative Analysis: Accounting Regulation and Emission Allowances

Firms subjects to the EU ETS regulation are supposed to represent the EU ETS mechanisms in their balance sheets. The institutional framework of EU ETS environmental regulation translates GHG emissions into emission allowances with market prices, and thus potentially permits the measurement of environmental performance and its inclusion into firms' financial statement through the accounting for emission allowances (Allini et al., 2018; de Aguiar, 2018; Gibson, 1996; Lehman, 1996; Milne, 1996; Rathee & Kapil, 2015; Stechemesser & Guenther, 2012; Wambsganss & Sanford, 1996). In this section, we aim to analyse the EU ETS emission allowances' accounting practices. We develop a comparative analysis of the IAS/IFRS and Italian accounting standards related to the recording of emission allowances.

IAS/IFRS Standards

As far as IAS/IFRS standards are concerned, nowadays there is not a specific standard dealing with the accounting for EUAs. In 2002, the IFRS Interpretation Committee developed the IFRIC 3 *Emission Rights*, but 6 months later it has been withdrawn because of the several critiques received. The IFRIC 3 establishes that EUAs, whether freely allocated or purchased, are recorded as intangibles assets following IAS 38- *Intangible Assets*. In the case of free allocation, a government grant is recorded under IAS 20- *Accounting of Government Grants and Disclosure of Government Assistance*. EUAs freely allocated and the related government grants are recorded at the fair value. The obligation of delivering an amount of EUAs equal to the GHG emissions produced is recorded by recognising a liability under IAS 37-*Provisions, contingent Liabilities and Contingent Assets*. The liability is measured, at the end of each reporting period, at the best estimate of the costs for complying the EU ETS obligation of surrendering EUAs. The critiques to the IFRIC 3 are related to the mismatches arising from the application of the interpretation. Specifically a time and measurement mismatching potentially emerge: EUAs are recognized, at the moment they are obtained, at cost or fair value, whereas the EUAs liability is recognised during the years when GHG emission production incurs, and they are recognized at the best estimation for complying with the EU ETS obligation of surrendering EUAs (EY, 2017).

In May 2012, the International Accounting Standards Board (IASB) supported a research program about Emissions Trading Schemes, with the aim of addressing the EUAs accounting challenges. In April 2016 the IASB provide an update of the programme, and working is in progress to provide solutions (IASB, 2015).

Against this background, firms accounts for EUAs developing their own accounting policy according to IAS 8- *Accounting Policies, Changes in accounting estimates and errors* or following the indications of the IFRIC 3, even if withdrawn. The accounting policy developed by firms under IAS 8 are (EY, 2017):

-***the net ability approach***. Differences form IFRIC 3 emerge as far as the government grant (IAS 20) and the liability (IAS 37) are concerned. Specifically, the EUAs allocated freely are recorded at nominal amount and the entity recognises a liability only once the GHG emission produced exceed the amount of EUAs held.

-***the government grant approach.*** It differs from IFRIC 3 only for the measurement of the liability. The liability under IAS 37 is recognized for the obligation of surrendering an amount of EUAs equal to the GHG emissions produced. For the EUAs owned, liability is measured at the value of the first recognition of the EUAs. For the emission exceeding the EUAs owned, liability is measured at the market value of EUAs necessary to cover the excess of emissions.

To summarize, the lack of an international accounting standard concerning emission allowances leads firms to implement different accounting practices at the expense of the comparability of financial statements. Besides the differences among the three different EUAs accounting approaches, i.e. the IFRIC 3, the Net Liability approach and the Government Grant, the three approaches lead to the representation in the income statement, on an accrual basis, of the costs for complying with the EU ETS regulations.

The Italian Accounting Standards

The Italian *Organismo Italiano Contabilit*à (OIC) produced in 2013 the local standard OIC 8 related to the accounting for EUAs. Information about the EUAs freely allocated are disclosed in the notes to the financial statements. The purchase and selling of EUAs lead to a recognition of a cost/revenue in the income statement and the related debt/credit in the statement of the financial position. At the end of the reporting period, if the EUAs owned by the firms are not sufficient to cover EU ETS obligation of surrendering EUAs equal to the emission produced, a cost for acquiring the EUAs related to the excess of GHG emissions, is registered in the income statement and the related liability is recognised in the statement of the financial position.

