FAIR VALUE VERSUS HISTORICAL COST-BASED VALUATION FOR BIOLOGICAL ASSETS: PREDICTABILITY OF FINANCIAL INFORMATION

VALOR RAZONABLE VERSUS COSTE HISTÓRICO DE LOS ACTIVOS BIOLÓGICOS: VALOR PREDICTIVO DE LA INFORMACIÓN CONTABLE

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ABSTRACT

There is an intense debate on the convenience of moving from historical cost (HC) toward the fair value (FV) principle. The debate and academic research is usually concerned with financial instruments, but the IAS 41 requirement of fair valuation for biological assets brings it into the agricultural domain.

This paper performs an empirical study with a sample of Spanish farms valuing biological assets at HC and a sample applying FV, finding no significant differences between both valuation methods to assess future cash flows. However, most tests reveal more predictive power of future earnings under fair valuation of biological assets, which is not explained by differences in volatility of earnings and profitability. The study also evidences the existence of flawed HC accounting practices for biological assets in agriculture, which suggests scarce information content of this valuation method in the predominant small business units existing in the agricultural sector in advanced Western countries.

KEYWORDS: Fair value, historical cost, biological assets, earnings prediction, cash flow prediction.

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RESUMEN

La evolución de la contabilidad desde el coste histórico (CH) hacia el valor razonable (VR) ha suscitado debates y controversias, tanto en el ámbito profesional, como en el académico. Si bien el debate y los estudios se han referido principalmente a los instrumentos financieros, el requerimiento de la NIC41 de valorar los activos biológicos al VR ha ampliado el debate a la contabilidad agrícola.

Este trabajo realiza un estudio empírico mediante una muestra de explotaciones agrícolas españolas que valoran sus activos biológicos al CH y otra que valoran al VR, para comparar el poder predictivo de ambos criterios de valoración. No se encuentran diferencias significativas entre ambos criterios para la predicción de los futuros flujos de tesorería. No obstante, la mayor parte de los tests realizados revelan un mayor poder predictivo de los futuros resultados contables bajo el valor razonable, que no se explica en función de diferencias en la volatilidad. El estudio evidencia también la existencia de prácticas defectuosas de cálculo del CH por parte de las explotaciones agrícolas, lo cual sugiere un escaso contenido informativo de la contabilidad bajo este criterio dado el universo de pequeñas explotaciones familiares predominantes en los países occidentales avanzados.

PALABRA CLAVE: valor razonable, coste histórico, activos biológicos, predicción del resultado contable, predicción de flujos de tesorería.

1 INTRODUCTION

The reform of the accounting standards towards fair value (FV) accounting has raised an intense debate in recent years. Major accounting groups and institutions worldwide, such as The International Accounting Standards Board (IASB), the U.S.A. Financial Accounting Standards Board (FASB), and the Accounting Regulatory Committee and the European Financial Reporting Advisory Group in the European Union (EU) have encouraged the convergence of international accounting towards standards based on market prices.

The FASB issued several standards requiring recognition or disclosure of fair values estimates for assets and liabilities, mainly for financial instruments. For example, Statements of Financial Accounting Standards number 87 in 1985 on employer's accounting for pensions, number 105 in 1990 on disclosure of information about financial instruments, number 107 in 1991 on disclosures about financial instruments, etc. The International Accounting Standards Committee issued International Accounting Standard (IAS) requiring measurement at FV and value changes to be recognised in profit or loss. The most important were the IAS 32 on disclosure and presentation of financial instruments, issued in 1995 and revised in 1998 by IAS 39, and the IAS 41 on Agriculture, issued in 2000. The EU adopted the whole existing IAS in the form of Commission Regulation (EC) 1725/2003, with the exception of IAS 32 and 39, that were adopted in 2004 under Commission Regulations (EC)2086/2004 and (EC)2237/2004.

FV is defined as the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction (e.g. IAS 39, IAS 41, SFAS 107). In 2006 the SFAS 157 redefined FV as the price that would be received to sell the asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date[1].

In spite of this persistent trend towards FV, the reform has caused controversy among practitioners, especially over financial instruments (e.g. Day, 2000; Economist, 2007). Together with enthusiastic supporters of fair valuation (e.g. Chartered Financial Analyst Institute, 2007), there are also sceptics (e.g. Joint Working Group of Banking Associations on Financial Instruments, 1999). A report of the European Central Bank (2004) summarizes the potential drawbacks and advantages of a FV accounting framework from the point of view of financial institutions. André et al. (2009) argue that, as long as the market was rising, no one was too shocked by FV accounting. According to these authors, it started to be stigmatized when it began to reflect the market downturn in banks' balance sheets.

(1) The IASB started a project on fair value measurement and issued a discussion paper (IASB, 2006a) aiming at a providing a single source of guidance on fair valuation, adopting the same definition as in SFAS 157, but stating that "it will neither introduce nor require any new fair value measurements" (IASB, 2008).

The evolution towards FV reflects the needs of users of financial accounting and the efforts of accounting standard-setting bodies to reverse the pattern of declining relevance of financial information (Barlev and Haddad, 2003). Reporting the FV of assets and liabilities in the balance sheet draws the attention of shareholders to the value of their equity and to periodic changes in this value, as is reflected by the market mechanism. FV reflects changes in assets values that will be realized in subsequent operations. In this respect, Aboody et al. (1999) found that upward revaluations of fixed assets by UK firms are positively associated with future performance, share prices, and returns. Given the growing process of globalization and economic integration, as well as the increasing importance of financial markets, shareholders and stakeholders need a better assessment of the true performance and management of the firm, than allowed through HC. Two primary criteria required by accounting standards are relevance and reliability. Relevance of accounting information is defined and measured in accounting research as its degree of association with share prices or share returns[2]. Equity market value is used as the valuation benchmark to assess the usefulness of accounting information for investors and financial users. According to Barth et al (2001) and Landsman (2007), the extant research provides an overall conclusion that FV-based information is more relevant than historical cost (HC)-based information.

