ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Bachelor Thesis: Financial Accounting

Revisions to IAS 41: Impact of historical cost accounting on firm profitability in Asian agricultural firms

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Date of submission (3rd draft)	24th August 2020

Abstract

Changes to accounting conventions can have a considerable impact on a firm's reported profitability. Methods for measuring financial information, in particular, impact firm fundamentals; thus careful consideration is needed in order to ensure that they enable true and fair financial reporting. Based on a sample of 150 Asian agricultural firms between 2014-2018, this study investigates the *effect of the introduction of historical cost measurement of biological assets on firm profitability of Asian agricultural companies. To answer this research question, I study the effects of the* amendment to IAS 41 requiring a reversion to historical cost measurement. The results conclude that there is no significant change in profitability in the year this amendment was adopted. Therefore, the switch in the measurement method does not seem to impact profitability. This indicates that criticism on the basis of unfair impacts on profitability to the original IAS 41 standard, which imposed fair value measurements, cannot be empirically verified within the scope of this study.

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Introduction

Profitability is the holy grail of modern private enterprise. Indeed, even government owned firms aren't exempt from the need to generate returns to ensure continuity. (Cormier et. al., 1995) It therefore comes as no surprise that varying accounting methods, with their potential to exert significant influence on profitability with no particular action on the part of the firm, are subject to heated debate. The focus of this paper is on one such standard which was rather controversial at its inception, IAS 41. Originally requiring certain biological assets to be measured on a fair value basis, the latest amendment to this standard requires that they be recorded at historical cost (IASB, 2014)

The impact of this change in measurement method is investigated in this work through a study of Asian agricultural companies. Asia has historically been known for its rich agricultural practices; even today, many Asian countries make up a significant proportion of their GDP through agriculture (Dorjee et. al., 2003). In light of this, the central research question of this paper is:

What is the effect of historical cost accounting of biological assets on firm profitability of Asian agricultural companies?

Prior studies have criticised and speculated about the excessive burdens IAS 41 would bring on its adherents, by requiring that biological assets be stated at fair value. Cited inconveniences include high measurement costs, higher risk prognoses and a need for more complicated accounting expertise. (Herbohn and Herbohn, 2006; Lefter and Roman, 2007) These factors imply an adverse impact on profitability since the implementation of this standard. This study assesses an amendment to the aforementioned standard which reverses the requirement to record certain assets at fair value, but rather at historical cost. By empirically investigating the impacts on profitability of this amendment, this study contributes to the literature on fair value versus historical cost accounting. Furthermore, by the means of literature review, this paper unpacks the importance of agriculture, agricultural accounting and its implications for Asian societies. By addressing a niche in an under-researched region with respect to agricultural accounting, this paper adds to the current body of scientific knowledge on the subject.

In terms of social relevance, this study can empirically test if a return to historical cost accounting had any significant impact on firm profitability. This can serve to caution standard-setting bodies such as the International Accounting Standards Board (IASB) when prescribing standards that could have considerable impacts on reported profits due to no action on part of the firm. Firms generally depend on robust, reliable firm fundamentals to attract investment and induce growth; agricultural firms are no exception. Significant revisions to accounting standards need to be weighed against their potential to undermine the reliability and comparability of accounting information.

This paper is structured as follows: The upcoming section curates background information and analyses existing research to establish the importance of agriculture, its application to the Asian context, and the implications of the accounting standard IAS 41 (as well as its relevant amendment). This section concludes with the formulation of the hypothesis that will be tested in this paper. Next, the dataset and its source used in this work is described, and descriptive statistics are displayed. The research methodology employed to test the hypothesis is also explained. The subsequent section is dedicated to the analysis of results obtained through this research. Finally, the discussion and conclusion section summarises the results, discusses the implications of the findings and critically analyses this work by outlining its limitations and offering suggestions for future research.

Background and literature review

In this section, first the links between agriculture and economic development as well as economic equality are explored. Next, an explanation is provided of the Asian agricultural context followed by the implications of IAS 41 for agricultural firms. Each of these subsections start with a short background, followed by insights drawn from relevant literature. Finally, the hypothesis to be tested in the course of this paper is developed.

Agriculture and economic development

To some, the term agriculture evokes images of lush greenery and the odours of manual labour. A more technical definition yields that agriculture refers to highly intensive forms of environmental management, involving cultivating in vast, arid, permanent field plots. Cultivation, in turn, refers to all forms of environmental management that interferes with a natural ecosystem on a regular, systemic basis, such as deliberate planting, weeding, sowing etc. Increased productivity of cultivated crops beyond what would be expected to occur naturally is a by-product of this process. Agriculture is thus a larger scale, intensive subset of cultivation. (Hutterer, 1983) Agribusinesses, essentially a portmanteau of agriculture and business, command growing influence in the modern-day agricultural sector and the term is used interchangeably with ‘agricultural companies’ for the course of this paper.

