Is the biological assets measured by historical cost value-related?

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Abstract

For listed agriculture companies,resource allocation decisions based on biological asset information of investors is related to the sustainable development.We examine the impact of the implementation of China Accounting Standards No.5 - Biological Assets (CAS5) on the value relevance of biological assets, which is essential convergence with International Financial Reporting Standards (IFRS), by analyzing the data from 2002 to 2016 of A-share listed companies in Shanghai and Shenzhen Stock Exchange. We find that, under historical cost-measurement model, the value relevance of the biological asset information of Chinese listed companies increased significantly after the implementation of CAS5. Further analysis shows that the value relevance of biological assets for groups under analyst following was higher than the others, which suggests that analyst following plays an alternative governance function. The results indicate that the biological asset information measured under historical

costs model has value relevance and provide empirical evidence from emerging market for the revision of IAS41 in 2014. It shows that the development of capital market information intermediary can enhance the value relevance of biological assets information, and facilitates the sustainability of agricultural enterprises in emerging market under the absence of strict external regulations and other infrastructures.

Keywords: Biological assets. Value relevance. Historical cost

1. Introduction

As the largest emerging market and developing country in the world, China has always attached great importance to agricultural development. As the basic industry of the national economy, agriculture is not only a major source of raw materials for many downstream industries, but also its development is also related to the problem of poverty alleviation of farmers (World Bank, 2015), which is a prerequisite for social stability and sustainability. In recent years, with the rapid development of China's economy, agriculture has gradually become a popular investment area in many sectors. For example, the number of listed companies in the Shanghai Stock Exchange and Shenzhen Stock Exchange under the agriculture, forestry, and animal husbandry industry classification increased over time. In addition, the number of listed companies involving agricultural operations in other industries is also steadily increasing. Agricultural listed companies have become a powerful force in the Chinese capital market (Figure 1). The influx of huge capital provides good opportunities for Chinese agricultural development, but also raises higher requirements for the accounting of agricultural companies. Investors in capital market need information which reflect the value of agricultural enterprises for decision-making, and agricultural enterprises have to maintain high-quality accounting information to meet investors' requirements. The major need in agricultural enterprises accounting is the treatment of biological assets.

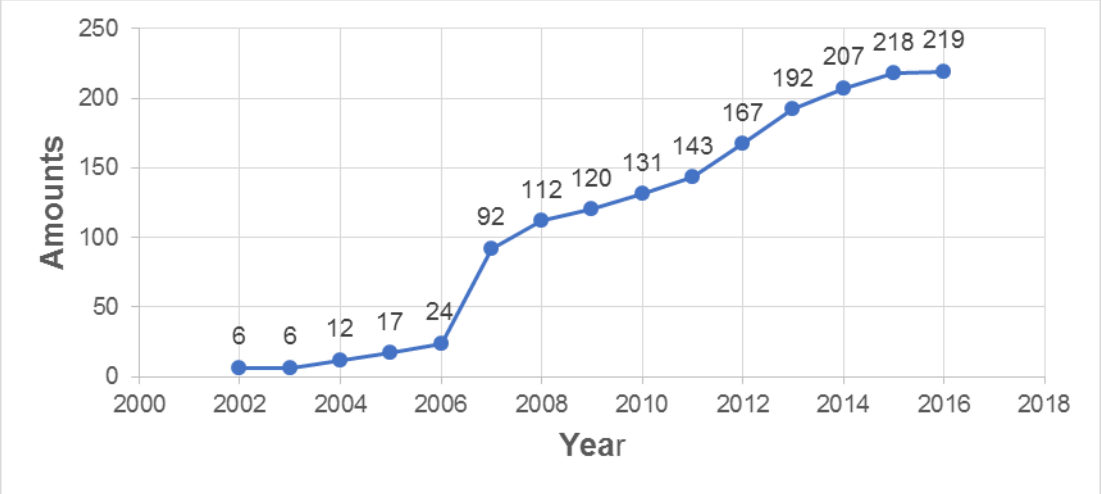

Figure 1: Amounts of Chinese agricultural listed companies in 2002-2016

Biological assets refer to animals and plants relevant to agricultural production and operation (IASB, 2001; China's Ministry of Finance, 2006), such as livestock, fishes, economic forest, and fast-growing, high-yield plantations. Biological assets are the basis for enterprise that engage in agricultural operations. It embodies the characteristics of the agricultural industry and vitality, which emphasizes the need for accounting recognition, measurement, and disclosure (Elad, 2004). However, the accounting research in biological assets has not received proper attention from both theoretical and substantive studies for a long time (Argils and Slof, 2001; Herbohn.K and Herbohn.J, 2006; Fischer and Marsh, 2013). Without accounting standards for biological assets at the national level then, it greatly affects the recognition of the biological assets of agricultural enterprises. In Chinese capital market, accounting fraud in biological assets in many listed agricultural companies, such as Silver Guangsha corporate limited, Lantian corporate limited, Fengle Seed corporate limited, and Xingfa Grassland corporate limited, have raised investors´ worry about the quality of accounting information of biological assets among listed companies in China. In February 2006, based on the International Accounting Standards 41–Agriculture (IAS 41), Chinese Ministry of Finance released the China Accounting Standards No. 5–Biological assets (CAS5), and in January of 2007 implemented these standards among the listed companies. Chinese capital market regulators aim to further improve the quality of biological asset accounting information and to promote the development of agricultural enterprises in capital market through CAS5. An interesting question is: Does the capital market value the biological asset information of listed companies in China? In other words, does the biological asset information has any value relevance? Further, will the implementation of CAS5 help to improve the value relevance of biological asset information?