Academic debate is usually concerned with financial instruments and framed within the agency theory, assuming information asymmetry between market participants and the existence of perfect versus imperfect market conditions. Barth and Landsman (1995) conclude that in perfect and complete markets a FV accounting-based balance sheet reflects all value-relevant information. However, in more realistic market settings management discretion applied to fair valuation can detract from balance sheet and income statement relevance. Watts (2003) argues that fair valuation is subject to more manipulation and, accordingly, is a poorer measure of worth and performance than historical cost (HC). He argues that any attempt to ban accounting conservatism is sure to fail and that accounting can not compete with the market in valuing the firm (Watts, 2006). Ball (2006) complains that fair valuation does not necessarily make investors better off, and that its usefulness has not been demonstrated. Rayman (2007) concludes that FV accounting is liable to produce absurdities and misleading information, if it is based on expectations that turn out to be false. Ronen (2008) complains that FV suffers from a lack of reliability and can be subject to manipulation. In the same vein, Liang and Wen (2007) are critical of the beneficial effects of moving to FV because it inherits more managerial manipulation and induces less efficient investment decisions than cost valuations. Plantin and Sapra (2008) conclude that, when there are imperfections in the market, there is the danger of the emergence of an additional source of volatility as a consequence of fair valuation, and thus a rapid shift to full mark-to-market regime may be detrimental to financial intermediation

(2) According to Holthausen and Watts (2001), 94 percent of value relevance papers perform association studies.

and therefore to economic growth. On the contrary, Bleck and Liu (2007) find that HC accounting makes it easier to hinder bad investment projects, preventing their liquidation therefore accumulating volatility to hit the market at a later date and producing a crash in the asset price, increasing overall volatility and reducing efficiency (i.e. reducing profitability). Gigler et al. (2006) conclude that even in the case of a mixed attribute report (i.e., some items are valued at market while others are carried at HC), FV performs better: it provides stronger signals of financial distress. Finally, Choy (2006) shows that for FV to be relevant, necessary and sufficient conditions must be fulfilled.

Almost all existing empirical studies on FV test its relevance when applied to financial instruments, analyzing associations between accounting numbers and share prices. They provide conflicting findings; while Nelson (1996) does not find FV relevance, Barth (1994), Barth et al. (1996) and Bernard et al. (1995) do. Ahmed and Takeda (1995), Carrol et al. (2003), Eccher et al. (1996) and Barth and Clinch (1998) do find relevance, but under certain conditions. A recent study of Hann et al. (2007) finds FV pension accounting does not improve the informativeness of the financial statements and even impairs it. Laswad and Baskerville (2007) find no association between cash flow and unrealized earnings from revaluation of assets to FV, under pension schemes required in New Zealand. Ahmed et al (2006) find that recognition of derivative financial instruments at FV is relevant, while disclosure is not. Danbolt and Rees (2008) find that FV is consistently more value relevant than HC, although this value relevance can be conveyed via asset values and need not be incorporated into income computations. They also find evidence consistent with earnings manipulation under FV.

The IAS 41 brings the debate into the agricultural accounting domain. Most authors are critical with the requirement of fair valuation for biological assets and value changes to be recognised in the profit and loss statement. Penttinen et al. (2004) claim that fair valuation would cause unrealistic fluctuations in the net profits of forest enterprises. Herbohn and Herbohn (2006) and Dowling and Godfrey (2001) stress the increased volatility, manipulation and subjectivity of reported earnings under this standard. Both studies are performed in the context of the Australian Accounting Standards Board 1037 (similar to IAS 41) and provide empirical evidence of Australian entities preference for cost valuation or delaying the adoption of FV. Specifically, Herbohn and Herbohn (2006) calculate coefficients of variation of profits, and of gains and losses from timber assets, of eight public companies and five state and territory government departments. The authors argue that figures provide an insight into the volatility caused by the fair value measurement[3]. Elad (2004) complains that the IAS 41 is a major departure from historic cost accounting; this could signal the demise of the French *Plan Comptable Général Agricole* (PGCA) model,

(3) Barth et al. (1995) find that FV based earnings and capital are more volatile than HC earnings and capital with a sample of banks. However, they do not find this incremental volatility to be associated with bank share prices.

entail the recognition of unrealized gains and increase profit volatility. However, Argilés and Slof (2001) welcome FV measurement for biological assets because it avoids the complexity of calculating their costs, given the predominance of small family farms in Western countries, and specifically in the EU, with no resources and skills to perform accounting procedures and valuations. The nature of farming makes HC valuation of biological assets inherently difficult because they are affected by procreation, growth and death, as well as joint-cost situations. Allocation of indirect costs is another source of complexity for cost calculation in farms. This is an especially acute problem for small family households. The American Institute of Certified Public Accountants (1996) and the Canadian Institute of Chartered Accountants (1986) recommend HC, considering also the possibility of realizable value as an alternative. The 1986 French PGCA adheres also to the HC principle. However, Kroll (1987) regrets that the complexity in asset valuation and accounts is an important barrier to its use in the French PGCA. Elad (2004) points out that where there is not an active market for a biological asset, simplicity is not a merit of FV. Argilés and Slof (2001) state that the IAS 41 conceptual framework has already been widely and successfully implemented in the EU through the Farm Accountancy Data Network (FADN). The latter has been fulfilling the role of a quasi-standard-setting body in the absence of previous pronouncements on agricultural standards from other authorities (Poppe and Beers, 1996).

