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Financial Accounting

Impact of amendments on agricultural firms

The effect of amendment IAS 16 and IAS 41 on reported gross profit of South American agricultural firms.

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Abstract

The various accounting standards that exist in our world can potentially have an influence on the reported profits of the firms. This thesis researches what the impact of the amendment of IAS 16 and IAS 41 is on reported gross profit based on a dataset of 1,035 South American agricultural firms between 2014-2018 with the use of a fixed effects panel data regression analysis. The results show a non-significant coefficient for the dummy variable Amendment. From this is concluded that there was no significant change in profitability after introducing the amendment and thus there was no clear effect on the reported gross profit of agricultural firms in South America.

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1 Introduction

One of the primary goals of a business is profitability. If a firm is not profitable, it will not survive long-term. Measuring and projecting profitability is thus of importance. The various accounting standards that exist in our world potentially have influence on the reported profits of the firms and are therefore heavily debated (Hofstrand & Johanns, 2019). This paper looks into an amendment of one of the standards proposed by the International Accounting Standards Board (IASB) who makes the International Financial Reporting Standards (IFRS), namely the amendment of IAS 16 *Property, Plant and Equipment* and IAS 41 *Agriculture* where bearer plants are moved from the scope of IAS 41 to IAS 16. The consequence is a change in measurement method for this certain type of biological asset (Deloitte, 2014).

In this thesis the impact of this change in measurement method is investigated in the context of South American agricultural firms. South America currently produces around a quarter of the world's export of agricultural produce and is only expected to grow even more (FAO, 2019). The central research question of this thesis is:

What is the impact of the amendment of IAS 16 and IAS 41 of biological assets on the reported profitability of South American agricultural companies?

At the moment of writing this paper there are quite some papers about the general effect of this amendment. Most papers focus on the effects in the Czech Republic, which has a very different style of agricultural industry and is not comparable to South America (Jana & Marta, 2014; Svoboda & Bohušová, 2017). Other papers focus solely on the comment letters given when the IASB proposed the amendment (Bozzolan et al., 2016; Damian et al. 2014). One paper discusses the influence of the amendment on Brazilian sugar-energy companies (Souza & Shikida, 2021). Thus, this thesis will add to the existing literature since there is limited research done into South American agricultural firms. Furthermore, it broadens the search scope of data compared to the paper by Souza & Shikida (2021) by taking data from more countries and more types of agricultural firms.

The social relevance of this thesis is that the amendment was quite a change for the agricultural firms and it will be interesting for them to see whether it influenced their reported profitability. The change of valuation method was mainly brought forward because it would be more in line with the nature of the assets. Mature bearer biological assets are not in a biological transformation anymore and thus it is thought by stakeholders that fair value measurement is not appropriate (Damian et al., 2014). This thesis will analyze whether the amendment has mainly brought benefits or drawbacks for the firms that use IFRS. Moreover, it is interesting for the IASB to see what the influence has

been of the amendment on the profitability of the firms. The goal of the IASB is to make standards which are comparable between firms and represent the accounting information reliably. Moreover, the IASB cares about the stakeholders' interest and they should receive true and fair information as much as possible. If a significant impact is found it can be concluded that the amendment reached the goals of the IASB as it resulted in a view of the firm's performance which was fairer and closer to reality.

The paper continues as follows: the first section provides some background information on the agricultural sector, both globally and specified on South America. Furthermore, this section contains the implications of IAS 41, IAS 16 and the amendment and concludes with a literature review of existing papers. The next section presents the hypothesis that is tested in this paper. Section 4 explains the methodology. Section 5 describes the dataset and its source, including descriptive statistics. Section 6 presents the analysis of the results. Finally, the conclusion summarises the results and discusses the implications of the findings, the limitations of this research and suggestions for future research.

2 Background and literature review

This chapter provides some background information for this thesis. It starts with the importance of agriculture in general and discusses the agricultural situation in South America in more detail. Next, it explains IAS 41 before the amendment and the amendment of IAS 16 and IAS 41. Finally, it reviews existing relevant literature.

2.1 Importance of agriculture

Even though agriculture only accounts for a small share of the global economy, the average value added in 2019 as percent of GDP was 10.19% (The global economy, n.d.), it is a sector that is a key part in the lives of many. In 2012 approximately 19% of the world population was engaged with farming. Furthermore, the agricultural sector is still developing and growing. In the past half century, the agricultural output grew more than threefold, an average growth of 2.25% per year. Since the world population is expected to increase even more in the future, enough food and thus agricultural commodities are necessary. Hence this sector will only grow even more (Alston & Pardey, 2014).

