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Association between accounting for biological assets and the cost of debt for the firms in the global economy: impact of the implementation of amended IAS 41

Orientador: Prof. Dr. Ricardo Luiz Menezes da Silva
Coorientador: Prof. Josep Maria Argilés-Bosch, PhD

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EPÍGRAFE

"A safe and nutritionally adequate diet is a basic individual right and an essential condition for sustainable development, especially in developing countries."

Gro Harlem Brundtland, Ex-Diretora-Geral da OMS, e Enviada Especial para Mudança Climática da ONU.

RESUMO

MOUTINHO, R. A. **Associação entre o método de mensuração de ativos biológicos e o custo da dívida das empresas da economia global: impacto da revisão da IAS 41.** 2022. Dissertação (Mestrado) – Faculdade de Economia, Administração e Contabilidade de Ribeirão Preto, Universidade de São Paulo, 2022.

Este estudo investiga o efeito da revisão da IAS 41 sobre o custo da dívida das empresas da economia global que adotam as normas IFRS. Esta alteração determina que as plantas portadoras sejam mensuradas apenas ao custo histórico. Embora pesquisas anteriores documentem que plantas portadoras mensuradas ao valor justo estão associadas a um maior custo de capital das empresas, o impacto da implementação da IAS 41 revisada sobre o custo da dívida ainda não foi explorado. Neste contexto, utilizando os modelos de mínimos quadrados ordinários de dados em painel (POLS), efeitos fixos, efeitos aleatórios e modelos de regressão de dados em painel dinâmico (GMM) para uma amostra decomposta em ativos biológicos do subgrupo das plantas portadoras e de ativos biológicos de outros subgrupos (por exemplo, ativos biológicos consumíveis) de 140 empresas localizadas em 43 países de 2005 a 2019. Os resultados inicialmente são consistentes com pesquisas anteriores, pois indicam que a contabilização do valor justo para ativos biológicos que não são plantas portadoras está associada a um menor custo de dívida das empresas. Este estudo também evidencia que a mensuração das plantas portadoras a valor justo está associada a um maior custo da dívida no período de 2005 a 2019; no entanto, a contabilização do custo histórico para plantas portadoras no período pós-alteração da IAS 41 (2016-2019) não reduziu o custo da dívida da empresa, sugerindo que, embora a contabilização do custo histórico para plantas portadoras esteja associada a um menor custo da dívida para todo o período analisado, as alterações da IAS 41 ainda não refletiram em menor custo da dívida para empresas que possuem plantas portadoras nos primeiros anos de sua implementação. Ainda, cabe destacar que o valor justo carrega informação relativa aos fluxos de caixa futuros que reflete o benefício econômico futuro dos ativos, assim as empresas que alteraram o método de mensuração do valor justo para o custo histórico perderam essa informação, o que pode ter impacto na avaliação dos credores sobre o custo da dívida dessas empresas. Espera-se que os resultados desta pesquisa sejam relevantes para reguladores e normatizadores, como o IASB, para avaliar o efeito da norma IAS 41 revisada e propor políticas contábeis destinadas a melhorar a harmonização contábil no setor agrícola.

Palavras-chave: Ativos Biológicos; Valor Justo; Custo da Dívida; IFRS.

ABSTRACT

MOUTINHO, R. A. **Association between accounting for biological assets and the cost of debt for the firms in the global economy: impact of the implementation of amended IAS 41**. 2022. Dissertation (Master's Degree) – School of Economics, Business, and Accounting of Ribeirao Preto, University of Sao Paulo, 2022.

This study investigates the effect of amended IAS 41 on the cost of debt of the firms in the global economy that adopt IFRS. This amendment determines that bearer plants should be valued at historical cost. Although prior research documents that the fair value measurement of bearer plants is associated with higher firms' cost of capital, the impact of amended IAS 41 implementation on the cost of debt was still not examined. To explore this context, I utilize panel data ordinary least square (POLS), fixed-effects, random effects, and GMM dynamic panel data regression models for a sample decomposed in non-bearer (i.e. consumable biological assets) and bearer plants subsamples from 140 companies located in 43 countries from 2005 to 2019. Firstly, my findings are consistent with prior research as it indicates that fair value accounting for biological assets other than the bearer plants subset is associated with lower firms' cost of debt. This study also evidences that the measurement of bearer plants at fair value is associated with a higher cost of debt from 2005 to 2019 period; however, the historical cost accounting for bearer plants in the post-amended IAS 41 period (2016-2019) did not reduce the cost of debt of firm, suggesting that although the historical cost accounting for bearer plants is associated with firms' lower cost of debt, the amendments on IAS 41 did not still result in a lower cost of debt for firms that shifted from fair value to historical cost accounting of bearer plants subset. Additionally, the fair value model conveys information on future cash flows that reflects the future economic benefits, and firms that shifted from fair value to historical cost accounting have lost this information content, which might have impacted creditors' assessment of the cost of debt. I expect that my findings are relevant for regulatory and standard-setters, such as the IASB, to assess the effect of amended IAS 41 and propose accounting policies aimed to improve accounting harmonization in the agricultural sector.

Keywords: Biological Assets; Fair Value Accounting; Cost of Debt; IFRS.

SUMÁRIO

1 Introduction

This study investigates the effect of amended International Accounting Standard 41 (IAS 41) on the cost of debt of the firms in the global economy that adopt IFRS. IAS 41 (IASB, 2001) was issued by the International Accounting Standard Committee (IASC) in 2001 and became effective in 2003. The Standard prescribes the accounting treatment for biological assets, defined as living animals or plants. As a general rule, IAS 41 requires biological assets to be measured at fair value less costs to sell on initial recognition and at subsequent reporting dates. However, stakeholders in the agricultural sector were concerned that the fair value measurement of bearer plants did not provide relevant information to users of financial statements (Hsu, Liu, Sami & Wan, 2019), since there is no observable market for these assets; therefore, their fair value estimation is subject to earnings management and lacks reliability. To address these concerns, the International Accounting Standard Board (IASB) issued an Exposure Draft in 2013 recommending amendments to the accounting requirements for bearer plants (Gonçalves & Lopes, 2015). Following these amendments, the IASB decided that bearer plants should be accounted for in the same way as IAS 16 – Property, Plant, and Equipment (IASB, 1993), which means they should be valued at historical cost. The amendments included bearer plants in the scope of IAS 16; instead of IAS 41. Bearer plants are used in the production of agricultural produce and have a remote likelihood of being sold. The amendments to IAS 41 have been approved in 2014 and became effective from the 2016 fiscal year period.

Consistent with the views of the IASB's stakeholders on fair value for bearer plants, empirical evidence suggests that the fair value accounting information of such assets is not relevant for users of financial statements, with implications for firms' cost of capital (Daly & Skaife, 2016; Huffman, 2018; Hsu et al. 2019). As specified in IAS 41 biological assets can be classified in two types: consumable and bearer biological assets. Consumable biological assets are those that are to be harvested as an agricultural product or sold as a biological asset. In terms of market valuation, consumable biological assets have active markets and are generally sold in the short term, thus its fair value can be easier determined (Gonçalves, Lopes & Craig, 2017). On the other hand, bearer biological assets are held to bear produce for more than one year and have little or no active markets during this period. Huffman (2018) found that fair value measurement of bearer biological assets is not relevant for users of financial statements related to consumable biological assets. Daly and Skaife (2016) evidenced that the fair value valuation of bearer plants is associated with higher firms' cost of debt. In this sense, the main goal of this study is to analyze whether amended IAS 41 improved decision-useful information related to the measurement method of bearer plants for users of financial statements.

Examining accounting for biological assets is important because firms in the agricultural sector generate revenue from the transformation and harvesting of biological assets. Improvements in the accounting standards are still needed to meet the informational demands of investors and creditors in the agricultural sector. The radical shift from the traditional historical cost model to fair value accounting for biological assets provoked a broad range of practical and theoretical problems for the widespread application of IAS 41 and comparability of financial statements between and within the countries, which impose a challenge on the harmonization of accounting practices in the agricultural sector (Elad, 2004; Cairns, Massoudi, Taplin & Tarca, 2011; Elad & Herbohn, 2011; He, Wright & Evans, 2018). The agricultural sector is essential for the global economy, especially in emerging countries. Data from the World Bank (2020) indicate that agricultural activities added US$ 3.261 trillion to the world economy in 2019. Agriculture represents more than 25% of the Gross Domestic Product (GDP) of some emerging countries. Also, World Bank states that agricultural development is one of the most powerful tools to end extreme poverty, boost shared prosperity, and projects to feed 9.7 billion people by 2050 (World Bank, 2021). Moreover, ending hunger and promoting sustainable agriculture are some of the Sustainable Development Goals set out by The United Nations Development Programme by the year 2030 (UNDP, 2015), which requires investment and support to the agriculture sector. The socioeconomic relevance of agriculture on a global scale, especially in emerging countries, reinforces the need for financing in the agricultural sector. Barry and Robinson (2001) explain that agricultural firms rely heavily on debt capital, especially in developing economies. In this sense, direct access to capital markets is beyond the reach of firms engaged in agricultural business (Zhao, Barry & Katchova, 2008). Considering that debt is one of the main financing alternatives for most agricultural firms (Mondelli & Klein, 2014; Daly & Skaife, 2016) and most firms around the world (Graham, Li & Qiu, 2008; Kim, Tsui & Yi 2011), this study examines the association between the measurement method of biological assets on firms' cost of debt.

It should be noted that accounting numbers information and accounting quality are important for banks when assessing credit risk (Graham, Li & Qiu, 2008; Kim, Tsui & Yi 2011; De George, Li & Shivakumar, 2016). De George, Li, and Shivakumar (2016) highlight that accounting numbers are helpful to debt holders to evaluate debt (principal and interest) and reduce information asymmetry between borrowers and lenders. Kim, Tsui, and Yi (2011) provide evidence that financial reporting quality also matters to banks, as the authors demonstrate that non-US firms that adopt IFRS pay lower interest rates in comparison to those firms that report under local GAAP. Even though there is little evidence on the effect of fair value on debt contracting (Demerjian, Donovan & Larson, 2016; Whang & Zang, 2017); De George, Li, and Shivakumar (2016) argue that debt holders pay attention to the liquidation value of the assets. In this sense, Daly and Skaife (2016) explain that the fair value of some biological assets provides a better estimation of the liquidation value of those assets than the historical cost valuation. As banks assess if the future cash flows of the firms will be sufficient to pay the principal and interest of the debt contracts, Daly and Skaife (2016) highlight some factors of biological assets, related to their fair value estimation, that may impact their ability to predict future cash flows. Bearer plants, for instance, because they have a long lifecycle and are not easily replaced during their transformation process, their fair value estimation might not be helpful to estimate their future cash flows, which may lead to a higher cost of debt.

Analyzing the post-amended IAS 41 period allows me to investigate the effect of amended IAS 41 on the cost of debt, specifically for firms that cultivate bearer plants. Some authors argue that the fair value of bearer plants is difficult to achieve due to the lack of an active market, then fair value valuation for bearer plants may lead to earnings volatility and a lack of relevant information (Herbohn & Herbohn, 2006; Aryanto, 2011; Muhammad & Ghani, 2014; Gonçalves & Lopes, 2015). Amended IAS 41 intended to address concerns about the cost, complexity, and practical difficulties of fair value measurement of bearer plants in the absence of observable markets for these assets and the volatility that arises from this recognition, which affects the reliability of its fair value estimation and leads to higher firms' cost of debt. This valuation method allows managers more discretion, and, as a result, creditors may demand higher returns (Bova, 2016). Thus, I expect that amended IAS 41 will reduce the cost of debt of the firms that manage bearer plants.

The main dataset of this study consists of 791 firm-year observations of biological assets for 140 listed firms in 43 countries that adopt IFRS. The sample is decomposed into 593 non-bearer plants firm-year observations and 198 bearer plants firm-year observations. The sample of this study consists of firms that adopt International Financial Reporting Standards (IFRS) because firms provide more disclosure reporting under IFRS when compared to local accounting standards (Ashbaugh & Pincus, 2001; Bae, Ten & Welker, 2008; Lang & Stice-Lawrence, 2015; Daly & Skaife, 2016). Moreover, lenders may offer less strict debt contracts for firms that adopt IFRS because they make better disclosures than firms that report under local GAAP (Moscariello, Skerrat & Pizzo, 2014). From a country-level perspective, IFRS adoption has significantly benefited adopting firms and countries in terms of improving transparency, lower costs of capital, improving cross-country investments, better comparability of financial statements, and increased following of financial analysts (Byard, Li & Yu, 2011; Amiram, 2012; Brochet, Jagolinzer & Riedl, 2013; Wang, 2014; Bath, Calen & Seagal, 2016; De George, Li & Shivakumar, 2016). Finally, financial reports under IFRS have better quality that those prepared under local GAAP, and improve coordination between borrowers and lenders; then IFRS adopters tend to face lower cost of debt (Kim, Tsui & Yi, 2011; De George, Li & Shuvakumar, 2016).