Therefore, an assessment of the convenience of FV for agriculture should balance its advantages and drawbacks. Simplicity is the main advantage of using FV for biological assets with respect to HC. But there is no unanimous agreement in previous literature with respect to whether volatility in income and profits, relevance, income smoothing and profitability are improved or worsened with FV. The present study contributes to this debate providing empirical evidence in valuation of biological assets in agriculture. No previous study has empirically contrasted the predictive power of FV versus HC valuation with respect to income and cash flow comparing two samples of firms each one using different valuation criteria. Comparing data from two samples of farms, one applying the Spanish accounting standard (based on HC, and hereafter referred to as HC) and the other FV for biological assets, we find no significant differences in future cash flow predictive power. Most tests performed reflect lower earnings predictive power for farms using HC with respect to those using FV. In-depth interviews maintained with agricultural accountants help to explain these results, as generalized flawed accounting practices are found. Given the real setting in which agricultural accounting is produced, accurate and reliable cost calculations cannot be expected.

The remainder of the paper is organized as follows. Section 2 explains the research question, section 3 the research design, results are provided in the fourth section and discussions in the fifth. Finally, the sixth section presents the conclusions.

2 RESEARCH QUESTION

Choy (2006) complains that the predictive power of FV has never been tested, in spite of the fact that both the Statement of Financial Accounting Concepts (SFAC) No. 2 and the current project of the IASB (2006b) emphasize the need for predictive value of financial information. FASB Concepts Statement No. 1 also states that one of the three objectives of financial reporting is to help users to assess future cash flows. Moreover, SFAC No. 5 stresses that to be relevant information must have predictive value.

More predictable earnings and cash flows may help managers to anticipate financial problems, adjust inventories, negotiate funding, adjust resources, exercise judgement in financial reporting, increase or reduce production, etc. Improved accuracy may also lessen agency problems, because managers are considered to be more accountable. Empirical research has found that firms with lower forecast errors have lower implied costs of capital (Gebhardt et al., 2001)[4] and valuations in the stock market (Lang et al., 2003). To a great extent, financial statements are used as a basis for estimating future performance and assessing future cash flows prospects (SFAC No. 5). Firm managers, as well as any other user of accounting information, may benefit from more predictable accounting information.

However, the comparative predictive power of FV and HC accounting valuation methods has not been previously tested. To our knowledge, only Chen et al. (2006) test the predictive power of FV, finding that it reduces the ability to predict future cash flows. However, they study this relation indirectly, comparing the association between accounting numbers and future cash flows over time, assuming that accounting has been evolving to FV. Kim and Kross (2005) find an increasing relationship between earnings and one-year-ahead operating cash flows over time, but they attribute it to the increasing conservatism in accounting rather than to the influence of fair valuation.

Slightly related to these issues, Beaver et al. (2005) find a small decline in the ability of financial ratios to predict bankruptcy from 1962 to 2002, and an incremental explanatory power of market-related variables over this period. They explain the deterioration in predictive ability of financial ratios in terms of an insufficient improvement of FASB standards.

The main purpose of this study is to provide empirical evidence on the extant academic discussion about the predictive ability of HC versus FV-based accounting information. We perform an empirical study of the relevance of FV and HC of biological assets for predicting

(4) However, their results are not conclusive to the extent that multivariate results, partially contradicting this finding, are not satisfactorily explained.

future earnings and cash flows. For this purpose we use two samples of farms, one using FV and the other applying HC. No previous study has performed similar empirical research, for farms or any other sector. As we found no conclusive theoretical support with respect to this issue in previous research[5], we do not formulate a defined hypothesis on the higher/lower predictive power of HC with respect to FV.

3 RESEARCH DESIGN

Empirical design

We test the predictive power of income under HC and FV of biological assets through differences in errors provided by the following parsimonious prediction models:

(1)

(2)

(3)

where E_{ij} and CFO_{ij} are, respectively, the annual net earnings and cash flows from operations of farm i in period j., while ε is the corresponding error term in any equation.

Carnes et al. (2003) use similar parsimonious models to equation (1) to estimate forecasting earnings. Kim and Kross (2005), Dechow et al. (1998) and Chen et al. (2006) use similar variable definitions and models to equations (2) and (3) in the investigation of earnings and cash flow prediction. We use a well established calculation method for CFO (e.g. Kim and Kross, 2005; Dechow, 1994; Dechow et al., 1998; Chen et al., 2006)[6].

Different estimation methods have been performed for equations (1) to (3): OLS and panel regression models. Additionally, we run the Arellano-Bond estimator for equations (1) and (3). This estimator is obtained through autoregressive dynamic panel data models that use the orthogonality conditions that exist between lagged values of variables and the disturbances (Baltagi, 2005: 136-142).

(5) See for example Plantin and Sapra (2008) and Bleck and Liu (2008) as opposite supporters on this issue.
(6) According to these authors, and to the available data in the financial statements of the *Spanish* SABI data base, we perform the most feasible calculation for cash flow from operations: CFO = operating income + depreciation – change in inventory – change in debtors – change in prepayments and accrued income + change in current liabilities (excluding bank loans) + change in provisions.

With equations (1) to (3) we perform estimations and calculate subsequent errors, for samples of farms using HC and FV. Following Carnes et al. (2003) we then calculate the mean absolute percentage error (MAPE):

(4)

where N represents the total number of farm-years in the sample, A_{ij} is the actual value of earnings and cash flows for farm i in a year j and $F(A_{ij})$ is the forecast of earnings and cash flows for farm i in a year j as generated by each forecasting model. We then test differences in *MAPE* for both samples: farms using HC and those using FV for biological assets. We thus test the ability of incomes to predict future earnings and cash flows, where A_{ij} applies for E_{ij} and CFO_{ij} in equations (1) to (3).