The value relevance of accounting information is a basic theoretical problem in accounting. Since the pioneering research of Ball and Brown (1968), it was a focus of many accounting theorists (Easton and Harris, 1991; Ohlson, 1995; Barth et al., 2004; Kerr, 2018; Huffman, 2018). The existing research focuses on the value relevance of accounting statement items (Ball and Brown, 1968; Easton and Harris, 1991; Ohlson, 1995; Aboody and Lev, 1998;Barth et al., 2004; Ahmed et al., 2006; Zeng et al., 2016), value relevance of fair value measurement (Khurana and Kim, 2003; Christensen and Nikolaev, 2013; Huffman, 2018), impact of external environment on the value relevance of accounting information（Ali and Hwang, 2000; Hung, 2001; Aboody et al., 2002； Hung and Subramanyam, 2007; Kerr, 2018, and the effect of accounting information disclosure on value relevance (Francis et al., 2005; Venter et al., 2014; Middleton, 2015; Baboukardos and Rimmel, 2016). After the release and implementation of IAS41 in 2003, the value relevance issue of the fair value information of biological assets attracted extensive attention (Silva F et al., 2013a, 2013b; Gonalves et al., 2017; He et al., 2018; Huffman, 2018). But there is no clear conclusion on the value relevance of the fair value information of biological assets from these studies. For example, Gonalves et al. (2017) found that the fair value measurement of biological assets had a value relevance by studying on 27 national samples, while He et al. (2018) found that the fair value measurement information of biological assets from Australian listed companies did not have the capability to predict. These uncertainties indicate that the value relevance of the biological asset accounting information is relevant with the national characteristics (Ali and Hwang, 2000; Hung, 2001; Kerr, 2018), and is also related to the measurement attributes of biological assets (Huffman, 2018). In addition, the existing studies do not consider the impact of the accounting standards changes, such as the implementation of IAS41. Unlike IAS41, due to the characteristics of the emerging and transforming economy in China, the conditions for measuring the fair value of biological assets are not mature. The CAS5 recommends a priority of historical cost measurement for biological assets, most of conclusions from previous studies on value relevance may not be suitable for the Chinese market. Therefore, as the largest developing and emerging economy in the world, there is a need to study if biological assets information measured under historical cost of listed companies has value relevance, and whether the use of CAS5 improves the value relevance of biological assets. Additionally, the revision of the measurement attributes for biological assets under IASB in 2014 that allows measurement of productive biological assets at historical cost, this study measures biological assets at historical cost under the Chinese market and provides empirical evidence from

emerging economies for revising IASB standards.

In order to address these issues, this paper uses the data from A shares of listed companies in Shanghai and Shenzhen Stock Exchange from 2002 to 2016, and adopts a price model to study whether historical cost measurement suggested by CAS5 can improve the value relevance of biological asset information. We observe that, under the condition of historical cost measurement, biological asset information has significant value relevance after the implementation of CAS5, while it does not have value relevance before the implementation of CAS5. Using the biological assets' classification test, the information of both current and non-current biological assets measured at historical cost have value relevance after the implementation of CAS5, while both of these do not have value relevance before the implementation of CAS5. After a series of robustness tests, the findings remained the same. Furthermore, we include analysts following on behalf of the external governance environment in order to conduct a group test. The results show that the groups with more analyst following have higher value relevance of biological assets. To be specific, the value relevance of biological assets has been significantly improved both before and after the implementation of CAS5, while the value relevance of biological assets is relatively low in groups with less analysts.

This research makes the following contributions. Firstly, this article provides an empirical evidence of the value relevance of biological asset information after the application of IFRS in emerging market countries, which contributes the global convergence of IFRS. Since the release of IAS41, studies on biological assets mainly came from developed countries, such as Europe and Australia (Argils and Slof, 2001; Herbohn and Herbohn, 2006; Gonalves et al., 2017; He et al., 2018), those findings might not be suitable for developing countries (Elad, 2004). This paper provides positive feedback on the application of biological accounting standards from emerging market country through empirical study, which is committed to the global convergence of IFRS to IASB. Secondly, this paper supplements the literatures on the value relevance of biological assets information at historical cost measurement, and provides empirical evidence for the revision of IAS41 in 2014. Existing studies on the value relevance of biological assets mainly focus on fair value measurement information (Silva F et al., 2013a, 2013b; Gonalves et al., 2017; He et al., 2018; Huffman, 2018), while emerging market countries and underdeveloped countries use historical costs to measure biological assets (Daly and Skaife, 2016; Bova, 2016). Moreover, IASB revised IAS41 in 2014 to allow productive biological assets to be measured at historical cost.

Therefore, the question whether historical cost measurement of biological assets in emerging market countries has increased the value relevance has become a concern among developers of accounting standards. This study provides empirical evidence on this question. Third, this paper supplements the literatures on the role of analysts following in the IFRS adoption among emerging market countries. This study finds that analysts following can become an alternative external governance mechanism to enhance the value relevance of biological asset information in emerging market countries, especially under the absence of external governance environment, such regulation execution, company supervision, information acquisition, and utilization.

2. System Background And Literature Review

2.1. System background of CAS5 in China

As early as 1992, agricultural listed companies started in China, following with the trend that more and more listed companies were involved in agricultural operation. This increased the demand for agricultural activities accounting information of listed companies. However, China did not have a public accounting standard for the special business of agricultural listed companies for a long time. In the accounting system of listed companies in China, regardless of `Accounting system of joint-stock pilot enterprises` in early stages, or relatively complete `accounting system of the corporate Limited`, `Accounting Standards of Corporate`, and the `Accounting System of Corporate` have not provided systematic regulations on the accounting of biological assets. This accounting problems are only mentioned in the `supplementary provisions of the Accounting System of Agricultural Enterprises`, the notice of `the Implementation of the New Financial Accounting System by forestry Enterprises`, `the Financial Accounting System of national Forest and Nursery (Provisional)`, and `the Accounting Methods of Agricultural Enterprises`. Therefore, a relatively complete biological asset accounting system cannot be formed, and the information relevant of biological assets cannot be accurately disclosed. The accounting system of agricultural enterprises, which was implemented in 1993, advised that livestock and agricultural production costs should be recognized as inventory and become a part of the balance sheet, report biological assets such as plants, livestock, economic forest, and protected forest as construction-in-process, fixed assets, intangible assets, deferred expenses, and other items in the balance sheet, the different attributes and functions of biological assets

cannot be truly reflected, and there is no regulation on information disclosure of biological assets. The situation started to change in 2006.