Overall under IAS/IFRS and Italian accounting standards, the environmental performance is included in the financial statement by recognizing the cost for polluting on an accrual basis. However, differences between IAS/IFRS and OIC emerge. While IAS/IFRS recognize EUAs as intangible assets under IAS 38, the OIC considers EUAs as products. Additionally, differences concerning the measurement of the costs for complying the EU ETS obligations, and thus of the costs for polluting, emerge. To guarantee comparability among financial statements of firms subjects to the EU ETS, a common EUAs accounting practice at European level should be provided.

Conclusions

Environmental regulation potentially has a relevant role in reducing the negative effects of the firms' economic activities on the environment and thus in improving firms' environmental performance. However, environmental regulation can impose binding reduction targets of pollution, which can affect negatively the financial performance of firms. Additionally, the institutional framework of environmental regulation potentially affects the representation of firms' environmental performance in their financial statements. Against this background, the purpose of this paper is two-fold. First, it aims to investigate the effectiveness of the EU ETS in promoting companies' environmental and financial performance at the same time. From a theoretical and empirical perspective, fragmented and mixed literature focuses on the effectiveness of environmental regulation in promoting both firms' environmental and financial performance (Horváthová, 2010; Segura et al., 2018). This paper fills this literature gap by exploring the EU ETS environmental regulation and by analysing the effects of its institutional framework on firms' environmental and financial performance. The EU ETS is a recent environmental regulation with a flexible institutional design, and it represents a testing empirical basis for advancing research regarding how the institutional framework of environmental regulation potentially affects both environmental and financial performance. Second, it aims to investigate how EU ETS affects the representation of environmental performance inside firms' financial statements.

Our findings provide evidence about the effectiveness of the EU ETS regulation at improving the environmental performance of firms over the years while safeguarding also their economic performance. In line with Porter (1991); Porter & van der Linde (1995a, b)'s theoretical foundations, we show that the flexibility of the EU ETS environmental regulation is capable to generate positive effects on both environmental and economic performance. We demonstrate that firms' verified emissions decrease progressively over the three phases. In the third phase, a strong reduction of the firms' verified emissions emerges compared to the previous years. Additionally, the decreasing probability of finding firms with SURPLUS, when productivity (AT) increases, highlights the effectiveness of the EU ETS third phase institutional change at improving firms' environmental performance.

Then, we also provide evidence that the EU ETS institutional framework does not negatively affect firms' economic performance. Although the EU ETS forces firms to acquire EUAs to emit more than the EUAs freely allocated, the increasing amount of verified emissions does not negatively affect firms' profitability. Firms' profitability tends to increase during the EU ETS third phase, confirming that EU ETS institutional changes are effective at safeguarding firms' economic performance.

Finally, we find that under IAS/IFRS and Italian accounting standards, environmental performance is included in the balance sheet by recognizing the cost for polluting on an accrual basis. However, significant limitations emerge in accounting for emission allowances. We demonstrate differences in the accounting of EUAs under IAS/IFRS versus Italian accounting standards. While IAS/IFRS recognises EUAs as intangible assets, the OIC considers EUAs as products. Furtherly, differences arise with regard to the measurement of the costs of complying with EU ETS obligations. The lack of an international accounting standard concerning emission allowances leads firms to implement different accounting practices at the expense of the comparability of financial statements.

In total, our research shows that the EU ETS is a flexible regulation that is effective at improving firms' environmental performance and safeguarding firms' economic performance. The institutional framework of the EU ETS permits a reliable measure of firms' environmental performance and thus potentially offers the opportunity to include environmental performance in the financial statement. Our findings contribute to the extant literature by supporting the theoretical framework, according to which environmental regulations with flexible design are a condition for meeting the Porter Hypothesis and thus for promoting companies' environmental and economic performance at the same time. In addition, it contributes to deepening the study of environmental accounting (Milne, 1996), by providing evidence that EU ETS framework is suitable to permit the representation of environmental performance in the financial statement.