Agriculture is as well of importance for the economic development of a country. According to Muharram Macatta (2016): 'The agriculture sector is the backbone of an economy which provides the basic ingredients to mankind and now raw material for industrialisation.' There is a positive correlation between agricultural production and per-capita income, especially in developing countries. The overall economic development of countries grows when there is more invested into agricultural commodities and productivity. Similar results were found by Self & Grabowski (2007). Their results showed that agricultural modernization positively impacted economic growth.

In the article by Macatta (2016) it is even stated that when a country wants to focus on economic development, the starting point is in the agricultural sector. Due to it being the basic source for food and in each country, whether developed or underdeveloped, food is a basic need. Similar conclusions were made earlier by Meijerink & Roza (2007), Timmer (1992) and Johnston & Mellor (1961).

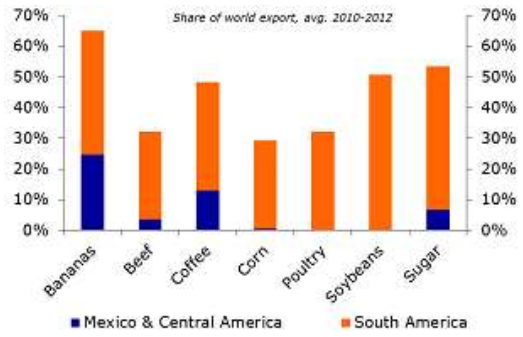
2.2 Agriculture in South America

Agriculture is thus of big importance in the whole world, but definitely in South America. This region represents 16% of total food and agriculture exports between 2012 and 2014 (Rabobank, 2015) and for certain kind of commodities they even represent 30% of the exports (see figure 1). Moreover, it is expected by the FAO (2019) that Latin America and the Caribbean will grow their exports of agricultural and fishery products to 25% of the global agricultural and fishery exports by 2028. This is

mainly due to the fact that in South America there are significant resources of unexploited agricultural land and fresh water, which ensures future possibilities of growth. Agriculture is not solely important for South America; South America is important for the global agricultural sector (Rabobank, 2015).

Another reason for their large share in exports is the variety of products. From Argentinian beef and Brazilian corn to Ecuadorian bananas. In figure 1 the share of export of South American agricultural firms are depicted for different commodities in 2010 to 2012. What can be taken from this figure is, as stated above, that South America has a wide variety of agricultural products it exports to the rest of the world and of these products it is moreover the main exporter (Rabobank, 2015).

Figure 1: Share of world export from 2010-2012 for Mexico & Central America and South America



Source: Rabobank (2015)

The structure of agriculture in South America has experienced quit a change in the last decades. Formerly it existed of small and medium farms who had ownership over the land and capital. However, corporate farming structures started to arise and farms started to merge. This trend got predominantly introduced by cost- and resource-saving incentives and public policies (Feshchenko, 2019). The same conclusions are made by Rabobank (2015). They conclude that a significant percentage of land is owned by large private owners.

2.3 IAS 41 *Agriculture*

IAS 41 *Agriculture* concerns the accounting treatment, presentation of financial statement and disclosures for agricultural firms. The scope entails biological assets during growth, degeneration, production and procreation. As well for the initial measurement of produce at point of harvest, including the produce on bearer plants, and government grants related to biological assets (IFRS, 2021).

IAS 41 was issued by the IASB in 2000, and first applied after the first of January 2003. The reason for the introduction of this standard was due to the agricultural sector being in need of an industry specific standard since they make use of living animals or plants (Deloitte, n.d. a).

According to IAS 41, initial recognition of a biological asset is only done if the entity has control over the asset resulting from past events, it is probable that future economic benefits will be provided and that the fair value or cost of the asset can be measured reliable. At initial recognition and subsequent reporting dates biological assets are measured by using fair value less estimated costs. The gain on initial recognition and changes after this is recognised in profit or loss (Deloitte, n.d. a). Furthermore, biological assets that are attached to land are measured separately from each other (IFRS, 2021).

The fair value of biological assets or produce is calculated by subtracting the costs to sell the produce from the market price. Commissions, levies, taxes and duties are included in costs to sell (IFRS, 2021).

2.4 Amendment of IAS 16 and IAS 41

From the beginning of IAS 41 there were many concerns from preparers and users of the standard, especially about the relevance and usefulness of information for the mature bearer biological assets.