Because I focus on a sample of firms that adopt IFRS, my first set of analyses examines whether fair value accounting for non-bearer biological assets is associated with firms' cost of debt. Next, before I examine the effect of amended IAS 41, using an IFRS sample, I analyze whether fair value accounting for bearer plants is associated with higher COD, which allows me to demonstrate that, in the overall period of this study (2005-2019), fair value accounting for bearer plants did not convey relevant information to creditors even when firms report under IFRS. Finally, I specifically analyze how amended IAS 41 affected the cost of debt of firms that cultivate bearer plants. As discussed above, amendments to IAS 41 moved bearer plants from IAS 41 scope to IAS 16 scope, so bearer plants have to be measured at the historical cost model. As bearer plants have little or no active markets, the corresponding fair value is difficult to achieve, leading to managers' discretion and earnings management. In this sense, amendments to IAS 41 that excluded bearer plants from the scope of the standard might reduce information asymmetry between managers and creditors and give more appropriate treatment to measure, recognize and disclose biological assets.

Moving to the results, I find a significant negative association between the fair value valuation of the non-bearer biological assets and the cost of debt, which is consistent with prior evidence that non-bearer biological assets have more active markets, so their fair value estimation is more useful to users of financial statements (Daly & Skaife, 2016; Huffman, 2018). Next, the results suggest that the fair value valuation of bearer plants is positively associated with the firms' cost of debt in the overall analyzed period; however, the measurement at historical cost of bearer plants did not reduce the cost of debt in the post-amended IAS 41 period (2016-2019). First, when I analyze the overall period (2005-2019), it was possible to demonstrate that the fair value measurement of bearer plants generates uncertainties for creditors in the agricultural sector (see Daly & Skaife, 2016; Huffman, 2018, Hsu et al., 2019). However, I did not find evidence that historical cost accounting for bearer plants in the post-Amended IAS 41 period (2016-2019) is associated with lower cost of debt, raising concerns on the appropriateness of the amendments to IAS 41. The overall results suggest that the amendments to IAS 4 still have not improved information for the firms that shifted from fair value to historical cost valuation of the bearer plants subset, as the IAS 16 scope cost model still requires some subjectivity and judgment to evaluate, then the complexity and earnings volatility may still be an issue for the bearer plants valuation (PwC, 2015; Gonçalves, Lopes & Craig, 2017).

This study contributes to the financial accounting literature on the ongoing debate on the relevance of fair value accounting by expanding evidence on the economic consequences of fair value for biological assets, which are a type of non-financial assets. According to the authors He, Wright, and Evans (2018), the relevance of fair value accounting to biological assets is still largely unknown. In this vein, I expand prior evidence on the association between the accounting for biological assets and the firms' cost of debt by investigating the effect of amended IAS 41 for firms that adopt IFRS. Daly and Skaife (2016) found that the fair value of bearer plants is associated with higher firms' cost of debt, but they do not control for specific countries' characteristics and accounting standards quality as their sample includes firms that adopt IFRS and other local GAAPs, and also, they analyze a pre-amended IAS 41 period. As discussed above, amendments to IAS 41 treat biological assets in the way they derive value, which can reduce information asymmetry resulting from fair value valuation; then analyzing post-Amended IAS 41 complements prior research on the impact of the measurement method of biological assets on users of financial statements (Daly & Skaife, 2016; Argilés-Bosch et al. 2018; He, Wright & Evans, 2018; Huffman, 2018). This paper might also be helpful to stakeholders in the agricultural sector to understand the differences between bearer plants and non-bearer biological assets in the way they bring economic value to firms since bearer plants are now treated as other property, plant and equipment (PPE) (Huffman, 2018; Hsu et al., 2019). Finally, my results have implications for accounting standard setters, such as the IASB, in its assessment of the effect of amended IAS 41 in its Post-implementation Review (PIR) process. The limited-scope project to amend IAS 41 aimed to improve information on bearer plants, and the findings of this study indicate that the Amendments to IAS 41, that shifted the measurement method of bearer plants to the historical cost model, still did not improve information to creditors of firms that report biological assets under IFRS. To the best of the author's knowledge, this study is one of the first to provide evidence on Amended IAS 41.

2 Literature Review and Hypotheses Development

2.1 IAS 41 Background

IAS 41 was issued by IASC in 2001 and first applied to annual periods beginning on or after January 1, 2003. This Standard prescribes the accounting treatment for biological assets, which are living animals or plants. Before IAS 41, biological assets received little attention from regulatory and standard-setters and there were no uniform accounting standards for these assets (Herbohn & Herbohn, 2006; Gonçalves & Lopes, 2015). According to Hsu et al. (2019), the diversity of accounting treatments for biological assets caused difficulty for stakeholders in the agricultural sector. In general, biological assets were measured using a historical cost model and were excluded from the scope of International Accounting Standards (Cairns, Massoudi, Taplin & Tarca, 2011; Huffman, 2018; Hsu et al., 2019). Upon IAS 41 adoption, this standard requires biological assets and agricultural produce to be measured on initial recognition and at the end of each reporting date at fair value less costs to sell, as a general rule. However, an exception is allowed when fair value cannot be measured reliably. According to paragraph 30 of IAS 41, when market quoted prices for biological assets are not available and alternative fair value measurements are unreliable, then biological assets shall be measured at their cost less any accumulated depreciation and any accumulated impairment loss.

Under IAS 41, firms are encouraged to classify their biological assets as "consumable" or "bearer" (Huffman, 2018). Consumable biological assets are those that are to be harvested as agricultural produce or sold as biological assets, such as animals, crops, and produce growing on a bearer plant. Bearer biological assets are those other than consumable assets; and are held to bear production, such as fruit trees. However, because of amended IAS 41, I will use non-bearer and bearer plants categorization (Daly & Skaife, 2016). The non-bearer plants' category includes consumable biological assets, such as animals and crops; and forests. Bearer plants are living plants that generate produce for more than one period and have a remote likelihood of being sold as agricultural produce. Examples of bearer plants are fruit trees, grapevines, oil palms.

The IASB has received feedback from investors, analysts and other users of financial statements who expressed concerns about the cost, complexity and practical difficulties of fair value measurements of bearer plants in the absence of markets of these assets. As a response, in 2013 the IASB issued an Exposure Draft proposing several amendments for accounting requirements for bearer plants under IAS 41. The project was initially developed by the

Malaysian Accounting Standards (MASB). In the Exposure Draft, the IASB decided to accept the argument of the MASB, investors, analysts, and other users of financial statements that the fair value for bearer plants is not very relevant. In response to an IASB's 2011 Agenda Consultation, users of financial statements mentioned they would adjust the reporting profit or loss to eliminate the effects of changes in the fair value of bearer plants. Bearer plants are used only to bear production over several periods, and once they become mature, apart from bearing produce, their biological transformation is no longer significant in generating future economic benefits. Because of their longer life cycle, bearer plants usually do not have a trading market. Due to the unreliability of their fair value valuation, there is a possibility of more discretion and earnings management regarding information about bearer plants at fair value.

The IASB decided that bearer plants should be accounted for in the same way as Property, Plant, and Equipment; and thus, they amended IAS 41 in 2014. Consequently, the amendments include bearer plants within the scope of IAS 16, instead of IAS 41. The produce growing on bearer plants remains within the scope of IAS 41. Amended IAS 41 became effective for the period beginning on January 1, 2016. The amendments to IAS 41 are expected to reduce costs, complexity, and earnings volatility for financial statement preparers without significant loss of information quality of financial reporting (Gonçalves & Lopes, 2015). It is also expected that these adjustments will increase the reliability of the measurement method of bearer plants since the fair value measurement models lacked reliability because they were subject to earnings management due to manager discretion when valued at level 3 discount cash flows models (Bova, 2016; Hsu et al., 2019).

2.2 Debate on Fair Value Accounting

Fair value accounting is one of the most controversial debates in the financial accounting literature (Laux & Leuz, 2009; Christensen & Nikolaev, 2013; Magnan, Whang, & Shi, 2016). Seminal studies have evidenced that the fair value measurement for financial assets is relevant to investors (Barth, 1994; Petroni & Whalen, 1995; Barth, Beaver & Landsman, 1996; Nelson, 1996). As Ball (2006) notes, fair value incorporates more information into accounting numbers than historical cost. On the other hand, there is a trade-off between relevance and reliability in measuring fair value (Laux & Leuz, 2009). As Magnam, Whang, and Shi (2016) ponder, while fair value is more relevant since its estimation is determined according to market quoted prices, there is the possibility of earnings management when there are no active observable liquid markets for a price quotation, which reduces its reliability. Despite the controversies, fair value is increasingly present in accounting regulation. The authors He, Wright, and Evans (2018) highlight that the major international accounting standard boards, such as the IASB and the Financial Accounting Standards Board (FASB), have encouraged convergence of accounting practices towards standards based on fair value. Ball (2006) argues that the extensive use of fair value under IFRS can lead to greater earnings volatility when there is no market liquidity or unobservable prices for traded assets, which is often the case for non-financial assets.

In this sense, the fair value of non-financial assets is even more controversial. Cairns et al. (2011) documented that companies in the UK and Australia did not generally take up the option to use fair value to measure non-financial assets around the time of mandatory IFRS adoption, from 1 January 2005. Christensen and Nikolaev (2013) also evidenced that, although IFRS allows fair value valuation for some non-financial assets, companies in the German and British markets generally choose to measure intangible assets, investment properties, property, plant, and equipment at historical cost. The authors add that managers' choice on cost model for non-financial assets is driven by the costs to establish reliable fair value estimates rather than an opposing view on fair value potential benefits.

In recent years, the literature on fair value accounting has been discussing the view of users and preparers of financial statements on fair value accounting numbers (Georgiou, 2017; Georgiou, Mantzari & Mundi, 2021; Goh, Lim, Ng, Pan & Yong, 2021). Georgiou (2017) argues that there is a disconnection between users of financial reporting and standard setters because investors and financial analysts do not estimate the fair value as expected by standard setters, as they are interested in assessing the business performance of the firms rather than provide market value of their assets and liabilities. Georgiou, Mantzari, and Mundy (2021) discuss how fair value decision-usefulness is perceived by financial analysts. Empirical evidence drawn from interviews with UK financial analysts reveals that fair value accounting is not unquestionably useful to decision making. Analysts also challenge fair value assumptions implicit in academic studies. In the context of a fair value-oriented financial reporting, Goh, Lim, Ng, Pan, and Yong (2021) documented that the stakeholders in the financial reporting process (preparers, auditors, and users of financial statements) have high confidence in financial statements, although they believe that fair value decreases trust in financial reporting. However, they also believe that fair value may be beneficial, as they are confident in the Conceptual Framework underlying the standard setting.

Fair value under IFRS is set out by International Financial Reporting Standard 13 – Fair Value Measurement (IFRS 13) (IASB, 2013), issued by IASB in 2011, as a result of a cooperation between IASB and FASB that aimed to develop common requirements for fair value measurement and disclosing information in accordance with IFRS GAAP and US GAAP. IFRS 13 defines fair value as the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date. The Standard establishes a fair value hierarchy that categorizes into three levels the inputs to valuation techniques for fair value measurement. Level 1 inputs are quoted prices (unadjusted) in active markets for identical assets or liabilities that the entity can access at the measurement date. Level 2 are inputs other than quoted prices included within Level 1 that are observable for the asset or liability, either directly or indirectly. Level 3 are unobservable inputs for the asset or liability. Level 3 inputs allow managers more discretion when measuring fair value. Because of this lower reliability, Level 3 fair value increases agency costs and affects firms' cost of debt capital (Wang & Zhang, 2017).