In order to achieve convergence with IFRS, Chinese Ministry of Finance adopted CAS5 in February 2006, which refers to IAS41. CAS5 was implemented within the scope of listed companies and other enterprises are encouraged to adopt the new standards. Biological assets were divided into consumable biological assets, productive biological assets, and public welfare biological assets in CAS5. Consumable biological assets belong to current assets, while productive biological assets and public welfare biological assets belong to non-current assets. Furthermore, the accounting information disclosure of biological assets is specified in detail, such as biological asset recognition conditions, biological asset measurement attribute selection, biological asset usage restriction, and biological asset quantity, which help accounting information users such as investors to easily understand the biological asset information.

Based on the provisions of IAS41 and conditions in China, CAS5 categorizes three types of biological assets according to the use intention, and standardizes the accounting information on recognition, measurement, and disclosure of biological assets of Chinese agricultural companies. At the same time, CAS5 stipulates strict conditions for the fair value measurement application of biological assets. All Chinese listed companies still use historical cost measurement method after the implementation of CAS5, excepting one listed company (Morning Paper Corporate Limited) which issues both A and B shares and can adopt fair value measurement method. This provides us a relatively pure environment to examine the value relevance of historical cost measurement information and helps to eliminate the interference factors. CAS5 is the first specific accounting standard released by China for biological assets. It enables Chinese listed companies to have a unified standard of reorganization, measurement, and disclosure of biological assets, which standardizes the biological assets accounting treatment, theoretically improves the information quality of biological assets, and enhances the value relevance of biological asset information. But these still need empirical evidence to support.

2.2 Literature on biological assets

Biological assets are the main components of the operating assets of agricultural enterprises, and important resources for their business operation and development. Even

though the recognition, measurement and disclosure of biological assets has always been a problem in the theoretical and practical accounting, it has not been paid enough attention by the theoretical and practical circles for a long time (Argils and Slof, 2001; Herbohn and Herbohn, 2006; Fischer and Marsh, 2013). Without clear and unified accounting policy for biological assets, the effectiveness of decision-making can be highly impacted.

The IASC formally published the IAS41 in February 2001 and announced to implement it since January 1, 2003. IAS41 regulates the accounting treatment of biological assets and government grants related to agricultural activities. IAS41 stipulates that biological assets should be measured at fair value, and historical cost only can be applied when the fair value cannot be obtained reliably. IAS41 provides a good opportunity for agricultural accountants to improve their status (Argils and Slof, 2001) because accounting helps to improve the management of agricultural enterprises and bring better performance. For example, comparing with those who do not prepare financial accounting reports, farmers who has financial reports are capable of carrying out cashflow forecasting and strengthen their management. Empirical studies have shown that accounting information has a significant influence on explaining and predicting the failure of agricultural enterprises (Argils and Slof, 2001). However, since biological assets are measured at fair value, the implementation of agricultural accounting standards such as IAS41 will have a significant impact on the assets and profits of agricultural enterprises. Moreover, there are still many theoretical problems such as separation of biological assets and land assets. IAS41 is not suitable for underdeveloped countries (Elad, 2004). The financial performance of agricultural enterprises is unstable due to uncertainties of fair value (Herbohn and Herbohn, 2006; Herbohn, 2006); Dowling and Godfrey (2001) found that historical cost method of measuring biological assets was more popular among listed companies in Australia. In addition, studies have shown that measurement of biological assets at fair value may lead to adverse effects such as tax increases (Elad, 2004), pressure on dividend distribution (Herbohn, 2006), profit manipulation (Herbohn, 2006, Silva et al., 2015), weaken the comparability of accounting information (Cairns et al., 2011), and raise the debt capital cost of related enterprises (Daly and Skaife, 2016).

Some scholars consider the fair value of biological assets in a more positive way. For example, Argiles et al. (2011), based on the data test of Spanish companies, show that the adoption of historical cost measurement or fair value measurement makes no significant difference in predicting the future cash flow of biological assets, but the fair value

measurement of biological assets is more predictable for future surpluses. There are also scholars who believe that the selection of the measurement attributes of biological assets should match with the intention of asset usage (Botosan and Huffman, 2015). For example, Huffman (2018) finds that the value relevance of accounting information can be improved by matching the corresponding measurement method (fair value/ historical cost) according to the method of realizing the value of biological assets (exchange/ use). With the extensive implementation of IAS41 among listed companies, some scholars conducted empirical studies based on the biological asset data of the listed companies. For example, Silva et al. (2015) used the data of 31 listed companies in Brazil to study the impact of the fair value measurement of biological assets on managing profits, and observes that when the active market does not exist and the discounted cash flow model is used to estimate the fair value of biological assets, the surplus management will be increased. Using data from listed companies in 28 countries from 2001 to 2013, Daly and Skaife (2016) find that the debt cost of listed companies, which measured biological assets at fair value, is higher than those that adopted historical costs. Some scholars have studied the value relevance of the biological assets at fair value (Silva F et al., 2013a, 2013b; Gonalves et al., 2017; He et al., 2018; Huffman, 2018), and they mainly study the value relevance of fair value measurement information, and have no systematic research on the value relevance of historical cost measurement information of biological assets, and have not considered differences in market environment. Considering that China is the largest developing country and emerging market in the world, there are many restrictions on the fair value measurement of biological assets. Existing listed companies mainly use historical cost to measure biological assets. Therefore, this paper tries to examine the value relevance of biological asset measured at historical cost of Chinese listed companies.

