# Exploring the value relevance of biological assets and bearer plants: an analysis with IAS 41 Revision

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## Abstract

The purpose of this paper is to explore whether a relation exists between share market valuation and the accounting information about bearer plants and biological assets. The focus is supported in the most recent revision of IAS 41 *Agriculture*. This revision formally introduced the concept of bearer plants, moved them from biological assets to PP&E, and changed their prior measurement by the fair value model to the cost model. Our approach explores the usefulness of these changes under a valuation market approach. Our analysis settles that there is a positive association between share prices and agricultural-related assets. Overall, our results suggest that biological assets are value relevant and reveal that bearer plants are incrementally value relevant after IAS 41 revision. Besides, we envisage that these conclusions are driven by companies in countries where the value add of agriculture, forestry, and fishing as a percentage of the country's GDP is lower.

**Keywords:** Biological assets. IAS/IFRS. European Union. Value relevance.

## 1. Introduction

The purpose of this paper is to explore whether a relation exists between share market valuation and the accounting information about bearer plants and biological assets. The focus is related with the revision of IAS 41 – Agriculture, made by the International Accounting Standards Board (IASB), effective on or after 2016. This revision formally introduced the concept of bearer plants, removed those that would be as such classified from biological assets to Property, Plant, & equipment (PP&E) category, and changed their prior measurement by the fair value model to the cost model, which is not usual in financial markets.

Although this is a IFRS related issue, the concerns with agricultural-related SDG targets are in the United Nations agenda (United Nations, 2015), and the agriculture's contribution to GDP is analysed to tracking progress on food and agriculture (FAO, 2020), assuming its key and essential role in the global economy. As such, we posit that biological assets and bearer plants, two of the foremost important assets for companies with operations in the agricultural activities, have potential to attract a great deal of attention currently and in the near future. So, the information on this type of assets may have importance for stakeholders, especially for those that are investing in this industry and interested in market valuation. Reminding that the IASB from time to time proposes to revise agricultural related accounting standards, the accounting academy seems to do not give high attention to agricultural related issues and its relation to the market valuation of the underlined firms.

Up to today, only a small number of studies have investigated the impact of biological assets into market valuation (e.g. Gonçalves *et al*., 2017; Huffman, 2018), and the impact of the new revision of IAS 41 (e.g., Damian et al., 2014; Bozzolan *et al*., 2016; Bohusova & Svoboda, 2017). However, they are supported in expected values instead of real data from post-effective implementation. Thus, this paper aims to fill this gap, empirically exploring whether the accounting information for bearer plants and biological assets is value relevant, before and after the effectiveness of the IAS 41 revision. We construct a sample with *all* the European listed companies applying IFRS with data available for statistics procedures. The sample is small but includes all the observations with data available applying IFRS mandatorily, so, it is the unique setting to do our research. We use the so-called Ohlson equity valuation model, traditionally used in highly cited *value relevance studies*, controlling either for the most frequent used variables (size, profitability, and leverage) or for the contribution of the agriculture industry to the GDP of each European country.

Our analysis settles that there is a positive association between share prices and agricultural-related assets. Overall, our results suggest that biological assets are value relevant and reveal that bearer plants are incrementally value relevant after IAS 41 revision. Besides, we envisage that these conclusions are driven by companies in countries where the value add of agriculture, forestry, and fishing as a percentage of the country's GDP is lower. This is, potentially, an important contribution in a time that concerns with agricultural-related SDG targets are in the order of the day by organizations such as United Nations.

We contribute to prior research on the economic consequences of mandatory IFRS adoption, assuming the potential to improve and/or to harmonize financial reporting practices across countries. First, we add with a study that can be categorized in the "value relevance

studies" in the proposal of Brüggemann et al. (2013), but in which the intended or unintended consequences of IFRS adoption is not from voluntarily to mandatorily adoption, but from a mandatorily accounting policy to another one in a compulsory way. Second, IFRS currently do not provide industry-specific accounting guidance, but the IAS 41 is of special interest for companies with agricultural activities, with biological assets contributing to their financial position and performance. Given the scarce literature on the value relevance of these type of assets, our paper adds to help understand whether the changes implemented by accounting standard setters had impacts in the market valuation of companies where biological assets or bearer plants are important inputs for their business.

The remainder of this paper presents successively a brief history of IAS 41 – Agriculture (Section 2), the literature review and hypotheses development (Section 3), the sample, model and results (Section 4), the sensitivity and robustness (Section 5), and conclusions (Section 6).

## 2. Theoretical Framework

### 2.1. Brief history of IAS 41 - Agriculture

The first version of a specific standard on Agriculture issued by the former International Accounting Standards Board (IASB), at the time named International Accounting Standards Committee (IASC), was issued in 2000 to be applied for annual financial statements covering periods beginning on or after 1 January 2003. The IAS 41 – Agriculture established principles for the recognition, measurement, and presentation of information in financial statements related to agricultural activities under which the element *biological asset* is critical. Prior to the creation of IAS 41, biological assets were generally classified as property, plant, and equipment (PP&E) and measured at historical cost. Upon the effectiveness of IAS 41, most firms switched measurement of their biological assets to fair value (but cost model continued to exist as an exception). Several years later, the IASB amended IAS 41 twice: (i) in May 2008, to be effective for annual periods beginning on or after 1 January 2009; and (ii) in June 2014, effective for annual periods beginning on or after 1 January 2016. While the first change was related with minor improvements, mainly due to discount rates to apply in the measurement process, the second one resulted from a more extensive process, not only in the scope of IAS 41 - Agriculture, but also involving IAS 16 - Tangible Fixed Assets, in relation to the topic "Bearer Plants". According to IAS 41 (2014), a bearer plant is a living plant that: a) is used in the production or supply of agricultural

produce, b) is expected to bear produce for more than one period, and c) has a remote likelihood of being sold as agricultural produce, except for incidental scrap sales. Before this clarification about the definition of bearer plants, the prior IAS 41 required all biological assets related to agricultural activity to be measured at fair value less costs to sell. Nonetheless, the IASB observed that there is a class of biological assets that are held by an entity solely to grow produce over their productive life. After a debate on this topic emphasized on the 2014 amendments, IASB decided that bearer plants (but not the produce growing on them) should be treated as PP&E and, accordingly, should be accounted in accordance with the requirements in IAS 16 Property, Plant and Equipment. Summarizing, with the new regulation, companies with agricultural activities must detach from biological assets those classified as bearer plants, and apply to them the cost model as if they were traditional PP&E.

