


**DERIVATIVE INSTRUMENTS ON EMISSION ALLOWANCES: FACTORS INFLUENCING DISCLOSURE IN PORTUGUESE COMPANIES**

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ARTICLE INFO	<u>ABSTRACT</u>
<p><b>Article history:</b></p> <p><b>Received</b> 10 August 2022</p> <p><b>Accepted</b> 09 November 2022</p>	<p><b>Purpose:</b> This article aims to analyze the degree of disclosure of information on Derivative instruments on Emission Allowances, analyzing the degree of compliance with the underlying accounting regulations, and their determinants factors.</p>
<p><b>Keywords:</b></p> <p>Emission Licenses on Gases; Derivative instruments; Carbon market; Disclosure index.</p>	<p><b>Theoretical framework:</b> With the evolution of the European Union Emission Trading System (EU ETS), which foresees that the emission licenses will no longer be allocated free of charge and will be negotiated at auction, it is expected that there will be an increase in the trading of derivative instruments on licenses, to cover any risks of future price fluctuations, and therefore an increase in disclosure in this area.</p>
	<p><b>Design/methodology/approach:</b> The methodology used in this study was the content analysis of the Reports and Accounts of the sample entities over a 12-year period, based on the creation of disclosure indexes for the topics under analysis. This is a longitudinal study that seeks to address possible changes in the behavior of companies' reporting practices in the periods 2008-2102 and 2013-2020 (corresponding to the 2nd and 3rd phases of the EU ETS).</p> <p><b>Findings:</b> The results of the derivative disclosure index, in general, is higher (average IDGD is 0.81), although it is still very low when it specifically refers to derivative instruments for risk hedging related to emission licenses (IDL_LE = 0.11). Contrary to expectations, not only companies do not use this type of instrument to cover the risk of fluctuations in the price of licenses, nor is the change in the behavior of companies between the 2nd and 3rd EU ETS periods significant. Regarding the explanatory factors studied, there is only a statistically positive correlation between the disclosure index and profitability.</p> <p><b>Research, Practical &amp; Social implications:</b> The study will focus on a sample of companies operating in Portugal, which are part of the National Emission Licensing Plan (PNALE) I and II. The literature is silent on previous studies related to disclosure on emission allowances derivatives, so our study represents a contribution to the advancement of literature in this area.</p> <p><b>Originality/value:</b> As far as we know, previous studies related to the disclosure of derivative instruments for gas emission licenses are non-existent, so our study represents a contribution to the advancement of the literature in this area.</p> <p>Doi: <a href="https://doi.org/10.26668/businessreview/2022.v7i4.e389">https://doi.org/10.26668/businessreview/2022.v7i4.e389</a></p>

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## INSTRUMENTOS DERIVADOS SOBRE LICENÇAS DE EMISSÃO: FATORES QUE INFLUENCIAM A DIVULGAÇÃO NAS EMPRESAS PORTUGUESAS

### RESUMO

**Objetivo:** Este artigo tem por objetivo analisar o grau de divulgação de informações sobre instrumentos derivados sobre Licenças de Emissão, analisando o grau de conformidade com os regulamentos contábeis subjacentes, e seus fatores determinantes.

#### **Estrutura teórica:**

Com a evolução do Sistema de Comércio de Emissões da União Européia (EU ETS), que prevê que as licenças de emissão não serão mais atribuídas gratuitamente e serão negociadas em leilão, espera-se que haja um aumento na comercialização de instrumentos derivativos sobre licenças, para cobrir quaisquer riscos de futuras flutuações de preços e, portanto, um aumento na divulgação nesta área.

#### **Design/metodologia/abordagem:**

A metodologia utilizada neste estudo foi a análise do conteúdo dos Relatórios e Contas das entidades da amostra durante um período de 12 anos, com base na criação de índices de divulgação para os tópicos em análise. Este é um estudo longitudinal que procura abordar possíveis mudanças no comportamento das práticas de relatórios das empresas nos períodos 2008-2102 e 2013-2020 (correspondente à 2ª e 3ª fases do ETS da UE).

#### **Descobertas:**

Os resultados do índice de divulgação de derivativos, em geral, é mais alto (IDGD médio é 0,81), embora ainda seja muito baixo quando se refere especificamente a instrumentos derivativos para cobertura de risco relacionado a licenças de emissão (IDL\_LE = 0,11). Ao contrário das expectativas, não só as empresas não utilizam este tipo de instrumento para cobrir o risco de flutuações no preço das licenças, como também a mudança no comportamento das empresas entre o 2º e 3º períodos do ETS da UE não é significativa. Quanto aos fatores explicativos estudados, existe apenas uma correlação estatisticamente positiva entre o índice de divulgação e a rentabilidade.

#### **Pesquisa, implicações práticas e sociais:**

O estudo se concentrará em uma amostra de empresas que operam em Portugal, que fazem parte do Plano Nacional de Licenciamento de Emissões (PNALE) I e II. A literatura é omissa sobre estudos anteriores relacionados à divulgação de derivativos de licenças de emissão, portanto, nosso estudo representa uma contribuição para o avanço da literatura nesta área.

**Originalidade/valor:** Tanto quanto sabemos, os estudos anteriores relacionados à divulgação de instrumentos derivados de licenças de emissão de gases são inexistentes, portanto, nosso estudo representa uma contribuição para o avanço da literatura nesta área.

**Palavras-chave:** Licenças de Emissão de Gases, Instrumentos Derivados, Mercado de Carbono, Índice de Divulgação.

## INSTRUMENTOS DERIVADOS SOBRE DERECHOS DE EMISIÓN: FACTORES QUE INFLUYEN EN LA DIVULGACIÓN EN LAS EMPRESAS PORTUGUESAS

### RESUMEN

**Objetivo:** Este artículo tiene como objetivo analizar el grado de divulgación de información sobre los instrumentos derivados sobre derechos de emisión, analizando el grado de cumplimiento de la normativa contable subyacente, y sus factores determinantes.

**Marco teórico:** Con la evolución del Sistema de Comercio de Emisiones de la Unión Europea (EU ETS), que prevé que las licencias de emisión dejen de ser asignadas gratuitamente y se negocien en subasta, es de esperar que se produzca un incremento en la negociación de instrumentos derivados sobre licencias, para cubrir posibles riesgos de fluctuaciones futuras de precios, y por tanto un aumento de la divulgación de información en este ámbito.

**Diseño/metodología/enfoque:** La metodología utilizada en este estudio ha sido el análisis de contenido de las Memorias y Cuentas de las entidades de la muestra a lo largo de un periodo de 12 años, a partir de la creación de índices de divulgación para los temas analizados. Se trata de un estudio longitudinal que pretende abordar los posibles cambios en el comportamiento de las prácticas informativas de las empresas en los periodos 2008-2102 y 2013-2020 (correspondientes a la 2ª y 3ª fase del RCCDE).

**Resultados:** Los resultados del índice de divulgación de derivativos, en general, es mayor (la media de IDGD es de 0,81), aunque sigue siendo muy baja cuando se refiere específicamente a los instrumentos derivados para la cobertura de riesgos relacionados con las licencias de emisión (IDL\_LE = 0,11). En contra de lo esperado, no sólo las empresas no utilizan este tipo de instrumentos para cubrir el riesgo de fluctuaciones en el precio de las licencias, sino que tampoco es significativo el cambio de comportamiento de las empresas entre el 2º y el 3º periodo del

RCCDE. En cuanto a los factores explicativos estudiados, sólo existe una correlación estadísticamente positiva entre el índice de divulgación y la rentabilidad.

**Investigación, implicaciones prácticas y sociales:** El estudio se centra en una muestra de empresas que operan en Portugal y que forman parte del Plan Nacional de Licencias de Emisión (PNALE) I y II. La literatura no contiene estudios previos relacionados con la divulgación de los derivados de los derechos de emisión, por lo que nuestro estudio representa una contribución al avance de la literatura en esta área.

**Originalidad/valor:** Hasta donde sabemos, son inexistentes los estudios previos relacionados con la divulgación de los instrumentos derivados de las licencias de emisión de gases, por lo que nuestro estudio representa una contribución al avance de la literatura en esta área.