Furthermore, our research has practical implications for Italian and European policy makers involved in the implementation of the EU ETS. Uncovering the mechanisms through which EU ETS regulation can act on corporate environmental and economic performance helps policy makers engage in environmental policy choices that take into account the effect on companies. An environmental policy tailored to the economic needs of companies is an important step on the path towards achieving sustainable development. Specifically, our findings offer evidence regarding the effectiveness of the institutional change of the EU ETS third phase, encouraging policy makers to follow this direction to further increase the EU ETS effectiveness at promoting both firms' environmental and economic performance. Our research also highlights the limitations and differences between existing international and domestic accounting standards with regard to accounting for the environmental performance of companies subject to the EU ETS, encouraging accounting regulators to develop common accounting practices at European level to guarantee the comparability of firms' financial statements.

Future research could extend our analysis to other European countries to compare the effectiveness of EU ETS policy across different countries. Future avenues could also concern the conceptual discussion of what could be the most appropriate accounting criteria for recording EU ETS allowances.

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Table 1
Environmental and Economic performance indicators

Firm Performance	Indicators	Indicators' description
Environmental Performance	**VER**	Firms' verified emissions
	SURPLUS	VER < FREE
Economic Performance	**ROA**	Operating Income/Total Assets
	AT	Total revenues/ Total assets
	RISK	Debt/Equity ratio

Table 2
Logistic linear regression of SURPLUS on AT.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Constant	-0,08	0,57	0,28	**1,31**	**0,95**	0,21	0,37	**0,73**	**-0,60**	**-0,96**	**-1,33**	**-1,45**
AT	-0,30	-0,21	-0,01	**-0,29**	-0,21	-0,12	-0,11	-0,23	**-0,55**	**-0,46**	**-0,56**	**-0,84**
RISK	0,08	0,09	-0,04	-0,01	-0,01	-0,01	-0,02	0,02	0,00	0,00	0,01	-0,01
Sector 1	0,31	-0,50	-0,39	-0,12	**1,14**	**1,12**	**0,74**	**0,86**	**1,48**	**1,38**	**1,55**	**1,80**
Sector 2	-0,09	**-0,99**	-0,57	-0,49	-0,25	0,28	-0,08	**-0,96**	**-1,55**	**-1,18**	**-1,31**	-1,04
Sector 3	-0,20	**-0,94**	**-0,79**	-0,47	0,04	-0,14	-0,23	-0,51	**0,92**	**0,83**	**0,92**	**1,24**
Pseudo R2	0,03	0,05	0,04	0,03	0,08	0,10	0,06	0,12	0,19	0,14	0,15	0,16

Table 3
Robust Linear Regression of ROA on VER.

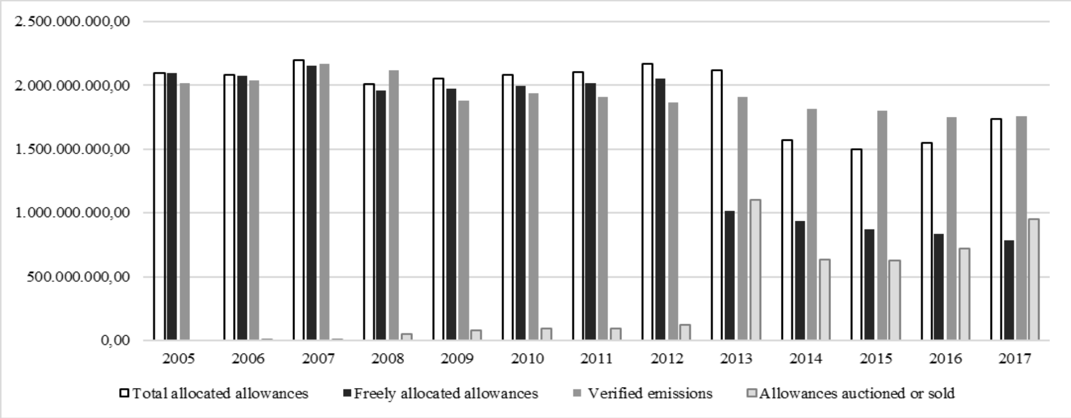
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Constant	**4,55**	**5,63**	**3,79**	**3,87**	**3,26**	**3,50**	**2,72**	**2,72**	**2,38**	**2,56**	**2,73**	**3,15**
VER	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	**0,00**	0,00	0,00
RISK	**-0,23**	**-0,37**	-0,02	-0,03	0,00	0,00	-0,02	-0,04	-0,10	0,03	-0,06	**-0,11**
Sector 1	0,14	-0,04	**2,17**	0,18	**-2,20**	**-2,03**	-0,60	**-1,54**	**-1,71**	-1,34	-0,90	-0,65
Sector 2	2,29	1,66	1,71	1,53	2,09	1,18	1,32	1,81	1,82	1,79	1,24	1,47
Sector 3	-0,86	-0,91	1,16	-1,85	-1,27	-0,70	0,20	-0,61	0,59	1,04	1,55	**1,93**
R2 modified	0,02	0,02	0,01	0,03	0,03	0,02	0,01	0,02	0,03	0,03	0,02	0,05