Historically, agricultural growth has been a faithful ally of economic development. Prior research has covered this link extensively. It had a key role in raising rural living standards, and subsequently stimulating demand for goods and services in other sectors of the non-farm rural economy. Overall growth multipliers linked to agriculture are thus argued to be frequently greater than one, and significantly so. (Hazell and Haggblade 1993). Furthermore, the agricultural sector provided relatively cheap labour to the industrial and service sectors; this was facilitated by increased output per unit of labour due to technological change within agriculture. Thus, the release of labour to other sectors was made possible without causing stagnation in agriculture or putting upward pressure on agricultural prices (Johnston and Mellor 1961; Timmer 1988). Thirdly, a growing agricultural sector was able to generate significant quantities of capital to finance the nonagricultural sector. This was achieved partly through rural savings and particularly through redistribution via taxation, as well as by turning terms of trade against agriculture. (Rozegrant and Hazell, 2000; Mellor 1973) Moreover, agricultural growth provided

additional foreign exchange earnings by enabling both export-led growth and import substitution - this was key to effective industrialisation. Furthermore, rural regions were essentially transformed by agriculture, allowing for diversified sources of income and increased opportunities for earning a livelihood without resorting to mass migration.

Agriculture and economic equality

Economic equality arises where income and wealth disparities in a population are minimal, or strictly speaking, non-existent. Moving towards greater equality is generally viewed as a positive goal to work towards; both from a moral ethical standpoint, and as a path towards sustainable economic prosperity. The wealthier the worst off in a society become, the better they are able to participate in the economy and drive growth.

Previous studies establish the importance of growth in the agricultural sector as a key element of connecting economic growth to the poor. (Ravallion and Datt 1996; Ravallion and Huppi 1991; Ravallion and Chen 2004; Sumarto and Suryahadi 2003; Timmer, 1997) This finding is crucial in the realm of economic development, for it is acknowledged that economic inequality must not rise drastically in order for economic growth to play an instrumental role in reducing poverty (Timmer, 2011)

Historically, this is partially illustrated by the fact that no country, with the exception of Singapore and Hong Kong, has been able to sustain a rapid transition out of poverty without raising productivity in agriculture. Through higher productivity, agriculture provides food, labour and savings to the processes of industrialization and urbanisation. Poverty is thus gradually diminished as higher labour productivity is accompanied by rising wages. (Timmer, 2011)

Agriculture in Asia and the growth of contract farming

In many developing economies, and indeed in many developed economies, agriculture plays a significant role in economic development and has consequences for economic inequality. Asia is no exception; a rich history of intensive agriculture adds colour to the development narrative of many Asian nations.

According to Dorjee et. al (2003), Food self-sufficiency policies pervade sector policies in this region, especially South Asia. Over the last three decades, research and agricultural support services have enabled food production growth in excess of population growth and alleviated poverty to a significant extent. Overtime, however, the proportion of the population dependent on agriculture for their livelihoods has been on the decline. This general trend of labour withdrawal from agriculture is argued to be able to boost agricultural wages and support the commercialisation and diversification of farming.

The commercialisation of farming and globalized supply chains have seen the rise of organized agricultural firms in modern times. Contract farming, or vertical coordination in agriculture, is a popular organizational model for many agribusinesses and is frequently employed in Asia as a consequence of the transformation of food production systems. It involves an agreement between a farmer and a 'first handler', such as a processor or exporter of agricultural produce, for the production of a certain commodity (Burch, 1994). This structure hints at the significant impact agribusinesses have on rural livelihoods, and by extension, living standards. The operating practises and financial health of these businesses are therefore of considerable interest to farming populations and Asian economies overall.

Fair value accounting in agriculture: Background of IAS 41 and its implications

Robust financial accounting, as for any industry, is essential for the continuity of agribusinesses. Reported firm fundamentals set expectations for future performance and drive further investment, and at the end of the day, influence the daily income of the average farmer (Dorjee et. al., 2003). Changes in accounting standards requiring significant revisions to practise should thus be welcomed with caution.

IAS 41 was originally introduced in 2003 with the aim of establishing accounting standards for agricultural activity - which is defined by the standard as 'the management of the biological transformation of biological assets (living plants and animals) into agricultural produce (harvested product of the entity's biological assets).' Biological transformation, in this case, refers to the production, procreation, growth and degeneration that cause change in biological assets. IAS 41 prescribes that the fair value of these physical changes be recorded in the income statement, regardless of whether or not they are sold; subsequently, the assets themselves will be listed on the balance sheet at its fair value at the date of the statement. This

is in contrast to the standard practise preceding this standard of recording biological assets at historical cost.

At its inception, IAS 41 was met with criticism and contention. Measuring fair values of biological assets reliably can be a challenge to say the least; consider the example of valuing a healthy calf as opposed to a slightly unhealthy one. Where reliable measurement is not possible, IAS 41 allows for reporting at historical cost; however, determining fair values is costly, and excessive cost cannot be used to gain an exemption from the fair value requirement. In line with this, the annual measurement of fair value is bound to be an additional, onerous task especially for firms in developing countries. Many countries in Asia, and indeed the subset of those represented in this study, fall under this category.