**Palabras clave:** Licencias de Emisión de Gases, Instrumentos Derivados, Mercado de Carbono, Índice de Divulgación.

## INTRODUCTION

The Earth's climate is changing because of steadily increasing CO<sub>2</sub> and other greenhouse gas (GHG) emission. Climate change is causing substantial economic, social, and environmental harm both in the lifetime of present generations and to future generations (Arnold, 2016). Companies should engage in climate change mitigation actions, caused by organizations' activity, then they are responsible for dealing with it (Unsworth, Russell & Davis, 2016). Currently, the direct way to solve this issue is to curb carbon emissions.

The global warming has become a growing concern for countries and international bodies around the world. The Kyoto Protocol (1997) was the first agreement between nations to commit them to achieve GHG emission reduction targets. In Europe, a cap-and-trade system<sup>E</sup> was viewed as a mean to ensure the targets achievement to which the EU and its member states had committed in the Kyoto Protocol. As part of its strategy to reduce GHG emissions, the EU has created The European Emissions Trading Scheme (EU-ETS), by the Directive 2003/87/EC of the European Parliament and of the Council, of October 13<sup>th</sup>, 2003. The EU-ETS has been in force since January 1<sup>st</sup>, 2005, having already taken place three compliance periods, 2005-2007, 2008-2012 (which coincided with the first compliance period of the Kyoto Protocol) and 2013-2020, respectively. Phase 4, 2021-2030 is currently underway.

EU-ETS is the world's largest cap-and-trade carbon program and arguably the most important market-based application of economic principles to the climate problem (Ellerman et al, 2015). One of the initial measures created by the EU-ETS was to grant free emission allowances to companies – grandfathering – to allow them to limit CO<sub>2</sub> emissions. Thus, each

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<sup>E</sup> In a cap-and-trade system, government limit, or cap, the total level of emissions of certain set of plants, particularly carbon dioxide, as a result of industrial activity. Companies that reduce their emissions can sell, or "trade," unused emission allowances to other plants.

Member State allocates, free of charge, the CO<sub>2</sub> emission allowances (initial allocation), being possible always the auction of 5% of the CO<sub>2</sub> emission allowances in the 1<sup>st</sup> phase (2005-2008) and 10% in the 2<sup>nd</sup> phase (2008-2012). In Portugal, free allocation took place through the national allocation plans: PNALE I and PNALE II. In other words, a limited number of licenses were granted to the entities for a certain period, and they could sell surplus licenses or acquire others if they were not sufficient.

With the publication of the new Directive 2009/29/EC, the rules changed considerably, starting the 3<sup>rd</sup> phase (2013-2020). There was a widening of the scope, with the introduction of new gases and new sectors, the total quantity of emission allowances is determined at a community level and the allocation of allowances through an auction, while free allocation is maintained marginally, using benchmarks defined at Community level.

As a response to increasing public concern in the accounting field, some organizations are adopting a green, transparent policy and environmental disclosure, sometimes seeking for legitimacy. Also, institutional, and legislative pressures are seen as main drivers for the adoption of CSR disclosures.

The evolution of the European carbon market foresees that the emission licenses will no longer be allocated free of charge and will be negotiated at auction. Thus, it is expected that there will be an increase in the trading of derivative instruments on licenses, to hedge any risks of future price fluctuations, and therefore an increase in disclosure in this area.

Some regulatory bodies issued accounting standards that emphasizes environmental issues and/or climate-change related disclosures. For example, in Portugal, the Accounting and Financial Reporting Standard No. 26 - Environmental Matters, has an appendix dedicated to the accounting of CO<sub>2</sub> emission allowances. This standard is particularly relevant on the Portuguese industries targeted for the European Union Emissions Trading System (EU-ETS). In an international context, at the end of 1994, the International Accounting Standards Board (IASB) has issued the International Financial Reporting Interpretations Committee (IFRIC) 3 'Emission Rights', providing a guidance on the accounting treatment of emission rights, but some months after, it was withdrawn due to various inconsistencies. From then, there has been no international accounting guidance for emission rights. On the other hand, although there is an international standard related to the disclosure of financial instruments, including derivative instruments (the IFRS 7- Financial instruments: disclosures) there is no specific guidance related to derivative instruments on Emission allowances accounting. Nevertheless, IFRS 7 can be applied to it.

Derivatives play an essential role in the European carbon market. Companies can use derivative instruments on Emission allowances to manage risk in the most cost-effective way. Therefore, it is expected an increase in corporate reporting in this field. Thus, this paper aims to explore the factors that influence derivative instruments on emission allowances disclosures, analysing the degree of compliance with IFRS 7.

After this introduction, the structure of this paper is organized in three points. The first point is dedicated to the background and the research hypothesis. Following is the research design, namely the presentation of the selected sample and the research methodology. Finally, the results are analysed and discussed, and the solutions and recommendations, the clues for future research and the conclusion are presented.

## **BACKGROUND AND RESEARCH HYPOTHESIS**

### **Risk hedging instruments associated with trading emission allowances: accounting treatment and disclosure**

The use of derivatives for hedging risks, in general, is related to the fact that derivative instruments reduce the costs of diversification and leverage in investment and hedging strategies. This is because the investment made in the derivative represents only a part of the asset underlying the derivative. That is, a greater diversification of the amount invested is possible, thus increasing its profitability, if everything goes according to the investor's expectations (Ferreira, 2011).

The fact that emission allowances are now traded at auction led to the trading of derivative instruments on these allowances, as entities seek to protect themselves against possible future price fluctuations (Chester & Rosewarne, 2011). According to Uhrig-Homburg and Wagner (2008, 2009), the emission allowance market has brought other challenges, namely that of covering the risk associated with these transactions. Also, according to these authors, the perspective of using derivatives to hedge risk seems to be a successful hypothesis, namely through Futures, Forwards and Options. However, they also launch clues that serve as the basis for this article, such as the need to detail the potential of derivatives in this area and how to value the financial instruments associated with the carbon market in accounting terms.

Regarding financial instruments, in the international context, IAS 39 – Financial Instruments, prescribed the accounting treatment of financial instruments and, as such, can be applied to the recognition and measurement of derivative instruments on CO2 emission licenses.

This standard advocates the recognition of all derivative instruments in the balance sheet, as assets and liabilities (§14) and their measurement at fair value (§43 to §47), with recognition of gains and losses, resulting from changes in fair value, in results for the period (§55).

However, this standard provides for a special treatment for risk hedging operations, which will depend on the classification of the operation in one of the following three types of hedging, identified by the standard (§86): fair value hedges; cash flow hedges; and hedging of a net investment in a foreign operating unit.

As in most cases derivative instruments on allowances are traded with the intention of hedging risk on future allowance transactions, they will be classified for accounting as cash flow hedges.

A hedging relationship is classified as cash flow hedge if it covers exposures to changes in cash flows, attributable to a certain risk, associated with a recognized asset or liability or a highly probable forecast transaction, which is expected to affect the results (IAS39: §86).

The gain or loss on the hedging derivative, that is considered to be effective hedging, should be recognized in equity, through the statement of changes in equity. The part of the gain or loss that is considered to be ineffective must be immediately reported in profit or loss for the period (IAS 39: §95). Subsequently, gains or losses, previously recognized in equity, will be transferred to results as the hedged position also affects current results.

On the other hand, if the entity intends to cover the risk associated with an emission license held, this operation is classified, under the terms of IAS 39, as a fair value hedge.

A hedge is classified as fair value when it covers exposure to changes in the fair value of an asset, liability, or firm commitment, or an identifiable part of an asset, liability, or unrecognized firm commitment, that is attributable to a particular risk and that will affect the reported net result (IAS 39: §86).

In fair value hedges, the gains or losses generated in the hedging derivative must be immediately recognized in profit or loss for the period. Likewise, losses or gains on the hedged position, attributable to the hedged risk, should adjust the carrying amount of the hedged item and immediately affect profit or loss for the period (IAS 39: §89). In this way, it is possible to measure the effectiveness of the hedge, as the net gain or loss resulting from the ineffectiveness of the hedge will be reported in current results (IAS 39: §90).

In 2007, IFRS 7 entered into force, with the objective of requiring entities to disclose, in their financial statements, information that allows the user to assess (IFRS 7: §1):

*“The meaning of financial instruments for the entity's financial position and performance;*

*The nature and extent of risks associated with financial instruments to which the entity is exposed during the reporting period and date, as well as how the entity manages those risks*". Regarding the object of study of this article, IFRS 7 requires the disclosure of information related to the accounting policies adopted, with the fair value, methods and procedures adopted in its determination, the risks incurred with the contracting of financial instruments and policies adopted in managing these risks and with hedge accounting.