2.3 Fair Value Accounting for Biological Assets

Prior evidence based on fair value accounting for financial assets may be less relevant for biological assets since they have characteristics of non-financial assets such as the lack of a liquid market. Furthermore, in the context of the agricultural sector, some biological assets have a long production cycle, with no market value until seasonal production is finished or produce agricultural products. In the absence of active markets, fair value is subject to manipulation, which reduces its relevance (Watts, 2003; Ronen, 2008; He, Wright & Evans, 2018). However, Argilés-Bosch, Aliberch, and Garcia-Blandón (2012) document that fair value accounting is more easily applied in the agricultural sector than historical cost model, and add that historical cost valuation for biological assets convey less accurate information and is more complex to calculate for small business farms, considering the specific context of the agricultural business. Silva Filho, Martins, and Machado (2013) analyzed the shift from historical cost to fair value accounting for biological assets around the time of early IFRS adoption in the Brazilian market (2008-2009) and suggested that fair value accounting best reflects the economic benefits of biological assets over time, as the historical cost model underestimated the value of biological assets. Rech and Pereira (2012), when analyzing fair value accounting under IAS 41 for bearer biological assets in the Brazilian markets, argue that the fair value can be applied to these assets, as its estimation techniques might include some subjectivity, such as interest rate and future prices estimation as the model's inputs. Hsu et al. (2019) analyze whether the mandatory adoption of IAS 41 influences firm-specific information flows capitalized into stock prices, which is better reflected in the share price informativeness. The authors concluded that the information on biological assets valued at fair value increases informational content for companies that adopt IAS 41 compared to companies that adopt local accounting practices. Finally, the study did not identify a significant difference between biological assets and bearer plants.

Argilés-Bosch, Miarons, Garcia-Blandón, Benavente, and Ravenda (2018) evidenced that fair value valuation of biological assets influences the accuracy to predict future cash flows, and this accuracy increases as the proportion of biological assets on total assets increases. The authors add that the evidence is weaker for bearer plants. However, in a similar paper, He, Wright, and Evans (2018) found different results when analyzing the Australian agricultural sector. They failed to provide evidence that the fair value of biological assets provides incremental forecasting power for future cash flows.

Empirical evidence on the relevance of fair value accounting for biological assets has provided mixed results. Even though, several studies evidenced that non-bearer and bearer biological assets have different implications for users of financial statements, consistent with the scope of amendments on IAS 41. Silva, Nardi, and Ribeiro (2015) examined Brazilian companies that adopt IAS 41, and revealed that firms that estimated fair value of their biological assets using discounted cash flows technique had higher levels of earnings management. Gonçalves, Lopes, and Craig (2017) documented that fair value valuation of biological assets is value relevant for investors, especially for firms with higher levels of disclosure. However, investors do not value consumable biological assets for firms with higher disclosure levels because they have more active markets and are sold in the short term. In the case of bearer assets, investors value bearer plants for firms with higher levels of disclosure because their fair value is not easy to estimate, and any further information disclosed is useful. Huffman (2018) analyzed whether fair value accounting for biological assets under IAS 41 is decision-useful to investors. The study finds that information of in-exchange biological assets (consumable) measured at fair value is more relevant in comparison with information of in-use biological assets (bearer) measured at fair value.

Finally, in a paper that provides evidence on the association of the measurement method of biological assets in the credit market, Daly and Skaife (2016) documented that fair value accounting for biological assets is associated with a higher cost of debt. However, delving further, the result is driven by the subset of bearer plants. Moreover, the study analyzed a cross-country sample, regardless of the accounting standards applied — IFRS GAAP or other local GAPP — and the period is pre-Amended IAS 41 adoption. Finally, the authors also find that fair value under IFRS of non-bearer biological assets is associated with lower cost of debt when compared with bearer plants.

2.4 Hypotheses Development

In the approach of Agency Theory (Jensen & Mecklin, 1976), it is relevant to highlight the influence of human behavior on the quality of accounting information. According to Watts (1977), financial statements are products of interactions between individuals who seek to maximize their self-interests. In this sense, Hendriksen and Van Breda (1992, p. 143) explain that "managers who are rewarded for high net income numbers have a clear incentive to increase those numbers by either deciding to manipulate given rules or, more interestingly, for accounting theory, by deciding on accounting rules that favor them". One of these accounting rules that can be decided on by accountants is the fair value estimation under IFRS 13 using level 3 inputs, as they are unobservable or unreliable, it allows managers discretion when using internal valuation techniques to estimate level 3 fair value. The measurement of biological assets at fair value requires discretion; therefore, it is subject to greater earnings management by managers (He, Wright & Evans, 2018). Based on the Agency Theory, there is information asymmetry between the managers and creditors, affecting the credit risk assessment of the companies, so creditors demand higher returns, which increases the cost of debt (Bova, 2016). In this vein, level 3 fair value valuation is associated with the higher corporate cost of debt (Magnam, Wang & Shi, 2016).

However, as discussed in the literature review, prior empirical evidence supports that fair value measurement of non-bearer biological assets is more decision-useful for users of financial statements (Daly & Skaife, 2016; Gonçalves, Lopes & Craig, 2017; Huffman, 2018; Argilés-Bosch et al., 2018). In this sense, the fair value of non-bearer biological assets has characteristics that facilitate their estimation: prices available on more liquid markets and a relatively short life cycle, so they are sold in the short term (Daly & Skaife, 2016; Gonçalves, Lopes & Craig, 2017). Following the discussion on Daly and Skaife (2016), their findings indicate that non-bearer biological assets measured at fair value under IFRS are associated with a lower cost of debt, as these assets have more active markets. Furthermore, IFRS require disclosure of the methods and significant assumptions applied in determining fair value of each group of biological assets; such disclosures are expected to reduce uncertainty, so credit providers will charge a lower rate of interest (Daly & Skaife, 2016). Thus, the first research hypothesis is presented:

H1: Fair value accounting for non-bearer biological assets is associated with lower firms' cost of debt.

Measurement at fair value is controversial in the case of bearer plants, since, unlike other non-bearer biological assets, bearer plants have a relatively long life cycle and unavailable active markets. Hsu et al. (2018) consider that the effect of applying IAS 41 varies in the subset of bearer plants since investors consider that its measurement at fair value is not useful for decision-making to the users of financial statements. Amid discussions on the amended IAS 41, stakeholders in the agricultural sector expressed concerns about the limitations of the fair value of bearer plants, which eliminated the effects of fair value variation for these assets (Gonçalves & Lopes, 2015). Huffman (2018) ponder that information on fair value of bearer plants does not provide useful information to users of financial statements when compared to consumable biological assets. The IASB's stakeholders consider that the bearer plants are perceived to be similar to property, plant and, equipment than a proper biological asset.

As discussed by Daly and Skaife (2016), bearer plants are hold to bear production of agricultural produce for more than one year, with little or no active market value during this period. In the absence of an active market, fair value is less relevant to users of financial statements, as it is subject to manipulation by managers (Ronen, 2008; He, Wright & Evans, 2018). The measurement of bearer plants is usually estimated by the discounted cash flows model (level 3 inputs of the fair value hierarchy), which can lead to higher cost of debt capital (Bova, 2016), since creditors may demand a higher return on the capital applied to mitigate agency conflicts (Wang & Zhang, 2017). This leads to the second research hypothesis:

H2: Fair value accounting for bearer plants is associated with higher firms' cost of debt.

Additionally, with the amended IAS 41, bearer plants must be measured only using the historical cost model. As discussed in the literature review, most of the controversy regarding the fair value measurement of biological assets focused on the fair value of the subset of bearer plants. In this sense, amendments in IAS 41 are expected to reduce compliance costs, complexity, and earnings volatility without significant loss of information to users of financial statements (Gonçalves & Lopes, 2015; Hsu et al., 2019). Considering prior empirical evidence that fair value accounting for bearer plants is associated with a higher cost of debt (Daly & Skaife, 2016), it is expected that, in the post-implementation period of amended IAS 41, there will be a reduction in the cost of debt for firms that transform bearer plants, due to the reduction of creditors' risk and the greater reliability of the accounting information related to the bearer plants measured using the historical cost model. It should be noted that the historical cost model for non-financial assets is more verifiable and reliable, as there are little active markets, fair value may not be measured based on observable quoted prices inputs (Ball, 2006; Ronen, 2008; He, Wright & Evans, 2018). Finally, as the users of financial reporting considered bearer plants to be more similar to PPE, amendments to IAS 41 is expected to reduce information asymmetry between managers and creditors because bearer plants are treated more closely with the nature with such assets. Thus, I have the third research hypothesis:

H3: The historical cost model valuation of bearer plants under amended IAS 41 reduces the firms' cost of debt of firms.

3 Research Design

3.1 Data and Sample

In order to identify firms that transform biological assets, the data were collected from the financial statements of listed firms in the global economy, available in the *Thomsom Reuters Eikon Refinitiv®* database, from Fish & Farming and Food Processing industry; and Paper & Forest industry group; because firms from these industries have a business model that manages biological assets. Next, I select firms from jurisdictions where IFRS is mandatory for listed companies to capture the effect of amended IAS 41 and other IFRS requirements, as discussed above. The sample period of the analysis will be from the fiscal year of 2005 to 2019. The beginning of the sample period is the fiscal year of 2005, because in 2005 a large group of countries, especially in the EU, mandated the IFRS adoption, and up to 2015, tens of thousands of firms adopted IFRS around the globe (De George, Li & Shivakumar, 2016). I hand-collected IAS 41 data, such as the measurement method of biological assets and the biological asset group, from firms' fundamentals reports available on *Eikon Refinitiv®* and annual reports available on *Eikon Refinitiv®* or from the firms' website.

I excluded observations of firms with missing values (50) and indeterminable measurement methods for biological assets (57) from the sample selection. Following Huffman (2018), I also excluded from the sample selection observations of firms with Biological Assets Intensity (biological assets over total assets) of less than 5% (169). The final data sample resulted in 140 firms located in 43 countries with 791 firm-year observations, with 634 firm-year observations of biological assets measured at fair value, and 157 firm-year observations measured at historical cost. I winsorize the continuous variables at the 1st and 99th percentiles to control for the potential outliers. Table 1 details the data sample selection.

Table 1

Data Sample Selection

Sample Selection	**Firms**
Total of firms with biological assets	407
(-) Firms with missing values	(-40)
(-) Firms with indeterminable measurement method for biological assets	(-57)
(-) Firms with Biological Assets Intensity of less than 5%	(-169)
(=) Final sample of firms	**140**

Table 2 shows the variation of the measuring method for biological assets by country. In this study, the three countries with the highest number of firm-year observations are Australia, Brazil, and Chile. As can be noted, only the observations located in Saudi Arabia and Turkey did not apply fair value valuation for biological assets in the sample period. The historical cost model is concentrated in countries such as Malaysia, Sri Lanka, Chile, and Singapore, as well as in Gonçalves and Lopes (2015), and Daly and Skaife (2016). Table 2 also highlights the method for measuring biological assets, classified according to their group: non-bearer biological assets and bearer plants. As in Daly and Skaife (2016), more than 90% of non-bearer biological assets observations under IFRS are measured at fair value. In the case of the bearer plants observations, 59% are valued at the historical cost. It should be noted that until 2015, bearer plants could be measured either at the fair value or historical cost model; however, amendments to IAS 41 in 2014 changed the scope of these assets to IAS 16. The amendments became effective from 2016 fiscal year; which may be the possible cause of the increase of firm-year historical cost observations in the post-Amended IAS 41 period (2016-2019).