Table 4
Robust Linear Regression of ROA on SURPLUS.

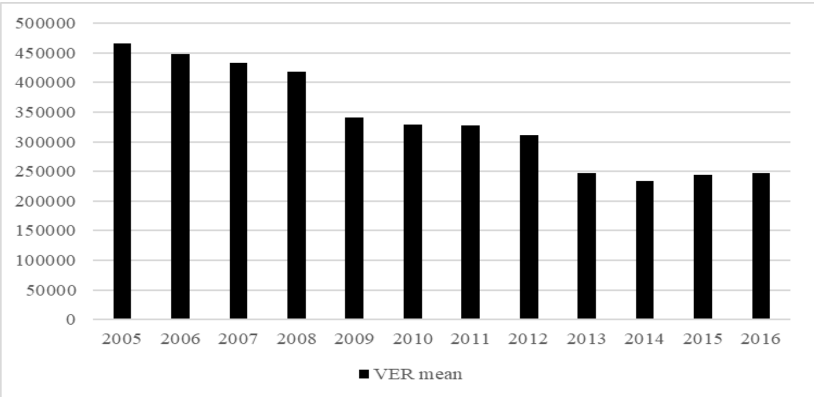
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Constant	**4,86**	**6,15**	**5,21**	**6,63**	**4,78**	**3,88**	**3,07**	**3,41**	**3,28**	**2,97**	**3,16**	**3,50**
SURPLUS	-0,72	-0,84	**-2,38**	**-3,39**	**-2,18**	-0,78	-0,60	**-1,16**	**-3,57**	**-2,97**	**-2,88**	**-3,45**
RISK	-0,22	**-0,35**	-0,02	-0,04	0,00	-0,01	-0,03	-0,03	-0,10	0,03	-0,06	**-0,11**
Sector 1	0,20	-0,18	1,86	-0,05	**-1,86**	**-1,84**	-0,49	-1,32	-0,49	-0,30	-0,05	0,46
Sector 2	2,33	1,56	1,41	1,34	2,12	1,21	1,31	1,47	0,88	1,12	0,91	1,07
Sector 3	-0,94	-1,13	0,59	**-2,44**	-1,36	-0,72	0,15	-0,75	1,27	**1,67**	**1,88**	**2,40**
R2 modified	0,02	0,03	0,02	0,05	0,04	0,03	0,01	0,03	0,07	0,06	0,05	0,09

Note: regression coefficients in bold are statistically different from 0 to 5%, significance level.