Sample

Table 1 summarizes our sample selection procedures. The Spanish firm CABSA provides analysis and financial data of Spanish firms, including 462 Spanish farms with notes to financial statements, which it provided to us. We classify the sample in two groups: those disclosing fair valuation for biological assets in their notes, and those disclosing historic cost valuation. We then select financial data from those farms available in SABI, which is a database of financial statements of about 1,000,000 Spanish and 150,000 Portuguese firms. Our review of notes to financial statements yields 13 farms indicating that they value biological assets at FV and 334 at HC, and thus prepare their financial statements according to these valuation methods, while 115 are discarded because they do not provide information about their valuation method, the method applied is not clear, or there is no available financial data for them. Through SABI we collect the available twelve-year data for these firms (from 1995 to 2006), with 3,286 farm-year observations of earnings for farms applying HC and 134 applying FV earnings. "We converted all the data into values of 1995, applying the Spanish consumer price index."

CABSA and SABI databases collect information on financial statements of companies obliged to file in the Spanish *Registro Mercantil*. Most farms have no legal obligation to disclose financial information because of their small size and legal form, and usually do not write up accounting. Only the farms which, according to their legal form, are incorporated businesses ("sociedades") must file financial statements in the aforementioned *Registro Mercantil*, which is the primary data source for financial statements from Spanish farms.

TABLE 1. - SAMPLE SELECTION AND SCREENING

	TOTAL	HC	FV
Total potential farm sample	462		
Removed	115		
Final number of farm sample	347	334	13
Farms with available data for earnings	347	334	13
Farm-year observations for earnings	3,665	3,648	147
Farm-year observations with earnings in current and previous year	3,420	3,286	134
Farms with available data for calculating CFO	105	97	8
Farms-year observations for CFO	494	437	57

The small proportion of farms from our sample using FV can be explained in terms of the requirement from Spanish accounting standards to use HC, stated in the accounting standards numbers 3 and 13 of the Spanish *Plan General Contable* in force for the period of our data sample. Market value is only allowed when cost price is higher. The 8th report of accounting principles from the *Asociación Española de Contabilidad* (AECA) recognising the possibility of using market prices in agricultural and mining companies under certain conditions, is a mere recommendation from this association. However, 13 farms in our sample state that they depart from the Spanish standard, many of them alleging that they apply market valuations because they found it difficult to apply HC to their biological assets. No farm in our sample specified that market price was lower than cost.

SABI provides a rough item on cash flow data, consisting in adding depreciation to earnings. We, however, calculate a more reliable cash flow as previously indicated (see footnote 6). We obtain all the necessary items to calculate CFO for 97 farms valuing biological assets at HC and 8 at FV, thus yielding 439 year-data observations for the former and 58 for the later (see Table 1).

Table 2 displays descriptive statistics for our sample. While farms valuing at FV present significantly higher total assets, inventories and fixed assets compared to those valuing at HC, there are no significant differences in earnings, revenues and CFO between both types of farms. Farms in our sample usually record biological assets as inventories, although a few of them also record them as fixed assets. The fact that neither the share of fixed assets, nor the share of inventories over total assets are significantly different between both types of farms,

suggests that, rather than being a mere valuation effect, the difference in total assets reveals that farms valuing at FV are larger than those using HC. According to their larger size, farms using FV are less financially stressed: their shareholders' equity, as a percentage of total assets, is higher. However, they do not attain higher revenues and earnings, and consequently the assets turnover of these farms is significantly lower, thus suggesting that they are less efficient than farms valuing at HC in our sample. There are no significant differences in margin between both types of farms, but the subsequent ratios of earnings on total assets and shareholders' equity are lower for the subsample of HC-based farms, with $p<0.1$ and 0.01 respectively. As farms in our sample do not offer data on the effect of FV versus HC valuation in assets and revenues, the assessment of its influence on the difference in profitability in our sample remains unknown. Columns displaying standard deviations suggest that farms applying FV belong to a more homogenous group than those valuing at HC.

TABLE 2. - DESCRIPTIVE STATISTICS (IN DEFLATED €)

	Number of observations		Mean		Median		Std deviation		Significant
	HC	FV	HC	FV	HC	FV	HC	FV	Differences[1]
E: Earnings	3,286	134	168,092.8	216,552.5	34,458.05	52,486.56	1,267,312	612,037.5	
Total assets	3,286	134	4,467,829	5,718,481	1,784,396	3,798,870	1.01e+07	4,680,873	***
REVENUE: Revenues	3,271	134	4,949,146	4,679,438	2,417,167	1,957,554	1.40e+07	6,919,477	
CFO: Cash flow from operations	437	57	1,089,538	571,275.2	400,082.6	304,767	3,183,789	1,134,846	
Fixed assets	3,285	134	2,379,405	2,954,942	721,954.9	1,544,537	6,756,086	3,403,701	***
% Fixed assets on total assets	3,285	134	42.07	45.87	40.84	44.85	25.06	26.73	
Inventories	3,140	133	790,428.4	1,262,651	374,581.1	557,766.3	1,865,299	1,770,251	***
% Inventories on total assets	3,140	133	24.69	25.03	19.78	23.41	21.21	18.47	
Shareholders' funds	3,286	134	2,302,185	3,420,670	724,695	2,415,948	7,193,530	3,752,628	***
% Shareholders' funds on total assets	3,286	134	40.41	54.98	40.33	56.37	37.30	25.65	***
Earnings on total assets	3,286	134	2.99	2.51	1.96	1.51	20.28	7.32	*
Earnings on shareholders' funds	3,286	134	23.73	2.64	6.70	3.61	1,134.79	44.98	***
Margin: Earnings on sales	3,271	134	35.65	6.22	1.35	1.10	969.90	31.32	
Turnover: Sales on total assets	3,271	134	1.80	1.03	1.36	0.62	1.95	0.94	***

