



Review

Opening the black box of accounting for greenhouse gas emissions: The different views of institutional bodies and firms

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ABSTRACT

This paper highlights the current accounting approaches to greenhouse gas (GHG) emissions. In particular, it explores and critically discusses the treatment of emission rights (ER) under carbon trading schemes from two distinct angles. On the one hand, it reviews the domestic solutions adopted by accounting bodies and, on the other, it examines current practices followed by firms in the European Energy Exchange (EEX). Regarding the former group, there are substantial differences, which would suggest some potential difficulties in finding a common solution for the future. Not surprisingly, there is still a diversity of approaches with regard to how firms report ER. Although the most common practice is not to include free ER in the main financial statements, the proportion of firms that recognize both ER and liabilities is larger than in prior studies (Warwick and Ng, 2012; Lovell et al., 2010; Ascui and Lovell, 2012; Black, 2013). Leaving aside sample differences, the new auctioning system introduced by Phase 3 of the European Emission Trading Scheme (EU ETS) may have affected firm behavior. Furthermore, it is also worth pointing out the decrease in non-disclosure. Interestingly, we show that local accounting rules on ER issued by EU bodies do not generally affect corporate financial reporting. To the extent this study updates the knowledge about current institutional developments and company practices on ER, it could help the International Accounting Standard Board (IASB) to develop a standard.

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Contents

1. Introduction	2195
2. Background on accounting for carbon trading	2197
2.1. The early reaction of the IASB	2198
2.2. The reaction of EU standard setters	2199
3. Current accounting developments in the international arena	2199
3.1. Looking for an international solution	2200
4. Empirical literature review	2201
5. Empirical study and discussion	2201
6. Conclusions and implications	2204
Acknowledgement	2204
References	2205

1. Introduction

The need to reduce greenhouse gas (GHG) emissions following the 1997 Kyoto Protocol, and more recently highlighted by the 2015 World Conference on Climate, has motivated regulatory bodies

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worldwide to introduce mechanisms that affect firm behavior. In this study, we focus primarily on carbon trading. However, firms may follow a number of alternative approaches, such as meeting standards in products and services, or incorporating renewable energy into new projects and initiatives.

The term carbon is often used as a shorthand way to refer to GHG, of which carbon dioxide (CO₂) is the largest element. Carbon trading has the effect of putting a price on what was until recently considered free. Indeed, it goes a step further from physical carbon accounting into financial carbon accounting. While meeting the challenge of global climate change goes beyond providing financial carbon accounting information, it is also generally agreed that the latter might be useful to regulators to evaluate whether emission reduction requirements are being met by firms (Asci and Lovell, 2012; Milne and Grubnic, 2011). Additionally, carbon accounting information may help investors to estimate their risk more effectively when making investment decisions, as well as assessing the impact of GHG investments and cost-efficiency projects on firm's financial performance and related liabilities. There is evidence that market users penalize firms for GHG emissions, although they value voluntary disclosure of this information (Chapple et al., 2013; Griffin and Sun, 2013; Matsumura et al., 2014; Clarkson et al., 2015; Plumlee et al., 2015; Jaggi et al., 2017). While it is not the focus of this paper, we admit that carbon accounting is also relevant from the managerial perspective. Indeed, it should help firms to not only manage and reduce GHG emissions but also to control related risks, especially in the form of regulatory and competitive risks (Bebington and Larrinaga-Gonzalez, 2008). The former perspective stems from the policies adopted by agencies or institutions at the national and international levels to reduce climate impacts, and the latter arises from the likelihood that emission-intensive products and services become obsolete compared with lower carbon technologies and investments.

Prior literature has stressed the relevance of financial accounting as a central means by which firms in a capitalist society report their activities. In particular, Lovell and MacKenzie (2011) consider accountants as crucial actors in governing climate change; but accounting studies have lagged behind research from environmental, economics, and other social science perspectives (Ebrahim, 2013). Nevertheless, gradually the implications of carbon trading have captured the attention of accounting scholars (Gibson, 1996; Lehman, 1996; Wambsgans and Sanford, 1996; Stechemesser and Guenther, 2012).

The accounting profession and standard setters have also been very slow in putting forward concrete proposals to regulate the assets and liabilities that carbon trading entails, but, it does not mean there have been no interesting initiatives.

Greatly influenced by the introduction of the European Emission Trading Scheme (EU ETS), in 2004 the International Accounting Standards Board (IASB) issued the International Financial Reporting Interpretations Committee (IFRIC) 3 on *Emission Rights* (IFRIC, 2004), which was at first approved, only to be surprisingly withdrawn some months later. In the United States (US), the Financial Accounting Standards Board (FASB) started to work on this topic back in 2003 through its Emerging Issues Task Force (EITF), but the project was soon removed from its agenda. Lack of urgency and the need to have a more comprehensive analysis were the two main reasons given by the standard setters for this change in plan. So far, neither the IASB nor the FASB has issued a standard on this matter.

This absence of international accounting standards has led companies to adopt different approaches to account for tradeable emission rights (ER), as well as the obligations to deliver them, which potentially undermines the comparability of financial statements. Interestingly, a group of major international companies in the energy industry has been active and has created an

international association, the International Energy Accounting Forum (IEAF). With the aim to advance understanding and promoting best practices in external financial reporting to account for ER —also called allowances or permits, IEAF has issued some guidelines.

At European level, some local accounting bodies have issued their own domestic standards to fill this gap. However, such activism might create even further divergence worldwide. Given the lack of an international reporting solution, European firms may follow their domestic rules even if they are obliged to use International Financial Reporting Standards (IFRS) issued by the IASB. It is important to mention that starting from 2005 onwards, European listed firms have to use IFRS —once endorsed by the European Commission (EC) — for their consolidated financial statements.

The following figures help to realize the importance of the lack of a common accounting language to recognize these schemes. By the end of 2011, the EU ETS —which is the main driver of the international carbon market— had 8171 million allowances in circulation, and 549 million international credits were used for compliance purposes, in total adding up to about 9 billion units that were available over the period 2008–2011. However, due to the financial crisis, the demand of allowances decreased, and by 2012 the EU ETS accumulated a surplus of more than 2 billion allowances (later added to the Market Stability Reserve that will start in 2019). The trading volume in EU allowances jumped from 3.1 billion in 2008 to 6.3 billion in 2009, and continued growing up to 8.7 billion in 2013, but has decreased afterwards to 8.3 billion in 2014, and 6.6 billion in 2015 with a total value of around €49 billion (EC, 2016).

In this rather free scenario, our paper aims to address the current accounting approaches for ER from two angles, which complement each other. On one side, we critically review the positions of the European accounting bodies at local level, and on the other side we analyze current practices adopted by European firms. Based on prior accounting literature, it could happen that both domestic existing rules (even if they are not compulsory) and industry practices could be influential (e.g. Jaafar and McLeay, 2007; Kvaal and Nobes, 2010).