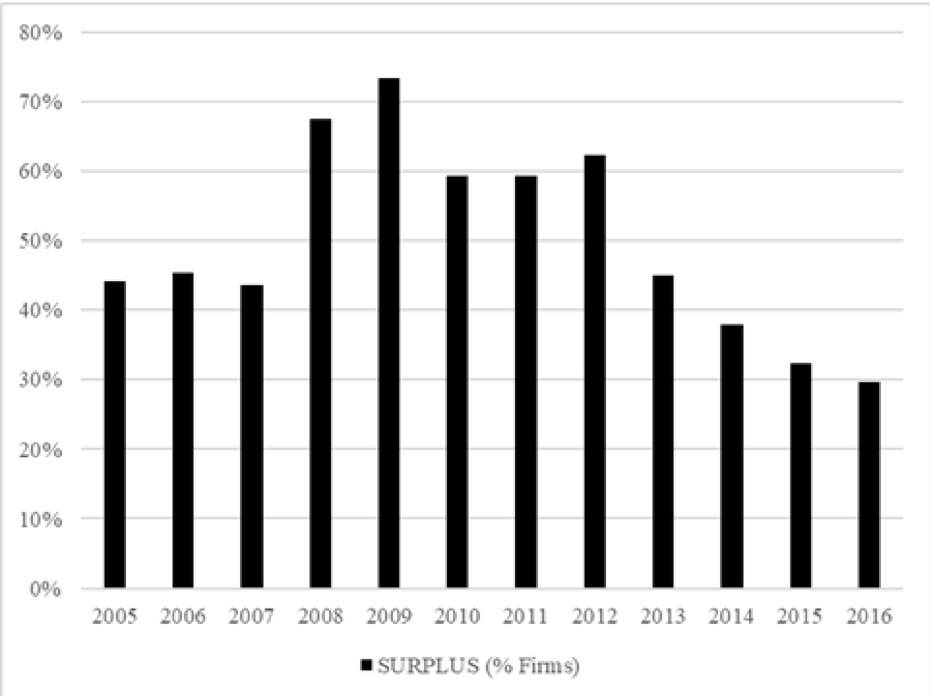
Graph 1: EU ETS trend over the three phases. Source: own elaboration of data extracted from the European Environment Agency (EEA)'s database.



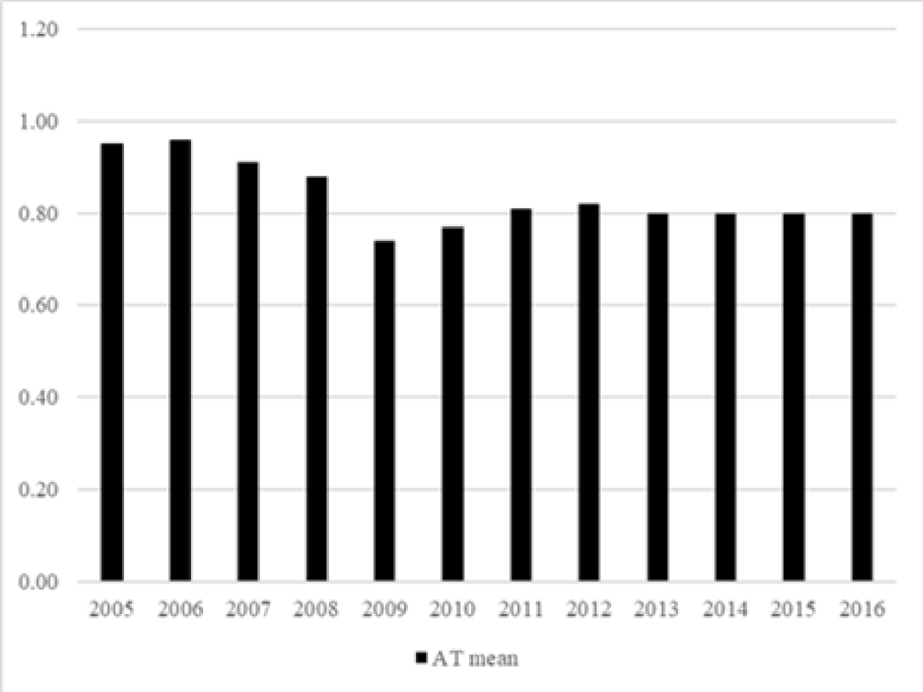
Graph 2: Trends of the VER mean for Italian companies.