We present, in the Table 1 below, a summary of the disclosure requirements on hedge accounting, contained in IFRS 7.

Table 1 - Disclosures about risk hedging (IFRS 7).

Fair value hedges	Cash Flow hedges	Hedges of net investments in foreign operations	
A description of each type of hedge; A description of the financial instruments designated as hedging instruments and their fair values at the reporting date; The nature of the risks being hedged.			<b>Generic requirements</b> (Applicable to the three types of hedge operations)
Gains or losses: (i) on the hedging instrument; and (ii) on the hedged item attributable to the hedged risk;	The periods when the cash flows are expected to occur and when they are expected to affect profit or loss	the ineffectiveness recognized in profit or loss that arises from hedges of net investments in foreign operations.	<b>Specific requirements</b> (Vary depending on the type of hedge operation)
	A description of any forecast transaction for which hedge accounting had previously been used, but which is no longer expected to occur;		
	The amount that was recognized in equity during the period;		
	The amount that was removed from equity and included in profit or loss for the period, showing the amount included in each line item in the income statement;		
	The amount that was removed from equity during the period and included in the initial cost or other carrying amount of a non-financial asset or non-financial liability whose acquisition or incurrence was a hedged highly		

	probable forecast transaction.		
	The ineffectiveness recognized in profit or loss that arises from cash flow hedges;		

Source: Adapted from Hausin, Hemmingsson & Johansson (2008).

IFRS 9 replaced IAS 39, effective from January 1, 2018. With regard to cash flow hedges, this standard defends that gains or losses, considered to be effective hedges, incurred in the hedge derivative, start to be recognized in components of other comprehensive income. This amount accumulated in components of other comprehensive income shall be transferred to profit or loss at the same time as the hedged position affects profit or loss for the period. Any remaining gain or loss resulting from the hedging instrument constitutes hedging ineffectiveness and must be recognized in profit or loss (IFRS 9, §6.5.11).

Regarding fair value hedges, this standard establishes that the gain or loss resulting from the hedging instrument should be recognized in profit or loss. The gain or loss resulting from the hedged item must adjust the carrying amount of the hedged item (if applicable) and be recognized in profit or loss. When a hedged item is an unrecognized firm commitment (or a component thereof), the accumulated change in the hedged item's fair value subsequent to its designation is recognized as an asset or liability, with the corresponding gain or loss recognized in profit or loss. (IFRS 9, §6.5.8).

Following the publication of IFRS 9, IFRS 7 underwent several changes to accommodate the changes approved in the meantime regarding the accounting treatment of financial instruments, in general, and risk hedging operations, in particular. The level of disclosure has increased significantly, and it is important that, in relation to risk hedging, entities disclose information on (IFRS 7, §21 A):

- “ – the entity's risk management strategy and how it is applied to manage the risks;
- how the entity's hedging activities may affect the amount, timing and uncertainty of its future cash flows; and
- the effect that hedge accounting had on the entity's statement of financial position, statement of comprehensive income and statement of changes in equity”.

### Theoretical framework and hypothesis

Although there are still few studies that correlate emission allowances and the financial instruments used to cover its risk, some researchers are already beginning to study this market. On the one hand, they analyse the acceptance of emission allowance futures as a risk hedging



instrument. On the other hand, the price variations that these instruments suffer, their consequences and the origin that lead to these variations are already studied (Mazza & Petitjean, 2015; Rajput, Oberoi, & Arora, 2015). There are also studies that seek to identify the determining factors that lead to changes in carbon prices, carbon emissions and the futures on emission allowances (Chevallier, 2009; Creti, Jouvet & Mignon, 2012; Yunus, Elijido-Ten & Abhayawans, 2016). The most studied derivatives, correlated with carbon emissions, are Futures (Chevallier, 2009; Costa, 2012; Creti et al., 2012; Fang, Lu, Li & Qu, 2018; Mazza & Petitjean, 2015; Rajput et al., 2015; Tang, Shen, & Zhao, 2015).

Several studies have been developed with the intent to identify the determinants of derivatives instruments in general (Chalmers & Godfrey, 2004; Gope, 2017; Hassan, Percy & Stewart, 2006; Kota & Charumathi, 2018; Lemos, 2011; Lemos, Serra & Barros, 2019; Leote, Pereira, Brites & Godinho, 2020; Lopes & Rodrigues, 2007; Ponte, 2019; Kota & Charumathi, 2018; Probohudono, Sugiharto & Arifah, 2019; Martins, Lemos & Serra, 2020; Mir Fernández, Moreno & Olmeda, 2006; Tahat, Mardini & Haddad, 2018). Nevertheless, as far as we are aware, prior research has not addressed the topic of derivatives on emission allowances disclosures, which highlights the contribution of this paper to the literature.

It has been argued that a single theory approach is not adequate to explain the multifaceted nature of corporate reporting. Based on a joint and complementary perspective of Institutional (isomorphism coercive) and Legitimacy theories, the paper aims to explore the factors that explain the disclosures on derivative instruments on emission allowances.

The legitimacy theory is the dominant theoretical framework in the context of corporate disclosure. The legitimacy theory suggests that climate-change related disclosures allows firms to legitimize its performance and manage the perception of their stakeholders, preserving the status of legitimacy in society. Although information on emission license derivatives is quite scarce, Bamber and McMeeking (2010) and Lemos (2011) understand that the disclosure of information by companies about derivatives is a means of legitimacy in society.

Legitimacy can be considered the central axis of institutional theory. In fact, according to Oliver (1991), the central premise of this theory is that institutional means have a powerful influence on organizations that often leads organizations to behave in a manner consistent with social norms, values and assumptions regarding acceptable behaviour.

The Institutional theory, and particularly the coercive isomorphism<sup>F</sup>, can also explain the corporate reporting as result of formal pressures, which can drive companies to high levels of compliance with mandatory disclosure requirements. Lemos (2011) obtained evidence of the increased level of disclosure on derivative instruments following the mandatory adoption of the IASB standard in 2005 and the adoption of IFRS 7 in 2007. Tahat, Dunne, Fifield and Power (2016) also obtained evidence of increased disclosures after the adoption of IFRS 7.

Given the scarcity of articles on our specific topic, it is important to address the identification of potential factors that may influence the disclosure of derivatives on emission allowances. Thus, with the support of the literature and based on Institutional and Legitimacy theories, we formulate our research hypotheses, related to the following companies' characteristics and external pressures:

- Social pressure factor: size
- Shareholders' pressure factor: capital concentration;
- Market pressure factor: profitability and Carbon Disclosure Project (CDP); and
- Institutional pressure factor: EU Emissions Trading Scheme's period

### ***Social Pressure Factor: Size***

Larger and/or polluting companies are more subject to regulations and stakeholders' pressures. Being more exposed, they tend to be controlled by society through the media and the information disclosed. Thus, there is empirical evidence of an association between the disclosure of GHG emissions and the company's size (Alciatore & Dee, 2006; Brammer & Pavelin, 2008; Freedman & Jaggi, 2005; García-Sánchez, 2008; Haddock-Fraser & Fraser, 2008; Liu & Anbumozhi, 2009; Stanny & Ely, 2008; Walden & Stagliano, 2003).

With regard to derivative instruments, after several news published by the media about several companies that reported high losses as a result of their involvement in operations with these instruments, companies operating in the derivatives markets face a threat that could lead to question its legitimacy. In this sense, it seems to us that these companies will feel encouraged to disclose detailed information about their operations with derivative instruments, allowing the perception of the type of operations carried out, the strategies adopted in the management of the associated risks and the impact of these operations on the economic and financial situation of the company.

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<sup>F</sup> The coercive isomorphism of DiMaggio and Powell (1983) concerns features of political influence, such as regulations, laws and cultural expectations, that can cause organizations to form identical procedures.

The existence of an association between the level of disclosure on derivative instruments and the size of the company has been proven by several authors (Chalmers & Godfrey, 2004; Gope, 2017; Hassan et al., 2006; Kota & Charumathi, 2018; Lemos, 2011; Lemos et al., 2019; Leote et al., 2020; Lopes & Rodrigues, 2007; Ponte, 2019; Martins et al., 2020; Mir Fernández, Moreno & Olmeda, 2006).