Interestingly, we do not find that domestic accounting rules and proposals regarding ER affect predominantly corporate financial reporting. Instead, firms follow their own solutions which potentially undermine accounting comparability. Surprisingly, in some circumstances, IFRIC 3 seems to play a relevant role even though after its withdrawal. We consider this knowledge extremely useful within the framework of the international debate in regulating the accounting treatment for these transactions.

A further aspect that makes this research very timely relates to the significant changes derived from Phase 3 of the EU ETS program (as regulated by Directive, 2009/29/EC) which commenced in 2013 and runs until 2020. In particular, Phase 3 marks an important transition. Although free allocation will be still used, auctioning is the default method for allocating ER. Auctioning is a more transparent method of transferring allowances and puts into practice the principle that the polluter should pay. Otherwise, it could be argued that free allowances become subsidies for pollution. Although under the free system it is relatively accepted not to recognize ER in the primary financial statements, scholars argue that auctioning and carbon trading will force firms and standard setters to find a method to account for these transactions (e.g. McGready, 2008; Boyd et al., 2011; Lovell et al., 2013). We concur with this view that auctioning is likely prompting a review of accounting practices by preparers and it offers a valuable window of opportunity for the IASB to fill this gap.

Our analysis mainly shows that IFRIC 3 provided a consistent solution for recording ER transactions, albeit with some valuation and reporting mismatches between the allowances and the

obligation to deliver them. Not surprisingly, later proposals try to avoid the perceived artificial income volatility, but none of them follows what we think is the simplest procedure, namely to consider ER as payment instruments. Similar to [Kolk et al. \(2008\)](#) and [Clarkson et al. \(2015\)](#), it is our view that ignoring free ER in the financial statements and netting the allowances and the obligations deprive users, i.e. investors, of a set of information on assets and liabilities, crucial to obtaining appropriate figures for relevant ratios and measures. Should this happen, the societal cost of the firm's environmental actions will not be fairly perceived by stakeholders.

The paper provides a threefold contribution. In complying with recent calls for more research (e.g. [Lovell et al., 2013](#); [Clarkson et al., 2015](#); [Pollitt, 2016](#)), it adds knowledge to the international debate, since it is the first study that focuses on the exploration of existing domestic accounting standards at European level. Second, it updates and complements past research on accounting practices adopted by firms to account for ER; it is based on a (larger) sample of firms admitted to the European Energy Exchange (EEX) market, the leading European central market platform, which includes most participants that are directly involved in the new auctioning system. Third, the results of this study may be useful to standard setters and the IASB, in particular, by providing information that could help frame a baseline understanding of current accounting approaches. Indeed, respondents to the 2015 Agenda Consultation that was launched by the IASB to seek public inputs for future actions considered this project both important and urgent ([IASB, 2016](#)). Furthermore, the findings may help to select the best accounting model for ER transactions, and thus improve the quality of accounting reporting.

The remaining paper is organized as follows: Section 2 discusses the background and analyzes relevant domestic standards. Section 3 reviews the current developments in the international arena. Section 4 discusses prior empirical literature. Section 5 is devoted to the empirical analysis and section 6 presents the conclusions and implications.

2. Background on accounting for carbon trading

Since firms are primary producers of GHG, the way in which they embrace climate change in their decision-making is a salient factor in the attempt to slow down global warming. Institutional investors, as relevant stakeholders, are thought to be turning their attention to the impact of climate change in their investment return and have been instrumental in the Carbon Disclosure Project (CDP). In some way, they are harnessing their disciplinary power and engendering change in firm behavior ([Solomon et al., 2011](#)), but some national and supra-national bodies have also been active in this field.

In 2000, the international organization of the CDP emerged as a call from institutional investors to the largest firms worldwide to report the way they mitigate climate change. Thus, participants have voluntarily disclosed strategic information regarding GHG risks and opportunities in terms of metric tonnes of CO₂ emissions and target savings (nowadays CDP holds the largest repository of carbon emission information). Despite the increased acceptance of CDP among firms, some studies have found a strategic use of the CDP report versus the financial report. In particular, [Depoers et al. \(2016\)](#) document that GHG amounts are significantly different in both channels; moreover, they also find firms increase the traceability (the details in the financial report), in order to enhance the potential diminished credibility due to discrepancies between the emissions reported in the two channels. CDP is not the only channel to disclose information on CHG, on the contrary, environmental reports and website are also used to do it; but as [Freedman and](#)

[Jaggi \(2005\)](#) conclude, there is lack of consistency in the way firms disclose this information. These concerns question the usefulness of voluntary information in helping to inform interested parties.

Regarding public initiatives at European level, Directive 2003/87/EC regulated the EU ETS program that was launched in 2005 in order to reduce GHG. It introduced a cap-and-trade system, in which an emission limit (cap) is initially allocated (free or via auctioning) to each sector, although the allowances can be traded in the market later on. Under this scheme, those that want to pollute can buy from those that prefer to reduce emissions (by investing in low emission technologies for instance), but the cap of rights fixed by the regulatory body helps to control the amount of pollution. The program was organized in three different phases. Phase 1 (2005–2007) adopted a free mechanism to allocate ER throughout EU countries, and penalties were introduced to constrain lack of compliance. According to the EU program to cap emissions, permits were distributed free of charge (free ER), although they could be traded later on. The assumption is that ER carry an opportunity cost. Such mechanism aims to incentive firms to reduce GHG in order to make a profit by selling excess allowances. Phase 2 (2008–2012), still confirming the free allocation procedure, increased both the limit of emissions and penalties. Thus, Phase 3 (2013–2020) marks an important change where auctioning became the default method to allocate ER; for the electricity sector, the removal of free allocation started immediately in 2013.

However, in July 2015 the EC proposed a reform to postpone auctioning for those sectors deemed to be exposed to carbon leakage, and introduced a Market Stability Reserve to better align demand and supply of emission allowances (to be in force in the new Phase 4, 2021–2030). Hence, nowadays ER continue to be allocated for free, and over Phase 3 this is expected to amount around 41% (while auctioning will be about 57%) of the total ER—there is a 2% of the cap which is reserved for an EU-wide new entrants reserve ([EC Report, 2017](#)). This is just one manifestation of the policy response to global climate change, but there are others. In particular, in July 2016 the EC Council presented a legislative proposal for GHG reductions in non-ETS sectors (i.e., buildings, agriculture, and transport), that would cover more than half of emissions. Negotiations between the EU Parliament, the EU Council, and the Commission are in process for both proposals.