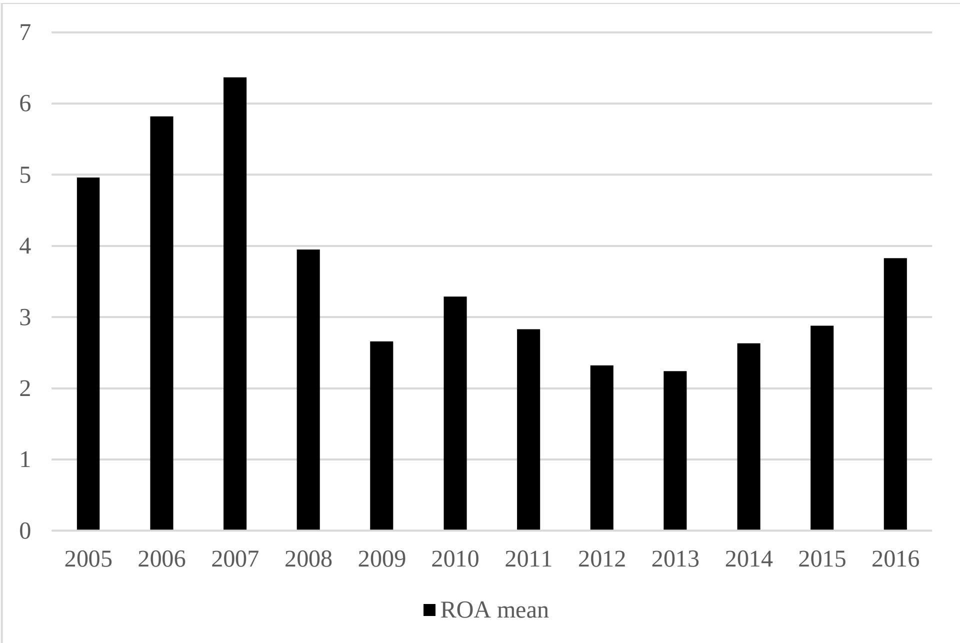
Graph 3: Trends of firms with SURPLUS (%).



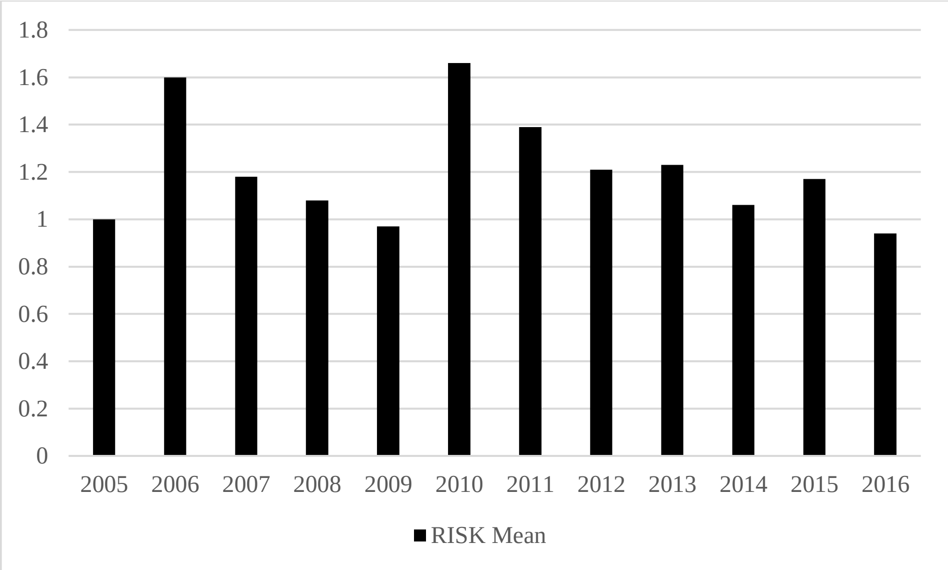
Graph 4: Trends of AT mean.



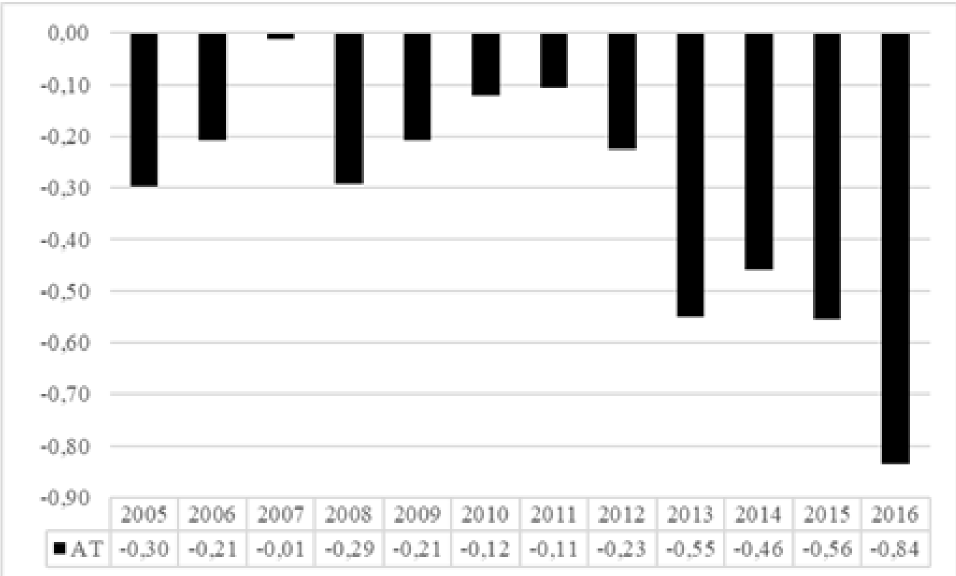
Graph 5: Trends of ROA mean.