On the other hand, larger companies are subject to greater scrutiny, which leads them to increase the degree of compliance with disclosure requirements, in response to institutional pressures and in an attempt to avoid threats to their legitimacy.

In light of the Legitimacy Theory and taking into account the greater empirical evidence of the existence of a positive association between the size of the entity and the level of disclosure of information on licenses and derivatives, the following research hypothesis was defined:

**H1.:** Larger companies have a greater degree of disclosure on derivative instruments on emission allowances

### ***Shareholders' pressure factor: capital concentration***

Shareholders play an important role in promoting and lobbying for the disclosure on environmental matters by companies (Lee, Park & Klassen, 2015). This type of information can be useful for attracting investors, which can, in turn, guarantee the profitability of shareholders, as well as value their investments (Lee *et al.*, 2015). Lopes and Rodrigues (2007) argue that, when ownership is concentrated in a smaller number of holders, it will be easier for them to access internal information, thus reducing the need to disclose information about derivative instruments abroad.

Some studies claim that a smaller group of shareholders leads to greater disclosure of voluntary information (Baek, Johnson & Kim, 2009; Borghei-Ghomi & Leung, 2013). On the other hand, other studies affirm that a greater number of shareholders will lead to greater pressure for the transparency of the company, namely at the level of disclosure (Prencipe, 2004; Cormier, Magnan & Van Velthoven, 2005). This is further supported by Reverte (2009) who argues that, in the case of a large number of shareholders, a higher level of disclosure leads to a reduction of agency risks between managers and shareholders.

Nevertheless, the studies of Brammer and Pavelin (2008) and González-González and Zamora Ramírez (2016) provided empirical evidence of a negative association between environmental/ GHG disclosure and the ownership concentration. That is, the more the concentration of capital in shareholders, the less environmental/emissions disclosures.

As for the association of this variable with the disclosure of information about derivatives and their use, Kota and Charumathi (2018) concluded that the greater the concentration of capital, the greater the disclosure. Tahat et al. (2018) and Lemos (2011), in turn, find a negative relationship between the disclosure of information about financial instruments and the concentration of capital.

In our study, in line with the results obtained in the aforementioned studies, we consider that the company's capital concentration is expected to negatively influence the level of information disclosed, defining the research hypothesis in the following terms:

**H2.** Companies with the lowest concentration of capital have a higher degree of disclosure on derivative instruments on emission allowances

### ***Market Pressure Factor: Profitability and Carbon Disclosure Project (CDP)***

- *Profitability*

From a theoretical point of view, the most profitable companies tend or can release greater resources for social and environmental responsibility practices and, if they do so, it is in the best interest that these practices are made known to the stakeholders, in order to achieve the legitimacy with them. In this perspective, a positive relationship between the profitability of companies and the level of disclosure on environmental matters is to be expected. However, the existing empirical evidence points to inconclusive results about this relationship.

Ismail and Chandler (2005) have found evidence that there is a positive relationship between disclosure and profit. According to some studies, companies with greater profit are better positioned to face the costs related to CO<sub>2</sub> emissions and indirectly with disclosure (Bewley & Li, 2000; Cormier, Gordon & Magnan, 2004). Furthermore, the studies carried out by Luo, Tang and Lan (2013), Liesen, Hoepner, Patten and Figge (2015), González-González and Zamora Ramírez (2016), Kalu, Buang & Aliagha (2016), Hermawan, Aisyah, Gunardi and Putri (2018), Hapsoro and Ambarwati (2018), Faisal, Andiningtyas, Achmad, Haryanto, and Meiranto (2018), Borghei, Leung and Guthrie (2018), and Akbas and Canikli (2018) have proven a positive association between profitability and GHG disclosure.

Theories such as legitimacy give strength to the interest of companies to disclose environmental matters to have the approval of third parties, and the companies with the best financial position are the ones that most disclose their business and financial information (Magness, 2006; Stanny & Ely, 2008).

Chalmers and Godfrey (2004) argue that the greater visibility of some companies creates, in them, a greater need to respond and comply with institutional requirements regarding

the disclosure of derivatives, than in less publicized and scrutinized companies, as a way of guarantee of legitimacy.

Firms face higher costs if, as a result of not disclosing information about their operations with derivative instruments, their legitimacy is called into question. Thus, according to the Legitimacy Theory, these companies will be more interested in disclosing information abroad about activities with derivative instruments, as a way of maintaining their reputation. Hassan et al. (2006) proved the existence of a positive association between the quality of information disclosed on derivative instruments and the profitability of companies. Probohudono, Sugiharto, and Arifah (2019) also obtained empirical evidence of a positive association between profitability and disclosure on financial instruments. In contrast, the results of the studies by Lemos (2011) and Martins et al. (2020) show the existence of a negative association between profitability and the level of derivatives disclosure.

In our study, we believe that the company's profitability is expected to positively influence the level of information disclosed, defining the following research hypothesis:

**H3.1.** The most profitable companies have a greater degree of disclosure on derivative instruments on emission allowances

- *CDP*

Climate change is a social concern today, and stakeholders have different expectations in this regard, exerting pressure on organizations to disclose relevant information (Prado Lorenzo, Rodríguez-Domínguez, Gallego-Álvarez, & García Sánchez, 2009; Luo *et al.*, 2013). Disclosure of environmental information for stakeholders, and the disclosure of information through CDP, is strategic for organizations. Carbon disclosure can be used by the organizations' managers to show their compliance to social expectations regarding climate change and thus achieve legitimacy (Luo, Lan & Tang, 2012).

In addition to the above, companies that respond to the CDP show a willingness to increase their environmental disclosure, which may also suggest an increase in disclosure about emission allowances (Hassan, Wright & Struthers, 2013). Therefore, we believe that the response to the CDP may influence the disclosure of derivatives related to these licenses, so we define the hypotheses below:

**H3.2.:** Companies responding to the CDP survey present a greater degree of disclosure on derivative instruments on emission allowances

***Institutional pressure factor: EU Emissions Trading Scheme's period***

As mentioned above, phase III of the EU-ETS had different rules regarding the free allocation of allowances and their negotiation by auction, leading to changes in the way of trading emission allowances and, therefore, to the disclosure made. Thus, we seek to verify whether the period of the EU-ETS is a determining factor in the degree of disclosure on emission allowances and the respective risk hedging policies, using derivatives.

Considering the possible increase in the contracting of CO<sub>2</sub> emission allowances, because of the change in the way they are attributed, and the possible increase of the experience acquired by the companies in their negotiation, it is expected the existence of supposed changes in the behaviour of companies between the 2nd and 3rd phases of the EU-ETS. Thus, an increase in the use of derivative instruments to hedge emission allowances price fluctuation is expected, due to the greater fluctuations expected in the period 2013-2020. Thus, it is expected that the levels of disclosure on these derivatives increase over the period 2008 to 2020, with a special focus on the last EU Emissions Trading Scheme's phase.

On the other hand, considering the basic concepts of Institutional Theory, institutional and normative pressures (coercive isomorphism) may trigger the adoption of accounting practices and dissemination of environmental information, more specifically, the dissemination of information on emission allowances and derivative instruments to hedge risks. On the other hand, Petty and Cuganesan (2005) argue that the reporting of information by the best companies encourages other companies to reproduce their benchmarking to be among the best market practices (mimetic isomorphism). Thus, it is expected that the non-disclosing companies feel pressured to follow the example of the disclosing companies on emission allowances. That is, based on a mimetic isomorphism, it is expected a gradual increase in the number of disclosing companies during the period under study.

In view of the above, the following hypothesis of investigation is formulated:

**H4:** The degree of disclosure on derivative instruments on emission allowances is higher in the period 2013 -2020 compared to the period 2008-2012.

Table 2 summarizes the research hypothesis and the predicted sign to the association of each explanatory factor with the degree of disclosure about derivative instruments on emission allowances.