Table 2

Sample by Country, Year, and Biological Asset Category

	Historical Cost	**Fair Value**	**Total**	**Percent**
Panel A: Sample by Country				
Argentina	4	7	11	1,4%
Australia	12	76	88	11,1%
Belgium	2	1	3	0,4%
Brazil	0	68	68	8,6%
Canada	0	13	13	1,6%
Chile	12	57	69	8,7%
Colombia	2	6	8	1,0%
Cyprus	0	3	3	0,4%
Denmark	0	13	13	1,6%
Estonia	0	7	7	0,9%
Finland	0	15	15	1,9%
France	0	8	8	1,0%
Greece	0	8	8	1,0%
Hong Kong	0	15	15	1,9%
Jamaica	0	2	2	0,3%
Kenya	0	3	3	0,4%
Korea (S. Korea)	0	13	13	1,6%
Kuwait	0	1	1	0,1%
Latvia	0	6	6	0,8%
Lithuania	0	1	1	0,1%
Luxembourg	5	11	16	2,0%

Malaysia	45	12	57	7,2%
Mexico	0	9	9	1,1%
Netherlands	0	25	25	3,2%
New Zealand	2	10	12	1,5%
Nigeria	4	7	11	1,4%
Norway	0	50	50	6,3%
Oman	0	9	9	1,1%
Peru	6	37	43	5,4%
Poland	0	5	5	0,6%
Portugal	10	8	18	2,3%
Qatar	0	1	1	0,1%
Russia	0	11	11	1,4%
Saudi Arabia	2	0	2	0,3%
Singapore	16	10	26	3,3%
South Africa	0	25	25	3,2%
Spain	4	4	8	1,0%
Sri Lanka	20	9	29	3,7%
Sweden	0	22	22	2,8%
Turkey	11	0	11	1,4%
Ukraine	0	38	38	4,8%
United Kingdom	0	6	6	0,8%
Zimbabwe	0	2	2	0,3%
Total	**157**	**634**	**791**	**100,0%**
Panel B: Sample by Year				
2005	0	5	5	0,6%
2006	1	11	12	1,5%
2007	1	10	11	1,4%
2008	3	13	16	2,0%
2009	2	16	18	2,3%
2010	2	29	31	3,9%
2011	3	47	50	6,3%
2012	6	54	60	7,6%
2013	9	61	70	8,8%
2014	11	60	71	9,0%
2015	17	56	73	9,2%
2016	18	57	75	9,5%
2017	26	67	93	11,8%
2018	32	72	104	13,1%
2019	26	76	102	12,9%
Total	**157**	**634**	**791**	**100,0%**
Panel C: Sample by Biological Assets Categories				
Non-bearer	40	553	593	75,0%
Bearer plants	117	81	198	25,0%
Total	**157**	**634**	**791**	**100,0%**

3.2 Empirical Model

The econometric model to be used to test H1 and H2 is shown in equations (1) and (2). The initial model is represented in equation (1). As I detail below, the specified models are estimated separately for the non-bearer and bearer biological assets sub-samples because prior research indicates that fair value impacts differently according to the subsets of biological assets (see Daly & Skaife, 2016; Gonçalves, Lopes & Craig, 2017; Argilés-Bosch et al., 2018; Huffman, 2018).

$$COD_{it} = \beta_0 + \beta_1 FV_{it} + \beta_2 BIO_{it} + \beta_3 LEV_{it} + \beta_4 SIZE_{it} + \beta_5 ROA_{it} + \beta_6 GRW_{it} + \beta_7 CFO_{it} + \beta_8 BIG4_{it} + \beta_9 DEV + \varepsilon_{it} \quad (1)$$

Where Cost of Debt (*COD*) represents the average interest rate firms have to pay to their debtholders (Sengupta, 1998; Pittman & Fortin, 2004; Francis, LaFond, Olsson & Schipper, 2005; Minnis, 2011; Moscariello, Skerratt & Pizzo, 2014). See table 3 for detailed definition and equation of the variables.

Fair Value (*FV*) is 1 when companies measure their biological assets at fair value and 0 if the measurement is at historical cost. I will regress the specified models for the subsamples of non-bearer and bearer assets separately because the fair value accounting has distinct impacts on different biological assets groups (Daly & Skaife, 2016; Huffman, 2018). For the non-bearer assets subsample, this study expects firms with *FV = 1* have a lower cost of debt, then I expect a negative sign for *FV* when analyzing H1. On the other hand, for the bearer plants subsample, this study hypothesizes that if *FV = 1*, they have a higher cost of debt, then this study expects a positive sign for the estimations for bearer plants subsample. Prior empirical evidence demonstrated that before amended IAS 41 became effective in 2016, there were little or no active markets for bearer plants, so their fair value estimation using level 3 fair value inputs may lead to higher subjectivity, and therefore, there is a higher possibility of earnings management; then creditors demand a higher return on the capital provided (Daly & Skaife, 2016; Bova, 2016; Magnam, Wang and Shi, 2016; Whang & Zhang, 2017).

Biological Assets Intensity (*BIO*) is the ratio between total biological assets and total assets. The predicted sign can be positive or negative because the type of biological asset can have different impacts on the *COD*. Leverage (*LEV*) is one of the firm's characteristics that determine its credit risk rating (Francis, LaFond, Olsson & Schipper, 2005). Despite its importance, this indicator is still controversial. Some studies consider that there is a positive relationship between *LEV* and *COD* (van Binsberg, Graham & Yang, 2010; Daly & Skaife, 2016); however, Francis et al. (2005) found a negative association between LEV and COD. Therefore, I do not predict a specific sign to the association between LEV and COD.

The Size (*SIZE*) is a proxy for the firm's total assets. It is an important characteristic in determining the firm's interest rates (Francis et al., 2005). This study predicts a negative relationship between *SIZE* and *COD* (van Binsberg, Graham & Yang, 2010). Return on Assets (*ROA*) controls for the profitability of firms. As evidenced by Francis et al. (2005), companies with higher *ROA* are less vulnerable to the credit risk of default. Therefore, this study predicts a negative sign for *ROA*. Growth (*GRW*) represents the sales growth of the firm. It is included in the model used by Francis et al. (2005) as a firm's characteristic that explains the credit risk rating. Although *GRW* may be seen as a positive characteristic, it can be argued that the relationship between *GRW* and *COD* is positive because greater sales growth can restrict the firm's ability to invest (van Binsberg, Graham & Yang, 2010); and generate incentives for earnings management (Park & Yoon, 2013). The predicted sign is positive.

Cash Flow from Operations (CFO) represents the firm's ability to generate operational cash. The greater this ability, the lower the firm's risk of default (Daly & Skaife, 2016). Thus, a negative sign is predicted for *CFO*. *BIG4* is a dummy variable that takes a value of 1 if the entity is audited by the "Big 4" consulting audit firms (Deloitte, EY, KPMG, and PwC), and 0 otherwise. Some studies demonstrate that firms that contract independent audit services from the "Big 4" group tend to have a lower cost of debt (Mansi, Maxwell & Miller, 2004; Pittman & Fortin, 2004), so the predicted sign for *BIG4* is negative. Development (*DEV*) is a dummy variable that takes 1 if the country's economy is considered developed and 0 if the country's economy is considered emerging, according to the International Monetary Fund (IMF) classification (IMF, 2020). The variable is justified in the model due to the possibility of finding less reliable inputs for fair value estimation models in emerging markets (Daly & Skaife, 2016; Bova, 2016). The predicted sign is negative.

In addition to the initial econometric model, I also estimate the econometric models (2) with macroeconomic control using the macroeconomic variables Gross Domestic Product Annual Growth (*GDP*) and Annual Inflation (*INF*). A negative sign is expected for GDP variation, as GDP growth indicates an improvement in the country's economic conditions, reducing the cost of corporate debt. In the case of the inflation rate the expected sign is positive. An increase in inflation rates usually requires restrictive monetary policies, resulting in an increase in the interest rate.

To test hypotheses H1 and H2, I will regress models (1) and (2) for the non-bearer and bearer plants subsamples separately.

$$COD_{it} = \beta_0 + \beta_1 FV_{it} + \beta_2 BIO_{it} + \beta_3 LEV_{it} + \beta_4 SIZE_{it} + \beta_5 ROA_{it} + \beta_6 GRW_{it} + \beta_7 CFO_{it} + \beta_8 BIG4_{it} + \beta_9 DEV + \beta_{10} GDP + \beta_{11} INF + \varepsilon_{it} \; (2)$$

To test H3, the initial equation (3) is estimated for the subsample of bearer plants.

$$COD_{it} = \beta_0 + \beta_1 COST + \beta_2 POST_{it} + \beta_3 COST * POST_{it} + \beta_4 BIO_{it} + \beta_5 LEV_{it} + \beta_6 SIZE_{it} + \beta_7 ROA_{it} + \beta_8 GRW_{it} + \beta_9 CFO_{it} + \beta_{10} BIG4_{it} + \beta_{11} DEV + \varepsilon_{it} \; (3)$$

Where — in addition to the variables already mentioned — Historical Cost (COST), unlike *FV*, has a value of 1 when the bearer plant is measured at historical cost and 0 otherwise. In this scenario, the *COST* variable is expected to be negatively associated with the firms' cost of debt, since bearer plants measured at historical cost are more reliable and useful for users of the financial statements.

The variable Post-amended IAS 41 (*POST*) represents the post-amended period of the standard and takes the value of 1 for the period from 2016 to 2019 when amended IAS 41 became effective. For the other periods (2005-2015), *POST = 0*. The predicted sign for this variable is negative since the historical cost valuation of bearer plants is associated with a lower cost of debt. The amended IAS 41 shifted the measurement method model for bearer plants at historical cost. To test H3, I analyze the interaction between the variables *COST* and *POST* (*COST*POST*) — which represents the historical cost accounting for bearer plants in the post-amended IAS 41 period. Thus, in line with the hypothesis developed in H3, *COST*POST* is expected to reduce the cost of debt for firms that hold bearer plants.

In addition to equation (3), I also estimate equation (4) with macroeconomic control with macroeconomic variables *GDP* and *INF* for the subsample of bearer plants.

$$COD_{it} = \beta_0 + \beta_1 COST + \beta_2 POST_{it} + \beta_3 COST * POST_{it} + \beta_4 BIO_{it} + \beta_5 LEV_{it} + \beta_6 SIZE_{it} + \beta_7 ROA_{it} + \beta_8 GRW_{it} + \beta_9 CFO_{it} + \beta_{10} BIG4_{it} + \beta_{11} DEV + \beta_{12} GDP + \beta_{13} INF + \varepsilon_{it} \; (4)$$

Table 3 shows the definition and equation of the variables used in the empirical model.

Table 3

Variables Equations and Definitions

Variable	Equation/Definition	Predicted Sign
Cost of Debt (COD)	$COD = \frac{Ineterest\ Expense}{(Debt_{t-1} + Debt_t)/2}$	N.A.
Fair Value (FV)	FV = 1 whether a biological asset is valued at fair value; FV = 0 whether a biological asset is valued at historical value	$+/-$*
Biological Assets Intensity (BIO)	$BIO = \frac{Total\ Biological\ Asstes}{Total\ Assets}$	$+/-$
Levarage (LEV)	$LEV = \frac{Debt}{Debt + Equity}$	$+/-$
Size (SIZE)	$SIZE = \ln Total\ Assets$	$-$
Return on Assets (ROA)	$ROA = \frac{Net\ Income}{Total\ Assets}$	$-$
Growth (GRW)	$GRW = \frac{(Sales_t - Sales_{t-1})}{Sales_{t-1}}$	$+$
Cash Flows from Operations (CFO)	$CFO = \frac{Cash\ Flows\ from\ Operations_t}{Sales_t}$	$-$
Big 4 (BIG4)	BIG4 = 1 when a firm contracts Deloitte, EY, KPMG, or PwC; BIG4 = 0, if otherwise	$-$
Development (DEV)	DEV = 1 for developed economies; DEV = 0, for emerging economies	$-$
Post-amended IAS 41 (POST)	POST = 0, pre-amended IAS41 period (2005-2015) POST = 1, post-amended IAS41 period (2016-2019)	$-$
Historical Cost (COST)	COST = 1 whether a bearer plant is measured at historical cost; COST = 0 whether a bearer plant is measured at fair value	$-$
GDP	Annual GDP growth (%)	$-$
INF	Annual Inflation rate (%)	$+$

Notes: *The expected sign for FV is positive for the bearer plants estimation and negative for the non-bearer plants estimation (See 2.4 Hypotheses Development subsection for further details).

4 Main Results

4.1 Descriptive Statistics

Table 4 shows the descriptive statistics of the full sample (N = 753) and the observations of historical cost (N = 157) and fair value (N = 637) valuation of biological assets. In the third column, it is possible to observe Student t-tests for the difference in means and Wilcoxon rank-sum test[1] for differences in medians between these subsamples. The mean *COD* observed during the analyzed period was 10.3%, higher than that identified by Daly and Skaife (2016), who found mean *COD* of 7.7% in the period analyzed by the authors. A possible explanation is because the sample period includes years of economic financial crisis. The standard deviation was 22%, which indicates high variation of the firms' cost of the debt over the analyzed period, a probable cause for that is because the sample includes countries with heterogeneous economies. However, Argilés-Bosch et al. (2018) note that eight firms with few observations impact the calculation of standard deviation and the volatility analysis. Finally, the median for *COD* is 5.8%, slightly higher than that identified by Daly and Skaife (2016) (5.1%).