3. Theoretical Analysis and Research Assumptions

One important goal of accounting information system is to provide useful information for decision-making. It is generally accepted that accounting information need to qualify with the requirements of relevance and reliability. In accounting, the term relevance means making a difference to a decision maker (FASB, 1984). If an accounting number impact on the value prediction of the stock market, it is considered as having relevance (Barth et al., 2001). In another word, investors use the accounting information in the process of stock evaluation. In

the classical valuation model, forecast cash flow, enterprise operation period, and risk return rate are three major factors of stock valuation. Information on biological assets, as resources for enterprise engaged in agricultural activities, can reflect the characteristics of the agricultural business activities. These characteristics have an impact on the three factors of the stock valuation model. If an enterprise owns an apple farm, the information disclosed in financial report about the apple trees owned by the company, such as the amount, tree age, geographical location, and area, are helpful for investors to predict the productivity, estimate the cash flow, and potential risks of the apple farm. Some existing empirical studies have also verified that stock market investors use biological asset information in the process of valuation (Silva F, 2013a; Gonalves, et al., 201; Huffman, 2018). However, higher quality accounting information can help improve the value relevance of accounting information (Barth et al., 2001; Shan, 2015). As mentioned before, there is no unified accounting policy for the accounting treatment of biological assets for Chinese listed companies before 2007, also there is a lack of the financial notes disclosure requirements about biological assets, therefore, the information quality of biological assets is quite low. After the application of CAS5 in 2007, there was a clear standard for the accounting treatment of biological assets for listed companies in China. The disclosure of biological asset information was sufficient, achieving convergence with IFRS and improving the value relevance of biological assets (Liu and Liu, 2007; Hung and Subramanyam, 2007). On the other hand, different types of biological assets realize economic benefits in different way, thus affecting the value relevance of biological assets. Huffman (2018) analyzes the differences in the companies´ use intention of biological assets, and believes that the use intention of current biological assets (consumable biological assets) is to trade, while the use intention of non-current biological assets (i.e. productive biological assets) is to use. Taking enterprises which adopt IAS4 as research samples, she finds that the value relevance of biological asset information can be significantly improved by using fair value to measure consumable biological assets and historical cost to value productive biological assets. However, Chinese listed companies use historical costs to measure both types of biological assets (current biological assets and non-current biological assets). Therefore, these two types of biological assets have different value relevance after the application of CAS5.

According to the above discussion, this article proposes the following hypothesis.

H1: After the implementation of CAS5, the value relevance of biological asset information of Chinese listed companies will be significantly improved.

H1a: After the implementation of CAS5, the value relevance of non-current biological assets information of Chinese listed companies will be significantly improved.

H1b: After the CAS5 implementation of CAS5, the value relevance of current biological assets information of Chinese listed companies will not be significantly improved.

4. Research Design

4.1. Sample selection and data base

In this research, A shares of listed companies in Shanghai and Shenzhen Stock Exchange, which have disclosed biological asset information, are selected as research samples. Before 2007, according to the Agricultural Enterprise Accounting System, companies reported biological assets under inventory, construction projects, fixed assets, intangible assets, or amortization expenses, and made specific descriptions in the notes of financial report. Therefore, we use the balance sheet items and relevant notes disclosed from the Wind and CSMAR databases, and collect samples from those listed companies. Since the implementation of CAS5 from 2007, enterprises should report biological assets into consumable biological assets, productive biological assets, and public welfare biological assets respectively. The data is thus more complete and qualified. The related data are from the CSMAR database. Other data used in this research, such as financial data, stock transaction, and analyst following, are from the CSMAR database as well. We rejected the samples with missing data and finally obtained the annual observation list of 1230 companies from 2002 to 2016. The sample screening process is shown in Table 1.

Table 1: Sample screening process

	Sample Quantity
Original sample:	1666
Samples of missing analyst following data:	436
Final sample:	1230

The number of samples obtained in each year is shown in Table 2. In order to eliminate the impact of extreme values, winsorizing is applied on all continuous variables at the 1% level. The standard errors of all regression models are processed by the cluster at the company level.

Table 2: Distribution of final samples

Year	Number of Samples	Proportion in Final Samples	Proportion of all listed companies in the year
2002	1	0.08%	0.08%
2003	6	0.49%	0.47%
2004	7	0.57%	0.51%
2005	16	1.30%	1.18%
2006	21	1.71%	1.51%
2007	46	3.74%	3.15%
2008	57	4.63%	3.61%
2009	80	6.50%	4.77%
2010	93	7.56%	4.63%
2011	116	9.43%	5.08%
2012	136	11.06%	5.56%
2013	155	12.60%	6.39%
2014	154	12.52%	6.23%
2015	163	13.25%	6.15%
2016	179	14.55%	6.14%
Total	1230	100%	--

4.2. Research model and variable definition

The price model and revenue model are commonly applied in the study of accounting information value correlation. Since historical cost is used to measure the biological assets of listed companies before and after the implementation of CAS 5, the change in the reporting method does not impact the items in a profit report. Therefore, this paper applies the model of Khurana and Kim (2003), and only uses price model to study the value relevance of the balance sheet. The model represented by equations (1) and (2) is used to check the impact of CAS5 implementation on the value relevance of biological assets information measured at historical cost, at the same time, this paper controls the current assets, non-current assets and total liabilities excepting biological assets. The model is as follows:

$$P_{i,t+1} = \alpha_0 + \alpha_1 BA1_{i,t} + \alpha_2 BA2_{i,t} + \alpha_3 OA_{i,t} + \alpha_4 DEBT_{i,t} + \varepsilon \quad (1)$$

$$P_{i,t+1} = \alpha_0 + \alpha_1 CBA1_{i,t} + \alpha_2 CBA2_{i,t} + \alpha_3 NCBA1_{i,t} + \alpha_4 NCBA2_{i,t} + \alpha_5 COA_{i,t} + \alpha_6 NCOA_{i,t} + \alpha_7 DEBT_{i,t} + \varepsilon \quad (2)$$