Notes:
Mann-Witney test
Significance levels: * p<0.1, ** p<0.05 and *** p<0.01

Table 3 displays additional information for the subsample of 13 farms applying FV. As can be seen, they do not belong to any specific subindustry. There are cereal growers, different types of livestock farms, such as for example pig, poultry or milk, as well as mixed farming. Although on average they are larger than HC farms, there is a wide array of figures of assets and earnings in this group. Seven of these farms are regularly audited, of which three received qualified opinions that are unrelated to the valuation of biological assets. Only one audit report mentioned the fact that the farm applied FV to biological assets. The auditor supported the valuation employed in terms of the difficulties of cost calculation in agriculture and the acceptation of market price by AECA. Seven farms provided no argument for their departure from HC principle in their notes to financial statements. The remainder supported the use of FV with arguments about being unable to afford the cost of applying cost accounting, the difficulties of cost calculation for biological assets, that the market price is accepted by AECA, and that there are no appropriate standards for agriculture in Spain, while the IAS41 provides useful guidance. We found specific mention of the difficulties of applying HC to common livestock, pigs, reproductive livestock, eggs, farm production for feeding livestock, calves, common farm output, cotton, olives, etc.

TABLE 3. - CHARACTERISTICS OF FARMS APPLYING FV.

Farm name	year data observations	Total assets (mean in deflated €)	Earnings (mean in deflated €)	CNAE primary code (according to SABI) and description CNAE secondary code (according to SABI) and description Type of farming according to notes to financial statements	
CUARTE SA	10	1.48e+07	1,074,896.00	123 1571 –	Pig farming Manufacture of prepared feeds for farm animals Pig farming
GANADERIA PRIEGOLA SA	11	7,779,565.00	-36,555.29	130 – –	Mixed farming – Dairy and mixed farming
JOLMA SA	10	7,063,441.00	1,173,054.00	110 111 –	– Growing of cereals and other crops All agricultural activities
ARLESA SEMILLAS SA	11	6,568,584.00	-7,327.15	111 – –	Growing of cereals and other crops – Growing and trading of seeds
CUAPEL SA	11	2,336,885.00	20,462.29	123 – –	Pig farming – Pig farming
AGRICULTORES UNIDOS SA	11	3,298,214.00	58,564.94	110 111 –	– Growing of cereals and other crops Cereals (corn) and research and development activities
RANCHOS PECUARIOS SAU	11	726,025.50	11,537.94	124 124 –	Poultry farming Poultry farming Poultry farming
CULTIVADORES Y GANADEROS SA	10	5,735,766.00	-57,981.53	130 110 –	Mixed farming – Growing and trading of agricultural production
GANADERIA BERTA SA	11	3,223,471.00	-27,060.22	120 121 –	– Raising of cattle and production of raw milk Raising of cattle and production of milk
EUROEXPLOTACIONES AGRARIAS SA	11	1.52e+07	546,316.40	130 113 –	Mixed farming Fuits Mixed farming
GRANGES BUADES SL	8	1,008,662.00	56,808.44	130 – –	Mixed farming – Pig farming
COTOS REGABLES GUADALQUIVIR SL	11	2,546,390.00	-11,880.97	130 –	Mixed farming – Agriculture
AGROPECUARIA SIERRA MORENA SA	8	3,054,835.00	71,156.48	121 120 –	Raising of cattle and production of raw milk – Livestock

4 RESULTS

Table 4 displays a comparison of the predictive power of farms under historic cost and fair valuation. OLS, as well as the more robust estimation methods of panel data and Arellano-Bond have been employed. Skewness-Kurtosis tests reveal that errors from our estimations are non-normally distributed. Bartlett's tests yield that equal-variance assumption between errors of our samples is implausible. We thus perform two sample t-tests with unequal variances and further check them with nonparametric Mann-Whitney U tests.

TABLE 4. - COMPARISON OF ERROR FORECASTING UNDER HISTORIC COST AND FAIR VALUE

	Number of observations		Mean absolute percentage error (MAPE)			
	HC	FV	HC	FV	t-test uneq. var.	Mann-Whitney
Panel A: One-year–ahead earnings prediction model: equation (1) $E_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \varepsilon_{ij}$						
OLS estimation	3,286	134	13.38284	3.855784	***	***
Panel data estimation (fixed effects)	3,286	134	17.59503	6.331572	***	
Arellano-Bond estimation	2,813	119	5.134423	1.960496	**	
Panel B: Cash flow prediction depending on earnings of previous year: equation (2) $CFO_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \varepsilon_{ij}$						
OLS estimation	437	57	3.922158	4.718276		
Panel data estimation (random effects)	437	57	3.614197	5.045603		
Panel C: Cash flow prediction depending on earnings and cash flow of previous year: equation (3) $CFO_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \beta_2 \cdot CFO_{ij-1} + \varepsilon_{ij}$						
OLS estimation	322	48	2.628344	3.610359		
Panel data estimation (fixed effects)	322	48	3.954732	7.733764		
Arellano-Bond estimation	236	40	1.264479	2.094354		