The cost of debt of the historical cost observations obtained a mean of 7.4%, while for fair value *COD* was relatively higher, 11%. Using the Student t-test, it was verified that there is a significant difference at a 5% level between the means of the cost of debt for non-bearer bearer plants. The Wilcoxon rank-sum test reveals that the difference of the medians of the cost of debt for the historical cost and fair value observations is significant at the 1% level. For the independent variables the Student t-test indicates significant differences between the means of *BIO* and *SIZE* at the 1% significance level. Wilcoxon rank-sum test displays difference between medians for *BIO* and *CFO* at the 1% significance level; and between medians for *SIZE* and *GRW* at the 5% level of the observations valued at the historical cost and fair value.

Table 4

Descriptive Statistics

	Full Sample (N = 791)			**Historical Cost (N = 157)**			**Fair Value (N = 634)**		
Variable	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**	**Mean**	**Median**	**SD**
COD	0.103	0.058	0.220	0.074**	0.049***	0.116	0.110	0.060	0.238
BIO	0.215	0.154	0.154	0.280***	0.240***	0.178	0.199	0.138	0.144
LEV	0.284	0.278	0.180	0.325	0.303	0.180	0.273	0.273	0.178
SIZE	19.934	19.879	1.774	19.582***	19.753**	1.514	20.021	19.929	1.823

[1] Also called Mann-Whitney U Test.

ROA	0.017	0.029	0.136	0.012	0.021	0.099	0.019	0.031	0.144
GRW	0.142	0.040	0.521	0.051	-0.008**	0.354	0.164	0.050	0.553
CFO	0.052	0.101	0.495	0.080	0.116***	0.597	0.045	0.097	0.467

Notes: See variable definitions in Table 3. Student t-test and Wilcoxon rank-sum test were applied for the paired differences between the means and medians of the HC and FV subsamples. See variables definitions in Table 3. N – number of observations. SD – sample standard deviation. Rejection of the null hypothesis (Student t-test and Wilcoxon rank-sum test): ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 5 presents the Spearman Correlation Matrix (see Appendix A: Variables Normality and Post-estimation Tests). The dependent variable *COD* is positively associated with the variables *FV*, *ROA*, *GRW*, *INF*; and negatively associated with *BIO*, *LEV*, *SIZE*, *CFO*, *BIG4*, *DEV* and *GDP*. It should be noted that the low correlation between the dependent variables reduces the possibility of a multicollinearity problem. The correlation matrix indicates that *FV* is positively associated with the full sample cost of debt, which anticipates the same findings of Daly and Skaife (2016) for the association between the measurement method of biological assets and the cost of debt.

The ratio of biological assets on total assets (*BIO*) is negatively associated with firms' cost of debt, indicating that creditors in the agricultural markets might take into consideration the investment in biological assets for firms engaged in agricultural activity. Even though there is no significance at 5% for the Leverage correlation with the cost of debt, it is interesting to note that the sign is positive, inconsistent with previous literature (van Binsberg, Graham & Yang, 2010), however Francis et al. (2005) found a negative association between *LEV* and *COD*. There is a significant positive association between *SIZE* and *COD*. Sales growth is also positively correlated with the cost of debt, as expected by van Binsberg, Graham, and Yang (2010); and Daly and Skaife (2016).

The negative association between *BIG4* and *COD* corroborates the notion that firms attested by the Big 4 group of auditors tend to have a lower cost of debt (Mansi, Maxwell & Miller, 2004; Pittman & Fortin, 2004). As expected, there is a positive correlation between *DEV* and *COD*, showing that firms located in developed economies generally have a lower cost of debt. *ROA* and cash flow from the operations are positively correlated with *COD*, different from the expected; however, with no significance at the 5% level. Finally, macroeconomics variables *GDP* is negatively associated with *COD*, and *INF* is positively associated with the dependent variable, both at the 5% level.

Table 5

Spearman Correlation Matrix

	COD	***FV***	***BIO***	***LEV***	***SIZE***	***ROA***	***GRW***	***CFO***	***BIG4***	***DEV***	***GDP***	***INF***
COD	1.00											

FV	**0.15**	1.00										
BIO	**-0.08**	**-0.20**	1.00									
LEV	**-0.12**	**-0.11**	**-0.20**	1.00								
SIZE	**-0.28**	0.06	-0.03	0.27	1.00							
ROA	0.01	**0.09**	**0.09**	**-0.38**	0.06	1.00						
GRW	**0.08**	**0.11**	0.05	**0.01**	-0.06	**0.22**	1.00					
CFO	-0.01	**-0.09**	**0.09**	-0.12	**0.26**	**0.40**	0.01	1.00				
BIG4	**-0.17**	**0.07**	**-0.12**	**0.11**	**0.38**	-0.02	-0.03	0.02	1.00			
DEV	**-0.22**	**0.16**	0.05	**-0.11**	0.04	**0.09**	**0.07**	-0.07	**-0.07**	1.00		
GDP	**-0.09**	**-0.22**	0.12	**-0.12**	**-0.11**	0.00	0.06	**-0.08**	-0.04	**-0.22**	1.00	
INF	**0.32**	**0.08**	0.02	**0.08**	-0.01	0.03	0.05	0.06	-0.02	**-0.58**	0.01	1.00

Notes: See variables definitions in Table 3. Correlations in bold are statistically significant at 5%.

4.2 Results for H1

Table 6 shows the estimates of the econometric models to test the hypothesis developed in H1. I first estimate Equations (1) and (2) for the subsample of non-bearer biological assets. I first applied the models using pooled ordinary least square (POLS) regression model. However, to address potential problems, such as self-selection bias, reverse causality, endogeneity, and correlated omitted variables bias, I also apply panel data models and dynamic panel data using the generalized method of moments (GMM) model, as introduced by Arellano and Bond (1991). Because the non-bearer biological assets subsample suffers from serial autocorrelation problems, as found in the Wooldridge test for autocorrelation in panel data, I report regressions results for the POLS and Arellano-Bond GMM models to test H1 (see Appendix A: Variables Normality and Post-estimation Tests).

Moving to the regression results, the negative association between *FV* and *COD* for the non-bearer plants' subsample is consistent with the hypothesis developed in H1. For the POLS models, the p-value of *FV* is 0.0454 for the POLS (1) model estimated in equation (1), 0.0294 for the POLS (2) estimated in equation (2), as shown in columns (1) and (2) in Table 6. For the Arellano-Bond GMM estimations, Table 6 also shows that the p-value of the *FV* variable is 0.000 in both estimations presented in columns GMM (3) and GMM (4), indicating that, consistent with Daly and Skaife (2016), there is a negative statistical significance on the association between fair value accounting for non-bearer biological assets and the firms' cost of debt at the 1% level.

Moving to the control variables, *BIO* has a positive sign for the POLS estimations and positive for the GMM results (*p-value = 0.0935; 0.0777; 0.00; 0.00*). LEV has a negative sign for the GMM and POLS estimations, which corroborates the Daly and Skaife (2016) and Francis et al. (2005) evidences that *LEV* has a negative association with the firm's cost of debt (*p-value = 0.00*). I found a negative sign for *SIZE* for POLS and GMM estimations (*p-value = 0.003; 0.036; 0.00; 0.00*), as expected in the literature, considering that larger firms have less information asymmetry (Francis et al., 2005). *ROA* also has a negative sign with *COD* (*p-value = 0.0291*; *0.0324; 0.00; 0.00*) for all estimations; however, *CFO* (*p-value = 0.077* and *0.0246; 0.00; 0.000*), has a positive sign, different from the predicted in Table 3. BIG4 has a positive sign for the GMM estimations (*p-value = 0.00)*, different from the expected in Table 3. In the POLS estimations, *GDP* is negatively associated with *COD*, but it has no statistical significance (*p-value = 0.5471*). However, *GDP* is significant at the 1% level for the GMM estimation with macroeconomics variables, however with a positive sign for the GMM estimations, different from the expected. The macroeconomic variable *INF* has positive association with *COD* for the POLS and GMM estimations, even though it has no statistical significance in the GMM estimations (*p-value = 0.0532; 0.1512*). It is important to note that I find a negative association between fair value accounting for biological assets applied under IFRS requirements, which provides more disclosure and credit-useful information for the firms that hold non-bearer biological assets (Daly & Skaife, 2016).

It is important to note that I find a negative association between fair value accounting for biological assets applied under IFRS requirements, which provides more disclosure and credit-useful information for the firms that hold non-bearer assets (Daly & Skaife, 2016). Gonçalves, Lopes, and Craig (2017) also corroborate with this notion of more useful information on the fair value accounting for consumable biological assets, as their findings indicate that the recognition of fair value for consumable biological assets under IAS 41 provides relevant information to users of financial statements. Because consumable biological assets usually are sold in the short term, fair value can be easily estimated, as they have more available market prices. Huffman (2018) also evidenced that fair value for non-bearer biological assets (classified as in-exchange in the way they derive value) provides more relevant information for users of financial statements, as the in-exchange assets are market-driven, as it can be estimated on quoted market prices, and generate value on a standalone basis.

Table 6

Regressions of FV on the COD for Non-Bearer Biological Assets Subsample

Variable	**Pred. Sign**	**POLS (1)**	**POLS (2)**	**GMM (3)**	**GMM (4)**
FV	-	-0.04714335	-0.05801012	-0.06676649	-0.06627619
		(-2.01)	(-2.18)	(-68.3)	(-68.47)
		*0.0454***	*0.0294***	*0******	*0******

BIO	?	-0.11664256	-0.1223544	0.1104801	0.10355713
		(-1.68)	(-1.77)	(20.28)	(25.3)
		*0.0935**	*0.0777**	*0****	*0****
LEV	?	-0.37841975	-0.43395864	-0.08940664	-0.09298751
		(-4.59)	(-4.61)	(-31.71)	(-42.59)
		*0****	*0****	*0****	*0****
SIZE	-	-0.01403489	-0.01259678	-0.03359531	-0.03233666
		(-3.65)	(-2.93)	(-55.33)	(-44.82)
		*0,0003****	*0.0036****	*0****	*0****
ROA	-	-0.2000303	-0.21107999	-0.04804006	-0.05173782
		(-2.19)	(-2.14)	(-22.94)	(-25.4)
		*0.0291***	*0.0324***	*0****	*0****
GRW	+	0.05466976	0.05086647	0.01188084	0.0116509
		(1.35)	(1.49)	(149.45)	(113.35)
		0.1766	*0.1378*	*0****	*0****
CFO	-	0.05197404	0.04396207	0.1575267	0.15824821
		(2.38)	(2.25)	(122.2)	(79.68)
		*0.0177***	*0.0246***	*0****	*0****
BIG4	-	-0.04029196	-0.0193664	0.01788321	0,01659644
		(-1.31)	(-0.88)	(11.9)	10.49
		0.1909	*0.3778*	*0****	*0****
DEV	-	-0.09874188	-0.03595555	0	0
		(-4.93)	(-1.31)		
		*0****	*0.1916*		
GDP	-		-0.17539407		0.02443178
			(-0.6)		(4.1)
			0.5471		*0****
INF	+		1.6570627		0.00731162
			(1.94)		(1.44)
			*0.0532**		*0.1512*
Lag COD				0.48253724	0,48350852
				(450.3)	(445.74)
				*0****	*0****
Constant		0.63751019	0.53266592	0.76621476	0.74179289
		(6.18)	(4.79)	(62.71)	(50.75)
		*0****	*0****	*0****	*0****
N		593	593	416	416
Adj. R^2		0.17779642	0.24110501		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (1). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (2). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (1). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (2). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

4.3 Results for H2

In order to examine the hypothesis developed in H2, I also estimate equations (1) and (2), but for the bearer plants subsample. To address the same concerns as mentioned in the Results for H1, I utilize POLS and dynamic panel data models, as the Wooldridge test for autocorrelation in panel data indicates that the subsample of bearer plants also presented serial autocorrelation problems (see Appendix A: Variables Normality and Post-estimation Tests). GMM dynamic panel data technique, as developed by Arellano and Bond (1991), mitigates the effects of no serial autocorrelation, using individual effects and lagged dependent variables as instrumental variables. It is also efficient to mitigate potential endogeneity and bias from omitting variables that might affect *COD*, considering that this study analyzes firms that operate in heterogeneous economies. Thus, I report results for POLS and Arellano-Bond GMM estimations to analyze H2.