Table 2. Hypothesis summary

Factors	Variables	Hypothesis	Predicted sign	References
Social Pressure	Size	H1	+	Chalmers and Godfrey (2004); Gope (2017); Hassan <i>et al.</i> (2006); Kota and Charumathi (2018); Lemos (2011); Lemos <i>et al.</i> (2019); Leote <i>et al.</i> (2020); Lopes and Rodrigues (2007); Martins <i>et al.</i> (2020); Mir Fernández <i>et al.</i> (2006); Ponte (2019);
Shareholder's pressure	Concentration of capital	H2	-	Lemos (2011); Tahat <i>et al.</i> (2018).
Market pressure	Profitability	H3.1	+	Hassan <i>et al.</i> (2006); Probohudono <i>et al.</i> (2019).
	CDP	H3.2	+	=====
Institutional Pressure	EU Emissions Trading Scheme's period	H4	+	_____

## RESEARCH DESIGN

### Sample

Many studies on environmental disclosure and on derivatives tend to focus on samples composed of listed companies. On the other hand, most studies on mandatory environmental disclosure are on entities from industrial activity sectors, since the sector of activity in which the company operates positively influences environmental disclosure (Cho & Patten, 2007; Zeng, Xu, Dong & Tamb, 2010). The study by Luo *et al.* (2012) shows that companies operating in emissions trading are more likely to disclose information related to this topic.

Thus, to select our sample, we defined as the main criterion the fact that they are companies operating in Portugal and that were part of PNALE I and II. These entities, given their activity, are considered highly polluting, making it interesting to study them in light of the topic under analysis. PNALE is a list that includes a total of 214 installations, which translate into 179 companies. For the selection of the final sample, we took into account the following criteria:

- That the companies were continuously integrated in the PNALE during the 12 years of the analysis period: 2008 to 2019;
- That it includes at least one company from each of the sectors referred to by PNALE;
- That companies have environmental certification, since authors such as Barros & Monteiro (2012), Del Brio *et al.* (2001) and Monteiro (2006) conclude that companies with environmental certification tend to give greater importance to the environmental issue and, therefore, tend to make greater disclosure about this matter;
- That the reports and accounts were available on the internet during the entire period of analysis: 2008 to 2019.

Cumulatively applying the above criteria, we were only able to obtain a sample of 5 companies - Cimpor, Secil, EDP, Navigator, Galp - having analysed the reports and accounts available for the years 2008 to 2019, making a total of 60 observations, to be treated as panel data. Table 3 below presents a brief characterization of the selected companies:

Table 3 – Sample characterization

Company	Sector	Activity location	Environmental certification	Turnover 2019 (Millions)
<b>CIMPOR</b>	Cement and lime	Portugal and Cape Verde	ISO 14001	1.374
<b>SECIL</b>	Cement and lime	Portugal, Angola, Cape Verde, Brazil, Spain, Netherlands, Tunisia and Lebanon	ISO 14001	510,9
<b>NAVIGATOR</b>	Pulp and paper	Portugal	ISO 14001	1.688
<b>EDP</b>	Energy/ thermoelectric plants	USA, Canada, Mexico, Spain, Portugal, Belgium, Greece, France, Ireland, Italy, United Kingdom, Romania, Poland, China, Mozambique, Nigeria, Brazil, Colombia and Peru	ISO 14001	14.333
<b>GALP</b>	Energy/ cogeneration	Spain, Portugal, Cape Verde, Guinea-Bissau, Brazil, São Tomé and Príncipe, Angola, Namibia, Mozambique, East Timor	ISO 14001	15.962

## METHODOLOGY

As mentioned previously, environmental policies regarding emission allowances have gone through several phases of EU ETS, with different specificities, and the post-2012 period may bring differences in the behaviour of companies in their reporting practices, in view of the new rules of implementation of the EU ETS scheme. It is therefore important to examine whether there are significant differences in derivative instruments information disclosed between the EU ETS periods (2008-2012 and 2013-2020).

To assess the type and degree of disclosure on emission allowances derivative instruments, we used the content analysis of the information disclosed in the reports and accounts for the periods 2008 to 2019, in the Management Report and in the notes to the financial statements.

Annual accounts have been pointed out in the literature as the best source to be used in this type of studies and several empirical studies have used it (Faisal *et al.*, 2018; Hapsoro &



Ambarwati, 2018; Hermawan et al., 2018; Kalu et al., 2016; Kiliç & Kuzey, 2019; Liesen et al., 2015; Luo et al., 2013; Prado-Lorenzo et al., 2009).

According to Bardin (2011), content analysis is a method that aims to systematically evaluate text, in order to unravel and quantify the occurrence of key themes that allow for further comparison. This methodology was also used in numerous studies such as Borghei et al. (2018), Faisal et al. (2018), Hermawan et al. (2018), Kalu et al. (2016), Kiliç and Kuzey (2019), Nasih, Harymawan, Paramitasari & Handayani (2019) and Prado-Lorenzo et al. (2009).

From the content analysis, a disclosure index was prepared based on the requirements of IFRS 7 in relation to derivative instruments (Disclosure Index on emission allowances derivative instruments – DI\_EADI). This standard has undergone changes over time, mainly due to the entry into force of IFRS 9, which slightly changes the accounting treatment of hedging operations. However, for the sake of consistency and comparability of information, in the construction of the index, the 2011 version of IFRS 7 prior to the changes in disclosure requirements resulting from the issuance of IFRS 9 was taken into account.

Thus, for the construction of the Disclosure Index, 2 sub-indices were considered:

- Derivative Instruments General Disclosure Index (DI\_GDI), comprising 6 items regarding generic information on derivatives (4 items) and generic information on hedging operations (2 items) – table 4;
- Disclosure Index on Derivative Instruments for hedging the emission allowances risk (DI\_DIHEA), with a total of 8 items that refer exclusively to information on hedging operations, distinguishing fair value hedges (3 items) and Cash Flow hedges (5 items) – table 5.

Table 4 - Items for DI\_GDI construction

General information about derivatives	1	Risk Management/Hedge Policy
	2	Purpose of contracting derivatives
	3	Accounting policies and methods used
	4	Identification of derivative instruments held/contracted
General information on hedging operations	5	Nature of risk
	6	Fair value of hedging instruments at the reporting date

Table 5 - Items for the construction of DI\_DIHEA

Information on emission allowance hedging operations	Fair value hedging	1	The gains or losses of fair value hedges on the hedging instrument
		2	The fair value hedges gains or losses on the hedged item, attributable to the hedged risk
		3	Use of derivatives to hedge risk on assets held
	Cash flow hedging	4	Use of derivatives to hedge assets for future transactions
		5	Period in which operations are expected to affect results
		6	Carrying amount in equity during the period/gains losses incurred in the year
		7	Amount that was removed from equity and included in profit or loss for the period
		8	The ineffectiveness recognized in the results arising from cash flow hedges

For the construction of the index a score was assigned according to the following criteria: 1 if the company discloses information about the item in question and 0 if it does not. The total index value is therefore the result of the division of the total score obtained by each company by the maximum number of assigned points, as described in Table 5. This will cause the index to vary between 0 and 1, and whenever the company discloses all the required information items it will have the maximum score.

Table 6. Disclosure index determination formula

$DI\_EADI = \sum_{n=1}^i in/i$	DI_EADI <sub>j</sub>	Disclosure Index - Company Total j
	i <sub>n</sub>	Item i under analysis. Dichotomous dummy variable with value 1 if the company discloses information about the element and value 0 if the company does not disclose information about the element
	i	Maximum number of items of the sub-index

Model and variables

To analyse the factors that influence the degree of disclosure on emission allowances derivative instruments, a regression model was developed in which DI\_DIHEA (Derivative Instruments for hedging the emission allowances risk) was considered as a dependent variable. On the other hand, the following variables were considered as independent variables (possible explanatory factors) (Table 7), which were the basis of the previously formulated research hypotheses. A multivariate analysis was carried out using STATA software, to verify if the independent variables together explain the level of disclosure on emission allowances derivative instruments.

Table 7. Multiple linear regression model

$DI\_DIHEA = \alpha_0 + \beta_1 SIZE + \beta_2 COC + \beta_3 ROA + \beta_4 CDP + \beta_4 PERIOD + \varepsilon_i$	
<b>DI_EADI</b>	Disclosure Index on emission allowances derivative instruments
<b>SIZE</b>	Size, measured by the logarithm of total assets.
<b>COC</b>	Concentration of capital - measured by the % of capital held by the 3 largest shareholders.
<b>ROA</b>	Variable calculated according to the formula of the ratio of the Return of the assets.
<b>CDP</b>	Dummy variable, which assumes the value 1, if the company responded to the CDP survey, and 0, otherwise.
<b>PERIOD</b>	Dummy variable, which assumes the value 1, if the observation refers to the period 2013-2019, and 0, if the observation refers to the period 2008-2012.
$\alpha_0$	Constant.
$\alpha_i$	Residual random variable.