In the model represented in (1) and (2), $P_{i,t+1}$ are explanatory variables, indicating the share price of company i at the end of April in year t+1. CBA1 indicates that the number of biological assets listed in the current assets are divided by the total number of shares before 2007. The data of biological assets listed in the current assets is achieved manually, according to the data disclosed in the inventory and deferred expenses. For samples after 2007, the value

of CBA1 is 0. The CBA2 indicates that the number of biological assets in the current assets are divided by the total number of shares after 2007. The biological assets in the current assets refer to the consumable biological assets. The CBA2 of the samples before 2007 is 0. The NCBA1 indicates that the number of biological assets in non-current assets are divided by total shares listed before 2007. The NCBA1 of samples after 2007 is 0. For the biological asset data reported in non-current assets, we collected the data manually based on the data disclosed in construction engineering, intangible assets, fixed assets, and long-term deferred expenses. The NCBA2 indicates that the number of the biological assets are divided by the total shares in non-current assets after 2007, which is the sum of productive biological assets and public welfare biological assets divided by the total number of shares. The NCBA2 of samples before 2007 is 0. The COA status that the amount of current assets minus the amount of current biological assets then divided by the total number of shares, which is expected to show positive correlation with the stock price. The NCOA presents that the amount of non-current assets minus the non-current biological assets then divided by the total number of shares, which is expected to be positively correlated with the stock price. The DEBT indicates the ratio of total liabilities to total shares, which is expected to be negatively correlated with stock prices. The BA1 equals to the total amount of biological assets before 2007 divided by the total number of shares, equals to 0 after 2007, and the amount equals the sum of the CBA1 and the NCBA1. The BA2 equals to the total amount of biological assets after 2007 divided by the total number of shares, it equals 0 before 2007, and the amount equals the sum of the CBA2 and the NCBA2. The OA represents the amount of other assets except biological assets divided by the total number of shares. The number equals the sum of the COA and the NCOA. Table 3 describes all the research variables.

Table 3: Definition and calculation of variables

Variable nature	Variable symbol	Variable calculation
Interpreted variable	P	The share price disclosure in annual report of April 30.
Explanation variable	BA1	Before 2007, biological assets /total number of shares; After 2007, 0.
	BA2	Before 2007, 0. After 2007, number of biological assets / total stock.
	CBA1	Before 2007, current biological assets / total shares; After 2007, 0.
	CBA2	Before 2007, 0; After 2007, current biological assets / total number of shares.
	NCBA1	Before 2007, non-current biological assets / total shares; After 2007, 0.
	NCBA2	Before 2007, 0;

Control variable	OA	After 2007, non-current biological assets / total number of shares. (Total assets -Biological assets) / Total number of shares
	COA	(Current assets -Biological assets in current assets) / Total number of shares
	NCOA	(Non-current assets -biological assets in non-current assets) / Total number of shares
	DEBT	Total liabilities / Total number of shares

5. Empirical Analysis

5.1. Descriptive statistical analysis of main variables

Table 4 is the descriptive statistics of the variable. Panel A shows the descriptive statistical result of the whole sample. Panel B is the sample descriptive statistics before 2007, while Panel C is those after 2007. As shown in the figures, the average value of P is 17.28, the median is 12.66, and the standard deviation is 15.42, illustrates that the difference between the average stock prices of the sample company in the end of April is quite large.

Table 4: Descriptive statistics of research variables

Variable	Sample Size	Average	Standard deviation	Median	Minimum Value	Maximum value
Panel A: Full sample						
P	1230	17.28	15.42	12.66	1.790	148.1
BA1	1230	0.0100	0.0979	0	0	2.353
BA2	1230	0.280	0.622	0.0404	0	6.356
OA	1230	9.983	8.860	7.632	0.414	99.12
CBA1	1230	0.00191	0.0281	0	0	0.893
CBA2	1230	0.221	0.582	0.0104	0	6.162
COA	1230	5.761	7.198	3.872	-1.050	86.67
NCBA1	1230	0.00811	0.0930	0	0	2.353
NCBA2	1230	0.0587	0.175	0.000500	0	2.332
NCOA	1230	4.223	3.748	3.041	0.00840	35.02
DEBT	1230	5.574	7.376	3.329	0.102	81.68
Panel B: Samples before the implementation of CAS5 in 2007						
P	51	6.684	3.727	5.700	1.790	21.93
BA1	51	0.242	0.422	0.0934	0	2.353
OA	51	8.461	5.234	6.985	1.811	28.43
CBA1	51	0.0462	0.131	0.00130	0	0.893
COA	51	4.289	3.738	3.317	0.507	17.12
NCBA1	51	0.196	0.419	0.0616	0	2.353
NCOA	51	4.172	3.280	2.773	1.198	19.57
DEBT	51	4.887	4.381	3.383	0.387	24.08
Panel C: Samples after the implementation of CAS5 in 2007						
P	1179	17.74	15.57	13.17	2.360	148.1
BA2	1179	0.292	0.632	0.0462	0	6.356
OA	1179	10.05	8.980	7.680	0.414	99.12
CBA2	1179	0.230	0.593	0.0132	0	6.162
COA	1179	5.824	7.305	3.903	-1.050	86.67
NCBA2	1179	0.0613	0.178	0.00100	0	2.332
NCOA	1179	4.225	3.769	3.049	0.00840	35.02
DEBT	1179	5.604	7.479	3.324	0.102	81.68