Furthermore, the unrealised gains and losses arising from revalued agricultural produce will introduce a greater degree of volatility into the financial statements that may result in a higher risk prognosis for some of its users (Herbohn and Herbohn, 2006; Lefter and Roman, 2007). Pentinnen et. al., (2004) posit that utilizing fair values would inflict unrealistic fluctuations on and possibly adversely affect the profitability of forest companies in particular. Dowling and Godfrey (2001) point to the potential for manipulation and subjectivity of results under this standard. Furthermore, detailed estimations of future cash flows and their probabilities are required for fair value measurements, which requires a relatively large source of input data. It is necessary to use the data for a relatively long period of time in relation to the useful life of bearer plants (twice the lifetime – for the purposes of calculation moving values) to take into account of and incorporate the most likely scenarios for the nature of the production, as well as biological and climatic and weather conditions. The effect of this way of measurement is controversial, and could lead to additional costs to practitioners (Svoboda and Bohušová, 2017)

Amendments to IAS 41 and IAS 16

Considering the criticism relating to IAS 41, the IASB issued an amendment to the standard effective as of 1st January 2016. This version allows for the recognition of bearer plants, which

are living plants used to grow produce, under IAS 16, (property, plant and equipment) allowing for the recognition of these assets at cost subsequent to initial recognition or revaluation. The effects of this amendment is investigated in this paper as it signifies a switch from fair value measurement to historical cost measurement.

The IASB defines a bearer plant as: “A living plant that: is used in the production or supply of agricultural produce is expected to bear produce for more than one period, and has a remote likelihood of being sold as agricultural produce, except for incidental scrap sales.”
The justification offered for this move was that certain biological assets, especially mature bearer biological assets, which no longer undergo significant biological transformation and are used solely to grow produce, were perceived to be more akin to property, plant and equipment and their operation similar to that of manufacturing (IASB, 2014).

This is expected to address feedback IASB has received from stakeholders expressing concerns about the relevance and usefulness of information provided to users regarding biological assets accounted for at fair value. Indeed, Svoboda and Bohušová (2017) note that bearer plants cannot be separately traded and thus fair value as they define it (the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date) is not applicable, and thus the historical cost method is argued to be more effective.

Hypothesis development

Agriculture plays a key role in economic development and economic equality. This importance of this role is magnified in South Asia, where a large proportion of the population still engages in agricultural activity. Agricultural workers have become inextricably linked with global supply chains and its facilitators: agribusinesses. The profitability and continuity of agribusiness impacts many stakeholders in these countries. It is therefore vital to ensure that profitability is measured in a fair, transparent and consistent manner; once such a measurement is employed, drastic changes should be thoroughly justified. IAS 41, by stipulating that biological assets need to be recorded at fair value rather than historical cost, brings about such a change. Even prior to its implementation date, speculation was rife as to whether it would cause excessive burdens on farmers and adversely impact profitability. The 2016 amendment eases these burdens by

reducing both measurement costs and taking away the volatility of external influences such as worsening climatic conditions which tend to adversely affect fair value.

While the focus of the IASB is to provide a framework for accounting that provides a true and fair insight into firm performance, it is nevertheless important to acknowledge its impacts on the profitability and hence longevity of firms. It is therefore interesting to investigate the actual effect of the implementation of this amendment on the profitability of South Asian agribusinesses. As discussed earlier, a switch from historical cost to fair value accounting was predicted to yield negative effects on profitability; it is thus sensible to expect that a reversal of these measurement methods would result in an increase in profitability, given that measurement costs and other unexpected costs would decrease. In line with this, the following hypothesis is formulated:

> **H1:** The implementation of the 2016 amendment to IAS 41 led to a significant change in reported net profit of agricultural firms.

Data and Methodology

This section discusses the dataset used for the purpose of this study. First the data source from which observations are drawn is described, followed by a definition of the variables used. A table of descriptive statistics for the included continuous variables over the studied time frame is also provided. The research methodology employed is also discussed.

Sample identification and data source description

The data used in this study is extracted from Orbis, an online financial database with records pertaining to more than 375 million companies globally. It caters to a large user base of companies, governments and public sector teams, academics, financial institutions and professional service firms worldwide (Orbis, 2019)

The sample of firms is first restricted by industry, specifically to the category Agriculture, forestry, fishing and hunting. This category indicates a relatively broad interpretation of 'agricultural firms' and includes firms engaged in crop production, animal production and aquaculture, forestry and logging, fishing, hunting and trapping, and support activities for agriculture. The region is specified to include all subregions available on Orbis in continental Asia, specifically the Middle East, Far East and Central Asia. A full list of countries this includes can be found in appendix 1.

The downloaded data included the variables profit and loss, total assets, operating revenue, financial expenses for each company over the years 2014-2018, and the accounting system employed by the firm. The continuous variables are transformed into percentage changes for further analysis. The transformed variables are more suitable to investigate whether there is a significant change at a point of time. Profit and loss is selected as the dependent variable in the regression conducted. The main variable of interest is Amendment, which is a categorical variable that takes the value 0 for periods before 2016, and 1 for periods including and after 2016. The other firm-level variables including total assets, operating revenue and financial expenses are selected as they also influence profit and loss independent of the change in IAS41, and to some extent control for the size of the firm.

The initial dataset contained the records of 150 firms over the financial years 2014 - 2018 (inclusive). Manually calculating the year on year percentage changes resulted in 4 time periods 2015 - 2018, whereby 2015 reflects the percentage change from 2014 to 2015. Converting this data to panel (long) data yielded 600 observations in total. All financial values are in Euros (thousands) with exchange rates applied at the end of each financial year closing date. Furthermore, only companies with all data for all included variables and time periods are included, meaning the panel data is balanced.