As [Wambgans and Sanford \(1996\)](#) posit, using a market system has benefits beyond regulating procedures, as it establishes an 'arm's length' value for pollution and encourages efficiency in dealing with emissions. However, others propose using a less economically-based solution and suggest following a more ecologically-based approach ([Gibson, 1996](#); [Lehman, 1996](#)). The market solution evolves from the neoclassical idea that markets are an efficient method to allocate resources. Consequently, the right or permit must have the characteristics of exclusivity and transferability to discover a market price and assist decision-making of participants, whether industry or speculative investors ([Mete et al., 2010](#)). This solution creates the need for financial accounting to consider how to reflect the transactions, as allowances must be recognized in the annual financial statements ([Stechemesser and Guenther, 2012](#)); otherwise, we contend they will not produce the desired effect, namely reducing GHG.

Turning to the managerial perspective, although the firm's internal system might provide information to make decisions (e.g. [Burrit et al., 2002](#)), the reliability and comparability of financial information cannot be guaranteed without a general accepted accounting model. Thus, if the primary financial statements (balance sheet and income statement) do not capture free ER as assets, nor the obligations to deliver ER are recognized as liabilities, how will the GHG cost be taken into the decision-making process? If ER are

not properly measured in monetary terms, how will mitigation strategies (such as the efficient use of resources, sourcing renewable energy and offsetting residual GHG emissions) be implemented? (Yunus et al., 2016). Strategic choices for a low carbon transformation might be supported by showing in the balance sheet free ER and the related government grant, which draws attention to the subsidy character of free ER (Haupt and Ismer, 2013). It goes without saying that purchased ER should also be considered, and that liabilities to deliver allowances cannot be ignored after pollution has been made.

2.1. The early reaction of the IASB

The announcement of the EU ETS program in 2003 exacerbated the debate on whether and how to recognize ER as assets and the obligation to deliver them as liabilities. As mentioned in the introduction, the IASB reacted immediately. Thus, in the same year the Draft D1 on *Emission Rights* was issued and in December 2004 the interpretation IFRIC 3 *Emission Rights* was published. It should be noted that an interpretation cannot contradict the standards in force, thus IFRIC 3 was prepared under the constraints of several International Accounting Standards (IAS); in particular, IAS 32 *Financial Instruments: Presentation*; IAS 38 *Intangible Assets*; IAS 20 *Accounting for Government Grants and Disclosure of Government Assistance*; and IAS 37 *Provisions, Contingent Liabilities and Contingent Assets*.

Despite ER are tradeable assets, and in some way similar to financial assets, they do not meet the definition stated in IAS 32, therefore this standard could not be directly applied. Hence, IFRIC 3 required companies to recognize pollution rights as intangible assets (which are identifiable non-monetary assets without physical substance). Consequently, following IAS 38, two valuation criteria were allowed, cost and fair value, usually measured through the market value (with changes of value in comprehensive income instead of profit and loss). Considering the residual value (that is the expected market value when the entity has to give the allowances), IFRIC 3 did not impose amortization. When ER were distributed to the emitter for less than their market value, the difference between the amount paid (if any) and that value represented a government grant, which was recognized under IAS 20. Based on IAS 37, the liability should be measured at its current market value on reporting date (with changes in value in profit and loss). As with any other asset and liability, compensation was not allowed; in other terms, a so-called gross approach was imposed. This accounting treatment makes firms record expenses when they pollute and, simultaneously, forces them to report a liability; the asset is credited when the liability is cancelled.

The reaction to IFRIC 3 by major EU ETS participants and some professional bodies was mainly negative, leading to its immediate withdrawal (Cook, 2009). In particular, in its letter of May 2005, the European Financial Reporting Advisory Group (EFRAG) did not advise the EC to endorse the Interpretation based on unsatisfactory measurement and reporting mismatches, and in June it was withdrawn by the IASB. As MacKenzie (2009) highlights, given that free ER can be treated as hedging instruments of a forecast transaction (i.e. future emissions), the withdrawal allows ER to become invisible.

As mentioned earlier, there have been no pronouncements by the FASB on this issue, and the only existing US official document dates back to 1993 —much earlier than the EU ETS program. The accounting guidelines were issued for utilities and other regulated energy companies, and required to always measure ER maintained for the course of business at cost (market value for trading purposes). As long as free ER have a zero cost (and market value when granted is not allowed) no expense is recognized unless actual

emissions exceed free ER. When purchased ER are held and emissions are made, an expense account is recorded, and ER inventory is credited for an equal amount. When emissions exceed such amount, the additional expense is accrued at market price and a liability is recognized. In other words, assets and liabilities are compensated as long as both exist. As Wambsgans and Sanford (1996) argue, this inconsistent treatment between free and purchased ER does not permit firms to fully assess the economic consequences of pollution. Moreover, the netting of assets and liabilities fails to capture the total obligations of the firm.

This solution differs from the gross approach in IFRIC 3, and highlights the debate with regard to the choice between cost and fair value to measure ER (Elfrink and Ellison, 2009). In particular, at acquisition date, when the cost measurement base is used, ER are measured at the amount the firm paid to acquire them. After initial recognition, ER may continue to be measured at cost (i.e., historic cost), or at their fair value (i.e. market value). When fair value is used, ER are measured at the price they could be sold in a transaction with a market participant at each reporting date. Regarding free ER, IFRIC 3 requires to use the fair value when granted, which is the market value at initial recognition (considered as a deemed cost).

While the cost measurement base guarantees representational faithfulness, it does not allow to capture the economic aspects surrounding ER. Instead, the fair value measurement base captures the opportunity cost to the entity of continuing to hold ER, regardless of how and when ER have been acquired or how they are employed. In contrast to the gross approach, the net approach leaves out accounting numbers from the body of the primary financial statements. Consequently, financial statements are less transparent, and there is no information about the real impact of pollution activity. We discuss the impact of these accounting decisions in more detail below.

If ER have a market value, then free allowances might be seen as 'gifts'. Regardless of whether they are recognized in the financial statements or not, they become equity in the end (as they compensate for the cost of pollution). However, only when the income statement captures the operating expenses related with ER, managers and stakeholders have useful information about the monetary impact of pollution. Moreover, it is also important for users to be informed about the obligations to handle ER to the authority. To achieve such result, IFRIC 3 states that the expense in the income statement must be recorded when pollution is made and simultaneously a liability appears. Therefore, as long as ER remain in the firm, they should be displayed in the balance sheet as assets, which prevents from using nil value for free ER (zero cost). Thus, those accounting procedures that credit the ER account when the expense is recognized are not wholly capturing the economic effects of the ER transactions. Indeed, this could be a relatively minor issue if the end of the accounting period coincides with the time to deliver the ER, but it would affect the information prepared at any other moment, i.e. the interim statements.

The net approach is a case of offsetting assets and liabilities, which has an impact on some ratios and accounting measures. Specifically, given that total assets and total liabilities are always lower with the net approach, leverage ratios (i.e. debt/equity) do not capture the real financial structure of the firm. Regarding profitability ratios, when assets are not included in the balance sheet and expenses are not recorded, return on assets and operating margins are overstated. In summary, the net approach provides a better firm image than the gross approach, which explains why firms are reluctant to use the latter.