Table 7 shows that fair value accounting for bearer plants is positively associated with the firms' cost of debt, as expected by the hypothesis developed in H2. POLS estimations, as shown in the columns (1) and (2), reveal a significant positive coefficient for *FV* variable (*p-value = 0.0022* and *0.00148*). Moving to GMM estimation models, results are similar. In the model in column (3), the statistical significance of *FV* is 1% (*p-value = 0.000*). Using the macroeconomic control variables, in column (4), there is also statistical significance at 1% (*p-value = 0.000*). For the POLS estimations in the columns (1) and (2), the control variables *LEV* and *ROA* are negatively associated with *COD* at the 5% level; *BIG4* has a negative sign at the 10% significance level for the POLS (2) estimation with macroeconomic control variables model. The initial control variables *LEV*, *SIZE*, and *ROA* have a negative sign and are statistically significant at the 1% level (p-value = 0.00), however, *CFO* have a positive sign, different from the expected in Table 3. *BIG4* has a negative sign (*p-value = 0.00*; *0.02*). *GDP* and *INF* are relevant in the model with macroeconomics control variables; however, *INF* has a positive sign, different from the expected in Table 3.

These results are consistent with the study by Daly and Skaife (2016), which evidenced that the fair value measurement of bearer plants is associated with a higher cost of debt for companies, and confirm the hypothesis developed in H2. The IASB itself understands that the measurement at fair value of bearer plants is not relevant for users of accounting information, which culminated in the amendments on IAS 41 that changed the measurement method of bearer plants to the historical cost model. It is worth noting that the estimation of the fair value of bearer plants has several limitations, due to the lack of active market and volatility of results due to the possibility of managing earnings in their estimation by managers. As a result, debtholders demand higher return on their capital provided, which results in higher firms' cost of debt (Aryanto, 2011; Muhammad & Ghani, 2014; Gonçalves & Lopes, 2015; Daly & Skaife, 2016; Bova, 2016; He, Wright & Evans, 2018; Huffman, 2018).

Table 7

Regressions of FV on the COD for Bearer Plants Subsample

Variable	**Pred. Sign**	**POLS (1)**	**POLS (2)**	**GMM (3)**	**GMM (4)**
FV	+	0.07941326	0.08471121	0.01164799	0.01700536
		(3.1)	(2.46)	(7.11)	(7.6)
		*0.0022****	*0.0148***	*0****	*0****
BIO	?	-0.00735976	-0.0067013	-0.04931993	-0.06653484
		(-0.05)	(-0.04)	(-3.25)	(-5.5)
		0.9632	*0.968*	*0.0012****	*0****
LEV	?	-0.37646813	-0.38775728	-0.11785782	-0.12088723
		(-2.36)	(-2.37)	(-18.31)	(-14.29)
		*0.0193***	*0.0187***	*0****	*0****
SIZE	-	-0.00953915	-0.0105666	-0.0463	-0.05315605
		(-0.57)	(-0.67)	(-10,81)	(-11.22)
		0.5716	*0.5052*	*0****	*0****
ROA	-	-0.44789972	-0.44758541	-0.41429005	-0.36235376
		(-2.02)	(-2.1)	(-52.71)	(-18.01)
		*0.0451***	*0.0374***	*0****	*0****
GRW	+	0.03239471	0.03635021	0.01609764	0.01678576
		(1.3)	(1.38)	(42.7)	(29.47)
		0.1966	*0.169*	*0****	*0****
CFO	-	-0.04892579	-0.04812565	0.02841139	0.01958985
		(-1.46)	(-1.44)	(10.22)	(3.57)
		0.1457	*0.1512*	*0****	*0.0004****
BIG4	-	-0.05526503	-0.05741671	-0.02601287	-0.02894666
		(-1.61)	(-1.66)	(-4.86)	(-2.26)
		0.1097	*0.0995**	*0****	*0.0237***
DEV	-	-0.02738315	-0.04381101	0	0
		(-1.08)	(-1.31)		
		0.2803	*0.192*		
GDP	-		-0.86985329		-0.20923775
			(-0.69)		(-5.31)
			0.4915		*0****
INF	+		-0.10479151		-0.28848977
			(-0.29)		(-6.83)
			0.7704		*0****
Lag COD				0.51622943	0.46342786
				(31.43)	(19.06)
				*0****	*0****

Constant	0.41347296	0.47688459	1.0345552	1.203017
	(1.12)	(1.51)	(11.76)	(12.43)
	0.2632	*0.1319*	*0****	*0****
N	198	198	129	129
Adj. R^2	0.1359321	0.13236671		
Macroeconomics Controls	No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (1). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (2). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (1). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (2). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

4.4 Results for H3

Table 8 presents the estimations to test the hypothesis developed in H3, that the amended IAS 41 is negatively associated with the cost of debt of firms holding bearer plants. For this, according to the model specified in equations (3), the interaction between the *COST* and *POST* variable is used, resulting in the *COST*POST* variable. In addition to the initial model specified in equation (2), there is also a model with macroeconomic control through the macroeconomic indicators *GDP* and *INF*. To address the same concerns as discussed in the Results for H1 and H2, I regress equations to exam H3 using POLS, panel data, and GMM dynamic panel data. Based on the Wooldridge test for autocorrelation in panel data, the bearer plants subset has serial autocorrelation problems (see Appendix A: Variables Normality and Post-estimation Tests), thus I employ GMM dynamic panel data technique (Arellano & Bond, 1991) in addition to the POLS estimations.

As it can be seen in Table 8, the interest variable *COST*POST* has statistical relevance to explain the *COD* of companies for POLS and GMM estimations in columns (1), (3), (4), at the 1% significance level (*p-value = 0.00*) and at 5% for the POLS (2) estimation with macroeconomics control variables (*p-value = 0.0114*). However, it has a positive coefficient sign, different from the negative predicted sign as expected in H3. The control variables *COST (p-value = 0.0015; 0.0044*), *POST* (*p-value = 0.0246*; *0.0489*), *LEV* (*p-value = 0.0189; 0.0184*), and *ROA* (*p-value = 0.0402; 0.0322*) have a negative association with *COD* at the 1% and 5% level. All the control variables are relevant at the 1% level in all GMM estimations. *BIO*, *LEV*, *SIZE*, *ROA*, *BIG4*, and *GDP* have a negative sign, as expected in Table 3. However, *INF* has a negative sign, different from the positive coefficient sign as expected in Table 3. *CFO* has a positive sign, different from the expected positive sign.

Based on the results displayed in Table 8, I reject the hypothesis developed in H3. The results presented in Table 7 indicate that in the overall sample period the fair value estimation is positively associated with firms' cost of debt for the bearer plants subset, as evidenced on prior research (Daly & Skaife, 2016); however, in the post-Amended IAS 41 period, the change to historical cost valuation did not reduce the firms' cost of debt. There are several possible causes for this result, such as a relatively small sample size for bearer plants, low variability in the firms' cost of debt. It should be noted that the IAS 41 amendment is relatively recent, so it may still take longer for creditors to consider its impact on their risk assessment processes. In addition, protection contracts, hedging, cooperatives, credit unions, subsidized interest rates, and other government grants may influence the long-term cost of debt of firms in the agricultural sector (see Barry & Robinson, 2001).

Delving further, Gonçalves, Lopes, and Craig (2017) found that fair value recognition of biological assets is value relevant for both consumable and bearer biological assets, however in the case of bearer assets, the fair value is value-relevant for users of financial statements for firms with higher levels of disclosure. In fact, the authors question if amendments would likely remove complexity and volatility in profit and loss because there is still subjectivity in determining the point when depreciation of bearer plants begins (PwC, 2015). Argilés-Bosch et al. (2018) indicated that the shift from fair value to the cost model for bearer plants is not likely to improve the ability to predict future cash flows, raising concerns on the appropriateness of the amendments to IAS 41. Moreover, Bova (2016) notes that firms in some developed economies can still benefit from fair value valuation of biological assets because they operate in more developed markets where the fair value data inputs for estimation are more reliable, accurate, less complex, and less costly. Then firms that reliably estimated the fair value of bearer plants, the shift from to cost model might be less informative and less faithfully represented. It also should be highlighted that fair value information under IFRS since the implementation of IFRS 13 has been improving over time (Filip, Hammame, Huang, Jeny, Magnam & Moldovan, 2021), indicating that more discussion should be needed before a complete shift from fair value to cost model for bearer plants as required on Amended IAS 41.

Finally, the amendments to IAS 41 recommended by the Exposure Draft in June 2013 were initially proposed by the Malaysian Accounting Standards (MASB), which required an alternative to fair value for the bearer plants. Even though investors, analysts, and users of financial statements listened by the IASB also criticized the fair value for bearer plants due to the lack of active markets, in some economic environments, such as the Anglo-Saxon countries, fair value is still the mainstream valuation method (Elad & Herbohn, 2011; Gonçalves & Lopes, 2015). Considering that fair value is still important to some firms because it better represents the future economic benefits, then the change of the scope of the bearer plants valuation to the historical cost model might be less informative for the creditors of these firms, which might be a possible cause to the increase on the cost of the debt after the Amended IAS 41 period (2016-2019). Based on these results, the change of the scope of the bearer plants to IAS 16 did not reduce complexity in applying IAS 41 and still has not improved accounting information on the bearer plants subset to creditors as such amendments generalized accounting practices to different institutional contexts. The international accounting harmonization in the agricultural sector is still a challenge to be addressed by the IASB.

Table 8

Regressions of COST*POST on the COD for Bearer Plants Subsample

Variable	**Pred. Sign**	**POLS (1)**	**POLS (2)**	**GMM (3)**	**GMM (4)**
COST	-	-0.102068	-0.10150412	-0.01716459	-0.02012861
		(-3.22)	(-2.88)	(-9.63)	(-8.43)
		*0.0015****	*0.0044****	*0****	*0****
POST	-	-0.17354053	-0.18573237	0	0
		(-2.27)	(-1.98)		
		*0.0246***	*0.0489***		
*COST*POST*	-	0.20161682	0.20579019	0.00548335	0.00493124
		(2.7)	(2.56)	(3.67)	(2.77)
		*0.0076****	*0.0114***	*0.0002****	*0.0055****
BIO	?	-0.00775962	-0.00646237	-0.04943779	-0.05300772
		(-0.05)	(-0.04)	(-3.05)	(-3.57)
		0.9615	*0.9697*	*0.0023****	*0.0004****
LEV	?	-0.38525654	-0.39588065	-0.11772638	-0.12541896
		(-2.37)	(-2.38)	(-19.15)	(-12.38)
		*0.0188***	*0.0184***	*0****	*0****
SIZE	-	-0.01052386	-0.01125467	-0.04454908	-0.05031731
		(-0.61)	(-0.69)	(-7.61)	(-7.91)
		0.5407	*0.4935*	*0****	*0****
ROA	-	-0.47029599	-0.46719387	-0.41423972	-0.3705067
		(-2.07)	(-2.16)	(-40.3)	(-21.49)
		*0.0402***	*0.0322***	*0****	*0****
GRW	+	0.0284475	0.03285202	0.01540647	0.01704411
		(1.14)	(1.25)	(32.18)	(17.72)
		0.2572	*0.2143*	*0****	*0****
CFO	-	-0.04499591	-0.04472453	0.02877319	0.02216693
		(-1.35)	(-1.35)	(8.38)	(3.77)
		0.1802	*0.1792*	*0****	*0.0002****
BIG4	-	-0.05369142	-0.05467857	-0.03120954	-0.03694235
		(-1.5)	(-1.51)	(-3.63)	(-3.19)

		0.1346	*0.1318*	*0.0003****	*0.0014****
DEV	-	-0.02552396	-0.04026323	0	0
		(-0.97)	(-1.26)		
		0.3342	*0.2076*		
GDP	-		-0.8451431		-0.15600954
			(-0.63)		(-7.13)
			0.5281		*0****
INF	+		-0.10130471		-0.22962046
			(-0.27)		(-3.31)
			0.7869		*0.0009****
Lag COD				0.51015685	0.4488121
				(31.54)	(18.82)
				*0****	*0****
Constant		0.51569657	0.57585998	1.0197961	1.1638889
		(1.37)	(1.77)	(8.89)	(9.32)
		0.172	*0.0776**	*0****	*0****
N		198	198	129	129
Adj. R^2		0.13158213	0.12744718		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (3). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (4). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (3). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (4). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

4.5 Robustness Tests

I conducted additional tests in order to verify the robustness of my main results (see Appendix B: Robustness Tests for further details on the results). To test if specific countries are driving the results, I exclude all the firm-year observations located in Australia, Brazil and Chile, because a large percentage of firm-year observations are located in these three countries, and the main results are qualitatively similar to those displayed in Tables 7, 8, and 9. I also tested H2 and H3 after excluding all the firm-year observations from Malaysia, because the largest percentage of the bearer plants observations are located there, and the main results presented are also qualitatively similar to those shown in Tables 8 and 9.