Descriptive statistics

The table below summarises the descriptive statistics for the relevant continuous variables used in this study. It should be noted that all variables represent percentage changes. A full list of the variables along with their descriptions is provided in Appendix 2.

Table 2. Summary of continuous variables

Number of observations = 600	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Operating Revenue	0.223	2.670	-1.000	59.821
Total Assets	0.079	0.456	-0.897	7.467
Financial Expenses	1.722	31.933	-1.000	79.197
Shareholder's Funds	62.748	19.325	9.600	99.340
Solvency Ratio	0.0316	0.281	-0.638	1.689
Profit/Loss	-0.879	28.592	-504.682	353.822

A scatterplot is constructed to observe the relationship between the dependant variable of interest pl_percentchange over the years, this is shown below:

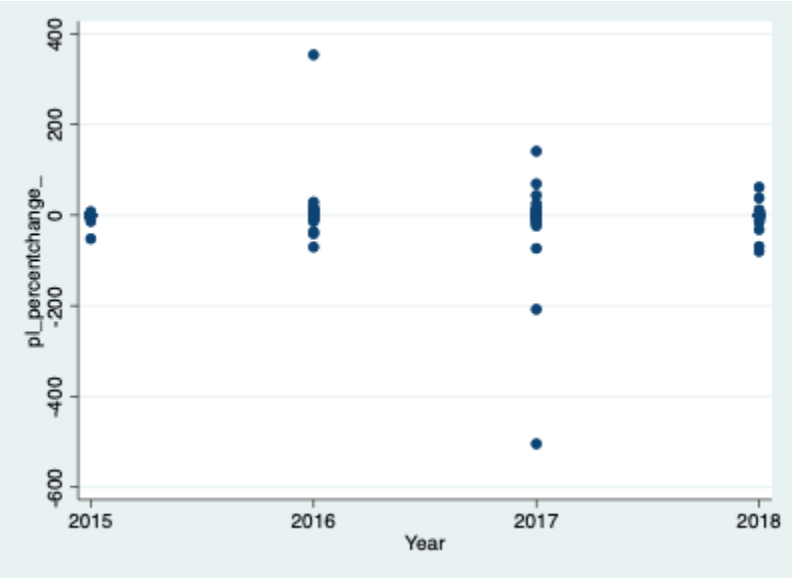

Figure 1: Scatterplot depicting the percentage change in profit/loss over the analysed time period

The plot shows a relatively stable profit/loss percentage change over the years. Visually no break can be observed in the year of interest (2017) which reflects the change from 2016 to 2017.

Methodology

This section describes the methodology employed in this paper to obtain the relevant results. In order to test the hypothesis of this work, regression analysis based on panel data is carried out. The primary objective of this research is to investigate the impact of the 2016 amendment to IAS 41 on profitability, as described by H1:

> ***H1:*** *The implementation of the 2016 amendment to IAS 41 led to a significant change in reported net profit of agricultural firms.*

This is operationalised to test a potential link between the percentage change in profitability of firms against various firm level variables including a dummy variable for the year in which the aforementioned amendment took effect, that takes the value value 1 for periods including and after 2016. Panel data fixed effects models are used for this purpose, which use ordinary least squares (OLS) to estimate the following equation (whereby y, x and ε refer to the dependant variable, independent variable and error term respectively, and the subscripts i and t refer to unit and time):

$$(y_{it} - \overline{y}_i) = (\mathbf{x}_{it} - \overline{\mathbf{x}}_i)\boldsymbol{\beta} + (\epsilon_{it} - \overline{\epsilon}_i)$$

Subsequently, the first regression model utilized is as follows:

> ***Model 1:*** *Profit/Loss = Amendment + Operating Revenue + Total Assets + Financial Expenses + IFRS Compliance*

This model clusters observations by firms; it makes use of clustered sandwich estimators which are used to account for the fact that error terms will be correlated within clusters. In this case, correlation within companies is allowed. This relaxes the requirement for observations to be independent; observations are independent across companies, but not within each company.

Furthermore, year fixed effects are used to control for variables that are constant across firms but vary over time. Controlling for year effects in a panel regression such as this can prevent results from being influenced by aggregate trends that are unrelated to the causal relationship being measured. The variable Amendment, is a binary variable representing the periods before

and after the implementation of the amendment, thus if this variable is significant, it could mean that there is a break in the data during this period which can potentially be explained by the IFRS amendment. The variables *Operating Revenue, Total Assets, Financial Expenses* are numeric variables that serve to control for other factors within firms that influence profitability.

To account for the impact of prior values of profit and loss on the observed values of the same, two lagged variables of profit and loss are introduced in a subsequent model (lag1 and lag2). In addition to these, this model uses the same aforementioned variables included in the previous model.

> **Model 2:** *Profit/Loss = Amendment + Operating Revenue + Total Assets + Financial Expenses + lag1 + lag2 + IFRS Compliance*

These models are run on the full sample of 600 observations, as well as a smaller sample of 60 observations of IFRS compliant only firms. Due to a high degree of collinearity, it is difficult to estimate the coefficient of the IFRS Compliance variable using the full sample; the reasons for this are explained in the following results section. Therefore, it is chosen to rerun the regressions on the subset of IFRS compliant firms. Should significant results be obtained for the relevant year coefficients, this sample separation would allow for better evaluation whether any change after 2016 occured due to the IFRS amendment, or due to other external events that took place in the same time period.