It is our view, however, that the net approach not only deprives investors of a set of accounting information that is key to assessing firm performance and its financial position effectively, but it does

not allow the societal cost of the environmental and pollution actions to be fairly perceived by the stakeholders. Another aspect to be considered is the valuation criteria used to measure assets and liabilities, as it has a clear impact on net income and consequently on return on equity.

2.2. The reaction of EU standard setters

The withdrawal of IFRIC 3 encouraged some EU national standard setters to produce their own domestic solutions to account for carbon related transactions. We argue that these domestic rules might have an impact on the IFRS financial statements as well, resulting in divergence between countries that follow IFRS (in the empirical analysis we look into this specific aspect). Next, we provide an overview of the standards issued, through a critical evaluation of their contents. Given the way in which IFRS are developed, it would not be surprising if these local rules influence the IASB, either through the preparers or the pressure of standard setters.

In 2006, some standard setters were very active. The Spanish *Instituto de Contabilidad y Auditoría de Cuentas* (ICAC) issued a compulsory standard, as did the Dutch Accounting Standards Board (DASB), the German *Institut Deutscher Wirtschaftsprüfer* (IDW) and the Austrian Financial Reporting and Auditing Committee (AFRAC) also provided their own guidelines. More recently, in 2013, the Italian *Organismo Italiano Contabilità* (OIC) produced its local standard; in 2015, the Austrian Board issued their revised guidelines; and in 2016, the Spanish ICAC made an amendment to its 2006 rules.

The Spanish standard imposes a gross approach that is relatively consistent with IFRIC 3, although it introduces some changes to avoid volatility (Giner, 2014). While in the 2006 version, ER were considered intangible assets (but not subject to amortization), they could not be revaluated. However, after the recent change, ER are characterized as inventory. When received free, the market value at initial recognition should be used, and a deferred income credited. The accounting entries to be recorded when the firm pollutes coincide with those in IFRIC 3.

The guidelines provided by the Austrian AFRAC CO₂-Emissionszertifikaten, the Dutch DAS 274, and the German IDW 15 differ from IFRIC 3; all of them consider ER as inventory. DAS 274 and IDW 15 allow to measure free ER at market value at initial recognition or at nil (on the basis of their cost, it means at zero value), which implies ER do not appear in the balance sheet (Karai and Bányi, 2013), while the Austrian standard imposes market value. With the exception of DAS 274 that requires market value, subsequent measurements are based on the prudence rule, which requires the lower between market value and cost (market value at grant date for granted ER). The recently issued Austrian standard *Stellungnahme 1 CO₂-Emissionszertifikate UGB* (AFRAC, 2015) keeps the same view as the 2006 version, and considers that ER are current assets.

Regarding the obligation to deliver ER, the Austrian, Dutch, German, and Spanish bodies agree that it appears when firms pollute, and assume that ER (either obtained free or purchased) are used up; thus, their value should be taken into consideration to measure the expense, and the related liability. When there are not enough ER, the Spanish ICAC refers to the best estimate (although the standard does not clarify which one should be used). The other three bodies are more precise and refer to the use of market value at reporting date.

A completely new net approach was proposed by the Italian professional body in 2013. According to the Italian standard OIC 8 on *Emission Rights*, free ER do not represent a patrimonial resource that increases firm value; rather it results in an avoidable production cost which derives from the legislation. Hence, free ER should

only be disclosed in the notes, measured at market value at the allocation date. This view deviates from the market perspective of the trading schemes, by which, as mentioned earlier, ER are perceived as tradeable rights to pollute. The Italian standard states that purchased ER do not immediately meet the conditions to be recognized as assets. But at reporting date, when the total quantity of free and purchased ER exceeds (is lower than) the quantity necessary for the fulfillment of EU legal obligations, will there be an asset that should be measured at cost (liability at market value at reporting date). According to this standard, the delivery of ER to the authority to fulfill the obligation does not involve any accounting entry. Table 1 displays a summary of the accounting standards on ER discussed above.

3. Current accounting developments in the international arena

In the European accounting arena, the debate has further increased since the advent of EU ETS Phase 3. In May 2012, the French standard setter *Autorité des Normes Comptables* (ANC) (ANC, 2012) issued the paper *Proposals for accounting of GHG emission rights* with the aim of developing a debate regarding ER accounting. It distinguishes between production and trading business models. Regarding the former, the valuation criteria to be used is cost (fair value for the trading portfolio). ER received for free should be accounted at nil value. ANC states a liability is only recognized when the company has emitted GHG without having previously purchased emission rights, which should be valued at the best estimate of the outflow of resources, thus it supports a net approach. This solution is close to the one adopted in 1993 for US regulated industries (see Section 2.1). Moreover, it adopts a new definition of de-recognition date for the liabilities, “the emission rights purchase date and not the date of surrender of the emission rights to the State” (para. 4.1.2). However, as Giner (2014) posits, it is arguable that an obligation is fulfilled by having purchased the asset destined for delivery. In fact, as mentioned below no standard setter has followed that route.

Some months later, in December 2012 EFRAG (EFRAG, 2012) published a draft paper for comments before the end of April 2013. Complying with the majority of European standard setters, EFRAG states that ER are close to inventory. Consequently, ER should be valued at cost, and in accordance with IFRIC 3, EFRAG states that granted ER should be measured at market value when received. As in the French proposal, a dual model is introduced; while the production portfolio is measured at cost, the trading one is valued at market value at reporting date. In order to minimize the valuation mismatch that IFRIC 3 created, EFRAG suggests linking the measurement of the liability with the existing asset, in line with most of the European standard setters.

As summarized by EFRAG staff (EFRAG, 2013), in total, eleven comment letters were received, five from standard setters, not surprisingly those bodies whose positions were analyzed earlier. To the extent that EFRAG view is based on prior domestic solutions, it comes as no surprise to find reasonable acceptance from these relevant stakeholders. Indeed, with the exemption of the Italian body, their letters are quite favorable.

The Austrian AFRAC strongly agrees with EFRAG position, although considers all ER as intangible assets, which also contradicts its domestic view. The Austrian body supports the gross approach and confirms that liabilities should only be extinguished when the underlying obligations are discharged (AFRAC Comment Letter 1). The Dutch Board complies with EFRAG suggestion that free ER should be measured at market value at initial recognition. This is one of the two options allowed under its domestic rules. In its view, ‘this method best reflects the costs of the emissions, which

Table 1
Summary of the main content of ER accounting standards.