### 2.2. Capital markets theory and value relevance studies

To date, there is no single theoretical framework that has been uniquely used to study the expected financial market consequences of IFRS adoption. Consistent with previous IFRS-related research, we frame out study by the Ball and Brown (1968) capital market paradigm that analyses the impact of accounting numbers on market values. In particular our study focuses questions related with “Are accounting numbers value relevant?” (Kothari and Wasley, 2019). These focus fits the broad positive accounting theory firstly developed by Watts and Zimmerman (1986) to interpret the expected financial market consequences of accounting numbers - IAS 41 revision in this case-, and the view of Holthausen and Leftwich (1983), arguing that changes in accounting standards may adjust the distribution of firms' cash flows, or the wealth of those who use financial reporting numbers for decision-making. These perspectives help in the understanding of how financial markets are enforced to adopt global accounting standards, with both intended and unintended consequences, which might either result in positive or negative effects on capital markets at the macro-economic level (Brüggemann et al., 2013).

## 3. Literature Review and Hypothesis Development

There is a limited number of research studies related with the accounting for biological assets and agricultural activities, and the majority examines the value relevance of accounting

information of fair value (required by the first version of the IAS 41) and the historical cost (proposed as an exception in the first version of IAS 41). These studies were conducted before the effective date of the new IAS 41 (i.e., 2016), in a time when the debate was the switch from the cost model to the fair value model. At the time, authors suggested that the introduction of fair value measurement in biological assets had led to the provision of accounting information more relevant to the decision-making process of agricultural investors (e.g., Argilés *et al*., 2011; Silva *et al*.,2013), more useful for decision-making than historical cost (e.g., Argilés *et al*., 2011), with greater impact in the net worth of companies (e.g., Silva *et al*., 2013), and higher value relevance of accounting numbers in companies that have a high level of disclosures of (e.g., Gonçalves *et al*., 2017). Yet, only a restricted number of studies concerning the application of the revision of IAS 41 after its issue (i.e., 2014) and its effectiveness (i.e., 2016) on the implications of the changes caused by new guidance on a specific type of biological assets are published.

The need for further research studies is called by Gonçalves *et al*. (2017) and Damian *et al*. (2014), namely: to evaluate the effect of changes to IAS 41 and IAS 16 on the comparability of financial information; to assess whether or not changes to IAS 41 and to IAS 16 improve financial reporting; to measure whether changes to IAS 41 and to IAS 16 influence the investor's decision-making process. As such, value relevance of accounting information, especially when there is a change in regulations to study how it is reflected in the stock price and how this influences investor decision-making, is needed (Barth *et* al., 2001), and the changes in the measurement and reporting of reporting of bearer plants fits these calls.

The past research findings (e.g., Gonçalves *et al*.,2017; Argilés *et al*., 2011; Silva *et al*., 2013) consider the application of a standard with accounting procedures that are no longer in force. The impacts of the new standard included in earlier studies the are prospective, supported in expected values and not based in real data (e.g., Damian *et al*., 2014; Bozzolan *et al*., 2016; Bohusova & Svoboda, 2017). Svoboda & Bohušová (2017), in turn, is the first experience with the implementation of new requirements from IAS 41 after its effectiveness date, assessing the most appropriate measurement for these two different types of assets related to agricultural activities. Their results suggest that historical cost is the most appropriate for the measurement of bearer plants, while the measurement at fair value is more appropriate for animals alive, supporting that the changes to the revision of the IAS 41 are appropriate. Also, Huffman (2018) finds support for the IASB's decision to amend IAS 41 with respect to bearer biological assets. He examines whether fair value is more relevant when it is applied to in-exchange assets than when it is applied to in-use assets, and finds that

earnings information is significantly more relevant when firms measure in-exchange biological assets at fair value, but book value and earnings information is significantly less relevant when firms measure in-use biological assets at fair value. Thus, because bearer plants are classified in his study as in-use assets, he justified the appropriateness of the application of the cost model. However, his sample predates the IAS 41 amendment, and all the other studies (except Svoboda & Bohušová, 2017) cover sample period until 2014 at the most. A research covering data for 2016, date of the effectiveness of the IAS 41 revised in 2014, , as well as its potential impact on capital markets, is not acknowledged.

Thus, the purpose of this paper is to explore whether a relation exist between share market valuation and the accounting information about bearer plants and biological assets, examining its value relevance. The focus is related with the 2014 revision of IAS 41 – Agriculture, made by the International Accounting Standards Board (IASB), effective on or after 2016. This revision formally introduced the concept of bearer plants, moved them from biological assets to PP&E, and changed their prior measurement by the fair value model to the cost model. The relevance of accounting information can be determined through the quality of its association with firm market value (Barth et al, 2001; Holthausen and Wats, 2001). Based on previous studies, we question whether investors on companies with agricultural activities believe that information about biological is relevant for firm valuation, and it is measured with sufficient reliability. Our first research question is the following:

RQ: Is the accounting information of biological assets value relevant and, thus, associated with the companies' market value?

Furthermore, to analyze the (incremental) value relevance of bearer plants, presented as a category of PP&E and measured by the cost model, we state the following research question:

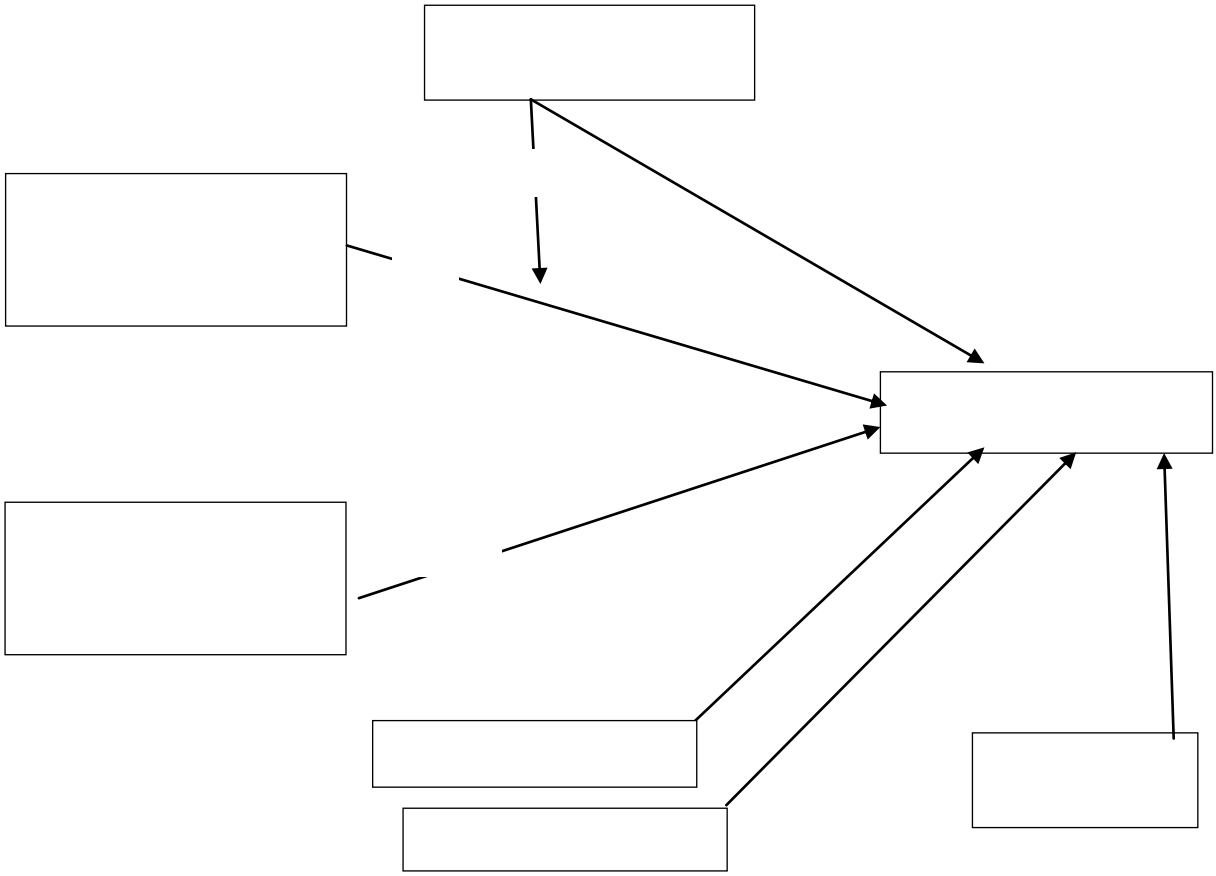
$RQ_2$: Is the stand-alone accounting information of bearer plants value relevant, beyond other accounting information?

Finally, it is important to point out that the stand-alone information about bearer plants is only captured after the effectiveness date of the IAS 41 revision (i.e., 2016), removing them from the scope of IAS 41 into the scope of IAS 16. Before that date, this element is included in the biological assets and measured at fair value. To empirically explore whether the change in the presentation and measurement of bearer plants have any impact on changes in the value relevance of biological assets, the following RQ is stated:

$RQ_3$: Has the value relevance of accounting of biological assets in explaining share prices remained constant after the separate recognition of bearer plants?

While the first RQ launches the validity of the explanatory power of biological assets, the second observes the strength of the revision of IAS 41 on bearer plants. The third examines if there is a maintenance, decline or increase of the value relevance on the biological assets considering the moderated role of the IAS 41 amendments to move bearer plants from biological assets to PP&E category. The conceptual model is depicted in Fig. 1.

**Figure 1: Conceptual diagram**



Legend:
The relation between the elements of the conceptual diagram and the variables used in the Equation models is as follows:
Biological assets: Includes $BAnc_{it}$ = Non-current biological assets per share of company i at the end of the fiscal year t; $BAc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t;
Bearer Plants: $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t;
Book value adjusted: $BV_{it}$ = Book value per share of company i at the end of the fiscal year t;
Earnings: $E_{it}$ = Earnings per share of company i at the end of the fiscal year t
Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$ = Residual random variable.
Market valuations: $VM_{it}$ = Market value per share of company i at the end of the fiscal year t; Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$ = Residual random variable.

## 4. Sample, Model and Results

### 4.1. Sample and data collection

The sample consists of companies listed in stock exchanges of European Union countries (because these are mandatorily applying IFRS in their consolidated financial statements) and with accounting information for biological assets available in Thomson Reuters Database. A first set of 86 entities is retrieved from 19 countries, confirming the small number of European companies with this element recognized and disclosed in financial statements. Five entities dropped because no websites were available, and no other procedure was effective for download their financial statements. Then, entities with financial statements prepared in a language other than English, and entities with negative shareholder´s equity, are removed. After eliminating outliers, the balanced final sample comprises information for 48 entities from 15 EU countries, with a total of 96 observations for the period before and after the adoption of the new version of IAS 14. To deal with extreme observation, winsorization is performed at 1% top and down. The years 2015 and 2016 are the only considered in this study, to capture the effect of the switch in the accounting and measurement procedures of bearer plants. Table 1 shows the selection (Panel A) and the composition of the sample by country (panel B). The percentage of companies with biological assets and bearer plants presented in the financial statements before and after the IAS 41 revision is presented in Panel C. As exposed, whereas all the companies in the sample presented biological assets but no bearer plants, after the IAS 41 revision only 56% of the companies showed no amounts for bearer plants, and the remaining are divided between those that recognized both type of assets (23%) and those who presented only bearer plants (21%).

The data related with accounting information comes from content analysis to the annual reports (consolidated financial statements) and then manually collected, downloaded from the websites of each entity included in the final sample. The content analysis depends of the narrative disclosed, but comprehends generally the Notes (e.g., accounting policies, prior year restatements, changes in accounting standards) and the Statement of financial position. Explicitly, the information collected covers: i) original currency; b) total shareholder´s equity; c) total assets; d) total fair value of current and non-current biological assets; e) total cost of bearer plants; f) analysis of the information about changes in IFRS. When necessary, all information is converted to Euros using the same procedure as Huffman (2018). Any other

data employed in the research models is retrieved from Thomson Reuters DataStream (e.g., number of shares outstanding, market prices).