Significance levels: * p<0.1, ** p<0.05 and *** p<0.01

Panel A displays a comparison of errors from the parsimonious one-year-ahead earnings prediction model. Estimations with OLS yield significantly lower errors in our sample of farms under FV than under HC. The commonly used Hausman test (Hsiao, 2005) rejects the null hypothesis of no correlation between individual effects and explanatory variables (χ^2=985.58 with p<0.01). As individual effects are correlated with the regressors in all estimations, the random effects estimator is inconsistent, while the fixed effects estimator is consistent and efficient. Errors from fixed effects estimations are significantly higher (with p<0.01) for the sub-sample of farms under HC with respect to the sub-sample under FV, while they do not exist with the Mann-Whitney test, which is more reliable under non-

normal distributions. Similar results (not displayed) are obtained with random effects estimations. Arellano-Bond estimation considerably reduces errors with respect to previous estimations, and also provides smaller errors for the sub-sample of farms under FV than for the sub-sample of farms valuing at HC. T-test adjusted for unequal variances shows significant differences in errors with $p<0.05$, while they do not exist with the Mann-Whitney test. It can be thus concluded that under FV accounting for biological assets, earnings are more, or at least no less, predictable than under HC.

Panel B from Table 4 displays no significant differences in errors between both valuation methods with parsimonious OLS and panel regression models forecasting farm *CFO* from previous year earnings. The Hausman test provides an insignificant p-value ($\chi^2=0.34$ with $p>\chi^2=0.5584$), thus indicating that the random effects model is more efficient. However, fixed effects estimations (not displayed) also yield no significant differences in errors. Panel C also displays no significant differences in absolute percentage errors with OLS, panel regressions and Arellano-Bond estimations, where *CFO* is forecasted with earnings from both valuation methods and *CFO* from the previous year. Results display MAPE from fixed effects estimations ($\chi^2=18.33$ with $p<0.01$), but random effects estimations (not displayed) also provide no significant differences in errors. Neither the t-test adjusted for unequal variances, nor Mann-Whitney tests show significant differences between both samples, in absolute percentage errors obtained with all regressions referring to panels B and C. Results displayed in both panels suggest no significant differences in the relevance of earnings, calculated according to HC and FV, to predict future cash flows.

Given the few farms found applying FV we have examined the consistency of our results with a jackknife procedure. It is a well-established technique employed under the absence of available hold-out samples, and widely used in empirical accounting studies (e.g. Argilés, 2001; Landsman et al., 2006). Results (displayed in Table 5) confirm those of Table 4.

TABLE 5. - COMPARISON OF JACKKNIFE ERROR FORECASTING UNDER HISTORIC COST AND FAIR VALUE

	Number of observations		Mean absolute percentage error (MAPE)			
	HC	FV	HC	FV	t-test uneq. var.	Mann-Whitney
Panel A: One-year–ahead earnings prediction model: equation (1) $E_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \varepsilon_{ij}$						
OLS estimation	3,286	134	13.38926	3.89817	***	***
Panel data estimation (fixed effects)	3,286	134	17.60172	6.38673	***	
Arellano-Bond estimation	2,813	119	5.137836	2.046517	**	
Panel B: Cash flow prediction depending on earnings of previous year: equation (2) $CFO_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \varepsilon_{ij}$						
OLS estimation	437	57	3.948018	4.854139		
Panel data estimation (random effects)	437	57	3.630547	5.114437		
Panel C: Cash flow prediction depending on earnings and cash flow of previous year: equation (3) $CFO_{ij} = \beta_0 + \beta_1 \cdot E_{ij-1} + \beta_2 \cdot CFO_{ij-1} + \varepsilon_{ij}$						
OLS estimation	322	48	2.666814	3.829859		
Panel data estimation (fixed effects)	322	48	3.991621	7.920008		
Arellano-Bond estimation	236	40	1.407788	1.355967		

Significance levels: * p<0.1, ** p<0.05 and *** p<0.01

Additional analysis is performed in order to assess whether comparisons of predictive power could be influenced by differences in volatility, displayed in Table 6. As none of the items from this table in our samples fits normality (revealed through Skewness-Kurtosis tests) and/or presents unequal variances (revealed through Barlett's tests), we perform Mann-Whitney tests. Significant differences in standard deviation of earnings with $p<0.05$ do not exist anymore when standard deviation is referred to mean values of earnings: no significant differences are found for the coefficient of variation of earnings. The table displays also no significant differences in volatility of revenues and return of assets, whether measured through standard deviation or the coefficient of variation. Results for the agricultural sector do not support the commonly accepted hypothesis (e.g. Plantin and Sapra, 2008; Dowling and Godfrey, 2001; Pentinen et al., 2004) of greater volatility with FV. Bleck and Liu's (2007) hypothesis of greater volatility with HC is not supported either. There are only significant differences in assets volatility. Farms using FV present a lower coefficient of variation of assets across periods.