Institution (year)	Approach	Asset recognition	Asset valuation	Liability valuation
IFRIC (2004)	Gross	Intangible	Market value at IR. (subsequent measurement: cost or market value at RD)	Market value at RD
Spanish ICAC (2006; 2016)	Gross	Intangible (2006) Inventory (2016)	Market value at IR	Linked to the asset; insufficient ER: market value at RD
Dutch DASB (2006)	Gross (when MV at IR)	Inventory	Nil and Market value at IR	Linked to the asset; insufficient ER: market value at RD
German IDW (2006)	Gross (when MV at IR)	Inventory	Nil and Market value at IR	Linked to the asset; insufficient ER: market value at RD
Austrian AFRAC (2006; 2015)	Gross	Inventory	Market value at IR	Linked to the asset; insufficient ER: market value at RD
Italian OIC (2013)	Net	Current assets under conditions	ER in excess at cost	Insufficient ER: market value at RD

IR: Initial Recognition; RD: Reporting Date.

is the most relevant information need for the users' (DASB Comment Letter 3, 2013). Nevertheless, in consistency with its local rules, the Dutch perspective leaves space for accounting options on gross versus net approach. Specifically, the Board argues that when the firm receives sufficient allowances for its operations and will use them to settle the liability, 'a gross up of the balance sheet should not provide more relevant information'. In its view, 'since the transactions have no impact on cash flows, an alternative solution consists of allowing also a net presentation only for the free ER' (DASB Comment Letter 3, 2013). The Spanish standard setter supports the two different approaches depending on the use to which the ER are held. Differently from EFRAG, the 2006 standard advocated that ER held for own use were intangible assets, while ER held for the purpose of selling were inventories (ICAC Comment Letter 2, 2013). However, this difference has been eliminated with the 2016 standard, which states that both types of ER should be considered inventories and measured at cost.

Not surprisingly, the Italian OIC totally contrasts EFRAG view and, coherently with its own local standard, believes that neither free, nor purchased ER represent a resource for the entity. Therefore, purchased ER 'should impact the balance sheet only for accrual reasons' (OIC Comment Letter 11, 2013).

Most respondents argue that a common solution is needed, but they do not always agree with the need for an international standard. Thus, the Austrian and the Dutch bodies concur with EFRAG that instead of an interpretation, it would be better to issue a standard without the limits of the existing ones. On the contrary, the Spanish body supports an interpretation. Yet, the German standard setter suggests that issued standards are sufficient, and does not recommend a specific solution, but asks for a holistic approach to solve the accounting gap (IDW Comment Letter 10, 2013). In particular, it proposes evaluating whether improvements and clarifications can be considered through changes in existing long-standing standards, such as IAS 2 *Inventories*.

Before concluding this section, we should also refer to IFAF. As stated earlier, this body has been proactive in order to fill the gap in the IFRS about the way to account for ER. To that end, it issued a best practice paper, and also replied to the EFRAG document questioning the need for specific guidance (IEAF Comment Letter 4, 2013). In accordance with their guidelines, IFAF disagrees with EFRAG in imposing market value for granted ER, and in eliminating the fair value option to measure ER held for own use. In other words, IFAF recognizes ER as intangible assets and prefers to leave more discretion in the initial valuation of free ER (nil value and market value at initial recognition), and in the subsequent valuation (cost and market value at reporting date).

3.1. Looking for an international solution

Not only the European local standard setters have become active after the failure of IFRIC 3, but also the IASB, together with its counterpart the FASB, declared a joint IASB-FASB *Emissions Trading* project, which aimed to bridge the gap by issuing clear guidance. The collaboration started in 2008 with the *Cap and Trade Schemes and Baseline and Credit Schemes* project, but its progress has been extremely slow. In 2010, the two Boards held some joint meetings. However, in January 2014 FASB decided to remove this project from its agenda, due to the prioritization of other projects.

With the starting of Phase 3 of EU ETS, IASB became active again and, in June 2015, the document *Pollutant Pricing Mechanisms (formerly Emissions Trading Schemes)* was formally discussed (IASB, 2015). It aims to develop a Discussion Paper that follows a fresh thinking approach in order to consider different possibilities about the nature of ER, the valuation criteria, and even the gross versus net presentation of assets and liabilities. Although it firstly focuses on the financial or economic effects of ER, the full scope is to cover other types of pollutant pricing mechanisms (e.g. baseline-and-credit schemes).

Different to IFRIC 3, and along the lines of both EFRAG and IFAF, the IASB is willing to consider a dual accounting model based on the intended use, trading versus held-for-use (recall that the 1993 US guidance also makes this distinction). The main issues arise in the held-for-use model. Introducing the distinction between ER based on the intended use might appear a convenient way to satisfy firms, but, in our opinion, it also conveys additional issues that could be rather cumbersome. Clarifying transfers between portfolios, and perhaps including anti-abuse rules as occurs in IFRS 9 on *Financial Instruments* are key examples.

There is another possibility that has not received much attention so far, ER could be considered payment instruments, as Giner suggests (2014). In fact, Button (2010) states that ER exhibit many hallmarks of currency markets, and the Interpretations Committee of the IASB before issuing IFRIC 3 reasoned that an emission unit is similar to a currency because its value is related only with its use to meet an obligation. This proposal would require amending IAS 32 to widen the definition of financial assets, or IAS 38 and classify ER as currency-like intangible assets, which would be measured at market value through profit and loss. Indeed, given the call made by the IASB for a fresh thinking approach, perhaps this alternative could be considered. It is true that although the changes in value could be compensated by those derived from the liability, when the allowances held and the emissions differ, a full fair value model could potentially impact net income. Nevertheless, given that all assets and liabilities would be properly captured in the balance

sheet, we think this solution has the merit of ensuring more transparency and less discretion to managers, although market participants may dislike it. Table 2 provides an overview of the main events regarding accounting for ER in the international arena.

4. Empirical literature review

While there is not much empirical accounting research on ER, two different streams can be identified, market-based and descriptive analysis.

Regarding the market-based approach, some literature has looked at the market reaction to voluntary information on GHG related issues, such as carbon emissions and other environmental information (Chapple et al., 2013; Griffin and Sun, 2013; Matsumura et al., 2014; Plumlee et al., 2015; Jaggi et al., 2017), but only a few papers investigate the usefulness of the alternative existing treatments for ER valuation and related liabilities. Results indicate that investors pay attention to liabilities and at a lesser extent to assets. Based on non-financial pollution measures (sulphur dioxide- SO₂ emissions) that capture the firms' exposure to future environmental liabilities, Hughes (2000) concludes that, on average, un-booked liabilities decrease the mean share price of high-polluting US firms. Clarkson et al. (2004) obtain similar conclusions for the high-polluting firms in the US pulp and paper industry. Johnston et al. (2008) reveal that the capital market assigns a positive price to a firm's bank of SO₂ emission allowances, confirming that they have an asset value component (which can be used to reduce future cash flows related with emissions). The EU ETS context has been considered by Veith et al. (2009) and Clarkson et al. (2015), but none of them find support for the complex models along the lines of IFRIC 3. It seems that allocation shortfalls are negatively associated with prices, suggesting that investors do not value ER per se, but value liabilities.