**Table 1: Sample selection**

| | | |
|---|---|---|
| ***Panel A: Sample selection*** | | |
| | # of entities | # of observations |
| Initial sample | 86 | 172 |
| (-) website not found | (5) | (10) |
| (-) unavailability by language or existence | (29) | (58) |
| (-) entities with negative shareholders' equity | (2) | (4) |
| (-) outliers | (3) | (6) |
| = Final sample | 47 | 94 |
| ***Panel B: Distribution by countries*** | | |
| Germany | 2 | 4 |
| Belgium | 2 | 4 |
| Croatia | 2 | 4 |
| Spain | 5 | 10 |
| Finland | 4 | 8 |
| France | 4 | 8 |
| Ireland | 2 | 4 |
| Italy | 1 | 2 |
| Lithuania | 1 | 2 |
| Luxembourg | 2 | 4 |
| Netherlands | 4 | 8 |
| Portugal | 4 | 8 |
| Sweden | 4 | 8 |
| Ukraine | 1 | 2 |
| UK | 10 | 20 |
| = Final sample | 48 | 96 |
| ***Panel C: Companies with biological assets and bearer plants (%)*** | | |
| | Before IAS 41 revision | After IAS 41 revision |
| Biological assets but no bearer plants | 100% | 56% |
| Biological assets and bearer plants | - | 23% |
| Bearer Plants but no biological assets | - | 21% |

## 4.2. Model specification

Following prior research using value relevance regressions (e.g., Oliveira *et al*., 2010; Barth & Clinch, 1998; Barth et al., 2001) the following basic model is estimated to examine the association between book value and earnings information with share prices:

$$VM_{it} = \beta_0 + \beta_1 BV_{it} + \beta_2 E_{it} + \varepsilon_{it} \quad (1)$$

where $VM_{it}$= Market value per share of company i at the end of the fiscal year t; $BV_{it}$= Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; and $\varepsilon_{it}$= Residual random variable, capturing the effect of other information not reported in the financial statements but reflected in the share prices.

Then, to extend the basic model to capture the separate accounting information about IAS 41 (e.g., Gonçalves *et al*., 2017) in order to answer to Research Question 1 (RQ1) and 2 (RQ2) the variable $BV_{it}$ is decomposed to determine whether separate information about biological assets and bearer plants are value relevant. The variable $BV_{it}$ is transformed into $BVaj_{it}$ (book value per share excluding the effect of all the biological assets), and three additional variables are added, namely, $BAnc_{it}$ (non-current portion of biological assets), $BAc_{it}$ (current portion of biological assets), and $BP_{it}$ (Bearer Plants). The isolation of the $BP_{it}$ permits to analyze the post-IAS 41 effect, because only after 2016 this information is included as a PP&E, while previously is included in the non-current portion of biological assets ($BAnc_{it}$), particular important for testing H2. Including controls, it is expected that all coefficients of the book value, earnings and biological assets variables are positive and statistically significant (meaning that investors incorporate information this information into shares valuation), but the signal for the variable $BP_{it}$ is not advanced. The Eq. 2 is:

$$VM_{it} = \beta_0 + \beta_1 BVaj_{it} + \beta_2 E_{it} + \beta_3 BAnc_{it} + \beta_4 BAc_{it} + \beta_5 BP_{it} + Controls + \varepsilon_{it} \quad (2)$$

where: $VM_{it}$= Market value per share of company i at the end of the fiscal year t; $BV_{it}$= Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; $ABnc_{it}$= Non-current biological assets per share of company i at the end of the fiscal year t; $ABc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t; $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t; Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$= Residual random variable

The controls added rely on previous studies on value relevance. Specifically, the size of the company (e.g., Gonçalves et al., 2017; Huffman, 2018) measured by the natural logarithm of market capitalization, the profitability (e.g., Kim & Shi, 2012) measured by return on assets and the leverage (e.g., Barth et al., 2008) proxied by the ratio between total debt and common equity.

Thereafter, and to test RQ3 a dummy variable (*After*) is added to the prior equation to control for the year, assuming 1 if the accounting information comes from financial statements prepared under the new version IAS 41 (on or after 2016) and 0 otherwise. This dummy variable is used to create an interaction with BAnc and with BAc, to examine the effect of the IAS 41 on the value relevance of the current and non-current portion of biological assets. The interaction permits to capture whether the change in the IAS 41 intensifies or mitigates the association between the summarized information about biological assets (other than bearer plants) and the market value, as follows:

$$VM_{it} = \beta_0 + \beta_1 BVaj_{it} + \beta_2 E_{it} + \beta_3 BAnc_{it} + \beta_4 BAc_{it} + \beta_5 BP_{it} + \beta_6 After_{it} + \beta_7 After_{it} * BAnc_{it} + \beta_8 After_{it} * BAc_{it} + Controls + \varepsilon_{it} \quad (3)$$

While Equation 2 allows to identify whether biological assets and production plants have statistical significance for the explanation of market value, Equation 3 allows us to analyze whether the association of biological with market value has changed after the separate recognition of bearer plants in tangible fixed assets.

### 4.3. Descriptive analysis

Table 2 presents some descriptive statistics based on comparisons between companies before and after the IAS 41 revision. Panel A shows that the standard deviation is relatively high for the variables VM and BVaj due to differences in the size of companies. However, the number of European listed companies recognizing biological assets and applying IAS 41 is small, so, we decide to not exclude any other company, but control for the size with additional control variables. Because our main interest is related with the analysis on the variables capturing the effect of IAS 41, only those are detailed in the text. Panel A also exposes that the mean of the variables related with biological assets and bearer plants shows differences that can be related with the change of the standards. While the average of the non-current portion of biological assets per share decreases in the period after the IAS 41 revision (3.074 vs. 0.899), the average of bearer plants increases (0 vs. 2.030), because they were previously included in biological assets and measured under a different model. Furthermore, the mean and the maximum values of Bearer Plans (BP) are higher than the total of biological assets (BAnc+BAc) after the IAS 41 revision when compared to the previous version. The data do not show a normal distribution in the two groups (Kolmogorov-Smirnov normal adherence test not tabulated). Therefore, Wilcoxon signed-rank tests were used for comparisons between

the period before and after IAs 41 revision, as presented in Panel B. After the revision of IAS 41, Wilcoxon signed-rank tests indicated a significant increase in the variable Bearer Plants (BP), a significant decrease in the non-current portion of biological assets (BAnc) and no significant change in the current portion of biological assets (BAc). This finding is consistent with the expected impact of the IAS 41 revision, removing from biological assets those that fill the definition of bearer plant.

Pearson correlation is presented in Table 3 to relate the measured biological and bearer plants parameters, and to see the extent of correlation between each independent and dependent variable. While the non-current portion of biological assets (BAnc) is positively and significantly related with the market value (MV) before the IAS 41 revision, turns to negative and not significant after that revision. On the other hand, the variable Bearer Plants (BP) assumes a positive and significant correlation with MV after the IAS 41 revision. The correlation of the other independent variables with MV is similar before and after IAS 41 revision. This information also allows for evaluating the extent of multicollinearity between predictors and should be considered a serious concern only when correlation between two variables exceed 0.8 (Gujarati, 2004). In our data, multicollinearity is unlikely.