Results

In an attempt to answer the central research question of this paper, the formulated hypothesis is tested. The following section discusses the results obtained from the statistical tests carried out to this 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 hypothesis to be tested is restated below:

> ***H1:*** *The implementation of the 2016 amendment to IAS 41 led to a significant change in reported net profit of agricultural firms.*

To test this hypothesis, a panel data regression with fixed effects is carried out. As described in the methods section, the models cluster observations by firms and account for year effects. The results of the two models pertaining to the total sample are presented in table table 2, and the results pertaining to the IFRS only sample are presented in table 3. Further checks concerning the validity of the results are only performed on the IFRS compliant sample of firms, as it is in this sample wherein all firms would respond to the amendment to IAS 41.

The decision to split the sample in this manner is made to better isolate IAS 41 specific effects. Including a categorical variable for IFRS Compliance in the full sample would have had a similar effect of accounting for IFRS compliance along with the higher explanatory power offered by a larger sample, however, this variable is dropped due to collinearity. This collinearity arises as the IFRS Compliance variable is perfectly correlated in observations within each cluster, as each firm is classified as either IFRS compliant or not.

The categorical variable Amendment takes on the value of 1 for the periods including and after 2016, and 0 for the periods before. Therefore, a significant coefficient for this variable would indicate a break in the model after the implementation of the said amendment. However, in all four models used, relating to both the full and IFRS only samples, this coefficient is not significant. This implies that there was no sudden change in profitability in this period, related to the implementation of the IAS 41 amendment or otherwise. Therefore, there is not enough evidence to reject the null hypothesis that *The implementation of the 2016 amendment to IAS*

41 lead to no change in reported net profit of agricultural firms, in favour of the proposed alternative hypothesis that there was an increase in profitability.

In both the first and second models, relating to the full sample, it can be observed that only the coefficients of the variables Operating Revenue and Financial Expenses are significant at a 10% significance level, which is, in any case, higher than the 5% threshold used in this paper. In models three and four, relating to the IFRS only sample, only operating revenue is significant at a 10% significance level. The signs of these coefficients are not useful in explaining the link with the dependent variable profit_percentage, as they can only take up positive values, while profit_percentage can take both positive and negative values. The magnitude of the coefficients can nevertheless indicate how strong this link is, ie. that a 13.1% change in operating revenues or a 1.2% change in financial expenditures could lead to 1% change in profit (in model 1).

Models two and four include lagged values of the dependent variable Profit/Loss, which measure the impact of profitability in previous periods on current period profitability. In model 2, the first lagged variable lag 1 is significant at a 1% significance level and in model 4, is significant at a 5% significance level (p=0.0000), indicating that prior year profitability has a -0.301% impact on current year profitability in the full sample and a -0.144% impact in the IFRS only sample.

In both samples, the models that include these lags (model 2 and 4) have a higher value for adjusted R squared (R2) within than their counterparts that don't (model 1 and 3). (The adjusted R-squared adjusts the regular R-squared for the number of predictors in the model.) This means model 2 and 4 have higher explanatory power in describing the links with percentage change in profitability. Falk and Miller (1992) suggest that R2 values should be equal to or greater than 0.10 in order for the variance explained of a particular endogenous construct to be considered sufficient. Both models 2 and 4 exceed this threshold with adjusted R2 values of 0.336 and 0.138 respectively. Model 2 has a relatively higher r-squared value compared to model 4 which is aligned with general expectations given the larger sample size it is based on. Of the three available R2 values of the panel regression, R2 within also has some relevance for the purpose of this analysis, despite not adjusting for predictors, as it is relevant to consider how much of the variation in profitability *within* firms is captured by the models. The comparative results are similar to that of adjusted R-squared, although the values are slightly inflated in R-squared

within. Variation between firms (R-squared between) is less relevant in clustered, time fixed effects models such as these, and given the context of this particular study.

Table 2. Linear regression estimates of determinants of the percentage change in profitability (full sample)

Variables	Coefficients (Model 1)	Coefficients (Model 2)
Constant term	-5.736	-7.979
	(3.559)	(4.179)
Amendment	2.312	3.144
	(2.443)	(1.880)
Operating Revenue	-13.136*	-12.741*
	(6.296)	(6.223)
Total Assets	-4.772	-4.490
	(3.452)	(3.441)
Financial Expenses	1.199*	1.147*
	(0.487)	(0.484)
Shareholder's Funds	-0.0004	0.001
	(0.006)	(0.006)
Solvency Ratio	0.092	0.123
	(0.076)	(0.084)
Lag1 (pl_percentchange)		-0.301***
		(0.040)
Lag2 (pl_percentchange)		-0.100
		(0.123)
Observations	600	598
R^2 within	0.305	0.396
R^2 between	0.360	0.001
Adjusted R^2	0.319	0.336

*Notes: This table reports coefficients from the OLS regression run on the dependent variable pl_percentchange conducted on the full sample of 150 firms. The variable Amendment is the variable of interest, while the variables Operating Revenue, Total Assets, Financial Expenses, Shareholder's Funds,Solvency Ratio, Lag1 (pl_percentchange), Lag2 (pl_percentchange), are used as control variables. Standard errors are given in parentheses, these are robust to clustering at the year and firm level. All variables are described in appendix 2. Significance stars are used to indicate p-values * p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01*