## ANALYSIS AND DISCUSSION OF RESULTS

### Descriptive analysis

At this point we will proceed to the analysis and discussion of the results obtained in our study. We begin with a global analysis of the degree of disclosure on derivative instruments and, particularly, on emission allowances derivatives, made by companies in the period under review (table 8)

Table 8. Derivate Disclosure Indexes: Descriptive statistics

Index	N	Average	Minimum	Maximum	Standard deviation
<b>DI_GDI</b>	60	.8055556	.6666667	1	.1599396
<b>DI_DIHEA (total observations)</b>	60	.10625	0	0,625	.1765143
<b>DI_DIHEA (Considering only the disclosing companies)</b>	22	.2897727	0	0,625	.1765143

The General Derivatives Disclosure Index (DI\_GDI) has an average of around 0.81, indicating that derivative instruments are widely used and disseminated. With regard to the degree of disclosure about derivative instruments to hedge the risk of emission allowances, the DI-DIHEA has a very low value (close to 0.11) leading us to conclude that companies are not using derivative instruments specifically for risk coverage on emission allowances. However, if we isolate the Index, analysing only the observations (22 observations) that made disclosure in this index, the average rises to around 0.29.

Next, we present, in table 9, the descriptive analysis of the indices subdivided by the companies that make up the sample.

Table 9. Derivate Disclosure Indexes: Descriptive statistics by company

DI\_GDI: Disclosure Index on derivative instruments (in general)

Company	N	Average	Standard deviation	Min	Max
Cimpor	12	.7083333	.1035969	.6666667	1
EDP	12	.75	.1507557	.6666667	1
Galp	12	.875	.1443376	.6666667	1
Navigator	12	.8055556	.1716429	.6666667	1
SECIL	12	.8888889	.164122	.6666667	1

DI\_DIHEA: Disclosure Index on derivative instruments of emission allowances

Company	N	Average	Standard deviation	Min	Max
Cimpor	12	.0729167	.1723693	0	.5
EDP	12	.0833333	.1946247	0	.5
Galp	12	.0625	.0652791	0	.125
Navigator	12	.1041667	.1671395	0	.5
SECIL	12	.2083333	.2282177	0	.625

Considering the General disclosure index (DI\_GDI), SECIL is the company with the highest average value (0.889), followed by GALP (0.875). In this Index, all companies have a disclosure average above 0.70. Regarding DI-DIHEA, the disclosure of this type of information is extremely low, with SECIL being the company with the highest average value (0.208). All other companies have disclosure averages below 0.10. In view of these results, it is also possible to see that general information on derivative instruments is the most disseminated information by all companies, given that these entities, given their size and turnover, feel the need to cover the risks associated with their transactions.

Another analysis that we have considered pertinent was separating the indices by the 2 periods of the EU-ETS and thus noticing any changes in the behaviour of companies' reporting practices in the periods 2008-2012 and 2013-2019 (see table 10, below).

Table 10. Derivate Disclosure Indexes: Descriptive statistics by period  
Period 2008 - 2012

Company	N	Average	Standard deviation	Min	Max
DI_GDI	25	.7866667	.1632993	.6666667	1
DI_DIHEA	25	.09	.1673942	0	.625

Period 2013 -2019

Company	N	Average	Standard deviation	Min	Max
DI_GDI	35	.8190476	.1584825	.6666667	1
DI_DIHEA	35	.1178571	.1842684	0	.5

Both indices show higher levels of disclosure in the second period of the EU-ETS (DI\_GDI: 0.819 against 0.787 and DI\_DIHEA: 0.118 against 0.090, respectively), even though the values are quite similar. As mentioned above, it was expected that the levels of disclosure of derivative instruments on these licenses would increase during the 3rd period of the EU-ETS, which came to be confirmed, albeit in a very tenuous way.

### Multivariate analysis

In order to identify the relationship between the DI\_EADI (DI\_GDI + DI\_DIHEA) and the independent variables, according to the research hypotheses previously formulated, we started by carrying out a multivariate analysis with a multiple linear regression model, with panel data, through the "STATA" program - Software for Statistics and Data Science".

According to Marques (2000), the random effects model is more adequate when one intends to make inferences regarding a population from a random sample of the same. When it is not possible to consider the sample as a random selection of a population, as is the case with the sample studied in this paper, then the correct choice is the specification with fixed effects. Thus, all the correlations obtained and taken into account for the discussion of results come from the fixed effects model.

In the multivariate analysis, we start by presenting the results of the regression model considering all observations (60), as shown in table 11.

Table 11. Results of the Multiple Regression Model (total observations)

DI_DIHEA	Fix effects	
N° observations	60	
N° Groups	5	
	Coef.	Sig.
ROA	1.95217	0,003
COC	.1936734	0,365
SIZE	-.2387593	0,024
PERIOD	.073805	0,111
CDP	.0145941	0,817
_cons	5.224998	0,027
R <sup>2</sup>	Within	0,2408
	Between	0,5072
	Overall	0,1011
	F(5,5)	3,17
	Prob>F	0,0146

The table presents the results for the correlation between the independent variables under study and the DI\_DIHEA. This index includes the 8 items, as already described in the methodology, which relate to the disclosure of hedge accounting, specifying derivatives on LE, under study.

Based on the data presented, we verified that the variables Profitability (ROA) and Size are statistically significant at a significance level of 5%. The profitability variable presents a positive correlation with the DI\_DIHEA, demonstrating that the higher the company's profitability, the greater the disclosure of information on derivative instruments to hedge the risk of emission allowances. The Size variable, on the other hand, has a negative correlation, that is, it suggests that the disclosure of information about derivatives is greater the smaller the size of the company. This result may be due to the fact that all observations in the sample are being analyzed. In fact, since the level of disclosure on derivative instruments to hedge emission allowances' risks is very low, the inclusion of all observations in the model may be biasing the results.

Analyzing the R2 data, we were able to conclude that the fixed effects model explains, in general, about 10.1% of the DI\_DIHEA value; about 50.7% of the differences between companies and finally, it explains about 24.1% of the temporal variations within the same company. These results may come from the fact that DI\_DIHEA has an extremely low disclosure average, translating into scarce information for statistical analysis. Using the F test, we can validate the model regarding the variables presented, considering it adequate.

Considering the objective of this work, we understand that it would be pertinent to develop the model sticking to observations that specifically consider the disclosure of derivative instruments to hedge risk of licenses (22 observations). The fact of not considering the observations whose disclosure is null, will clarify the obtained results. The model results are shown in table 12.

Table 12. Results of the Multiple Regression Model (22 observations)

<b>DI_DIHEA</b>	<b>Fix effects</b>	
<b>N° observations</b>	22	
<b>N° Groups</b>	5	
	<b>Coef.</b>	<b>Sig.</b>
<b>ROA</b>	2.855197	0,018
<b>COC</b>	-.5054927	0,313
<b>LSIZE</b>	.1396517	0,413
<b>PERIOD</b>	.0354142	0,705
<b>CDP</b>	.0705852	0,456
<b>_cons</b>	-2.559325	0,462
<b>R<sup>2</sup></b>	<b>Within</b>	0,4862
	<b>Between</b>	0,0108
	<b>Overall</b>	0
	F (5,5)	2,27
	Prob>F	0,1134

The results show that only profitability (ROA) is presented as a statistically significant variable, showing a positive correlation with the Index, validating H3. In other words, companies with better profitability tend to disclose more information about their activity, and in this case, about emission licenses hedging derivatives. This result corroborates the results of Hassan et al. (2006) and Probohudno et al. (2019), but they are contradictory with the results of Lemos (2011) and Martins et al. (2020) that concluded for the existence of a negative association between profitability and the level of disclosure of derivatives, in general.

We can also observe by the coefficient of the variable size (LogA) the existence of a positive correlation between company size and the disclosure index, even though it is not statistically significant.