Graph 6: Trends of RISK mean.



Graph 7: Trend of AT's regression coefficients from 2005 to 2016.



Appendix

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1. VER and SURPLUS Descriptive statistics

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Firms	473	496	512	518	529	568	571	565	651	640	629	617
VER mean	465279,8	447846,3	433455,4	417656,7	341654,3	329748,1	327111,7	311651,9	247649,2	233721,4	243694,3	246529,5
VER minimum	49	63	8	40	4	1	20	15	29	8	2	1
VER median	23495	22368	21185,5	21593,5	19291	18305	18385	18239	21695	21339,5	21881	22992
VER maximum	56189222	51566590	46728609	44403246	37049197	34281539	36831766	37975865	34557734	35767810	37523617	30670918
VER sd	2861166	2637191	2418256	2289438	1861787	1732158	1812980	1834373	1536057	1574236	1647897	1441348
SURPLUS (% Firms)	44%	45%	44%	68%	73%	59%	59%	62%	45%	38%	32%	30%

2. AT Descriptive statistics.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Firms	508	557	604	606	617	639	663	673	668	674	680	667
AT minimum	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
AT mean	0,95	0,96	0,91	0,88	0,74	0,77	0,81	0,82	0,80	0,80	0,80	0,80
AT median	0,87	0,89	0,88	0,79	0,67	0,72	0,73	0,74	0,74	0,74	0,72	0,71
AT maximum	10,23	6,14	5,92	6,46	5,00	4,50	5,27	5,10	6,03	6,59	7,14	7,13
AT sd	0,70	0,58	0,58	0,66	0,53	0,54	0,58	0,60	0,59	0,63	0,64	0,60

3. ROA Descriptive statistics.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Firms	508	557	604	606	617	639	663	673	668	674	680	667
ROA minimum	-27,37	-39,91	-52,72	-42,03	-45,97	-52	-84,67	-40,43	-60,39	-42,68	-58,18	-47,95
ROA mean	4,96	5,82	6,37	3,95	2,66	3,29	2,83	2,32	2,24	2,63	2,88	3,83
ROA median	3,76	4,31	4,36	3,26	2,17	2,56	2,8	2,19	2,39	2,55	2,63	2,84
ROA maximum	42,03	43,98	69,39	43,94	55,37	76,23	70,08	73,65	82,34	83,39	76,11	78,91
ROA sd	7,25	8,04	9,12	8,9	8,44	9,22	9,49	8,25	8,73	7,93	8,18	7,78

4. RISK Descriptive statistics.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Firms	508	557	604	606	617	639	663	673	668	674	680	667
RISK minimum	0,00	0,00	0,00	0,00	-1,00	-1,05	-0,91	-0,92	-0,92	0,00	-0,94	-1,02
RISK mean	1,00	1,60	1,18	1,08	0,97	1,66	1,39	1,21	1,23	1,06	1,17	0,94
RISK median	0,54	0,51	0,44	0,39	0,40	0,40	0,40	0,38	0,37	0,32	0,33	0,30
RISK maximum	9,34	283,62	23,57	68,50	34,27	386,82	194,54	105,87	63,47	45,75	107,68	67,93
RISK sd	1,33	12,09	2,25	3,34	2,14	15,56	8,13	5,01	4,13	3,06	4,85	3,25

Note: "sd" represents standard deviation.