Table 3. Linear regression estimates of determinants of the percentage change in profitability (IFRS Compliant firms only)

Variable	Coefficient (Model 3)	Coefficient (Model 4)
Constant term	2.665	3.885
	(2.317)	(2.343)
Amendment	3.229	3.264
	(3.414)	(3.067)
Operating Revenue	1.483*	0.669
	(0.938)	(1.355)
Total Assets	2.778	2.921
	(2.607)	(3.015)
Financial Expenses	-0.611	-0.283
	(1.113)	(0.807)
Shareholder's Funds	-2.191	-3.958
	(3.011)	(3.926)
Solvency Ratio	-0.023	-0.030
	(0.035)	(0.037)
Lag1 (pl_percentchange)		-0.144**
		(0.039)
Lag2 (pl_percentchange)		-0.307
		(0.247)
Observations	60	58
R^2 within	0.075	0.173
R^2 between	0.006	0.021
Adjusted R^2	0.119	0.138

*Notes: This table reports coefficients from the OLS regression run on the dependent variable pl_percentchange conducted on the restricted sample of 15 IFRS_only firms. The variable Amendment is the variable of interest, while the variables Operating Revenue, Total Assets, Financial Expenses, Shareholder's Funds,Solvency Ratio, Lag1 (pl_percentchange), Lag2 (pl_percentchange), are used as control variables. Standard errors are given in parentheses, these are robust to clustering at the year and firm level. All variables are described in appendix 2. Significance stars are used to indicate p-values * p-value < 0.1 , ** p-value < 0.05, *** p-value < 0.01*

Quality of linear regression models

Multicollinearity check

To check for collinearity between the independent variables, a pairwise correlation test is conducted on the variables used in the sample containing only IFRS compliant firms. The statistical results are presented below in appendix 4. In an OLS regression, it is assumed that the independent variables are uncorrelated with each other. Multicollinearity results if this assumption doesn't hold, which reduces the precision of the coefficients estimated.

The variables *Operating Revenue* and *Financial Expenses* display a concerningly high degree of correlation, ie. 0.9120. This could be due to, for instance, larger firms with a higher turnover being able to fund additional growth through borrowed funds, leading to higher financial expenditures. Conversely, firms with high financial expenditures arguably imply confidence in future prospects, better access to credit and good credit ratings allowing for a larger scale of operations and higher turnover. Furthermore, as can be expected, the variables Total Assets and Shareholder's funds display a moderately high degree of correlation (0.478) as Shareholder's funds contribute towards total assets. The statistical implication of this data collinearity issue is that the obtained coefficients of these variables and their respective p-values cannot be considered reliable.

These particular variables are not variables of interest so it is not considered necessary to fix this to answer the research question at hand. The variable of interest Amendment displays no major correlation with any other variable.

Heteroskedasticity check

OLS regression assumes that residuals are drawn from a population with constant variance (homoskedasticity). Heteroskedasticity is thus problematic for the precision of coefficients and their respective p-values. To check if heteroskedasticity exists in the estimated regression model 4, a Breusch-Pagan test is conducted with all independent variables used. This results in a chi^2 value with 6 degrees of freedom of 3393.17, and a p-value of 0.000 as depicted in Table 5. This allows for the rejection of the null hypothesis that no heteroskedasticity exists. Visually,

this is partially confirmed in a panel data equivalent of a residual-versus-fitted-value plot (figure 2) whereby the residuals are reflected on the y-axis and the fitted or predicted values on the x-axis. While the graph is atypical of the increasing trend observed in heteroskedastic plots, it also does not show that residuals are constant across the full range of fitted values. This suggests that the earlier discussed results should be interpreted with some caution.

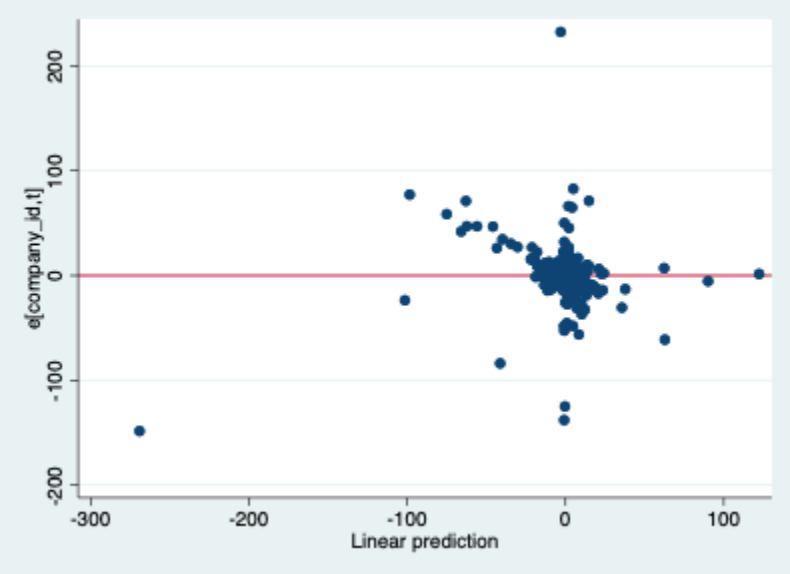

Figure 2: Fitted values versus linear prediction plot for all observations

Discussion and conclusion

The central question governing this research involves investigating the effect of historical cost accounting for biological assets on firm profitability, specifically, of Asian agricultural companies. This paper provides some insight into drivers of profitability in an under-researched region with respect to agricultural accounting. By exploring the impacts of accounting methods on profitability, this study contributes to the discussion on fair value versus historical cost accounting. The following section summarizes the main findings and discusses the implications of this work, and proceeds to describe its limitations and provide suggestions for future research.