The main results remain similar to those presented in Tables 7, 8, and 9 if I alternatively estimate all the specified models utilizing the system GMM technique developed by Blundell and Bond (1998).

5 Conclusion

This study investigated the effect of amended IAS 41 on the cost of debt of the firms in the global economy that adopt IFRS. Prior evidence on the role of fair value accounting for biological assets on the cost of debt (Daly & Skaife, 2016) demonstrated that fair value is positively associated with the cost of debt, especially for firms that transform bearer plants. However, for firms that adopt IFRS, fair value valuation is negatively associated with the firms' cost of debt. Similarly, Huffman (2018) showed that fair value accounting of consumable biological assets (in-exchange) provides more decision-useful information to users of financial statements in comparison to the fair value of bearer biological assets (in-use). These findings are consistent with the discussion that resulted in the amendments to IAS 41 that changed the scope of the bearer plants that are now measured using the cost model, following IAS 16 requirements.

My findings were partially consistent with the prior evidence, as the fair value valuation of non-bearer biological assets is negatively associated with firms' cost of debt and positively associated with the cost of debt for firms that hold bearer plants. On the other hand, it was not possible to evidence that the historical cost valuation model in the post-Amended IAS 41 period in this study (2016-2019) reduced the cost of debt for firms that hold bearer plants. One possible interpretation of this result is that the complete shift from fair value to the historical cost valuation model for bearer plants is unlikely to improve information on these assets to creditors of the agricultural sector. I analyzed a sample of 140 companies in 43 countries that adopt IFRS, resulting in 791 observations decomposed by non-bearer and bearer plants in the period between 2005 and 2019. I utilized POLS, panel data models, and GMM dynamic panel data to estimate the specified models.

The findings of my study may lead to some relevant interpretations. The amendments to IAS 41, that changed the scope of the bearer plants valuation to the IAS 16 cost model, did not completely remove the complexity and subjectivity of the measurement of the bearer plants (PwC, 2015; Gonçalves, Lopes & Craig, 2017). Another possible explanation is that the amended IAS 41 did not significantly change the accounting practices of firms to evaluate bearer plants, being indifferent to creditors. It is possible that creditors may not consider the effects of amended IAS 41 in their credit risk assessment yet. Finally, it should be noted that some firms that reported bearer plants at the fair value using market prices input might have lost relevant information on these assets in the shift from FV to HC because fair value conveys available market data information or future cash flow projections that may represent more faithfully the future economic benefits of these assets to some firms, especially those located in developed economies (Bova, 2016). Thus, the findings of this study demonstrate that the fair value of biological assets, even with the amendments of IAS 41, is still controversial, raising concerns about its usefulness for users of financial statements. As the accounting information on fair value have been improving since implementation of IFRS 13, more discussion might still be needed before complete shift to IAS 16 cost model for bearer plants.

There are several implications of the results found for various stakeholders, among which agricultural sector stakeholders, regulatory and accounting standard-setting bodies, such as the IASB, stand out. For the preparers of financial statements in the agricultural sector, the results demonstrate the importance of the valuation of non-bearer biological assets and bearer plants and its impact on the cost of debt capital, a relevant source of financing for the agricultural sector. For creditors in the agribusiness, the results of this research help to better understand the information related to non-bearer biological assets and bearer plants, and the differences between these assets, regarding how they generate value. In the context of discussions on the amended IAS 41 and accounting harmonization in the agricultural sector, regulatory and standard-setting bodies, such as the IASB, may find the results of this study relevant to assist the Post-implementation Review (PIR) process of the amendments. PIR is a process in which the IASB assesses whether the objectives of the standard-setting project have been met and whether the information provided by the Standards is useful to users of financial statements. This study may also provide evidence for the accounting-financial literature by exploring the usefulness of fair value accounting information for non-financial assets and the impact of fair value valuation on credit markets.

I believe that my results should be analyzed with several cautions, as they are possibly subject to limitations of the data sample. There are a relatively low number of observations, in particular for the subsamples of non-bearer and the bearer plants. Because I hand-collected the measurement method of biological assets from financial statements in different languages, they may contain some inaccuracies. In addition to that, the firms' cost of debt is not always clearly provided in their financial statements. Finally, the sample includes firms from heterogeneous economies. Some economies may have different policies to foment the agricultural activity, which impacts the cost of debt of the firms in the agricultural sector (Barry & Robinson, 2001). Also, firms located in more developed markets have better conditions to estimate the fair value because they have more readily available market data to do so (Bova, 2016). Finally, some countries are better than others to enforce IFRS (Brown, Preiato & Tarca, 2014; Huffman, 2018).

More research on amended IAS 41 is needed. Future research may examine a larger data sample or a group of countries with homogeneous economies to assess the impact of amended IAS 41 on the firms' cost of debt. Another suggestion would be to analyze a sample of firms that hold bearer plants that changed their measurement method in the post-Amended IAS 41 period, so it is possible to control for firms that specifically shifted from fair value to historical cost model. The impact of the amended IAS 41 can be explored for other financial statement users, such as the investors of capital markets. Finally, future research could explore the value relevance of the accounting information to users of financial statements of the amended IAS 41.

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Appendix A: Variables Normality and Post-estimation Tests

Table 9

Shapiro-Wilk and Shapiro Francia Normality Test for the Full Dataset Key Variables (*p-value*)

Variable	N	Shapiro-Wilk	Shapiro Francia
COD	1247	*0****	*0.00001****
FV	969	*0.00235****	*0.00001****
BIO	963	*0****	*0.00001****
LEV	1836	*0****	*0.00001****
SIZE	1836	*0****	*0.00001****
ROA	1836	*0****	*0.00001****
GRW	1754	*0****	*0.00001****
CFO	1822	*0****	*0.00001****
BIG4	968	*0.09745**	*0.00001****
DEV	2067	*0.99974*	*1*

Notes: See Table 3 for variable definitions. Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 10

Post-estimation Tests

	Equation (Research Hypothesis)					
Test	**1 (H1)**	**2 (H1)**	**1 (H2)**	**2 (H2)**	**3 (H3)**	**4 (H3)**
Ramsey Test	58.80***	85.83***	5,83***	5.75***	5.58***	5.61***
Breusch-Pagan/Cook-Weisberg	1395.62***	2091.92***	186.25***	222.88***	194.02***	229.62***
Mean Variance Inflation Factor	1.34	1.4	1.48	1.56	10.77	9.42
Wooldridge Test	12.907***	12.903***	19.293***	20.084***	19.440***	20.43***
Breusch-Pagan	126.20***	121.07***	15.37***	16.61***	15.69***	17.02***
Cluster Robust Hausman Test	3.24	3.19	1.18	0.95	4.97	4.05

Notes: Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Appendix B: Robustness Tests

Table 11

Regressions of FV on the COD for Non-Bearer Biological Assets Subsample After Excluding Firm-year Observations from Australia, Brazil, and Chile

Variable	Pred. Sign	POLS (1)	POLS (2)	GMM (3)	GMM (4)
FV	-	-0.03001	-0.0718	-0.10712	-0.10734
		(-0.8)	(-1.48)	(-32.26)	(-22.52)
		0.4261	*0.1399*	*0****	*0****
BIO	?	-0.22192	-0,28698	0.007527	-0.00461
		(-1.47)	(-1.85)	(1.51)	(-0.76)
		0.1421	*0.0655**	*0.1309*	*0.4482*
LEV	?	-0,68052	-0.82373	-0.11712	-0.10796
		(-3.29)	(-3.57)	(-39.6)	(-27.66)
		*0.0011****	*0.0004****	*0****	*0****
SIZE	-	-0.0068	-0.00687	-0.03727	-0.04284
		(-0.98)	(-0.93)	(-45.84)	(-35.16)
		0.3266	*0.3525*	*0****	*0****
ROA	-	-0.36326	-0.37097	0.036413	0.055136
		(-2.08)	(-1.88)	(10.93)	(16.63)
		*0.0381***	*0.0609**	*0****	*0****
GRW	+	0,188972	0.175114	0.001341	0.002661
		(1.39)	(1.65)	(4.38)	(5.02)
		0.166	*0.0991**	*0****	*0****
CFO	-	0.191642	0.148867	0.158484	0.150829
		(1.76)	(1.7)	(56.1)	(47.01)
		*0.0793**	*0.0904**	*0****	*0****
BIG4	-	-0.15376	-0.10651	0.017192	0.016298
		(-1.9)	(-2.01)	(4.98)	(5.42)
		*0.0581**	*0.0457***	*0****	*0****
DEV	-	-0.13343	0.067787	0	0
		(-3.34)	(0.96)	.	.
		*0.0009****	*0.3368*	.	.
GDP	-		0.378492		-0.22618
			(0.56)		(-11.42)
			0.577		*0****
INF	+		4.045672		-0.12174
			(2.19)		(-7.4)
			*0.0289***		*0****
Lag COD				0.515066	0.513335
				(532.33)	(653.28)
				*0****	*0****

Constant		0.69332	0.483005	0.90636	1.026101
		(4.62)	(3.05)	(51.97)	(45.47)
		*0****	*0.0024****	*0****	*0****
N		396	396	276	276
Adj. R²		0.162353	0.296782		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (1). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (2). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (1). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (2). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 12

Regressions of FV on the COD for Bearer Plants Subsample After Excluding Firm-year Observations from Australia, Brazil, and Chile

Variable	**Pred. Sign**	**POLS (1)**	**POLS (2)**	**GMM (3)**	**GMM (4)**
FV	+	0.098231	0.121892	0.024102	0.025413
		(2.05)	(1.62)	(12.38)	(10.18)
		*0.0424***	*0.1072*	*0****	*0****
BIO	?	0.157159	0.14747	-0.03466	-0.03054
		(0.42)	(0.39)	(-3.92)	(-2.79)
		0.678	*0.6956*	*0.0001****	*0.0053****
LEV	?	-0.54267	-0.52122	-0.18164	-0.1768
		(-1.84)	(-1.98)	(-32.34)	(-25.87)
		*0.0683**	*0.0499***	*0****	*0****
SIZE	-	0.001994	-0.0002	-0.10701	-0.11021
		(0.05)	(-0.01)	(-15.53)	(-15)
		0.9569	*0.9953*	*0****	*0****
ROA	-	-0,68671	-0,6677	-0.4163	-0.39761
		(-1.95)	(-2.02)	(-34.94)	(-43.64)
		*0.0529**	*0.0451***	*0****	*0****
GRW	+	0.059254	0.090437	0.008988	0.015157
		(1.07)	(1.72)	(1.82)	(2.98)
		0.2854	*0.0879**	*0.0681**	*0.0029****
CFO	-	-0.03414	-0.03207	0.033286	0.025623
		(-0.78)	(-0.73)	(6.41)	(5)
		0.4342	*0.4666*	*0****	*0****
BIG4	-	-0.05511	-0.06354	-0.07389	-0.08298
		(-1.26)	(-1.44)	(-8.37)	(-4.31)
		0.2081	*0.1529*	*0****	*0****
DEV	-	-0.01942	-0.08252	0	0
		(-0.52)	(-0.99)	.	.