**Table 2: Descriptive of the main variables before and after IAS 41 revision**

***Panel A: Mean and standard deviation***

| | *Before IAS 41 revision* | | *After IAS 41 revision* | |
|---|---|---|---|---|
| | Mean | SD | Mean | SD |
| VM | 22.911 | 30.691 | 24.247 | 29.436 |
| BVaj | 17.082 | 28.901 | 17.814 | 30.529 |
| E | 1.474 | 3.548 | 1.439 | 2.160 |
| BAnc | 3.074 | 6.735 | 0.899 | 2.196 |
| BAc | 0.137 | 0.337 | 0.150 | 0.367 |
| BP | 0.000 | 0.000 | 2.030 | 5.731 |

***Panel B: Wilcoxon signed ranks test comparing before and after groups***

| | Z | p-value | r |
|---|---|---|---|
| VM | -2.540[a] | 0.011 | -0.26 |
| BVaj | -3.672[a] | 0.000 | -0.38 |
| E | -1.692[a] | 0.091 | -0.17 |
| BAnc | -2.732[b] | 0.006 | -0.28 |
| BAc | -0.732[a] | 0.429 | -0.07 |
| BP | -3.920[a] | 0.001 | -0.40 |

a. Based on negative ranks

b. Based on positive ranks

$VM_{it}$ = Market value per share of company i at the end of the fiscal year t; $BV_{it}$ = Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; $BAnc_{it}$ = Non-current biological assets per share of company i at the end of the fiscal year t; $BAc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t; $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t; Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$ = Residual random variable.

**Table 3: Pearson correlation of the main variables before and after IAS 41 revision**

| ***Panel A: Before IAS 41 revision*** | | | | | |
|---|---|---|---|---|---|
| | VM | BVaj | E | BAnc | BAc |
| BVaj | .769** | 1 | | | |
| E | .724** | .436** | 1 | | |
| BAnc | .319* | 0.100 | 0.209 | 1 | |
| BAc | -0.062* | -0.150 | -0.003 | -0.065 | |
| BP | - | - | - | - | - |
| ***Panel B: After IAS 41 revision*** | | | | | |
| | VM | BVaj | E | BAnc | BAc |
| BVaj | .683** | 1 | | | |
| E | .850** | .693** | 1 | | |
| BAnc | -0.026 | -0.009 | 0.131 | 1 | |
| BAc | -0.068 | -0.154 | 0.077 | 0.265 | 1 |
| BP | .373** | 0.130 | 0.238 | -0.147 | -0.098 |

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

$VM_{it}$ = Market value per share of company i at the end of the fiscal year t; $BV_{it}$ = Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; $BAnc_{it}$ = Non-current biological assets per share of company i at the end of the fiscal year t; $BAc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t; $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t; Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$ = Residual random variable.

## 4.4. OLS regression and discussion

Before running the OLS regressions, a transformation method based on normal z-scores was performed using Blom's procedure (Headrick & Rotou, 2001) to warranty that all the variables follow a normal distribution. Table 4 presents the estimation results of models (1) to (3). The model fit can be assessed through the overall r-squared, and it ranges from 0.783 (Eq. 1) to 0.860 (Eq. 2 and Eq.3), indicating that empirical models explain nearly 78 to 86 percent of the variation in share prices.

**Table 4: Results for OLS Regressions**

| ***Dependent variable:*** | VM | VM | VM |
|---|---|---|---|
| Equation models: | Eq.(1) | Eq.(2) | Eq.(3) |
| Hypotheses: | Basic equity valuation | H1 & H2 | H3 |
| Constant | -0.004*** | -2.198*** | -2.213*** |
| | [0.048] | [0.314] | [0.310] |
| BVaj | 0.537*** | 0.416*** | 0.405*** |
| | [0.068] | [0.067] | [0.068] |
| E | 0.418*** | .411*** | .418*** |
| | [0.068] | [0.080] | [0.080] |
| **BAnc** | | **0.172*** ** | **0.230*** ** |
| | | **[0.052]** | **[0.067]** |

| | | | |
|---|---|---|---|
| **BAc** | | **0.120**** | **0.162**** |
| | | **[0.051]** | **[0.072]** |
| **BP** | | **0.205***** | **0.181**** |
| | | **[0.068]** | **[0.082]** |
| After | | | -0.030 |
| | | | [0.093] |
| After x BAnc | | | -0.139 |
| | | | [0.101] |
| After x BAc | | | -0.070 |
| | | | [0.097] |
| Controls | Not included | Included | Included |
| Max.VIF | 1.956 | 4.318 | 4.434 |
| DW | 1.811 | 1.832 | 1.842 |
| Adjusted $R^2$ | 0.783 | 0.860 | 0.860 |

Table 4 presents the results of OLS regressions examining the association between accounting information presented in financial statements and market value. Standard errors corrected for heteroscedasticity presented [in brackets]. *** p<0.01, ** p<0.05, * p<0.10.
$VM_{it}$ = Market value per share of company i at the end of the fiscal year t; $BV_{it}$ = Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; $BAnc_{it}$ = Non-current biological assets per share of company i at the end of the fiscal year t; $BAc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t; $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t; *After* = 1 if the accounting information comes from financial statements prepared under the new version of IAS 41 (on or after 2016) and 0 otherwise; Controls = a set of variables to control for size, leverage, and profitability; and $\varepsilon_{it}$ = Residual random variable.

The estimation of Eq. 1 shows that the coefficients of the variables assigned to book value per share and to earnings per share are positive and statistically significant, showing the accuracy of this equity valuation model to determine the explanatory power of summarized accounting information presented in financial statements to the share market prices.

The estimation of Eq. 2 demonstrates that BAnc, BAc and BP have a positive and statistically significant association with the market value of the companies with a regression coefficient of 0.172 (p<0.001), 0.120 (p<0.05) and 0.205 (p <0.01), respectively. These findings lead to not reject the null for H1 and H2. The variable BP, however, is 0 for half of the sample (pre-IAS 41 revision). Thus, the estimation of Eq. 3 includes the interaction term between *After* (information post-IAS 41 revision) and BAnc and BAc, to analyze the incremental value relevance of information related to biological assets when bearer plants are also separately presented. The coefficient of the variable BP is still positive but it is reduced in magnitude (β=0.181) and lost statistically significance (p>0.05). The coefficients on BAnc and BAc are still positive and they are somewhat increased in magnitude (β=0.230 and β=0.162, respectively) maintaining the same level of significance. However, the coefficient of the dummy variable After (β=-0.030) and of the interaction terms (After*BAnc: β=-0.139; After*BAc: β=-0.0370) are not statistically significant at conventional levels. These findings indicate that the mandatory information for bearer plants included in PP&E and measured at the cost model after IAS 41 revision is value relevant and may achieve higher valuations

relative to that information included in biological assets. Furthermore, accounting information about biological assets measured at the fair value model is also value relevant, and this relevance did not change after the IAS 41 revision. This suggests that the change of the IAS 41 revision drive up firm value due to the incremental value relevance of bearer plants.