Summary of results and implications of key findings

To test the hypothesis *The implementation of the 2016 amendment to IAS 41 led to an increase in reported net profit of agricultural firms,* two panel regression models each are run on two separate samples. The 'full sample' consists of 600 Asian agricultural firms listed on Orbis that may or may not be IFRS compliant. The 'IFRS compliant sample', as the name suggests, consists of 60 firms that follow IFRS standards.

Model 1 and model 2 capture the regression results of the 'full sample'. Only *Operating Revenue* and *Financial Expenses* is significant in both models, albeit at a high threshold for significance. The first lag of the percentage change in profitability is significant at a 1% significance level in the second model. This satisfies the 5% significance level chosen for this study, and it can be concluded that profitability 1 year prior has a significant effect of -0.301 (to 3 decimal places) percentage points on current year profitability. The variable Amendment is not significant in either model, which is unsurprising, as a majority of firms in this sample are not IFRS compliant. Since the variable Amendment represents the periods 2016 onwards which marks the implementation of the IAS 41 amendment, a significant coefficient for this within the first two models may have indicated a change in profitability due to another unknown external factor.

Meanwhile, Model 3 and model 4 capture the results relating to the 'IFRS compliant sample'. In these models, only Operating Revenue is significant at a 10% threshold. Similarly to Models 1

and 2, the first lag of profitability is significant at a 1% threshold, indicating that prior year profitability has a -0.144 (to 3 decimal places) percentage point effect on current year profitability. Here too the variable Amendment is not significant in both models. Since there seems to be no special effect on profitability from the year 2016 onwards, and given that this sample consists solely of IFRS compliant firms, it can be concluded that the null hypothesis that the implementation of the amendment to IAS 16 led to *no change* in profitability cannot be rejected.

The results of this study do not provide any evidence as to whether the switch to historical cost basis of measurement had an impact on profitability. If it is presumed that a switch to fair value measurement of biological assets would lead to a decrease in profitability, as suggested by Pennitten et. al (2004), then it is perhaps intuitive that a reversal of the same could lead to an increase in profitability. However, this argument cannot be confirmed by this work. It is also not possible to extrapolate the findings to check if this amendment alleviates the burden of measurement or otherwise affects the risk prognosis of firms as inferred by Herbohn and Herbohn (2006) and Lefter and Roman (2007). Overall, this would imply that criticism of the original IAS 41 standard on the basis of adverse impacts on profitability, or support for the amendment based on potential positive effects of the same are unfounded claims. It is not intended to address further arguments regarding which method of measurement is theoretically superior by the means of this research, and the findings cannot be used to justify such claims either.

Limitations and suggestions for future research

This work is subject to certain methodological and theoretical limitations that could discount from the validity of the aforementioned results. Firstly, omitted variable bias is of significant concern in all the regression models used in this paper, as there are innumerous internal and external factors that influence the profitability of an organization. This is especially true for agricultural companies which are affected by weather and climatic conditions. Furthermore, some companies in the sample are state owned enterprises which means bureaucratic and political factors also play an effect, especially as many regions covered by this study are known to be politically volatile. Countries such as Pakistan, India, Sri Lanka among others have been known for corruption within their public sectors, also influencing results (Quazi, 2014). Future

research could potentially create another categorical variable for public versus privately owned firms, to control for this effect.

Another specific example is percentage change in operating profits: operating expenses affect net profits, however, it forms an almost a perfect equation together with the other variables used in the models (operating revenue - operating expenses = net profit, in its most simplistic form) this could have potentially lead to misleading regression coefficients. The inclusion of financial expenses has a similar but a much smaller effect. Another issue with operating expenses is that it contains elements of a control variable but also accounts for items of interest such as measurement costs of applying fair value measurements, which is difficult to split. Perhaps a more meticulous research design could account for this in the future. Considering that the part of profitability affected by a switch in historical cost versus fair value measurements could be, in reality, very small, it is difficult to reliably capture its effect in the regression models employed in this study; future research is recommended with more precise models including more control variables.

To allow for the reliable addition of additional control variables, not to mention increased validity and representativeness, a larger sample size should also be used in future research. The time frame studied should also be expanded, this would better allow for a potential break to be observed, if one particular year deviates from a larger time frame. A sample size of 60 IFRS compliant observations is quite limited, especially considering the geographical scope of this research. During the data cleaning process, certain observations were dropped if data points were not complete, in an attempt to obtain balanced panel data. Not only does this lead to a smaller overall sample, but can also introduce certain selection bias as for instance the smaller, poorer performing firms may be the ones with incomplete data available on Orbis. If full, complete data spanning a wider timescale cannot be obtained at a future point in time, even from a different data source, it may be better to rerun the regression models on an unbalanced dataset while accounting for the potential bias caused by attrition.

