

## THE EFFECT OF IFRS ADOPTION ON THE VALUE RELEVANCE OF ACCOUNTING INFORMATION: THE CASE OF COLOMBIAN BANKS

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**RESUMEN:** Este artículo compara la evolución de la relevancia de la información contable de los ocho bancos que cotizan en la Bolsa de Valores de Colombia (BVC) antes y después de la adopción de las Normas Internacionales de Información Financiera (IFRS, por su sigla en inglés). La relevancia de la información contable se puede medir a través de las relaciones estadísticas entre la información presentada en los estados financieros y valores o rendimientos del mercado de valores. En este estudio se utilizan las series mensuales del valor en libros del patrimonio por acción (representa el estado de la situación financiera), las utilidades por acción (representa el estado de resultados integral) y el precio de la acción en bolsa entre enero de 2001 y diciembre de 2018. Mediante el uso de modelos de panel de datos basados en el modelo de (Ohlson, 1995), se muestra que la información contable ha sido relevante antes y después de la adopción de las IFRS, pero que la adopción de las IFRS no ha aumentado dicha relevancia.

*Palabras clave:* valor en libros, bancos colombianos, ganancias, NIIF, modelo de Ohlson, relevancia del valor.

**ABSTRACT:** The value relevance of accounting information can be measured through statistical relationships between the information contained in the financial statements and stock market values or returns. In this paper, we compare the value relevance of the accounting information of eight banks listed on the Colombian Stock Exchange (BVC, for its acronym in Spanish) before and after the adoption of the International Financial Reporting Standards (IFRS). For this purpose, we use three monthly time series (book value of equity per share—representing the statement of financial position—, earnings per share—representing the comprehensive income statement—, and stock price per share) from January 2001 to December 2018. In addition, we apply panel data models based on Ohlson's model. The results show that accounting information has been relevant before and after IFRS adoption, which means that the implementation of IFRS has not increased its value relevance.

*Keywords:* book value, Colombian banks, earnings, IFRS, Ohlson's model, value relevance.

## 1. Introduction

The value relevance of accounting information refers to the ability of information contained in the financial statements to capture and summarise the firm's market value. According to the International Accounting Standard Board (IASB) (2018), relevant financial information is capable of making a difference in the decisions made by users. Financial information is capable of making a difference in decisions if it has predictive value, confirmatory value, or both. For this reason, standard-setters investigate ways in which accounting measurements can become much more realistic and, thus, more useful to investors.

The concept of value has evolved over time. At first, classical economists assumed such concept as the quantity of labour or effort necessary to produce a commodity (i.e., its exchange value). Later, neoclassical economists defined it as its utility, that is, the commodity's capacity to satisfy needs (i.e., its use value). In addition, value depends on the scarcity or abundance of the commodity.

Accounting theory is based on economic theory in terms of valuation. Initially, accounting valuation strongly focused on cost of factors or replacement value, which is consistent with the notion of exchange value in economics. Subsequently, market prices became more important as an expression of the net realizable value, which corresponds to the concept of use value in economics. The International Financial Reporting Standards (IFRS) show a strong tendency towards this latter conception.

Use value (derived from the buyer's expectation, as well as from the scarcity of the commodity) could lead to an imprecise and subjective valuation, while historical cost (derived from the real price) is recognised for its objectivity and, therefore, has been a cornerstone of accounting valuation. However, the use of historical cost undermines the purpose of providing useful financial information for decision-making because it is not efficient in updating valuation. This is, indeed, one of the problems of the value relevance of book value. Consequently, the IASB issued IFRS 13 in order to reduce the complexity of fair value measurements and clarify this measurement framework.

Due to the robust presence of international audit firms in Colombia, its accounting practices received an important influence from the accounting principles in the United States (U.S.); even the Generally Accepted Accounting Principles in Colombia (COLGAAP)—contained in Decree 2649 of 1993—were a collection of those in the U.S. (USGAAP).