As for the second methodological approach, which is close to ours, a small number of academic studies provide an overview of accounting practices before the EU ETS Phase 3. They cover the different periods that characterize the EU ETS program. Warwick and Ng (2012) consider the financial reports of the highest emitters in Europe included in the Carbon Monitoring for Action (CARMA) database in 2007, which was the last year of the first phase of the EU ETS; Lovell et al. (2010, 2013) look at the largest emitters within the EU ETS in 2008, the first year of the second phase; and Black (2013) examines European firms in the National Allocation Plans of the EU ETS for the highest emitting Member States, namely Germany, Spain, and the UK for the year 2011, close to the end of phase 2. It is interesting to remark that in these two phases, allowances were mainly given free of charge, while auctioning becomes the main allocating system in the third period. Table 3 summarizes the main empirical findings of these studies, especially with regard on how firms recognize granted and purchased ER, their measurement base, and the treatment for ER liabilities.

Despite the different periods and samples under study, these

Table 2
Summary of the events to develop an ER accounting standard (after IFRIC 3).

Dates	Events
2008	Start collaboration FASB-IASB in the ET Project
2010	Joint meetings between FASB-IASB
2012	French ANC issues Paper
2012	EFRAG issues Draft Paper
2014	End FASB involvement in the Project
2015	IASB re-starts discussion on PPM

ET: Emission Trading; PPM: Pollutant Pricing Mechanisms.

papers show some commonalities. Firms tend to consider ER as intangible assets. For those received for free, nil value is the most common measurement criterion, therefore they prefer not to include the assets in the financial statements; firms use cost and market value for purchased ER. Given that both net and gross approaches are used, liabilities are not always recognized, and the measurement deviates from IFRIC 3; thus, to avoid income volatility, the liability usually takes into account the carrying value of ER. However, details about liabilities in those papers are not provided in a comparable manner.

Lovell et al. (2010) also carry out interviews with accountants at 5 of the 26 companies in their study to explore why accounting practices vary. This analysis reveals that the lack of a clear definition of allowance impedes firms from identifying the proper accounting treatment.

Another frequent issue that papers highlight is the lack of disclosure, which creates a real problem when trying to understand what firms do, and impedes making the necessary adjustments to make sensible comparisons. Lovell et al. (2013) emphasize the widespread extent of non-disclosure regarding ER, and raise questions about the ability of carbon financial accounting to influence the EU ETS policy and carbon markets more generally.

5. Empirical study and discussion

In the framework of the 2013 Phase 3 EU ETS program, we have examined the 2013 financial statements of a sample of firms in order to have an updated overview of the accounting practices. When Phase 3 started, the electricity industry was the only sector in which operators could no longer receive free allowances but had to buy them. It should be noted, however, that some EU Member States (i.e. Bulgaria, Czech Republic, Hungary, Poland, and Romania) have made use of a provision allowing them to continue granting limited numbers of free allowances to existing power plants until 2019.

One relevant point of distinction in this investigation refers to the selected sample. To our knowledge, this is the first study that focuses on the EEX market, the leading European central market platform for energy, oil and natural gas, environmental products, freight rates, metals, and agriculture. The EEX trades emission allowances based on the EU ETS since 2005. In 2012, the EC appointed EEX as the transitional common auction platform to auction Phase 3 EU allowances on behalf of 24 Member States. Thus, most participants in this market are directly involved in the new auctioning system. In 2012, the amount of allowances auctioned in the EEX market was 89,701,500, but this figure increased sevenfold in just three years. Hence, in 2015, the EEX Primary Market Auction Phase 3 EU ETS, which was carried out on behalf of the European Commission, auctioned off 632,725,500 allowances (EU Carbon Market Report, 2015). This market is strongly affected by price volatility. Thus, prices of EU allowances on the spot market have gone from a low of €3 in May 2013 to a high above €8 in December 2015. This volatility could impact the profit and loss account unless there is some accounting hedging between assets and liabilities, which helps to explain the opposition to IFRIC 3.

Initially, we considered the 237 firms admitted to the EEX market. Next, we screened the sample based on the following three criteria. First, the 2013 financial statements should be available in English online, which reduced the sample to 210 firms. Second, information about the accounting treatments for ER should have been disclosed. As in prior studies, we identified a large number of non-disclosure firms, thus 46 firms could not be included in our study (this is 22% of the remaining firms). Third, we limited our analysis to those firms with ER to meet their emission obligations (hence, we excluded firms holding ER only for trading purposes).

Table 3
Studies on accounting practices for ER.

Study	N. firms (year)	Asset side Recognition of ER	Asset side Measurement of ER	Liability side
Warwick and Ng (2012)	47 (2007)	<i>Granted ER:</i> 55.3% intangible asset 6.4% inventory 38.3% not disclosed <i>Purchased ER:</i> NI	<i>Granted ER:</i> 38.3% nil value 21.3% market value at IR 17% other 23.4% not disclosed <i>Purchased ER:</i> 59.6% acquisition cost 2.1% market value at RD 38.3% not disclosed	<i>ER held at RD:</i> 12.8% ER carrying amount 10.6% ER acquisition cost 21.3% other 55.3% not disclosed <i>ER required to meet the shortfall:</i> 27.7% market value at RD 14.9% market value 21.2% other 36.2% not disclosed
Lovell et al. (2010, 2013)	26 (2008)	<i>Granted and purchased ER:</i> 42% intangible asset 8% inventory 23% other 27% not disclosed	<i>Granted ER:</i> 31% nil value 15% market value at IR 31% other 23% no information <i>Purchased ER:</i> NI	73% ER carrying value; shortfall at market value 4% fair value 23% not disclosed
Black (2013)	62 (2011)	<i>Granted and purchased ER:</i> 69.4% intangible asset 14.5% inventory 4.8% other 11.3% not disclosed	<i>Granted ER:</i> 62.9% nil value 30.6% market value at IR 1.6% other 4.8% not disclosed <i>Purchased ER:</i> NI	56.5% net approach, the liability appears when emissions exceed ER held 29% gross approach 3.2% other 11.3% not disclosed

IR: Initial Recognition; RD: Reporting Date; NI: No Information.

The final sample consists of 94 firms, which is substantially larger than those used in prior papers (26 in Lovell et al., 2010; 47 in Warwick and Ng, 2012; and 62 in Black, 2013). Panel A Table 4 summarizes the sample selection process.

In Panel B Table 4, we indicate the country distribution of firms in the final sample; 22 different countries are represented. Unlike Black (2013)'s paper, where Spain and Germany are the countries with the largest representation, Germany and France occupy the first positions in our study. Panel C provides information about the industry distribution based on Global Industry Classification (GIC code). As specified earlier, the EEX market is mainly focused on some specific industry groups, so it comes as no surprise that the majority of firms (66%) belong to the energy sector, 18% to oil and gas, 12% to utilities, and the remaining 4% to metals and steel.