Analyzing the R<sup>2</sup> data, we can conclude that the fixed effects model explains, in general, about 48.6% of the disclosure index value; differences between companies are around 1%, and there is no explanation for temporal variations within the same company. However, the F test is not significant, and the model cannot be validated for this specific correlation between the independent variables and the disclosure index.

## CONCLUSION

The evolution of the EU-ETS for the period 2013-2020, which foresees that the emission allowances will be traded at auction, led to the negotiation of derivative instruments on these licenses, as the entities seek to protect themselves against possible risks of variation in future

prices. In this sense, an increase in disclosure on this matter was expected. The literature is silent on previous studies related to disclosure on emission allowances derivatives, so our study represents a contribution to the advancement of literature in this area.

However, the results of the study show that the degree of disclosure on derivative instruments for hedging risks related to emission allowances is very low ( $DI_{DIHEA} = 0.11$ ), with SECIL standing out as the most publicizing company. Contrary to expectations, not only do companies not use this type of instrument to hedge the risk of fluctuation in the price of licenses, but the change in the behaviour of companies between the 2nd and 3rd period of the EU-ETS is not significant.

Literature suggests that the Legitimacy Theory may explain the low level of compliance with the regulation of environmental disclosure (Alciatore & Dee, 2006; Llana, Moneva & Hernandez, 2007), and in this specific case regarding derivatives on licenses.

Regarding the explanatory factors studied, there is only a statistically positive correlation between the disclosure index ( $DI_{EADI}$ ) and profitability, which allows us to validate H3.

This study contributes to the understanding of disclosure practices on derivative instruments related to licenses in large Portuguese companies and may be useful for the various users of financial information and for accounting standardization bodies. It is concluded that companies are concerned about disclosing derivative-related information, but that the disclosure of hedging operations on said licenses is extremely limited.

One of the limitations of this study is the subjectivity inherent to the content analysis itself, that is, we are unable to assess whether the information not made available in the reports and accounts is due to voluntary non-disclosure or because there is effectively no information to disclose. The small sample size is also a limitation, which prevents us from generalizing the results. The scarce existing disclosure on derivative instruments to hedge the risk of emission allowances, also means that the information is insufficient for a more in-depth and robust statistical analysis.

The transposition to the 3rd phase of the EU-ETS is characterized by the reduction in the volume of annual licenses allocated free of charge, which are now acquired through auctions, instead of a free allocation. This led to the price of CO<sub>2</sub> rising to €25/ton. The new EU-ETS Directive will regulate this regime for the 4th period of the EU-ETS from 2021-2030. It is expected that at this stage the pace of reduction of the emission ceiling will intensify, with an estimated price of €55/ton of CO<sub>2</sub> in 2030, in view of the goals of the Paris Agreement. This



justifies, in the future, a greater use of derivatives to hedge the risk of these price variations and, as such, a strengthening of research in this area.

As clues for future research, we suggest continuing the study in order to contemplate the 4th phase of the EU-ETS (2021-2030), in the expectation of confirming the foreseeable increase in the use of derivative instruments on licenses and their dissemination. We also suggest a reformulation of the sample, both in terms of its size and in terms of the companies studied. Likewise, the reformulation of the studied indices is also suggested, using the most recent version of IFRS 7, which, however, has undergone several changes.

## REFERENCES

- Akbas, H. E., & Canikli, S. (2019). Determinants of voluntary greenhouse gas emission disclosure: An empirical investigation on Turkish firms. *Sustainability* (Switzerland), 11(1).
- Alciatore, M. L. & Dee, Carol (2006). Environmental Disclosures in the Oil and Gas Industry. *Advances in environmental Accounting & Management*, 3, 49-75.
- Arnold, D. (2016), Corporate Responsibility, Democracy, and Climate Change. *Midwest Studies in Philosophy*, XL.
- Baek, H. Y., Johnson, D. R., & Kim, J. W. (2009). Managerial ownership, corporate governance, and voluntary disclosure. *Journal of Business and Economic Studies*, 15(2), 44.
- Bamber, M., & McMeeking, K. (2010). An examination of voluntary financial instruments disclosures in excess of mandatory requirements by UK FTSE 100 non-financial firms. *Journal of Applied Accounting Research*, 11(2), 133-153.
- Bewley, K., & Li, Y. (2000). Disclosure of environmental information by Canadian manufacturing companies: a voluntary disclosure perspective. In *Advances in Environmental Accounting & Management* (pp. 201–226). Emerald Group Publishing Limited.
- Borghei-Ghomi, Z., & Leung, P. (2013). An empirical analysis of the determinants of greenhouse gas voluntary disclosure in Australia. *Accounting and Finance Research*, 2(1), 110.
- Borghei, Z., Leung, P., & Guthrie, J. (2018). Voluntary greenhouse gas emission disclosure impacts on accounting-based performance: Australian evidence. *Australasian Journal of Environmental Management*, 25(3), 321-338.
- Brammer, S., & Pavelin, S. (2008). Factors influencing the quality of corporate environmental disclosure. *Business Strategy and the Environment*, 17(2), 120–136.
- Chalmers, K., & Godfrey, J. M. (2004). Reputation costs: the impetus for voluntary derivative financial instrument reporting. *Accounting, Organizations and Society*, 29(2), 95-125.

- Chester, L., & Rosewarne, S. (2011). What is the relationship between derivative markets and carbon prices. In *Draft paper presented at the Conference "Nature™ Inc* (pp. 16–21).
- Chevallier, J. (2009). Carbon futures and macroeconomic risk factors: a view from the EU ETS. *Energy Economics*, 31(4), 614–625.
- Cho, C., & Patten, D. (2007). The role environmental disclosures as tools of legitimacy: A research note, *Accounting, Organizations and Society*, 32, 639-647.
- Cormier, D., Gordon, I. M., & Magnan, M. (2004). Corporate environmental disclosure: contrasting management's perceptions with reality. *Journal of Business Ethics*, 49(2), 143–165.
- Cormier, D., Magnan, M., & Van Velthoven, B. (2005). Environmental disclosure quality in large German companies: economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14(1), 3–39.
- Costa, J (2012). *Carbon markets and emission derivatives: the pricing of derivatives in the EU ETS*. Lisboa: ISCTE-IUL, Dissertação de mestrado.
- Creti, A., Jouvet, P. & Mignon, V. (2012). Carbon price drivers: phase I versus phase II equilibrium. *Energy Economics*, 34(1), 327-33.
- DiMaggio, P. J., Powell, W.W. (1983). The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48(2), 147-160.
- Faisal, F., Andiningtyas, E. D., Achmad, T., Haryanto, H., & Meiranto, W. (2018). The content and determinants of greenhouse gas emission disclosure: Evidence from Indonesian companies. *Corporate Social Responsibility and Environmental Management*, 25(6), 1397-1406.
- Fang, S., Lu, X., Li, J., & Qu, L. (2018). Multifractal detrended cross-correlation analysis of carbon emission allowance and stock returns. *Physica A: Statistical Mechanics and Its Applications*, 509.
- Ferreira, D. (2011), *Instrumentos Financeiros*. Cascais: Rei dos Livros, 2011. ISBN 978-989-8305-21-3.
- Freedman, M., & Jaggi, B. (2005). Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *The International Journal of Accounting*, 40(3), 215–232.
- García-Sánchez, I. M. (2008). Corporate social reporting: segmentation and characterization of Spanish companies. *Corporate Social Responsibility and Environmental Management*, 15(4), 187–198.
- González-González, J., & Zamora Ramírez, C. (2016). Voluntary carbon disclosure by Spanish companies: an empirical analysis. *International Journal of Climate Change Strategies and Management*, 8(1), 57-79.