		0.6014	*0.3222*	.	.
GDP	-		-2.48764		-0.19605
			(-0.92)		(-6.95)
			0.3599		*0****
INF	+		-0.50671		-0.07549
			(-0,66)		(-1.05)
			0.5099		*0.2926*
Lag COD				0.490143	0.474226
				(74.5)	(50.59)
				*0****	*0****
Constant		0.177114	0.351242	2,286655	2,360223
		(0.22)	(0.54)	(17.77)	(14.71)
		0.824	*0.5872*	*0****	*0****
N		170	170	110	110
Adj. R²		0.056388	0.058928		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (1). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (2). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (1). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (2). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 13

Regressions of COST*POST on the COD for Bearer Plants Subsample After Excluding Firm-year Observations from Australia, Brazil, and Chile

Variable	Pred. Sign	POLS (1)	POLS (2)	GMM (3)	GMM (4)
COST	-	-0.11772	-0.12335	-0.03914	-0.0321
		(-2.41)	(-2,08)	(-19.23)	(-10.08)
		*0.0169***	*0.0389***	*0****	*0****
POST	-	-0.24946	-0.28025	0	0
		(-1.7)	(-1.57)		
		*0.0915**	*0.1174*		
*COST*POST*	-	0.270992	0.275227	0.016852	0.014093
		(1.95)	(1.93)	(7.97)	(5.25)
		*0.0528***	*0.0555***	*0****	*0****
BIO	?	0.15705	0.148318	-0.04563	-0.02695
		(0.41)	(0.39)	(-3.72)	(-1.34)
		0.6805	*0.6964*	*0.0002****	*0.1808*
LEV	?	-0.55256	-0.52803	-0.17718	-0.17772
		(-1.84)	(-1.99)	(-61.72)	(-17.44)
		*0,0676**	*0,0479***	*0****	*0****
SIZE	-	0.001234	-0.00038	-0.11018	-0.10709
		(0.03)	(-0.01)	-15.74	-13.49
		0.9736	*0.9915*	*0****	*0****

ROA	-	-0.70929	-0.68612	-0.42062	-0.41529
		(-1.95)	(-2.02)	(-40.15)	(-27.72)
		0.0535*	0.0451**	0***	0***
GRW	+	0.053613	0.088769	0.001633	0.013098
		(0.96)	(1.63)	(0.8)	(2.48)
		0.3385	0.1045	0.4237	0.013**
CFO	-	-0.02855	-0.02765	0.03375	0.028385
		(-0.64)	(-0.62)	(9.44)	(4.89)
		0.5206	0.5349	0***	0***
BIG4	-	-0.04856	-0.0545	-0.0873	-0.09899
		(-1.07)	(-1.19)	(-5.86)	(-4.15)
		0.2883	0.2342	0***	0***
DEV	-	-0.01299	-0.074	0	0
		(-0.35)	(-0.95)	.	.
		0.7296	0.3458	.	.
GDP	-		-2.56362		-0.1711
			(-0.88)		(-4.98)
			0.3791		0***
INF	+		-0.52192		-0.08338
			(-0.65)		(-1.21)
			0.5177		0.2251
Lag COD				0.505918	0.498711
				(20.29)	(20.23)
				0***	0***
Constant		0.290684	0.478166	2.37586	2.320121
		(0.38)	(0.78)	(17.88)	(14.55)
		0.7072	0.4346	0***	0***
N		170	170	110	110
Adj. R^2		0.047547	0.050263		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (3). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (4). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (3). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (4). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 14

Regressions of FV on the COD for Bearer Plants Subsample After Excluding Firm-year Observations from Malaysia

Variable	**Pred. Sign**	**POLS (1)**	**POLS (2)**	**GMM (3)**	**GMM (4)**
FV	+	0.048927	0.058498	0.009982	0.016521
		(2.09)	(1.7)	(3.22)	(4.24)
		0.0382**	0.0907*	0.0013***	0***
BIO	?	-0.00558	0.000184	-0.06542	-0.00567

		(-0.03)	(0)	(-2.4)	(-0.2)
		0.9764	*0.9992*	*0.0164***	*0.8406*
LEV	?	-0.48064	-0.47719	-0.12305	-0.10527
		(-2.32)	(-2.35)	(-9.85)	(-6.14)
		*0.0218***	*0.0199***	*0****	*0****
SIZE	-	-0.00337	-0.00523	-0.03129	-0.06104
		(-0.16)	(-0.28)	(-2.17)	(-6.17)
		0.872	*0.7802*	*0.0299***	*0****
ROA	-	-0.51687	-0.49825	-0.44147	-0.323
		(-1.94)	(-2.02)	-46.79	(-8.2)
		*0.0539**	*0.0457***	*0****	*0****
GRW	+	0.034937	0.036529	0.019669	0.017869
		(1.08)	(1.09)	(11.97)	(11.55)
		0.2812	*0.2765*	*0****	*0****
CFO	-	-0.04232	-0.04237	0.034699	0.01698
		(-1.78)	(-1.78)	(7.06)	2.03
		*0.0764***	*0.0776***	*0****	*0.0427***
BIG4	-	-0.04688	-0.04931	-0.00429	-0.00557
		(-1.13)	(-1.2)	(-0.35)	-0.39
		0.2606	*0.2332*	*0.7258*	*0.6936*
DEV	-	-0.05517	-0.06979	0	0
		(-1.77)	(-1.66)	.	.
		*0.0782**	*0,0998**	.	.
GDP	-		-0.70646		-0.28961
			(-0.54)		(-5.17)
			0.5917		0***
INF	+		-0.20347		-0.13061
			(-0.51)		(-0.81)
			0.6091		*0.4169*
Lag COD				0.495896	0.452317
				(159.6)	(12.41)
				*0****	*0****
Constant		0.346771	0.415606	0.739687	1.311977
		(0.79)	(1.13)	(2.61)	(7.13)
		0.4305	*0.2614*	*0.009****	*0****
N		156	156	107	107
Adj. R^2		0.127698	0.119106		
Macroeconomics Controls		No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (1). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (2). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (1). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (2). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 15

Regressions of COST*POST on the COD for Bearer Plants Subsample After Excluding Firm-year Observations from Malaysia

Variable	Pred. Sign	POLS (1)	POLS (2)	GMM (3)	GMM (4)
COST	-	-0.08658	-0.08957	-0.02365	-0.02014
		(-2.1)	(-2.09)	(-13.13)	(-5.32)
		0.037**	0.0387**	0***	0***
POST	-	-0.17347	-0.18387	0	0
		(-2.03)	(-1.75)		
		*0.0445***	*0.0824**		
*COST*POST*	-	0.222428	0.224777	0.018198	0.012394
		(2.73)	(2.63)	(5.36)	(2.28)
		0.0072***	0.0095***	0***	0.0227
BIO	?	-0.01297	-0.0056	-0.01674	-0.01615
		(-0.07)	(-0.03)	(-0.47)	(-0.44)
		0.9466	*0.9779*	*0.6397*	*0.6574*
LEV	?	-0.49395	-0.49055	-0.07674	-0,10142
		(-2.33)	(-2.36)	(-3.83)	(-4.82)
		0.0214	*0.0194*	*0.0001****	*0****
SIZE	-	-0.00519	-0.00656	-0.05157	-0.06103
		(-0.24)	(-0.34)	(-3.4)	(-4.05)
		0.8106	*0.7369*	*0.0007****	*0.0001****
ROA	-	-0.56107	-0.5388	-0.41023	-0.36304
		(-2.04)	(-2.14)	(-12.8)	(-8.37)
		*0.0435***	*0.0343***	*0****	*0****
GRW	+	0.029599	0.031444	0.0154	0.01896
		(0.92)	(0.94)	(7.63)	(10.63)
		0.3588	*0.3468*	*0****	*0****
CFO	-	-0.03723	-0.03779	0.031657	0.027871
		(-1.53)	(-1.57)	(4.28)	(4.35)
		0.1289	*0.1186*	*0****	*0****
BIG4	-	-0.05014	-0.0506	-0.06105	-0.04653
		(-1.08)	(-1.08)	(-3.67)	(-1.52)
		0.2841	*0.2823*	*0.0002****	*0.1281*
DEV	-	-0.05617	-0.06854	0	0
		(-1.76)	(-1.71)	.	.
		*0.0798**	*0.0887**	.	.
GDP	-		-0.64314		-0.23238
			(-0.45)		(-3.59)
			0.6517		*0.0003****
Inflation	+		-0.19269		-0.31262
			(-0.46)		(-2.49)
			0.6456		*0.0129***
Lag COD				0.534304	0.501522
				(10.75)	(7.35)

			*0****	*0****
Constant	0.44272	0.506066	1.151621	1.349325
	(0.95)	(1.29)	(3.99)	(4.67)
	0.3451	*0.1979*	*0,0001****	*0****
N	156	156	107	107
Adj. R²	0.12228	0.112813		
Macroeconomics Controls	No	Yes	No	Yes

Notes: See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column POLS (1) indicates the initial model POLS estimation for equation (3). Column POLS (2) indicates the macroeconomics control variables model POLS estimation for equation (4). Column GMM (3) indicates the initial model Arellano-Bond GMM estimation for equation (3). Column GMM (4) indicates the macroeconomics control variables model Arellano-Bond GMM estimation for equation (4). Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.

Table 16

System GMM Regressions Results on the COD

		H1 (Non-bearer)		**H2 (Bearer Plants)**		**H3 (Bearer Plants)**	
Variable	**Pred. Sign**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
FV	*?**	-0.11637	-0.10795	0.033128	0.03773		
		(-92.36)	(-39.65)	(9.6)	(9.15)		
		*0****	*0****	*0****	*0****		
COST	-					-0.06322	-0.06293
						(-21.54)	(-16.26)
						*0****	*0****
POST	-	0	0	0	0	0	0
*COST*POST*	-					0.026013	0.028901
						(7.43)	(5.39)
						*0****	*0****
BIO	*?*	0.093711	0.091244	-0.15312	-0.18039	-0.16998	-0.31514
		(40.81)	(22.26)	(-5.8)	(-7.71)	(-4.92)	(-8.17)
		*0****	*0****	*0****	*0****	*0****	*0****
LEV	*?*	-0.06302	-0.10633	-0.15943	-0.17612	-0.13557	-0.33562
		(-63.54)	(-44.78)	(-11.48)	(-16.88)	(-8.24)	(-26.83)
		*0****	*0****	*0****	*0****	*0****	*0****
SIZE	-	-0.03545	-0.02671	-0,05805	-0.0575	-0.05401	0.007331
		(-86.08)	(-58.95)	(-12.24)	(-16.7)	(-16.3)	(7.44)
		*0****	*0****	*0****	*0****	*0****	*0****
ROA	-	-0.07528	-0.08473	-0.41613	-0.39859	-0.40019	-0.28559
		(-86.29)	(-67.23)	(-24.49)	(-27.74)	(-14.33)	(-11.41)
		*0****	*0****	*0****	*0****	*0****	*0****
GRW	+	0.046358	0.043206	0.02968	0.037858	0.026365	0.047145
		(440.32)	(294.5)	(51.41)	(18.41)	(31.52)	(54.02)
		*0****	*0****	*0****	*0****	*0****	*0****
CFO	-	0.135702	0.137289	0.016746	0.01836	0.020744	-0,10063

		(147.13)	(155.73)	(5.87)	(1.99)	(3.52)	(-8.62)
		*0****	*0****	*0****	*0.0462***	*0.0004****	*0****
BIG4	-	-0.03251	-0.0324	-0.05766	-0.06465	-0.05406	0.123666
		(-53.91)	(-24.07)	(-9.81)	(-7.17)	(-3.87)	(5.45)
		*0****	*0****	*0****	*0****	*0.0001****	*0****
DEV	-	-0.02782	-0.00342	-0.09463	-0.13793	-0.15053	0.310114
		(-30.42)	(-1.17)	(-2.16)	(-4.75)	(-3.89)	(7.29)
		*0****	*0.2417*	*0.0309***	*0****	*0.0001****	*0****
GDP	-		0.219409		-0.08019		-0.11937
			(29.68)		(-0.66)		(-1.52)
			*0****		*0,5082*		*0.128*
INF	+		0.682299		-0.51126		-1.13223
			(152.29)		(-4.23)		(-13.69)
			*0****		*0****		*0****
Lag COD		0,586031	0.568642	0.960646	0.960652	0.970194	0.967618
		(1207.85)	(970.21)	(299.96)	(220.72)	(287)	(266.26)
		*0****	*0****	*0****	*0****	*0****	*0****
Constant		0.886748	0.677723	1.289453	1.332556	1.271551	0
		(125.03)	(87.57)	(14.94)	(21.23)	(25.32)	.
		*0****	*0****	*0****	*0****	*0****	.
N		527	527	176	176	176	176
Macroeconomics Controls		No	Yes	No	Yes	No	Yes

Notes: *I expect a negative sign for FV for the non-bearer subsample, as developed in H1 and a positive sign for the bearer plant subsample, as developed in H2 (see 2.4 Hypotheses Development subsection for further details). See variables definitions in Table 3. t-statistics in parentheses. p-values in italic. Column (1) indicates the initial model for equation (1) for the non-bearer subsample. Column (2) indicates the macroeconomics control variables model estimation for equation (2) for the non-bearer subsample. Column (3) indicates the initial model estimation for equation (1) for the bearer plants subsample. Column (4) indicates the macroeconomics control variables model for equation (2) for the bearer plants subsample. Column (5) indicates the initial model estimation for equation (3) for the bearer plants subsample. Column (6) indicates the macroeconomics control variables model estimation for equation (4) for the bearer plants subsample. Rejection of the null hypothesis: ***significance level at 1%, **significance level at 5%, *significance level at 10%.