Through a content analysis, we have investigated the accounting policy for ER adopted by the firms included in the sample as reported in the notes to the financial statements. As in the prior literature, the unit of analysis is the published financial statements, and the selected items are coded on the basis of their existence within the 2013 annual report. In order to summarize the treatments adopted to record ER, received for free and obtained through the auctioning system or purchased, we employed the codification criteria displayed in Table 5.

Consistent with past evidence, a diversity of approaches exists in relation to the accounting treatment for ER held to meet obligations. However, there are some remarkable and interesting findings discussed below, adding new knowledge to earlier studies. Table 6 displays the main results.

The evidence reveals two well-identified groups. Thus 56.38% of firms do not recognize free ER and use nil value instead, which means they follow the net approach, while 43.62% use the market value and follow the gross approach. Compared with prior studies, this relatively larger percentage using market value could be due to the new auctioning system that has led more firms towards attributing a value to free ER. However, the different samples preclude us from providing a clear statement regarding this. Nevertheless, our findings comply with previous studies in showing that nil value is still the most common choice for free ER.

Looking at those 41 firms that recognize free ER, 58.53% do not

Table 4
Sample selection.

Panel A. Number of sample firms		
Firms		
Initial sample		237
N. firms without the English financial report on line		27
N. firms with ER missing information		46
N. firms with only ER for trading		70
Final sample		94
Panel B. Country Sample Distribution		
Country	N. firms	%
Austria	3	3.19
Bulgaria	1	1.06
Croatia	1	1.06
Czech Republic	2	2.13
Denmark	1	1.06
Finland	2	2.13
France	10	10.64
Germany	29	30.85
Greece	1	1.06
Hungary	1	1.06
Ireland	1	1.06
Italy	5	5.32
Netherlands	2	2.13
Norway	5	5.32
Poland	6	6.38
Romania	1	1.06
Slovenia	4	4.26
Spain	4	4.26
Sweden	2	2.13
Switzerland	4	4.26
UK	6	6.38
Ukraine	3	3.19
Total	94	100
Panel C. Sector Sample Distribution		
Sector (based on GIC code)	N. firms	%
Energy	62	66
Oil & Gas	17	18
Utilities	11	12
Metals and Steel	4	4
Total	94	100

Table 5
Codification criteria to collect data on accounting for ER.

Codification	Data collected
0	Free ER not recognized in the financial statements (nil value)
1	Free ER recognized at market value at IR
0	Free ER as inventory
1	Free ER as intangible asset
2	Free ER as financial asset
0	Free ER as intangible at market value at IR
1	Free ER as intangible at market value at RD
0	Purchased/auctioned ER as inventory
1	Purchased/auctioned ER as intangible asset
2	Purchased/auctioned ER as financial asset
0	Purchased/auctioned ER as intangible at cost
1	Purchased/auctioned ER as intangible at market value at RD
0	Purchased/auctioned ER as inventory at cost
1	Purchased/auctioned ER as inventory at lower cost vs market at RD

IR: Initial Recognition; RD: Reporting Date.

disclose any information, while 41.46% recognize them as intangible assets, and no firm considers them as inventory or financial assets. When free ER are reported as intangible assets, 29.41% adopt the fair value option, which is market value at reporting date, and 70.58% use the cost approach, which is market value at initial recognition. As long as the change in value due to the use of fair value does not affect the profit and loss account (as it goes to comprehensive income), we do not find an obvious reason for this behavior.

Regarding the recognition of purchased/auctioned ER, an almost equal distribution of firms considers them intangible asset (49%) and inventory (51%), while in past studies firms tended to prefer the intangible classification. To some extent this could have been affected by the recent proposals by the French accounting standard setter and the European body (EFRAG), but additional empirical research is required to confirm it. Yet, we do not find any firm classifying ER as financial asset.

Considering the measurement choice between fair value and cost used for purchased/auctioned ER, which are treated as intangible assets, in contrast with the decision made for granted ER, the majority of firms uses the fair value option, and measures ER at market value at reporting date (63%). This also contrasts with Warwick and Ng (2012)'s study, where only 2.1% of firms do it.

Table 6
Accounting for ER for own use (compliance model).

Accounting decision	Total sample	
	N. of firms	%
Free ER not recognized in the financial statements (nil value)	53	56.38
Free ER recognized at market value at IR	41	43.62
Free ER as inventory	0	–
Free ER as intangible asset	17	41.46
Free ER as financial asset	0	–
Free ER with no information on asset classification	24	58.53
Free ER as intangible at market value at IR	12	70.51
Free ER as intangible at market value at RD	5	29.41
Purchased/auctioned ER as inventory	48	51.00
Purchased/auctioned ER as intangible asset	46	49.00
Purchased/auctioned ER as financial asset	0	–
Purchased/auctioned ER as intangible at market value at RD	29	63.00
Purchased/auctioned ER as intangible at cost	17	37.00
Purchased/auctioned ER as inventory at cost	–	–
Purchased/auctioned ER as inventory at lower cost vs market	48	100

IR: Initial Recognition; RD: Reporting Date.

Unfortunately, we cannot compare with the other two surveys since they do not isolate this specific issue. Finally, the entire sample that considers ER as inventory uses the lower amount between cost and market value as the measurement basis, which is consistent with the EFRAG paper.

To have a better understanding of the accounting decisions, we analyze if they are related to the industry. Regarding purchased ER, we consider the asset classification and the measurement base of the intangible assets (cost or fair value). For free ER, we only consider the association between including them in the financial statements or not and the industry, as all firms classify ER as intangible assets. The sector distribution of our sample imposes us to categorize the industry variable into two groups, namely energy and other sectors. This classification is even more justified when considering the guidelines issued by IEAF specifically for the energy sector. The three accounting decisions are shown in the three Panels of Table 7.

With the exception of the energy sector, Panel A of Table 7 indicates that firms are more inclined to consider purchased ER as intangible assets. Panel B confirms that fair value (market value at reporting date), is the preferred criterion for purchased ER (more in the energy sector than in the others), and Panel C displays that nil is the most common option for free ER (once again, especially in the energy sector), but market value at initial recognition is also frequently used. However, the chi square tests are not significantly different from 0, therefore we cannot state that there is an industry association with the accounting decisions for ER.

Based on the analysis discussed in section 2.1, next we focus on those firms in countries where a local standard exists. Since we deal with consolidated financial statements, these standards are not compulsory, but we aim to find out if domestic guidelines exercise some influence on the way firms account for ER in those reports. We have also considered French companies, as the French standard setter has been very active. Table 8 summarizes the details about the 53 firms, and as mentioned below some interesting observations arise.