The average value of BA1 is 0.01 and the median is 0, which shows the proportion of samples with biological assets before 2007 is lower than 50%. The average value of BA2 is 0.28, the median number is 0.0404, and the standard deviation is 0.622. This presents that the number of companies with biological assets increases significantly after the implementation of CAS5, but also indicates that the distance of the amount of samples´ biological assets is huge. According to the statistical results of the CBA1, CBA2, NCBA1, and NCBA2, sample companies which have biological assets differ greatly before and after 2007. After 2007, the number of sample companies with biological assets increased significantly and the average amount of biological assets raised rapidly. In terms of assets other than biological assets, the differences among samples are large as well, but in general, the gap is smaller than that of biological assets, and the amount of current assets in the sample is larger. The average value of DEBT is 5.574, the standard deviation is 7.376, and the median is 3.329, which states that the average debit of each share is 5.574. However, the average debt level of samples has increased since 2007, and the gap of average debt level among samples has increased as well. In a word, from the descriptive results, we can tell that the CAS5, which converging with IFRS, standardizes the accounting treatment of the biological asset information for Chinese A-share listed companies.

5.2. Analysis of the impact of CAS5 implementation on value relevance of biological asset

Firstly, this paper uses model (1) to examine the value relevance of the general biological asset information before and after CAS5 application. The Table 5 shows that the coefficient of the BA1 is not significant. The coefficient of the BA2 is 4.06, and is significantly positive at the 1% level. The coefficients of the OA and the DEBT are significantly positive at the 1% level as well. This explains that the biological assets owned by the listed company before 2007 have no significant forecast relationship with the stock price. However, after the implementation of CAS5 in 2007, the biological assets of the listed company show an effective forecast on the stock price, and the value relevance of the biological assets is considerably improved, which preliminarily verify the assumption 1.

Secondly, we use model (2) to test the value relevance between the current biological assets and non-current biological assets information before and after the implementation of CAS5. As in the result shown in Table 5, the coefficient of CBA1 is not significant in terms of

current biological assets. The coefficient of CBA2 is 4.38 and shows significant positivity at the level of 1%. For non-current biological assets, the coefficient of NCBA1 is not significant. The coefficient of NCBA2 is 7.95 and shows significant positivity at 10% level. This illustrates the value relevance of current and non-current biological asset information before and after the implementation of CAS5 are significantly different. The value relevance of both current and a non-current biological asset measured at historical cost are significantly improved after the implementation of CAS4. The assumption 1a is preliminarily verified, but it is inconsistent with assumption 1b. Huffman (2018) argues that the use intention of current biological assets is trading, so that the information measured at fair value can improve the value relevance, while this research suggests that current biological assets measured at historical cost has value relevance. The possible explanation is that the market environment of emerging countries has some restrictions of the basic market trading, and there is no relatively reliable information about the fair value of the current biological assets. Therefore, the capital market investors prefer to rely on historical cost. On the other hand, the ultimate use purpose of current biological assets is not only limited to the trading, some current biological assets with other assets also produce economic benefits. As a result, the information of current biological assets measured at historical cost has value relevance.

The above findings also explain that, in emerging countries where market basic conditions are imperfect, the value relevance of historical cost measured information of biological assets can also be improved through the application of accounting standards that converge to IFRS. When IASB revised IAS41 in 2014, it also abandoned the insistence on the measurement of biological assets at fair value and allowed non-current biological assets to be measured at historical cost. This research could provide empirical evidence from emerging market countries that for IASB's revision.

Table 5: Impact of CAS5 implementation on value relevance of biological asset Information

Variable	Model (1) Overall biological assets P	Model (2) Classification of biological assets P
CBA1		47.37(0.83)
CBA2		4.38 (2.65) ***
COA		2.77 (5.28) ***
NCBA1		4.88(0.45)
NCBA2		7.95 (1.82) *
NCOA		1.84 (5.70) ***
BA1	8.24(1.10)	
BA2	4.06 (2.77) ***	
OA	2.71 (7.23) ***	

DEBT	-3.21 (-6.96) ***	-2.93 (-5.26) ***
Constant	0.71(0.20)	3.42(0.94)
Observations	1230	1230
R-squared	0.38	0.37
Year Fixed effects	Yes	Yes
Industry Fixed effects	Yes	Yes

Note: The numbers in the brackets present the corresponding t statistics. *, **, and *** present that at the level of 10%, 5%, and 1% are significant positivity.

5.3. Robustness test

In order to ensure the robustness of the results, we conducted a series of robustness tests. The test results are shown in Table 6 and Table 7. The findings in the main test does not change, and the related research conclusions are further verified.

5.3.1. Perform test on group before and after 2007 respectively

A regression analysis is performed on samples before and after 2007. Some values of certain variables are replaced by 0, which probably can affect the data distribution of regression samples or the model setting deviation, which can influence the conclusion of this paper. To eliminate the impact of these factors, we divide the samples into two groups, before and after 2007, for inspection. The results are listed in columns (1) and (2) in Table 6 and columns (1) and (2) in Table 7. It can be observed that, regardless of the overall biological assets or both current and non-current biological assets, the historical cost of biological assets information has a significant value relevance in the group after 2007, while the group before 2007 does not have value relevance. It illustrates that the application of CAS5 significantly improves the value relevance of biological assets, and the research findings of the main test are further verified.

5.3.2. Perform group test based on the importance of biological assets.

As mentioned above, biological assets are the basis for enterprises to engage in agricultural production and operation activities. The importance of biological assets differ for different types of enterprises. For example, to enterprises with high proportion of agricultural enterprises or biological assets, the impact of biological assets is higher on the determinants of enterprise's basic value, such as the future cash flow of enterprises. Therefore, capital

market investors will pay more attention to the biological asset information of those companies. We estimate that, if biological asset information has value relevance, the value of biological asset information is more relevant for companies with high proportion of agricultural enterprises or biological assets. As a result, we divide the samples groups by the industry clarification: agricultural enterprises and non-agricultural enterprises, also divide them based on the proportion of biological assets to total assets, then perform regression. The results are shown in columns (3), (4), (5), and (6) in Table 6, and columns (3), (4), (5), and (6) in Table 7. We find that agricultural enterprises with more biological assets show higher value relevance of biological assets.