TABLE 6. - VOLATILITY

	Number of observations		Mean		Median	
	HC	FV	HC	FV	HC	FV
STDE: Std. dev. of earnings	334	13	319,425.60	332,843.70	78,020.88	252,094.60**
Std. dev. of assets	334	13	1,240,429	887,817.70	451,801.40	716,459.10
STDREVENUE: Std. dev. of revenues	333	13	1,274,262	996,484.20	656,184.30	562,459.40
Coefficient of variation of earnings	334	13	-0.8767701	-2.542746	1.005028	0.739634
Coefficient of variation of assets	334	13	0.2921988	0.1660403	0.2350004	0.149725***
Coefficient of variation of revenues	333	13	0.3043578	0.2282905	0.2405416	0.1559959
Std. dev. of return on assets	334	13	7.392014	5.767836	4.528184	4.863414
Coefficient of variation of return on assets	334	13	-20.53559	9.721508	0.9579515	0.7118995

Notes:
Mann-Witney test
Significance levels: * p<0.1, ** p<0.05 and *** p<0.01

Tests on the influence of the valuation method on earnings volatility are reinforced with regression models. We consider earnings volatility as a dependent variable of the valuation method employed, controlling for the volatility of farm CFO that is supposed to be reliable data and independent of accruals and accounting manipulation. Additionally, we consider earnings volatility depending on the valuation method, but controlling for volatility of farm revenues. We thus define the following regression models:

(5)

(6)

(7)

(8)

where STD_{Ei} is the standard deviation of E of farm i, STD_{CFOi} is the standard deviation of CFO generated by farm i, FV is a dummy variable, whose value is 1 when the farm applies FV to biological assets and 0 otherwise; ΔE_{ij} is the first difference (annual variation) of E of farm i in year j with respect to the previous year; ΔCFO_{ij} is the first difference (annual variation) of CFO generated by farm i in year j with respect to the previous year; $STD_{REVENUEi}$ is the standard deviation of annual revenue of farm i, and $\Delta REVENUE_{ij}$ is the first difference (annual variation) of revenue of farm i in year j with respect to the previous year. We perform ordinary least squares (OLS) regressions for equation (5) to (8), displayed in Table 7. All estimations present significant goodness-of-fit. Control variables present the expected significant positive signs in all estimations, whereas the dummy variable for valuation method presents no significant signs in any column, whether the control variable is CFO or revenues volatility. Results suggest no influence of the valuation method of biological assets on earnings volatility.

TABLE 7. - OLS ESTIMATIONS RELATING EARNINGS VOLATILITY TO CASH FLOWS AND REVENUES VOLATILITY (T-STATISTIC IN PARENTHESIS)

Variables	(A) Eq. (5) STD_E	(B) Eq. (6) $\lvert\Delta E\rvert$	(C) Eq.(7) *STDE*	(D) Eq.(8) $\lvert\Delta E\rvert$
Constant	118,734.60 (1.57)	120,444.10 (1.53)	98,999.89 (1.61)	139,418.60 *** (5.92)
FV	-38,522.48 (-0.19)	-160,637.40 (-0.83)	60,857.03 (0.22)	59,896.84 (0.54)
Control variables:				
STD_{CFO}	0.454536 *** (12.19)			
|ΔCFO |		0.4184609 *** (18.35)		
$STD_{REVENUE}$			0.1735971 *** (6.89)	
|ΔREVENUE |				0.1608458 *** (14.60)
Model fit: R-square F Number of observations	 0.6841 74.72 *** 72	 0.4834 171.25 *** 369	 0.1216 23.73 *** 346	 0.0591 106.74 *** 3,399

Significance levels: * p<0.1, ** p<0.05 and *** p<0.0

Results from our sample suggest that there are no significant differences in volatility between the two valuation methods that could influence the differences in their respective

predictive ability. The lower ability of HC accounting for predicting future earnings should be explained in terms of less meaningful information content.

5 DISCUSSION

A question that arises when interpreting these results is why, given the importance of random factors derived from climate and market conditions in agriculture, farms applying FV do not present higher volatility and unpredictability for future earnings and cash flows. Given that market prices present pronounced fluctuations in the agricultural sector, less reliable accounting under FV would be expected. Bleck and Liu (2007) provide an interesting argument. They contend that FV does not increase volatility; on the contrary, HC transfers volatility across time and even increases it overall. Thus, given that market prices fluctuate sharply, volatility would emerge anyway at the point of sale. Barlev and Haddad (2003) argue that, as a consequence of prioritizing reliability and conservatism, HC accounting is a source of irrelevance.

The discussion on the appropriateness of both valuation methods makes full sense in the natural setting in which accounting is produced and used. Agriculture in advanced Western countries is characterised by the predominance of small family farms (Allen and Lueck, 1998) and the fact that cost calculations are inherently complex. Product diversification, the existence of joint-cost situations, seasonality, as well as the typical characteristics of procreation and growth of biological assets, entail considerable difficulties for such small business units. Tomkins and Groves (1983) note the need for accounting research to acquire knowledge of relevant behaviours of agents involved in the natural setting in which accounting interacts.

We contacted accounting offices that could provide us with a grasp of the real procedures used in accounting preparation for the predominant small business farms in the agricultural sector in Spain. Two accountants working in a private consulting firm specialized in agriculture, a director and two accountants of an agricultural trade union that provides accounting services to their affiliates, and the manager of a Government consulting firm agreed to in-depth interviews. These institutions prepare financial accounting statements for nearly 500 farms in Spain. Thus, we conducted four interviews with 6 different agricultural accountants about their accounting procedures during around 180 minutes. From these interviews the following picture emerges. Farmers generally view accounting procedures as unnecessary, being mainly useful for tax purposes. Accordingly, they only show a modest involvement in the preparation of accounting information. Common complaints from all the interviewed accountants are the scarce collaboration and the lack of detailed information from their clients. Accountants recognise that according to Spanish standards, they should apply HC. However, they admit that due to the amount of detailed information and work

required, in most cases they apply an average of insurance companies' valuations calculated some years ago. In addition, they never depreciate livestock, because they find its calculation and monitoring very difficult, and financial statements usually rely on rough standard costs, which they usually apply to many of their clients. All interviewed accountants admit trying to apply the required HC valuation in Spanish accounting standards. However, none of the private nor Government agencies prepare accurate cost accounting, with the exception of one consulting firm, which admits to doing so in only 5% of cases, while approximate data is provided for the remaining 95% of cases. In the specific case of breeding stock, in approximately 75% of cases they estimate the cost for specific livestock in some geographical areas, and then apply the same cost to any farm in these areas. These costs have not been updated for years. As can be seen, in most cases HC means the same cost for all farms, independently of their real performance. Many farms that attempt to apply (or disclose) HC valuations, finally rely on market values, as for example when in some cases the interviewed accountants admitted to calculating HC with market price minus the percentage applied in Spanish tax procedure to obtain the profit for tax calculations[7].