First the definition, according to Deloitte (2014), by the IASB of bearer plants is the following:
"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."

An example of a bearer plant are grape vines, which produce grapes for wine for example. Grape vines also clearly comply to the second and third definition aspect. They are used for many years; some wineries have grape vines of over 100 years old. Also, the plants will likely not be sold as agricultural produce.

Bearer plants thus are only used to grow produce and do not partake in any significant biological transformation. The IASB therefore states that they are comparable to manufacturing assets and should be measured in the same way, hence they moved bearer plants from the scope of IAS 41 to the scope of IAS 16 *Property, Plant and Equipment*. If bearer plants would have been kept in the scope of IAS 41, the use of the fair value method would result in under- or overvaluation of assets.

This under- or overvaluation is caused by the assets not partaking in a significant biological transformation. Another reason is that due to bearer plants having a very long life it is difficult to find a market to use for measuring the value of the asset in the fair value method in IAS 41. This all results in a wrong depiction of the financial information (Deloitte, 2013).

The amendment became effective from first of January 2016. Also, to stress again, the amendment only focuses on bearer plants and not on bearer animals. Furthermore, a bearer plant only entails the plant itself. The produce still falls under the scope of IAS 41 and is thus accounted for with a fair value method (Deloitte, 2014).

The main change caused by the amendment was the switch in valuation method for bearer plants. As discussed in 2.3, biological assets are measured at fair value less estimated costs under IAS 41. In IAS 16 assets and thus bearer plants are initially measured at cost. Recognition should be done when it is expected that the future economic benefits will flow to the entity and when the costs of the assets can be measured reliably. After initial recognition bearer plants are measured either through costs or at revaluation. The cost model values the asset at cost less accumulated depreciation and impairment. The revaluation model values the asset at a revalued amount. This revalued amount equals the fair value at the revaluation date less subsequent depreciation and impairment, under the assumption that fair value is measured reliably. With the latter model it is important to carry out revaluations regularly. Bearer plants are depreciated on a systematic basis over the useful life (Deloitte, n.d. b).

2.5 Literature review

A paper that focuses on the Exposure Draft (ED) of the amendment of IAS 16 and IAS 41 is the paper by Jana & Marta (2014). They aim to explain the processes of valuation of biological assets and agriculture produce within IAS 41. Moreover, they look into the ED for the amendment of IAS 16 and IAS 41 and compare the proposed solutions in the ED with the results of a research called the SGS 2013-040. This research consisted of a questionnaire survey on 104 agricultural enterprises from the Czech Republic. Their reasoning to write this paper is that the choice of measurement method influences the accounting information which is necessary to make decisions for investors, suppliers, employees and many more entities. So, the amendment can have a significant impact on these individuals and entities. The hypothesis they try to verify is that the results of the questionnaire survey are rather subdued about using fair value measurement and therefore consistent with the solutions of the ED. Their main conclusion is that the survey confirms the hypothesis and both positive and negative aspects of the fair value measurement method of biological assets are found.

Svoboda & Bohušová (2017) also researches agricultural firms in the Czech Republic, however they restrict their research to apple orchards and small dairy firms. The aim of their paper is to evaluate how the different methods for measurement and reporting of biological assets are appropriate. They focus on two ways of measuring: a cost method and a fair value method. They assume the biggest difference between bearer plants and living animals, hence the choice of kind of firms they use in their research. From their results it can be concluded that historical cost is the best way to measure bearer plants and a fair value method is most suitable for living animals. The main reason for this, according to the authors, is that the value of bearer plants is very low or even nil after they provided the maximum produce and are not useful anymore. Using a fair value method is then very time consuming since there is not market for unuseful plants. Moreover, it provides inaccurate information because the fair value measurement makes use of a lot of estimations which comes with a lot of uncertainty. For living animals, the situation is different for three reasons. First, there is an active market. Second, useful life of animals is shorter than for bearer plants. Third, for living animals the residual value is significant which is not the case for bearer plants. Since their result is that for bearer plants the best valuation method is the historical cost method, it is clear that according to this research the amendment was appropriate.

A paper that fully directs towards the effects of the amendment on bearer plants is the paper by Bozzolan et al. (2016). They analyse all aspects in relation to this amendment and mainly focus on the reasons why this amendment was proposed by the IASB. The method they use is through analysing the comment letters received by the IASB and by looking at previous research. They conclude that there is still no clarity on how to define bearer plants and whether reassessment needs to be done after initial recognition. Another missing aspect is guidance about when to recognize produce separately to ensure comparability between organizations. It is clear for the authors that the IASB has addressed some issues that were raised, but are far away from a clear standard that includes all solutions.