5.3.3. Use stock price disclosed in annual report as the explanatory variable

This research uses stock price in the annual report as the explanatory variable to test the value relevance of the biological asset information. To solid the research results, we use the stock price at the end of last year (PY), which is disclosed in the annual report, as the explanatory variable, and perform regression again. The results are shown in the column (7) of Table 6 and Table 7. We find that the research findings of the main test are not changed, which further verifies our research conclusions.

Table 6: Robust test results of overall biological assets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Before 2007	After 2007	Agricultural enterprises	Non-agricultural enterprises	High biological assets	Low biological assets	Replace stock price
Variable	P	P	P	P	P	P	PY
BA1	4.28		-1.51	11.02	13.35	25.31	-11.04
	(0.65)		(-0.09)	(1.18)	(1.13)	(0.39)	(-0.62)
BA2		4.12***	6.85***	1.41	4.89***	-47.95	2.10*
		(2.79)	(3.22)	(1.03)	(3.05)	(-1.06)	(1.85)
OA	0.50	2.74***	3.09***	2.65***	2.50***	2.73***	2.29***
	(1.59)	(7.26)	(4.98)	(6.52)	(5.90)	(4.92)	(5.39)
DEBT	-0.46	-3.26***	-3.36***	-3.14***	-2.86***	-3.14***	-2.64***
	(-1.42)	(-6.98)	(-4.16)	(-6.31)	(-4.83)	(-4.79)	(-5.25)
Constant	9.35***	9.72***	-1.97	3.93	-0.01	0.31	-1.57
	(3.26)	(4.11)	(-0.72)	(1.15)	(-0.00)	(0.04)	(-0.44)

Observations	51	1179	217	1013	615	615	916
R-squared	0.72	0.37	0.48	0.38	0.44	0.39	0.28
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed effects	Yes	Yes	No	No	Yes	Yes	Yes

Table 7: Robust test results of classified biological assets

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Before 2007	**After 2007**	**Agricultural enterprises**	**Non-agricultural enterprises**	**High biological assets**	**Low biological assets**	**Replace stock price**
Variable	**P**	**P**	**P**	**P**	**P**	**P**	**PY**
CBA1	31.83		-75.16	66.61	7.17	-103.37	-30.75
	(1.03)		(-0.69)	(1.05)	(0.10)	(-0.50)	(-0.37)
CBA2		4.45***	6.76***	2.95	4.31**	32.08	2.44**
		(2.69)	(3.16)	(1.61)	(2.23)	(0.46)	(2.05)
COA	0.66**	2.80***	2.98***	2.71***	2.40***	2.84***	2.49***
	(2.11)	(5.25)	(3.73)	(4.78)	(3.06)	(5.24)	(4.52)
NCBA1	10.67		-16.21	15.51	-3.98	19.04	-20.38
	(1.07)		(-0.49)	(1.13)	(-0.27)	(0.39)	(-0.88)
NCBA2		8.01*	6.59	4.97	7.60*	46.07	9.65**
		(1.82)	(1.51)	(0.75)	(1.69)	(0.61)	(2.34)
NCOA	0.35	1.85***	3.22***	1.89***	1.67***	1.60***	1.43***
	(1.24)	(5.65)	(4.18)	(5.63)	(3.01)	(3.59)	(4.25)
DEBT	-0.43	-2.97***	-3.38***	-2.92***	-2.18***	-3.02***	-2.47***
	(-1.64)	(-5.23)	(-4.05)	(-4.87)	(-2.63)	(-5.34)	(-4.51)
Constant	7.91**	10.70***	1.72	1.76	2.93	4.79	0.19
	(2.45)	(4.64)	(0.31)	(0.71)	(0.70)	(0.69)	(0.05)
Observations	51	1179	217	1013	615	615	916
R-squared	0.74	0.36	0.48	0.33	0.41	0.41	0.30
Year Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed effects	Yes	Yes	No	No	Yes	Yes	Yes

5.3.4. Further analysis: role of analyst following

Some studies find that the application of IFRS does not directly lead to the increase accounting information value relevance, and depends on the law-enforcement of regulation application (Daske et al., 2008; Christensen et al., 2013;Kerr, 2018), reporting motivation of company's management (Daske et al., 2008), information availability (Liu and Liu, 2007), and stock market efficiency (Aboody, 2002), etc. In emerging market countries, the law execution, information acquisition and utilization, corporate management supervision, and stock market

efficiency are greatly different from developed countries. As a result, the value relevance under IFRS applications is impacted. Eccher and Healy (2000) believe that lack of necessary supervision and infrastructure establishment is the reason why IFRS fails to provide more useful information in China. In order to improve the value relevance of biological assets information with the convergence of IFRS, it is important to improve the external governance environment. As an intermediary in capital market, financial analysts with their professions play roles on information production and supervision of corporate management （Chung and Jo, 1996; Liu, 2011; Gentry and Shen, 2013）, so that the information environment of the capital market is improved, the agency cost is reduced, and the value relevance of accounting information value is increased (Chung and Jo, 1996; Lang et al., 2004). Chung and Jo (1996) believe that analyst following expand investors' awareness of the company and has a positive impact on the company's value in stock market. Lang et al. (2004) finds that the increase of analyst following could improve the stock price of companies which might face corporate governance problems. Kim and Shi (2012) find that the application of IFRS is beneficial to the firm-specific information and reducing the stock price synchronicity, while more analyst following strengthen the effect of IFRS's application to reduce share price synchronization. Therefore, in emerging markets countries where the legal environment is imperfect, information acquisition and utilization are low, and the company's management lacks effective supervision, the analyst following can play an alternative governance role, so that promoting the implementation of CAS5 and improving the utilization and transfer efficiency of biological assets information. Therefore, the value relevance of biological asset information is improved.