At *IASB's 2011 Agenda,* the IASB sought to know the opinion of investors and analysts who use financial statements of companies with bearer plants. At the time, investors claimed that the fair value of bearer plants would not be relevant to their analyses, since they do not influence future cash flows (IASB, 2013, BC58), and most of the claimed that information on the fair value of bearer plants had limited, or not even had, use (IASB,2013, BC60). In addition, some of these users claimed that they would prefer the cost model in the measurement of bearer plants, because it would provide better information for future capital investments than a fair value model (IASB,2013, BC58). As such, the IASB expected that changes to the standard would provide more relevant/useful information for financial statement users (IASB,2013, BC59). Through this empirical study we can conclude that one of the objectives of the IASB was successful, since the findings suggest that the change produces incremental value relevance to investors.

Prior studies on the value relevance of biological assets indicate that the fair value model produces more relevant information than the cost model (Gonçalves *et al*., 2017; Argilés *et al*., 2011; Silva *et al*., 2013). But Huffman (2018) proposes that the measurement of biological assets should be done considering their use, and that measuring biological assets that are for production (not consumable) by the cost model provides more relevant information than measured by the fair value model. The results of our study support the suggestions of Huffman (2018) specifically applied to bearer plants and supports also the work of IASB in their agenda for revising the IAS 41.

## 5. Sensitivity and robustness checks

This section provides some sensitivity analyses designed to examine the robustness of the prior findings.

***Alternative regression model***. We have a small sample, in which the number of observations of each country varies widely, ranging from 2 to 20. This raises the probability that the variance of the prediction errors would not be constant, violating an important regression assumption, and we turn around this potential problem transforming the original

variables. In this section, and to confirm the analysis of the previous section, we test our hypotheses using the weighted least squares (WLS) regression, instead of OLS regression, weighting each case by the square root of the sample size, which reduces heteroskedasticity in the error variance (Hanushek and Jackson, 1977) and repeating all the analyses. When we use WLS estimator, the conclusions drawn are the same as those using the OLS estimator. Table 5, column (1), displays the results for Equation (3) to compare prior results.

***Alternative valuation model*.** To check the consistency of the hypotheses, we explore whether biological assets and bearer plants are associated with market valuation of companies using other variables for capture the equity valuation. Thus, market price for share is replaced by Tobin Q ratio, and by Market-to-Book value. The summarized information for book value and earnings is omitted. The signs of the main variables are maintained, but the association with the dependent value is weaker. By another hand, we also build up the Equation (3) based on the balance sheet approach, under which book value is replaced by its decomposition of assets (other than biological assets and bearer plants), and liabilities, maintaining all the other variables. The conclusions are the same as those presented in the previous section. Table 5, column (2) shows the results for the separate presentation of assets and liabilities using the OLS regression.

***Alternative control variables*.** Prior variables to control for size (natural logarithm of market capitalization) and profitability (return on assets) were replaced by natural logarithm of total assets and by return on equity. Furthermore, an additional variable "legal origin" is added to control for country differences. The main findings, not reported, are retained.

***Inclusion of information about value add of agriculture, forestry, and fishing as a percentage of GDP*.** The agriculture's contribution to GDP is assumed as having a key and essential role in the global economy (FAO, 2015), and the concerns with agricultural-related SDG targets are in the order of the day by organizations such as United Nations. Given the sample size, no additional values to capture differences among countries were added in the analyses of the previous section, except the legal origin as a sensitivity test. However, in this subpoint we include a variable to capture the contribution (in percentage) of agricultural activities to the GDP of each country, as disclosed by The World Bank (variable: Agricult_va). Results show that this new variable is not statistically significant, and its inclusion does not change any of the prior findings. Table 5, Column (3) presents.

***Split the sample based on information about value add of agriculture, forestry, and fishing as a percentage of GDP.*** Continuing from preceding paragraph, and since countries "need to step up efforts to support small-scale food producers, conserve plant and animal genetic resources for food and agriculture, adopt measures to counter food price volatility (…) in line with agriculture's contribution to GDP" (FAO, 2020:10), we present a cross-section comparison splitting the sample based on the median of the percentage of the contribution of agriculture to the GDP in each country. This procedure was run with both WLS and OLS regression, and the conclusions are the same. For ease of process and interpretation, only the OLS regression is presented in Table 5, Column (4). The direction, i.e., the positive sign of the coefficients of all main variables with the share prices presented in the previous section is sustained, regardless of the lower (column 4a) or higher (column 4b) contribution of the agricultural activities to the countries' GDP. But the statistical significance of the coefficients of the variables biological assets and bearer plants is preserved only in countries with lower percentage of agriculture activities to GDP, suggesting that only in these environments the accounting information about agricultural-related assets are incorporated into market valuation. This result is not additionally explored in this study but potentially is of interest for future research.

**Table 5. Sensitivity and robustness checks**

| | **Column (1)** | **Column (2)** | **Column (3)** | **Column (4)** | |
|---|---|---|---|---|---|
| | **WLS regression** | **OLS Regression** | **OLS regression** | **OLS regression** | |
| | | | | **Column (4a)** | **Column (4b)** |
| | Based on Eq. (3) | BVAj replaced | new variable added | lower Agric_va | higher Agric_va |
| Constant | -2.199*** | -2.259*** | -2.187*** | -2.536*** | -1.474*** |
| | [0.282] | [0.296} | [0.330] | [0.537] | [0.433] |
| BVaj | 0.424*** | | 0.407*** | 0.281*** | 0.670*** |
| | [0.059] | | [0.069] | [0.103] | [0.115] |
| E | 0.405*** | 0.305*** | 0.416*** | 0.421*** | 0.306*** |
| | [0.073] | [.084] | [0.081] | [0.141] | [0.097] |
| Assets | | 0.586*** | | | |
| | | [0.106] | | | |
| Liabilit | | -0.110** | | | |
| | | [0.073] | | | |
| **BAnc** | **0.113*** ** | **0.217*** ** | **0.230*** ** | **0.183** ** | 0.176 |
| | **[0.047]** | **[.063]** | **[0.067]** | **[0.098]** | [0.109] |
| **BAc** | **0.128** ** | **0.119** ** | **0.161** ** | **0.211** ** | 0.074 |