As can be concluded from the paper by Bozzolan et al. (2016) there is still a lot of criticism and debate concerning the standard for the agricultural sector. The paper by Damian et al. (2014) concludes something similar. They looked into the stakeholder's view on the measurement method used for bearer plants by which they contribute on the debate about fair value measurement. Their analysis method consists of a quantitative and qualitative analysis on the feedback on the Exposure Draft (ED) received by the IASB. They used the same method as Bozzolan et al. (2016), being the use of comment letters to the IASB. The final sample concluded 74 comment letters. Their final conclusion is that some of the respondents were very welcoming to the proposal of the amendment.

With the quantitative analysis of filling in a questionnaire for each comment letter, it came forward that most of the respondents have an alternative view on the scope, which made it necessary to conduct a qualitative analysis. The main findings of this paper are that many respondents want to include bearer livestock in the scope of the ED and are against the separation of bearer plants and its produce until the harvest.

The last paper discussed is very interesting for this thesis since it is the only paper found in which the amendment of IAS 16 and IAS 41 is discussed in the context of a South American country. Souza & Shikida (2021) focus on the effect of the amendment to the economic-financial position of Brazilian sugar-energy companies. They researched this effect from 2015 to 2017, using a sample of 64 Brazilian sugar-energy companies. To measure the impact of the amendment of IAS 16 and IAS 41 the inverse of the Gray Comparability index is used and significance is tested with the paired Wilcoxon test. The results show a significant positive impact on asset turnover and current liquidity and negative impacts on fixed assets, return on equity, third-party capital participation and general liquidity. No significant impact is found for net margin, return on investments, debt composition, operating cycle and quick liquidity.

3 Research hypothesis

From chapter 2 it is clear that there occurred some change through the amendment of IAS 16 and IAS 41 with regards to the valuation methods used for the biological assets. From the paper by Svoboda & Bohušová (2017) it is clear that the change of method for bearer plants is for the better, since historical cost method is the best choice for these types of assets. Souza & Shikida (2021) conclude that the amendment definitely had different significant impacts, positive and negative, on various variables. They concluded from this that this implied a loss in comparability of accounting and economic-financial indicators over previous periods. However, they specifically focused on the economic-financial position of sugar-energy companies situated in Brazil. It would be very interesting to extend this more broadly to more types of agricultural firms in South America and concentrate on one broad variable.

The IASB sets the IFRS standards with the goal to get information in the financial statement of high quality, to be comparable with other firms and let firms be transparent towards any interested person (Deloitte, n.d. c). The reason for the amendment was to achieve this goal, with regards to bearer plants since this was not achieved within IAS 41. The expectation is thus, that after introduction of the amendment, bearer plants are valued better in the financial statements and that the reported gross profit is significantly influenced by this. In line with this, the following hypothesis is made:

H1: The implementation of the amendment of IAS 16 and IAS 41 significantly changed the reported gross profit of South American agricultural firms.

4 Method

This section describes the methodology used in this thesis to test the hypothesis as stated in chapter 3. After this, it provides the definitions of all variables used.

4.1 Methodology

To see whether the amendment significantly changed the reported gross profit of South American agricultural firms, a comparison needs to be made between the reported gross profit before the amendment and after the amendment. This is done by using a regression analysis on panel data. Panel data is data of individuals observed at multiple points in time, in this case data from South American agricultural firms over the years 2014-2018.

The type of panel data regression analysis is a firm fixed effects model, which makes use of ordinary least squares. By using a firm fixed effects model it is possible to control for time-invariant unobserved characteristics of the individual firms that might be correlated with the independent variables. Moreover, the regression performed is a robust regression which means that the model takes into account possible heteroskedasticity.

The regression model used is as follows:

$$y = \alpha_i + \beta_1 x_{1,it} + \beta_2 x_{2,it} + \beta_3 x_{3,it} + \varepsilon_{it} \quad (2)$$

y is the dependent variable and represent the reported gross profit of the agricultural firms from South America. α_i is the intercept which is individual specific, and each β_i is a parameter value for the corresponding explanatory variable. $x_1$represents the dummy variable for amendment, which takes the value 1 for periods including and after 2016 and the value 0 for periods before 2016. x_2 represents operating revenue and $x_3$represents total assets. ε_{it} refers to the error term.