According to the median of the number of analysts following in each year, the sample is divided into two groups based on the analyst following level: high analyst following and low analyst following. The model (1) and model (2) are regressed respectively. Columns (1) and column (2) in Table 8 show the test results of the overall biological assets at different levels of analyst following. In the group with high analyst following, the coefficient of BA1 is 31.23, which shows significant positivity at the 10% level. The coefficient of BA2 is 4.53, which shows is positivity at the level 5%. We find that, besides the implementation of CAS5, value relevance of biological asset is increased with the growth of analyst following, which suggests that analyst following helps to improve the value relevance of biological asset information and exerts alternative governance in emerging market countries where market fundamentals are imperfect. In the group with lower analyst following, the coefficient of BA1

is not significant, but the coefficient of BA2 is 1.99, which is significantly positive at the 5% level, but it is extremely lower than the coefficient (P=0.0694) of BA2 of the high analyst group. It shows that low analyst following does not increase the value relevance of biological assets.

Columns (3) and column (4) in Table 8 show the results of the classification of biological assets under different levels of analyst following. From the results, we can find that the coefficients of the two types of biological assets, CBA2 and NCBA2, are both positive and significant in the group of high analyst following after the application of CAS5, while the coefficients of CBA1 and NCBA1 before the implementation of CAS5 are positive but not significant. It all enhance that high analyst following can improve the value relevance of biological assets.

Table 8: Test results of analyst following groups

	Overall biological assets		**Classification of biological assets**	
Variable	**(1) High analyst following P**	**(2) Low analyst following P**	**(3) High analyst following P**	**(4) Low analyst following P**
CBA1			111.65(0.92)	2.59(0.09)
CBA2			5.74(3.21)***	0.71(0.69)
COA			3.74(7.66)***	0.91(2.32)**
NCBA1			15.52(0.65)	0.45(0.08)
NCBA2			11.68(1.77)*	5.23(1.44)
NCOA			2.15(4.88)***	0.90(3.40)***
BA1	31.23(1.93)*	-0.56(-0.16)		
BA2	4.53(2.37)**	1.99(2.00)**		
OA	3.30(6.97)***	1.32(7.15)***		
DEBT	-4.13(-7.22)***	-1.51(-6.08)***	-3.96(-7.87)***	-1.04(-2.44)**
Constant	-11.86(-1.22)	2.37(1.20)	1.65(0.25)	3.90(1.59)
P Value (Test: BA2)	0.0694			
Observations	636	594	636	594
R-squared	0.42	0.34	0.38	0.40
Year Fixed effects	Yes	Yes	Yes	Yes
Industry Fixed effects	Yes	Yes	Yes	Yes

6. Conclusion

Driven by the implementation of CAS5, which complies with IFRS, this research uses firm-year observations of 1,230 China's A-share listed companies from 2002 to 2016 of the

Shanghai Stock Exchange and Shenzhen Stock Exchange, and use price model to examine whether the implementation of CAS5 can improve the value relevance of biological assets information at historical cost measurement. From the perspective of overall biological assets, this study finds that, implementation of CAS5 significantly improve the value relevance of biological asset information at historical cost. From the point of view of the classification of biological assets, the historical cost measurement of the current biological assets and non-current biological assets information has value relevance after the implementation CAS5, while it has no value relevance before the implementation of CAS5. After a series of robustness tests, the findings remain the same, and the value relevance of biological assets is more significant in agricultural enterprises and enterprises with high proportion of biological assets. Further, we use different level of analyst following to simulate external governance and find that the increase of the analyst following will promote the value relevance of biological asset information before the application of CAS5 application, besides the increase of value relevance of the biological asset information after the application of CAS5. However, the value relevance of biological assets is relatively low in groups with lower analyst following.

This research has the following contributions. Firstly, this article provides empirical evidence for value relevance of biological asset information after the application of IFRS in emerging market, which contributes to the global convergence of IFRS. Since the public of IAS41, the research on biological assets is mainly from developed regions, such as Europe and Australia. The market conditions of developed countries and other external environments that highly effects on accounting standards are different from those of emerging markets. Those research findings are not quite suitable for developing countries (Elad, 2004). Through the empirical evidence of the world's largest emerging market country, this article provides positive results for IASB on the application of biological asset accounting standards in emerging market countries, which is committed to IFRS's global convergence. Secondly, this paper supplements the literature on the value relevance of biological assets information and provides empirical evidence for the IAS41 revision in 2014. The existing research on the value relevance of biological assets mainly focuses on fair value measurement information, while emerging market and non-developed countries mainly adopt historical costs to measure biological assets (Hana B. et al.,2012;Daly and Skaife, 2016; Bova, 2016). IASB revised the IAS41 in 2014, which allow productive biological assets to be measured at historical cost. Therefore, the application of historical cost of biological asset information in emerging

market countries to improve value relevance has become a concern of IASB and other regulation setters. This research findings provide corresponding empirical evidence. Third, this paper supplements the literature on the role of analyst following in emerging market countries. Emerging market countries are lack of in external governance environment, such as law execution, corporate supervision and information acquisition and utilization, as an alternative external governance mechanism, analyst follow shows its governance effect and helps to enhance the value relevance of biological asset information.

In conclusion, the accounting standards that converge with IFRS improve the value relevance of biological assets in emerging market countries. In addition, fair value measurement of biological assets may not be suitable when lacking basic market conditions, while historical cost measurement can provide accounting information which helps information users' decision-making. This study provides evidence from emerging market countries for the revision of IAS41 in 2014. It also shows that, in emerging markets countries where infrastructure is imperfect, the development of capital market information intermediaries, such as analysts, can enhance the interpretation of accounting information, strengthen the supervision of enterprise management and improve the value relevance of biological asset information.

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