We infer from this information that only a small portion of farms in our sample applying HC did so with accurate cost calculation, while the rest did not bother to use flawed calculations. Accounting is scarcely used in the agricultural sector, it is usually considered as a mere formal procedure, deserving few resources and little attention from farmers. We guess that the 13 farms applying FV encountered no more problems than the average-sized farms in our sample in using and calculating HC, but they are more concerned about the reliability of their accounting information, and therefore use FV as alternative valuation for biological assets. This idea is supported by the fact that on average they are larger farms, and larger farms place greater reliance on accounting information.

Watts (2006) argues that FV is irrelevant because it lacks verifiability, but relevant HC accounting requires accurate and reliable cost calculations. However, this assumption is rebuttable in most farms. Beyond the theoretical discussion about unrealistic HC and FV accounting regimes and taking into account the characteristics of accounting practices in the agricultural sector, HC cannot be expected to be free of problems of volatility, smoothing and predictability. Given the real setting described above, HC accounting has scarce information content in agriculture. This seems to be a plausible explanation for our empirical findings. Lewis and Jones (1980) and Sturgess (1994) also warned that HC is generally not very informative to users in agriculture and that allocations to individual assets are arbitrary in most cases.

(7) In Spain only incorporated businesses (*sociedades*) have the obligation to disclose financial statements. Most farms, as well as most small business in other sectors, determine their taxes on the basis of a hypothetical profit calculated by means of a standard percentage of sales, previously specified by the Spanish Ministry. This procedure is called *Estimación Objetiva Singular*. Only when sales exceed certain level, is it necessary to determine a direct estimation of earnings through recorded revenues and expenses.

6 CONCLUSIONS

This paper reviews recent literature on the debate about the advisability of moving from HC toward the FV principle. There is a lack of agreement about the advantages and drawbacks of this movement. No unanimous pronouncement can be ascertained in previous literature with respect to whether volatility in earnings, revenues and assets, relevance, manipulation and profitability are improved or worsened with the use of the FV principle. However, a claim against the requirement of IAS 41 of fair valuation for biological assets prevails in the existing literature. Most authors complain that it is a major departure from the convenient valuation method required and will entail serious drawbacks for the agricultural sector.

Tests performed in this study reveal that farm cash flows are not less predictable with fair valuation than with HC. Consequently, there is no difference in the relevance of accounting information. On the contrary, most tests reveal a higher predictive power of future earnings under FV (but not confirmed by most robust estimations and tests). There are no significant differences in earnings, revenues and profitability volatility that could influence any difference in predictive power. None of the alleged drawbacks of FV have been empirically confirmed by this research. However, FV avoids the unaffordable complexities of cost calculation in the agricultural sector. Therefore, when there are reliable marked prices, fair valuation appears to be a useful simple valuation method for achieving a more widespread use of accounting in the agricultural sector.

Our findings reflect the realistic conditions under which HC accounting is performed. The accounting agents interviewed unveil rough cost calculation practices. Under such practices HC cannot be expected to be more reliable and relevant than FV. Our empirical evidence suggests less meaningful information content under HC accounting than under FV.

From the point of view of the craft of accounting, HC is far more appealing than FV when skills and resources are available. For management purposes, information about historic costs (or rather, current costs) is essential. We acknowledge that FV ignores the social and environmental relations of production that lie beneath market exchanges, and risks to legitimate unjust socio-economic relations, as pointed out by Elad (2007). However, we do not believe that HC is able to deal with these issues. Costs recorded in financial statements also lie beneath market exchanges. Opportunity costs of family work, externalities, environmental and social costs are also absent from HC in financial accounting. These are important factors that should be studied and analysed, whatever the valuation method applied, but there is no suggestion that HC would add any advantageous solution to these issues with respect to FV. Tools such as the Global Reporting Initiative or any other disclosure in this respect are equally compatible with FV in agriculture, provided that farms are big enough to overcome the necessary formal procedures and administrative costs. As

an example, the European FADN uses market valuations for biological and fixed assets, and this is no greater handicap than the use of HC would be for the analysis of opportunity costs of family work, social or environmental costs. Tax inconveniences can be easily solved, but these issues are out of the scope of the present article. We are merely claiming that FV has the advantage of simplicity, when market values are available, considering the complexities of cost calculations in agriculture, the characteristics of most farms and the real setting where accounting is produced. There can be no reliable accounting information from unreliable costs. Our empirical research does not support the existence of the alleged disadvantages of FV with respect to HC. On the contrary, given the real setting of agricultural accounting, FV entails a no less consistent valuation method, as well as reliable and comparable sources of information. Thus, the advantage of its simplicity as a useful tool for widespread accounting across the agricultural sector remains.

The small samples used in this research, especially in the sub-sample of farms applying FV, are one of the drawbacks of this study. We have tried to mitigate this drawback by enlarging our sample with a panel set of farm-year data. Our conclusions should be taken cautiously. Further research with wider samples and segmented studies for big/small agricultural businesses and different countries is needed. Analysis of sub-industries and characteristics of companies using FV is also a suggestion for future research. The setting in which accounting in agriculture is produced also requires in-depth research.

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