Gross profit is chosen since in annual reports of various agricultural companies with different countries of origin it is shown that the amendment had an impact on reported gross profit. In both the annual report of Ariston Holdings Limited (2017)[1], an agricultural firm from Zimbabwe, and Treasury wine estates (2017)[2], a vineyard in New-Zealand, it is clear that the change in accounting policy affected the cost of sales. In other words, the amendment had an impact on the cost of goods sold (COGS). COGS is subtracted from operating revenue to calculate the gross profit. Thus, to wrap up, the change in accounting policy impacts gross profit through COGS.

[1] Ariston Holdings Limited (2017), no. 13 'Change in accounting policy' to find influence on cost of sales.

[2] Treasury wine estates (2017), page 108 to find influence of amendment on cost of sales.

The annual report of Terra Vitae Vineyards (2017)[3] shows a good overview of what is included in cost of sales of an agricultural firm. With regards to bearer plants this is through the deprecation on bearer plants. For other measures of profit like EBITDA and net income there was only data for such a limited number of firms that after analysis the conclusion is not valid and not useable.

The control variables are operating revenue and total assets due to these variables having influence on the gross profit. As can be read in 4.2 the gross profit is partly defined by the operating revenue. For total assets the case is very similar. The assumption is that total assets influence gross profit through different ways (see 6.1) and by taking this as an independent variable this influence is taken into account.

To confirm the hypothesis as stated in chapter 3, β_1 needs to show a significant effect. All analyses are conducted in the statistical software STATA, and a significance threshold of 5% is used to determine whether to reject the null hypothesis, or conclude that there is insufficient evidence to do so.

The general form of the null and alternative hypothesis is:

$$H_0: \beta_i = 0 \qquad H_1: \beta_i \neq 0 \tag{3}$$

β_i is the parameter value corresponding to independent variable for each included independent variable.

The significance test that STATA automatically performs is a t-test, which is used as the significance test for this thesis. The t-statistic follows a t-distribution with $n - 3$ degrees of freedom and is calculated as follows:

$$t = \frac{(b_i - \beta_i)}{s_{b_i}} \sim t(n-3) \tag{4}$$

b_i is the parameter estimate and β_i is the value of β_i under the null hypothesis. s_{b_i} represents the estimated standard error of b_i and n is the number of observations.

Besides the t-statistic STATA provides a p-value as output. This p-value is based on the t-test statistic and shows the probability that the test outcome would occur when the hypothesis would be true. As stated above, in this thesis the significance level is chosen to be 5%. Hence, a variable is statistically significant if the p-value is smaller than 0.05.

[3] Terra Vitae Vineyards (2017), page 7 to find overview of what is included in cost of sales.

4.2 Definitions of variables used

The following variables are used in the data analysis:

Gross Profit (GP)

$$GP = OI - COGS \quad (5)$$

Where OI is the operating income (also called operating revenue by others) and $COGS$ is Cost Of Goods Sold (Bureau van Dijk, 2011).

Amendment

Consists of a dummy variable that takes value 1 if the publication year of the data is 2016 or after and takes value 0 if the publication year of the data is before 2016. This is because the amendment was issued to be in use from the first of January of 2016.

Operating Revenue

Operating revenue consists of the revenue received by the firm from sales of the products or services corresponding to the normal business operations. Orbis (see 5.1) provides this variable standing alone and does not make use of calculations for this (Accounting tools, 2021).

Total Assets (TA)

$$TA = IFAS + TFAS + OFAS + STOK + DEBT + OCAS \quad (6)$$

Where $IFAS$ is intangible fixed assets, $TFAS$ is tangible fixed assets, $OFAS$ is other fixed assets, $STOK$ is stocks (total inventory, which includes raw materials, in progress and the finished products), $DEBT$ is debtors and $OCAS$ is other current assets (Bureau van Dijk, 2011).

5 Data

In this part the dataset used for this study is discussed. First, a description of the data source is given. Followed by the explanation of the sample selection. Lastly, descriptive statistics of the data are provided.

5.1 Data source

The data used for this thesis is collected from Orbis. Orbis is an online financial database with information about almost 400 million firms around the world and includes detailed financial information on 41 million firms. One of the strengths of Orbis is the ability to compare information. Furthermore, the data can be pre-filtered on the basis of characteristics, like company characteristics, country of origin and which industry they partake in (Orbis, 2021).