- Gope, A. (2017). Accounting for derivative financial instruments: an analysis of disclosure determinants. *Amity Journal of Management Research*, 2(1), 10-19.
- Haddock-Fraser, J., & Fraser, I. (2008). Assessing corporate environmental reporting motivations: differences between ‘close-to-market’ and ‘business-to-business’ companies. *Corporate Social Responsibility and Environmental Management*, 15(3), 140–155.
- Hapsoro, D., & Ambarwati, A. (2018). Antecedents and consequences of carbon emissions’ disclosure: case study of oil, gas and coal companies in non-annex 1 member countries. *Journal of Indonesian Economy and Business*, 33(2), 99-111.
- Hassan, A., Wright, A., & Struthers, J. (2013). Carbon Disclosure Project (CDP) scores and the level of disclosure on climate change related activities: an empirical investigation of the FTSE 100 companies. *International Journal of Sustainable Economy*, 5(1), 36-52.
- Hassan, M. S., Percy, M., & Stewart, J. (2006). The transparency of derivative disclosures by Australian firms in the extractive industries. *Corporate Ownership and Control*, 4(2), 257-270.
- Hausin, M.; Hemmingsson, C., Johansson, J. (2008). *How to hedge disclosures? IFRS 7 and hedge accounting – a first stocktaking*. Master Thesis within Business Administration, Handelshogskolan Vid Goteborg Universitet.
- Hermawan, A., Aisyah, I., Gunardi, A., & Putri, W. (2018). Going green: determinants of carbon emission disclosure in manufacturing companies in Indonesia. *International Journal of Energy Economics and Policy*, 8(1), 55-61.
- Ismail, K., & Chandler, R. (2005). Disclosure in the quarterly reports of Malaysian companies. *Financial Reporting, Regulation and Governance*, 4(1), 1–26.
- Kalu, J., Buang, A., & Aliagha, G. (2016). Determinants of voluntary carbon disclosure in the corporate real estate sector of Malaysia. *Journal of Environmental Management*, 182, 519-525.
- Kiliç, M. & Kuzey, C. (2019). The effect of corporate governance on carbon emission disclosures: evidence from Turkey. *International Journal of Climate Change Strategies and Management*, 11(1), 35-53.
- Kota, H. B., Charumathi, B. (2018). Determinants of financial derivative disclosures in an emerging economy: a stewardship theory perspective. *Australasian Accounting, Business and Finance Journal*, 12(3), 62-86.
- Lee, S., Park, Y., & Klassen, R. (2015). Market responses to firms’ voluntary climate change information disclosure and carbon communication. *Corporate Social Responsibility and Environmental Management*, 22(1), 1–12.
- Lemos, K. (2011). *Contabilidade de instrumentos derivados. Estudo da informação divulgada pelas empresas portuguesas*. Tese de Doutoramento. Facultad de Ciencias Económicas y Empresariales, Universidad de Santiago de Compostela.
- Lemos, K., Serra, S., & Barros, A. (2019). The auditor as a determining factor on derivative financial instrument disclosures, *Organizational Auditing and Assurance in the Digital Age*, ed. IGI Global, 70-93.

- Leote, F., Pereira, C., Brites, R. & Godinho, T. (2020). Financial instruments' disclosure in compliance with IFRS 7: the Portuguese companies. *International Journal of Accounting, Finance and Risk Management*, 5(1), 52-61.
- Liesen, A., Hoepner, A., Patten, D., & Figge, F. (2015). Does stakeholder pressure influence corporate GHG emissions reporting? Empirical evidence from Europe. *Accounting, Auditing & Accountability Journal*, 28(7), 1047-1074.
- Liu, X., & Anbumozhi, V. (2009). Determinant factors of corporate environmental information disclosure: an empirical study of Chinese listed companies. *Journal of Cleaner Production*, 17(6), 593–600.
- Llena, F., Moneva, J. M. & Hernandez, B. (2007), “Environmental disclosures and compulsory accounting standards: the case of Spanish annual reports”. *Business Strategy and the Environment*, 16(1), 50-63.
- Lopes, P. T., Rodrigues, L. L. (2007). Accounting for Financial Instruments: An Analysis of the determinants of disclosure in the Portuguese stock exchange. *The International Journal of Accounting*, 42, 25-56.
- Luo, L., Lan, Y., & Tang, Q. (2012). Corporate incentives to disclose carbon information: evidence from the CDP Global 500 report. *Journal of International Financial Management & Accounting*, 23(2), 93-120.
- Luo, L., Tang, Q., & Lan, Y. (2013). Comparison of propensity for carbon disclosure between developing and developed countries: a resource constraint perspective. *Accounting Research Journal*, 26(1), 6-34.
- Magness, V. (2006). Strategic posture, financial performance and environmental disclosure: An empirical test of legitimacy theory. *Accounting, Auditing & Accountability Journal*, 19(4), 540–563.
- Martins, M. S, Lemos, K., & Serra, S. (2020). A influência das características do conselho de administração na divulgação sobre instrumentos derivados. *International Conference on Accounting and Finance Innovation Proceedings*, Aveiro, 12 e 13 de novembro.
- Mazza, P., & Petitjean, M. (2015). How integrated is the European Carbon Derivatives market? *Finance Research Letters*, 15.
- Mir Fernández, C., Moreno, D., & Olmeda, I. (2006). Determinantes de la Revelación de Información sobre derivados financieros en el mercado Español. *Working Papers*, Universidad Carlos III de Madrid.
- Nasih, M., Harymawan, I., Paramitasari, Y., & Handayani, A. (2019). Carbon emissions, firm size, and corporate governance structure: Evidence from the mining and agricultural industries in Indonesia. *Sustainability*, 11(9), 2483.
- Oliver C. Strategic responses to institutional processes. *Acad Manage Rev* 651 1991;6:145 – 79

- Petty, R., & Cuganesan, S. (2005). Voluntary disclosure of intellectual capital by Hong Kong companies: examining size, industry and growth effects over time. *Australian Accounting Review*, 15(36), 40–50.
- Ponte, E. (2019). *IFRS 9 and financial derivative disclosure practices: Euronext Lisbon vs NYSE*. Dissertação de Mestrado em Análise Financeira, Instituto Superior de Contabilidade e Administração de Lisboa, fevereiro.
- Prado Lorenzo, J., Rodríguez-Domínguez, L., Gallego-Álvarez, M., & García Sánchez, I. (2009). Factors influencing the disclosure of greenhouse gas emissions in companies worldwide. *Management Decision*, 47(7):1133-1157.
- Prencipe, A. (2004). Proprietary costs and determinants of voluntary segment disclosure: evidence from Italian listed companies. *European Accounting Review*, 13(2), 319–340.
- Probohudono, A. N., Sugiharto, B., & Arifah, S. (2019). The influence of corporate governance, audit quality, and ownership, on financial instrument disclosure in Indonesia. *Journal of Contemporary Accounting*, 1(3), 173-187.
- Rajput, N., Oberoi, S. & Arora., S. (2015). Carbon trading in Indian derivative market: an econometric validation. *Global Journal of Enterprise Information System*, 7(2), 47-57.
- Reverte, C. (2009). Determinants of corporate social responsibility disclosure ratings by Spanish listed firms. *Journal of Business Ethics*, 88(2), 351–366.
- Stanny, E., & Ely, K. (2008). Corporate environmental disclosures about the effects of climate change. *Corporate Social Responsibility and Environmental Management*, 15(6), 338-348.
- Tahat, Y. A., Dunne, T., Fifield, S., & Power, D. M. (2016). The impact of IFRS 7 on the significance of financial instruments disclosure: Evidence from Jordan, *Accounting Research Journal*, 29(3), 241-273.
- Tahat, Y., Mardini, G. H., & Haddad, A. E. (2018). A longitudinal analysis of financial instruments disclosure in an emerging capital market: the case of Qatar, *International Journal of Accounting and Finance*, 8(1), 60-79.
- Tang, B., Shen, C., & Zhao, Y. (2015). Market risk in carbon market: an empirical analysis of the EUA and sCER. *Natural Hazards*, 75(2), 333–346.
- Uhrig-Homburg, M., & Wagner, M. (2008). Derivative instruments in the EU emissions trading scheme—an early market perspective. *Energy & Environment*, 19(5), 635–655.
- Unsworth KL, Russell SV and Davis MC (2016). Is Dealing with Climate Change a Corporation's Responsibility? A Social Contract Perspective. *Front. Psychol.* 7:1212.
- Walden, W. D., & Stagliano, A. J. (2003). An assessment of the quality of environmental disclosure themes. In *Advances in Environmental Accounting & Management* (pp. 137–165). Emerald Group Publishing Limited.

Yunus, S., Elijido-Ten, E., & Abhayawansa, S. (2016). Determinants of carbon management strategy adoption. *Managerial Auditing Journal*, 31(2), 156-179.

Zeng, S., Xu, X., Dong, Z., & Tamb, V. (2010). Towards Corporate Environmental Disclosure: an empirical study in China”, *Journal of Cleaner Production*, 18, 1142-1148.