Although market value for free ER is only imposed in the Austrian and Spanish rules, about 50% of firms in each of the examined countries use it. In France, this diversity also occurs, as half of the 10 firms in the study use market value (the other half use nil value as suggested by the local standard setter). As for subsequent valuation of free ER, the cost approach (market value when granted) is

Table 7
Accounting decisions for ER by industry.

Panel A. Asset classification for purchased ER			
	Intangible	Inventory	Total
Energy	29	33	62
Others	17	15	32
Total	46	48	94
Chi square test	0.56		
Panel B. Measurement base for purchased ER classified as intangible asset			
	Fair value	Cost	Total
Energy	19	10	29
Others	10	7	17
Total	29	17	46
Chi square test	0.65		
Panel C. Measurement base for free ER			
	Nil	Market	Total
Energy	37	25	62
Others	16	16	32
Total	53	41	94
Chi square test	0.37		

Table 8
Accounting for ER for own use by country.

Country	N. of firms	Accounting decision							
		Free ER at nil value	Free ER at market value at IR	Free ER as intangible at market value at IR ^a	Free ER as intangible at market value at RD ^a	Purchased ER intangible	Purchased ER inventory	Purchased ER as intangible at cost	Purchased ER as intangible at market value at RD
Austria	3	2	1	NI	NI	1	2	1	0
France	10	5	5	2	0	5	5	2	3
Germany	29	15	14	3	1	10	19	3	7
Italy	5	4	1	NI	NI	3	2	1	2
Netherlands	2	1	1	1	0	0	2	0	0
Spain	4	1	3	2	1	2	2	2	0
<i>Total</i>	53	28	25	8	2	21	32	9	12

IR: Initial Recognition; RD: Reporting Date; NI: No Information.

^a 11 firms do not disclose what they do.

preferred in almost all countries. None of the Italian firms adopts the local approach. On the contrary, all firms consider purchased ER as assets and not as operating expenses.

Regarding the asset recognition, as already stated, none of the firms considers free ER as inventory. As for free ER treated as intangible, most firms do not disclose which valuation method they use (only 10 out of 25 give details), but market value at initial recognition is more common than fair value (which is market value at reporting date). The two Dutch firms fully comply with the local standard when consider purchased ER as inventory, and more than half of German and Austrian firms (66% and 67% respectively) comply with their local rules and classify ER as inventory. Nevertheless, there is lower compliance in other countries, only 50% of the Spanish firms follow the domestic standard. There is also a wide variety within French and Italian firms regarding this aspect, contrasting the views of their local bodies. Only half of French firms recognize that ER are inventory, although this is the domestic view, and 40% of Italian firms believe so.

While fair value for purchased ER treated as intangible is not allowed by any of the EU standard setters, French, German and Italian firms use it, and more frequently than cost (between 60% and 70% adopt fair value). Recall that all ER categorized as inventory are valued at cost, meaning that the two Dutch firms do not follow the local standard that requires fair value.

In summary, and contrary to our expectation, even in the absence of an international standard, firms do not follow local accounting standards for ER as they adopt their own solutions. This suggests that domestic rules are not threatening comparability in Europe and, interestingly, IFRIC 3 seems still to play a role in the accounting for ER. Firm practices are also within the IEAF guidelines, which is not surprising given its flexibility.

6. Conclusions and implications

This study explores and critically discusses the treatment of ER under carbon trading schemes from two distinct angles, the solutions adopted by accounting bodies and the practices followed by firms in the EEX market.

The absence of an international accounting standard has motivated local European bodies to find their solutions. Regarding ER for own use, most standard setters concur with a gross approach, meaning that all ER should be recognized in the primary statements, but the French and the Italian bodies do not share this view. Given that auctioning will be the main allocation system, it seems the differences due to granted ER will dissipate. However, purchased ER are still subject to creative proposals by these two accounting bodies, and both advocate not fully showing them in the financial statements. The adoption of a gross approach does not imply that the IFRIC 3 solution is accepted. On the contrary, the general view is that the measurement of the liability should be

linked to the existing asset. We strongly believe that by not including free ER in the primary financial statements and adopting a net approach, firms omit the societal cost of pollution activities, and deprive users, i.e. investors, of a set of financial information relevant for their decisions. Needless to say, solutions that by netting assets and liabilities avoid showing purchased ER and related obligations in the balance sheet are undesirable.

Regarding firms' reporting practices, we find a diversity of approaches. Although the majority of firms adopt the nil value for free ER, the proportion of firms that recognize them and use a gross approach is larger than in prior studies, which could be influenced by the new auctioning system. It is also noteworthy that about half of the companies in the sample consider ER as inventory, the other half as intangible assets. However, we should highlight the great level of non-disclosure (although not as much as in earlier studies). Interestingly, we notice that local rules and proposals do not always affect corporate financial reporting, which does not mean this is a case of misbehavior, as they are not compulsory when using IFRS. It is more than ten years since the IASB initiated its ER project, but after the withdrawal of IFRIC 3 there has not been an answer yet.

As our study documents, firms using IFRS have been forced to find their own solutions to communicate their transactions with allowances, which clearly is far from satisfactory. Hence, we ask for a common approach. Otherwise, given that lack of comparability, together with obscure information, investors and other stakeholders will not be able to make adequate decisions, and the schemes will not produce the desired effect. In particular, we suggest the IASB considering a different approach, which does not convey the reporting mismatches widely criticized in IFRIC 3, to treat ER as payment instruments. This option supports a full reporting of assets and liabilities related to ER, hence ensuring more transparency in the financial statements.

The study, however, has some limitations, which, in turn, may constitute fertile areas for future research. It has been restricted to reviewing the state of the art for ER accounting practices, hence identifying the relation between firm or country specific factors and the accounting choice for ER has not been the main aim of this research. Moreover, while the study observes firm behavior for a single year, an in-depth analysis across time may provide more useful insights.

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List of acronyms

- ANC: Autorité des Normes Comptables
 AFRAC: Austrian Financial Reporting and Auditing Committee
 CARMA: Carbon Monitoring for Action
 CDP: Carbon Disclosure Project
 CO₂: Carbon Dioxide
 DASB: Dutch Accounting Standards Board
 EC: European Commission
 EEX: European Energy Exchange
 EFRAG: European Financial Reporting Advisory Group
 ER: Emission Rights
 EU: European Union
 EU ETS: European Emission Trading Scheme
 FASB: Financial Accounting Standards Board
 IAS: International Accounting Standard
 IASB: International Accounting Standards Board
 ICAC: Instituto de Contabilidad y Auditoría de Cuentas
 IFRIC: International Financial Reporting Interpretations Committee
 IFRS: International Financial Reporting Standards
 IDW: Institut Deutscher Wirtschaftsprüfer
 IEAF: International Energy Accounting Forum
 OIC: Organismo Italiano di Contabilità
 SO₂: Sulphur Dioxide
 US: United States