5.2 Sample selection

The initial choice to select the sample of the database used in this thesis is first the type of industry. Only firms classified under NACE Rev. 2 011 Growing of non-perennial crops, 012 Growing of perennial crops and 013 Plant propagation. The NACE Rev. 2 classification system is chosen since this system narrows the industry the furthest down so that the database exists of firms that deal with bearer plants. The second step was to narrow it down to firms only based in South America. In this step only the twelve sovereign states of South America are used. In appendix A a list of these countries is provided. The third and last initial condition is that the firms needed to either apply IFRS standards or local GAAP, to be sure that the firms use an accounting standard which entails the amendment and that financial information is available for them. With these three conditions an initial dataset is provided by Orbis with information of 19,987 companies.

For those companies the following variables are obtained: operating revenue, total assets and gross profit for the years from 2014 until 2018. These variables are given in thousands of US dollars. Data is also provided on which accounting practice they use. When filtering the database for companies that only contain information for these variables of all years the list consists of 1,042 firms.

Due to the lack of data of firms from some of the twelve sovereign states as listed in appendix A, the final sample only consists of firms from Argentina, Bolivia, Chile, Colombia, Ecuador and Peru. These countries either use IFRS standards or their local GAAP is the same as IFRS with respect to accounting for bearer plants only. Brazilian GAAP has no significant differences with IFRS (EY, 2010) and according to Lima et al. (2020) the Brazilian GAAP implemented the amendment in 2016. The data of firms that use the Brazilian GAAP will thus be accounted for as if they use IFRS. The data of

firms that use the Colombian GAAP will be removed, due to them originally being similar to IFRS but they have not been updated since 1993. This means the amendment is not included in the Colombian GAAP (UK essays, 2018). For Uruguay nothing is found to make the conclusion whether the local GAAP is similar to IFRS, hence the information of these firms is removed as well. The final sample consists of 1,035 firms.

5.3 Descriptive statistics

To get a first indication of the data, descriptive statistics are provided. They are stated in Table 1. Column (1) contains the names of the variables. Column (2) contains the minimum of the variables, column (3) the maximum and column (4) the averages. Table 1 shows that there is a great variation in gross profit for all years from 2014 until 2018. As well as an increase in the mean gross profit in the year 2016, which is the exact year the amendment was introduced. However, a decline in the year after is also seen. The mean of total assets over the years shows some variation too. For operating revenue this does not hold for the mean, for this variable the mean was fairly steady over the years.

Table 1: Descriptive Statistics

Variables	Minimum	Maximum	Mean
Gross profit 2018	-2621.702	151499	1968.791
Gross profit 2017	-51318.56	97802	1695.575
Gross profit 2016	-25572.17	213289.7	2172.334
Gross profit 2015	-3864.218	95419.62	1660.101
Gross profit 2014	-13452.95	139821	1593.646
Total assets 2018	0.351	1247320	16273.66
Total assets 2017	0.387	671965.6	16362.81
Total assets 2016	0.350	835048.1	16379.82
Total assets 2015	0.319	894382.8	15191.61
Total assets 2014	0.331	1131958	18054.76
Operating revenue 2018	1.194	535660	6847.295
Operating revenue 2017	-6.980	388250	7016.377
Operating revenue 2016	-1.737	428406	7474.917
Operating revenue 2015	0.936	373716	6440.547
Operating revenue 2014	1.264	377590.2	6926.813

Notes: Given in thousands of US dollar. For each variable the number of observations is 1,035.

6 Results

This chapter discusses the results obtained from the statistical tests carried out to test the hypothesis as described in section 3. The analysis is conducted in STATA and a significance threshold of 5% is used to see whether to reject the null hypothesis or whether there is insufficient evidence to do so. The hypothesis is repeated below:

H1: The implementation of the amendment of IAS 16 and IAS 41 significantly changed the reported gross profit of South American agricultural firms.

As described in the method section a panel data regression with firm-fixed effects is carried out. The model clusters observations by firms and accounts for firm specific effects. The results of the panel data regression are presented in table 2. Checks with regards to the validity of the results are discussed in the last part.

6.1 Panel data regression

The dummy variable Amendment takes value of 1 for the period including and after 2016, and 0 for the period before. Therefore, if this variable shows a significant coefficient, it is clear that from 2016 onwards there is a significant change in reported gross profit. When looking at table 2 it is clear that this is not the case with this data. The coefficient of Amendment is not significant and this implies that there were no sudden changes in profitability from 2016 onwards related to the amendment of IAS 16 and IAS 41. Thus, there is not enough evidence to reject the null hypothesis that the amendment of IAS 16 and IAS 41 had no effect on the reported gross profit of agricultural firms in South America.