| | | | | | |
|---|---|---|---|---|---|
| | **[0.055]** | **[0.068]** | **[0.072]** | **[0.118]** | [0.084] |
| **BP** | **0.173*** ** | **0.227*** ** | **0.181** ** | **0.256** ** | 0.053 |
| | **[0.062]** | **[0.077]** | **[0.083]** | **[0.118]** | [0.135] |
| After | -.015 | -.073 | -0.140 | | .015 |
| | [0.088] | [0.087] | [0.062] | | [0.115] |
| After*BAnc | -.141 | -.135 | -0.043 | | -0.244 |
| | 0.094] | [0.096] | [0.042] | | [0.143] |
| After*BAc | -.089 | -.033 | [0.157] | | -0.002 |
| | [0.106] | [0.092] | [0.024] | | [0.114] |
| Agricult_va | | | -0.011 | | |
| | | | [0.043] | | |
| Controls | Included | Included | Included | Included | Included |
| Max.VIF | 5.305 | 8.541 | 4.384 | 4.776 | 5.654 |
| DW | 1.801 | 1.843 | 1.964 | 2.131 | 1.720 |
| Adjusted $R^2$ | 0.885 | 0.876 | 0.858 | 0.822 | 0.900 |

Table 5 presents the results of WLS regression (Column (1)) and OLS regressions (Column (2)-(4)), examining the association between accounting information presented in financial statements and market value. Standard errors presented [in brackets]. *** p<0.01, ** p<0.05, * p<0.10.
$VM_{it}$ = Market value per share of company i at the end of the fiscal year t; $BV_{it}$ = Book value per share of company i at the end of the fiscal year t; $E_{it}$ = Earnings per share of company i at the end of the fiscal year t; $BAnc_{it}$ = Non-current biological assets per share of company i at the end of the fiscal year t; $BAc_{it}$ = Current biological assets per share of company i at the end of the fiscal year t; $BP_{it}$ = Bearer plants per share of company i at the end of the fiscal year t; *After* = 1 if the accounting information comes from financial statements prepared under the new version of IAS 41 (on or after 2016) and 0 otherwise; Controls = a set of variables to control for size, leverage, and profitability; Assets= Total assets per share of company i at the end of the fiscal year t; Liabili= Total liabilities per share of company i at the end of the fiscal year t; Agricult_va=value added of agriculture, forestry, and fishing as a percentage of GDP.

## 6. Conclusion

This study examines whether the extent to which the accounting for bearer plants and biological assets is value relevant on a sample of European listed companies. We hypothesized that the accounting information of bearer plants measured by the cost model and presented as PP&E, according with the IAS 41 revision, may positively associate with share market valuation. Furthermore, we propose that the accounting information of biological assets measured by the fair value model and presented stand-alone may also be positively associated with share market valuation, and that this information after the revision of IAS 41 continues to be value relevant.

Following research in the field (e.g., Gonçalves *et al.*, 2017), we content-analyzed the annual report of European listed companies and hand collected information about biological assets and bearer plants, before and after the revision of IAS 41, which has been than incorporated in a equity valuation model. The outcomes of correlation and regression analysis suggests that information on biological assets and bearer plants is to some extent incorporated into market value, as prior research also suggests. The most interesting finding, however, is that the information of bearer plants is value relevant, and incremental

value relevant over the accounting information on biological assets. By the other hand, information about biological assets measured by fair value is also value relevant, and this relevance do not change after the removing of bearer plants from biological to PP&E. With the lens of positive accounting theory, these findings suggest that information in financial reports is incorporated in the equity markets valuation. Our results are in line with prior research with estimated values but extended to incorporate real effects of the change on IAS 41 revision effective for periods standing on and after 2016. This work supports the view of IASB on the usefulness and relevance for decision making process of this revision, by introducing the debate and the accounting for bearer plants. Furthermore, and considering the contribution of agricultural to the countries' wealth (e.g., GDP) and the concerns with the target of SDG, this study can shed light on future research to analyze the macro-economic consequences of IAS 41 revision. Our preliminary outcomes on this issue (robustness checks) reveal that the main findings (direction and statistical significance of the independent variables) are driven by companies located in countries where the value-added contribution of agriculture-related activities to the GDP is lower, but weaker in countries where that contribution is higher. This may suggest in those countries where the contribution of agricultural activities to GDP is higher, equity market prices incorporate information from other sources than financial statements, but in countries where that contribution is lower investors are aware of all sources of agricultural investments, and the accounting information in the financial statements plays a role for their decision-making process.

The potential contribution of this paper is twofold: first, our empirical results support and extend prior research on the value relevance of biological assets by lengthening its scope to include bearer plants; second, they add empirical substance to the debate surrounding the application of the cost model or the fair value model to assets related with the agricultural activity; third, they open an avenue to research on different country characteristics according to the contribution of agriculture activities to the country wealth (e.g., GDP) since our robustness tests reveal that our finding are completely corroborated in countries with lower percentual levels of this contribution, and partially achieved in countries with higher percentual levels.

Lastly, our study is not free from limitations. The foremost is the sample size and period. However, we have included all the European listed companies with data available on the main variables used, and the decision for the sample period is to focus on the first year of IAS 41 revision without bias from fluctuations in accounting procedures due to changes on other IFRS revisions.

## 7. References

ARGILÉS, J. M.; SLOF, E. J. New opportunities for farmaccounting. *European Accounting Review*, v.10, n.2, p. 361–383, 2001.

ARGILÉS, J. M.; GARCIA-BLANDON, J.; MONLLAU, T. Fair value versus historical cost-Based valuation for biological assets: Predictability of financial informations. *Revista de Contabilidad-Spanish Accounting Review*, v.14, n.2, p. 87-113, 2011.

BARLEV, B.; HADDAD, J. R. Fair value accounting and the management of the firm. *Critical Perspectives on Accounting*, v.14, n.4, p. 383–415, 2003.

BARTH, M. E.; CLINCH G. Revalued financial, tangibles, and intangible assets: associations with share prices and non-market-based value estimate. *Journal of Accounting Research*, v.36, p.199-233. 1998.

BARTH, M. E.; BEAVER, W. H.; LANDSMAN, W. R. The relevance of the value relevance literature for financial accounting standard setting: another view. *Journal of Accounting & Economics*, v.31, n.1-3, p.77-104, 2001.