A significant limitation of this work also arises due to the fact that accounting standards, and indeed their amendments, in practise, are not always implemented at a uniform point in time - delays can be common especially in regions where regulatory oversight is limited. In this study, this effect is further exacerbated by the fact that prior implementation of the amendment to IAS 41 was allowed, implying that the variable Amendment, measuring percentage changes from

2016 to 2017, is not sufficiently able to capture this effect. Even if the standard was simultaneously implemented across all firms at the specified time, the potential for manipulation of fair value measurement Dowling and Godfrey (2001), as discussed in the literature review, could dilute the effect being measured and lead to misleading results. Furthermore, this study does not account for inflation: increasing prices of biological assets could lead to gains from revaluation under the fair value method, resulting in increased profitability. This could offset increased measurement costs and other additional costs presumed to result from fair value measurements. Future studies should ideally control for inflation, although this is tricky when considering a sample that spans a wide geographical region with varying interest rates and with various biological assets in scope.

Finally, the qualifying effects from the statistical limitations of multicollinearity and heteroskedasticity must also be acknowledged. Multicollinearity exists in all four models as the variables Operating Revenue and financialexp_percentage are highly correlated with each other, with a correlation coefficient of 0.9120 to be precise. As discussed in the results section, this could be due to larger firms with a higher turnover being able to fund additional growth through borrowed funds, leading to higher financial expenditures; conversely, firms with high financial expenditures are likely larger firms with a higher turnover that can afford to borrow more funds. Heteroskedasticity is also identified as an issue, meaning that the variability of the dependent variable profit_percentage is unequal across the range of values of its predictors. In a panel dataset such as this, heteroskedasticity can sometimes be explained by measurement error of the observations decreasing over time due to the increasing availability of better measurement methods. This could be applicable to this work to a certain extent: improving financial accounting standards/ guidelines and stricter regulation could have led to more precise financial reporting values for the firm fundamentals observed in this research. However, a specific trend cannot be inferred from the residual scatterplot, so this cannot be asserted with certainty.

Both these issues of multicollinearity and heteroskedasticity work to undermine the quality of the regression models used, and thus the obtained coefficients of these variables and their respective p-values are not fully reliable. Future research that incorporates the suggestions mentioned earlier in this section might be able to organically mitigate these problems. Overall, this work can be considered an exploratory study into the subject, further research that makes use of more precise regression models and more advanced statistical techniques may be able

to yield more conclusive results.

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Appendix

Appendix 1: List of countries included in samples

Far East and central Asia

Azerbaijan (AZ)
Bangladesh (BD)
Bhutan (BT)
Brunei Darussalam (BN)
Cambodia (KH)
China (CN)
Georgia (GE)
Hong Kong, SAR (HK)
India (IN)
Indonesia (ID)
Japan (JP)
Kazakhstan (KZ)
Korea, Democratic People's Republic of (KP)
Korea, Republic of (KR)
Kyrgyzstan (KG)
Lao People's Democratic Republic (LA)
Macao, SAR (MO)
Malaysia (MY)
Maldives (MV)
Mongolia (MN)
Myanmar/Burma (MM)
Nepal (NP)
Pakistan (PK)
Philippines (PH)
Singapore (SG)
Sri Lanka (LK)
Vietnam (VN)
Uzbekistan (UZ)

Turkmenistan (TM)
Thailand (TH)
Tajikistan (TJ)
Taiwan (TW)

Middle East
Bahrain (BH)
Jordan (JO)
Kuwait (KW)
Lebanon (LB)
Oman (OM)
Qatar (QA)
Saudi Arabia (SA)
United Arab Emirates (AE)
Yemen (YE)

Appendix 2: Descriptions of variables utilized

Variable	Description
Profit/Loss	Percentage change in annual profit (or loss) of a firm.
Operating Revenue	Percentage change in annual operating revenue of a firm
Total Assets	Percentage change in annual total assets of a firm
Financial Expenses	Percentage change in annual financial expenditures of a firm
Shareholder's Funds	Percentage in annual shareholder's funds
Solvency Ratio	(Net After Tax Income + Non-Cash Expenses)/ Total Liabilit
IFRS Compliance	Dummy variable which takes the value 1 if a firm is IFRS co otherwise.
Year	Numeric variable with values 2015, 2016, 2017, 2018. (2015 changes from 2014 to 2015 and so forth)
Amendment	Dummy variable that takes the value 1 for the period includi 2016, and 0 for the period before 2016
lag1	1st lag of variable *Profit/Loss*
lag2	2nd lag of variable *Profit/Loss*

Appendix 3: Pairwise correlations of predictors (IFRS compliant firms only)

Variable	*Operating Revenue*	*Total Assets*	*Financial Expenses*	*Shareholder's funds*	*Solvency Ratio*	*Amendment*
Operating Revenue	1.000					
Total Assets	0.298	1.000				
Financial Expenses	0.912	0.260	1.000			
Shareholder's funds	-0.1097	0.478	-0.0272	1.000		
Solvency Ratio	0.0075	-0.0032	0.257	-0.0327	1.000	
Amendment	-0.2394	-0.1073	-0.0501	-0.0333	0.1761	1.000

Appendix 4: Breusch-Pagan test for heteroskedasticity

chi2(6)	= 3393.17
Prob > chi2	= 0.0000