The other variables, Operating Revenue and Total Assets, are both significant at a 1% significance level and 10% significance level respectively. The coefficients indicate that if the operating revenue rises by 1000 dollars, the gross profit will increase with 496 dollars. When total assets increase by 1000 dollars, the gross profit will decrease with 60 dollars. The former is intuitive since normally if you earn more revenue your profit will also grow since profit is revenue minus costs. The latter is not that intuitive, since the influence of total assets on gross profit can be explained in multiple ways. A view is that an increase in assets means investments and thus costs which decreases profit. However, another view is that when an asset is recorded there is no record of an expense. In this case there will be no decrease in gross profit by changes in assets.

Table 2: Panel data regression estimates of gross profit

Variable	Coefficient
Constant	-699.218
	(454.376)
Amendment	85.971
	(117.472)
Operating Revenue	0.496***
	(0.090)
Total Assets	-0.060*
	(0.031)
Observations	5,175
R^2 within	0.448
R^2 between	0.787
Adjusted R^2	0.684

Notes: This table reports coefficients from the panel data regression with fixed effects run on the dependent variable gross profit conducted on the sample of 1,035 firms. The variable Amendment is the variable of interest and the variables Operating Revenue and Total Assets are used as control variables. Standard errors are given in parentheses. Detailed description of the variables is described in 4.2. Significance stars are used to indicate p-values; * p-value < 0.1, ** p-value < 0.05, *** p-value < 0.01

6.2 Quality of regression model

To check the quality of the regression model, a few assumptions are looked at and tested if necessary.

First, to see if there is collinearity between the independent variables, a pairwise correlation test is performed on the variables Amendment, Operating Revenue and Total Assets. The results are presented in appendix B. The assumption made with the regression is that the independent variables are uncorrelated with each other. If this assumption does not hold it is said that there is multicollinearity and then the conclusion based on the coefficients are to be taken with precaution.

Between the variables Operating Revenue and Total Assets there is a high degree of correlation, being 0.8204. A reason for this might be that both these variables are a measure of firm size. Another possible reason is that to create revenue you make use of assets. Therefore, if a firm, for example, invests in an asset and thus total assets increases, the firm will also be able to generate more operating revenue. This high degree of correlation has the consequence that the obtained

coefficients and p-values cannot be considered reliable. However, due to these variables not being the variable of interest, the model can be used as is but with caution.

So, of most importance is that the variable of interest Amendment does not show major correlation with any other variable. This is the case and hence the results can be interpreted with caution as described in 6.1.

With the output of the panel data regression with STATA an F-test is provided. This F-test tests whether all coefficients are equal to zero. In this thesis the F-test has a value of 5.01. This is a sufficiently high value to reject the null hypothesis of the F-test and thus the assumption tested does not hold. In other words, at least one coefficient is significantly different from 0 and this shows there is a relationship between the dependent variable, gross profit, and the independent variables.

At last, the adjusted r-squared. The r-squared is a statistical measure to show how much of the variance of the dependent variable is explained by that of the independent variables in a regression model. The adjusted version of this r-squared adjusts for insignificant predictors. In the regression of this thesis the adjusted r-squared is 0.684. The rule of thumb, introduced by Falk and Miller (1992), is that r-squared should be equal or greater than 0.10. This is the case. As a result, the variance explained by the independent variables suffices in this thesis.

7 Conclusions

This thesis aims to answer the following research question: *What is the impact of the amendment of IAS 16 and IAS 41 of biological assets on the reported profitability of South American agricultural companies?* It provides insights into impacts of amendments on profitability in an under-researched region and industry. This study contributes to the discussion of classifying bearer plants under the scope of IAS 41 or IAS 16. The following section summarizes the results, formulates the key findings, discusses its limitations and provides future research suggestions.

7.1 Summary of results and key findings

With the use of a fixed effects panel data regression analysis an answer is found to the research question. By using a firm fixed effects model it is possible to control for time-invariant unobserved characteristics of the individual firms that might be correlated with the independent variables. Analysis is done with a dataset that contains data of 1,035 firms over the years 2014 until 2018. The independent variables in this model are Operating Revenue, Total Assets and a dummy variable Amendment.