BARTH, M.; LANDSMAN, W.; LANG, M. International Accounting Standards and Accounting Quality. *Journal of Accounting Research*, v.46, n.3, p. 467-498, 2001.

BOHUSOVA, H.; SVOBODA, P. Will the amendments to the IAS 16 and IAS 41 influence the value of biological assets? *Agricultural Economics (Czech Republic)*, v.63, n.2, p. 53–64, 2017.

BOZZOLAN, S.; LAGHI, E.; MATTEI, M. Amendments to the IAS 41 and IAS 16 – Implications for accounting of bearer plants. *Agricultural Economics (Czech Republic)*, v.62, n.4, p.160–166, 2016.

BRÜGGEMANN, U.; HITZ, J.M.; SELLHORN, T. Intended and unintended consequences of mandatory IFRS adoption: a review of extant evidence and suggestions for future research, *European Accounting Review*, v.22, n.1, p.1-37, 2013.

DAMIAN, M.; MĂNOIU, S.; BONACI, C.; STROUHAL, J. Bearer Plants: Stakeholders' View on the Appropriate Measurement Model. *Journal of Accounting and Management Information Systems*, v.13, n.4, p.719–738, 2014.

DOANE, D., SEWARD, L. *Statistics applied to administration and economics* (4thed.). Brazil : McGraw Hill, 2014.
ELAD C.; HERBOHN, K. *Implementing fair value accounting in the agricultural sector*. Edinburgh: Institute of Chartered Accountants of Scotland, 2011.

ELAD, C. Fair Value Accounting in the Agricultural Sector: Some Implications for International Accounting Harmonization. *European Accounting Review*, v.13, n.4, p.621–64, 2004.

ERNST AND YOUNG GLOBAL LIMITED. Bearer plants – the new requirements. https://vdocuments.net/ey-ifrs-developments-changes-proposed-to-the-requirements-for-bearer-plants.html, 2014.

FAO-FOOD AND AGRICULTURE ORGANIZATIONS OF THE UNITED NATIONS. Tracking progress on food and agriculture – related SDG indicators 2020. http://www.fao.org/sdg-progress-report/en/, 2020.

GONÇALVES, R.; LOPES, P.; CRAIG, R. Value relevance of biological assets under IFRS. *Journal of International Accounting, Auditing and Taxation*, v.29, p.118-126, 2017.

GUJARATI, D. *Basic Econometrics*, 4th edition. McGraw Hill, 2004.

HANUSHEK, E.A; JACKSON, J.E. *Statistical Methods for Social Scientist*. New York, Academic Press, 1977.

HEADRICKA, T.; ROTOUB, O. An investigation of the rank transformation in multiple regression. *Computational Statistics & Data Analysis*, v.38, p.203–215, 2001.

HERBOHN K.; HERBOHN J. International Accounting Standard (IAS) 41: what are the implications for reporting forest assets? *Small-scale Forest Economics, Management and Policy*, v.5, p.175–189, 2006.

HINKE, J.; STÁROVÁ, M. The Fair Value Model for the Measurement of Biological Assets and Agricultural Produce in the Czech Republic. *Procedia Economics and Finance*, v.12, p.213–220, 2014.

HOLTHAUSEN, R. W; LEFTWICH, R. W. The economic consequences of accounting choice: implications of costly contracting and monitoring. *Journal of Accounting and Economics*, 5, p.77–117, 1983.

HOLTHAUSEN, R. W.; R. L. WATTS. The relevance of the value relevance literature for financial accounting standard setting. *Journal of Accounting and Economic*, v.31, n.1–3, p.3–75, 2001.

HUFFMAN, A. Asset use and the relevance of fair value measurement: evidence from IAS 41. *Review of Accounting Studies*, v.23, n.4, p.1274–1314, 2018.

IASB - INTERNATIONAL ACCOUNTING STANDARDS BOARD. Exposure Draft /2013/8: Agriculture: Bearer Plants Proposed amendments to IAS 16 and IAS 41. http://archive.ifrs.org/Current-Projects/IASB-Projects/Bearer-biological-assets/Exposure-Draft-June-2013/Pages/Exposure-Draft-and-Comment-letters.aspx, 2015.

IASB - INTERNATIONAL ACCOUNTING STANDARDS BOARD (2015). IAS 41 - Agriculture. http://www.ifrs.org, 2015.

KIM, J.; SHI, H. Voluntary IFRS Adoption, Analyst Coverage, and Information Quality: International Evidence. *Journal of international Accounting Research*, v.11, n1, p.45-76, 2012.

KOTHARI, S.P.; WASLEY, C. Commemorating the 50-YearAnniversary of Ball and Brown (1968): The Evolution of Capital Market Research over the Past 50 Years. *Journal of Accounting Research*, v.57, n.5, p.1117-1159, 2019.

NIÅ, C., & ÅŽTEFEA, P. International Accounting Standard 41 (IAS 41) - Implication for Reporting Crop Assets. *Lucrări Ştiinţifice Management Agricol*, v.15, n.3, p.100, 2013.

OHLSON, J. Earnings, book value and dividends in security valuation. *Contemporary Accounting Research*, v.11, p.611–687, 1995.

OLIVEIRA, L.; RODRIGUES, L.; CRAIG, R. Intangible assets and value relevance: Evidence from the Portuguese stock exchange. *British Accounting Review*, v.42, p.241-252. 2010.

SILVA, A.; MARTINS, V.; MACHADO, M. Adoption of fair value for biological assets: analysis of its relevance in Brazilian companies. *Revista Universo Contábil*, v.9, n.4, p.110-127, 2013.

SILVA, R.; NARDI, P.; RIBEIRO, M. Earnings Management and Valuation of Biological Assets. *Brazilian Business Review*, v.12, n.4, p.1–26, 2015.

SVOBODA, P.; BOHUŠOVÁ, H. Amendments to IAS 16 and IAS 41: Are There Any Differences between Plant and Animal from a Financial Reporting Point of View? *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*, v.65, n.1, p.0327–0337, 2017.

UNITED NATIONS. Draft resolution referred to the United Nations summit for the adoption of the post-2015 development agenda by the General Assembly at its sixty-ninth session, Transforming our world: the 2030 Agenda for Sustainable Development. https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_70_1_E.pdf, 2015.

WATTS, R.; ZIMMERMAN, J. *Positive Accounting Theory*. New Jersey: Prentice-Hall Inc., 1986.

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