After analysis the coefficient of Amendment is found not to be significant which implies that there were no sudden changes in profitability from 2016 onwards related to the amendment of IAS 16 and IAS 41. The main conclusion made is that there is not enough evidence to reject the null hypothesis. Hence it is not possible to conclude that the amendment of IAS 16 and IAS 41 had an effect on the reported gross profit of agricultural firms in South America.

As described in the introduction, the goal of the IASB is to make standards which firms use to represent their accounting information in a true and fair way. When the gross profit would have changed due to the amendment, this shows that the bearer plants are probably better valuated under IAS 16 than under IAS 41. The IASB then provides better standards that adhere more closely to their goal. However, this is not found in this thesis. This means that the amendment did not have the effect of better valuation of bearer plants. Though there is also another possibility. Maybe the difference of the valuation caused by the change in measurement method is so small that this does not influence the firm's financial statement. This still leaves two options, maybe bearer plants are valued in the best way possible under both IAS 41 and IAS 16 and does it depict the true and fair view of the asset at agricultural firms. Or both standards value bearer plants wrongly and there is still some work left for the IASB to find a better measurement method for bearer plants to reach their goal.

7.2 Limitations and future research suggestions

This thesis is subject to methodological and theoretical limitations which influence the validity of the aforementioned results. First, the implementation date of the amendment can differ along firms. The IASB requires firms to use the amendment from the first of January 2016, however if firms want, they can adopt this change in measurement method earlier. The assumption is made in this research that all firms start using the amendment from 2016 onwards. The data possibly includes firms that introduced the amendment preliminary and therefore the results obtained need to be taken with caution since the possible impact on profitability might have happened for certain firms before 2016. A more in-depth research which takes into account this early implementation will provide a more valid result. The opposite is possible as well. Firms can experience delays in introducing the amendment especially in areas with limited regulatory supervision. A solution is to figure out of every firm in the dataset when they adopted the amendment.

In this thesis there is another potential flaw. It does not take into account the influence of inflation. For future research it is interesting to control for this. However, with a dataset stretched over multiple countries that use varying interest rates and different types of agricultural firms that make use of different biological assets this can be quite challenging.

Another limitation is that the data regards multiple small firms when looking at the descriptive statistics. This might influence the results obtained above. The effect of a measurement method is expected to be more limited for smaller firms compared to bigger firms. Due to the size of firms influencing the accounting numbers and the possibility that the larger the firm the more bearer plants they own. Future research suggestions are to, for example, either make a comparison between the size of firms to see if there indeed is a difference in result or to set a minimum condition with regards to size of firms.

The dataset used in this thesis experiences another limitation. In the analysis two independent variables and a dummy variable are used. With addition of more independent variables the results could become different and be more valid. Think of the variables like financial expenses or market stability. Furthermore, it is interesting to look into variables that are of particular influence for agricultural firms which fall under natural factors such as weather-related disasters. However, the downside is that this might reduce the number of observations. In this thesis more observations were preferred over more variables. Future research can search for data which includes more variables that might be correlated with profitability.

Furthermore, in this thesis the time frame is from 2014 until 2018. An option to expand current research is to expand the time frame. This will also make sure that validity is increased. Whether there is a break noticeable in profitability in 2016 due to the amendment can become more clearer when using a larger time frame. However, as with the limitation/future research suggestion on independent variables this will reduce the number of observations which also reduces validity. It is therefore a weighing game of what is more important to the researcher or to figure out what the best ratio is.

Finally, as mentioned in chapter 6 the existence of the statistical limitation of multicollinearity. A high correlation is found between Operating Revenue and Total Assets. Limited correlation is found between Amendment and the other independent variables and since this thesis is most interested in Amendment the results can be taken as described but with caution. From this last limitation it is clear that this thesis needs to be seen as an exploratory study and in further research there is the opportunity to make use of regression models that do not experience these limitations and thus are of a higher quality.

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Appendix A – List of the twelve sovereign states of South America

1. Argentina
2. Bolivia
3. Brazil
4. Chile
5. Colombia
6. Ecuador
7. Guyana
8. Paraguay
9. Peru
10. Suriname
11. Uruguay
12. Venezuela

Appendix B – Pairwise correlation test

Table 3: Pairwise correlation of independent variables

Variable	Amendment	Operating Revenue	Total Assets
Amendment	1.0000		
Operating Revenue	0.0073	1.0000	
Total Assets	-0.0030	0.8204	1.0000