Globalisation caused the emergence of spin-off operations and mergers and business transformations in Colombia which required updated and pertinent accounting standards. Additionally, the recurrent interest of large corporations in investing in the country and of national firms in participating in international markets demanded the development of accounting regulations to facilitate such processes.

In 2009, Colombia developed a strategy for the adoption of accounting standards in order to improve productivity and competitiveness and achieve a harmonious business development in the country. This strategy resulted in the enactment of Law 1314 of 2019 which required firms to implement the IFRS as a tool to manage their accounting and financial information. The transition period from COLGAAP to IFRS depended on the type of firm. In particular, Colombian banking institutions began this process by presenting their opening statement of financial position under IFRS in 2013 and their comparative statement of financial position in 2014. In 2015, they started to adopt full IFRS.

Although the previous Colombian accounting regulatory framework (i.e., COLGAAP) and the current one (i.e., IFRS) share many things in common due to the origin of the standards, they deeply differ in matters such as standards related to economic groups, financial instruments, revenue recognition, deferred taxes, fixed assets, leases, and currency conversion. The main difference between both regarding value relevance of book value is driven by the introduction of the concept of fair value because, as a mechanism for updating valuation, it undoubtedly affects book value of equity and earnings.

This study aims to compare the value relevance of the accounting information of the banks listed on the Colombian Stock Exchange (BVC, for its acronym in Spanish) before and after IFRS adoption. In this regard, our working hypothesis states that the implementation of IFRS has increased the value relevance of the

accounting numbers of Colombian banks. The obtained results are of interest to standard-setters, investors, and users of financial information in general.

The rest of this paper is structured as follows. Section 2 provides a literature review on the value relevance of accounting information. Section 3 describes the sample and econometric model used in this study. Section 4 discusses the results. Section 5 draws some conclusions.

## 2. Literature review

Given the recent regulatory changes in the different economies, researchers have become especially interested in the value relevance of accounting information. According to Ahmed, Chalmers, and (Ahmed et al., 2013), these transitions have encouraged the development of empirical studies into financial reporting and the capital-market effects associated with changes in the accounting regime. In addition, the authors report that said studies vary in terms of periods of analysis, jurisdictional environment, methodological design, among other aspects.

One of the first works to measure the value relevance of book value after IFRS adoption was conducted in Germany. Such study specifically examined the value relevance of book value of earnings and equity to explain the market values of DAX-30 firms from 1995 to 2004. Based on 265 observations, the authors concluded that the change in standards significantly increased the value relevance of earnings in relation to market prices (Jermakowicz et al., 2007).

Clarkson *et al.* (2011) conducted a similar study in a European context to analyse the effect of IFRS adoption on the value relevance of book value and earnings. They used a sample of 3,848 European and Australian firms that adopted such standards in 2005. Additionally, they compared the results obtained by firms in Common Law countries with those by firms in Code Law countries. The findings of such work suggest that financial reporting quality becomes similar between the two groups of countries after IFRS adoption.

Subsequently, Bepari (2015) studied the relative and incremental value relevance of book value and earnings in the Australian market. However, unlike the work of Clarkson et al. (2011), he compared the 2008 financial crisis period and the post-crisis period, instead of the pre- and post-IFRS periods.

Qu and Zhang (2015) investigated the value relevance of earnings and book value over the transition years (from 1991 to 2010) in China in order to determine the suitability of fair value accounting in emerging markets compared to mature markets. Their study yielded mixed results in terms of groups of firms and/or time periods, with the additional difficulty of China's transition to a market economy.

Furthermore, Beisland and Knivsfla (2015), examined the mandatory shift from GAAP to IFRS in Norway and found that fair value accounting increases the value relevance of book value and decreases that of earnings. In addition, such authors identified accounting factors specific to the aforementioned regulations, which leads to general differences.

Papadatos & Bellas (2011) compared the value relevance of accounting information reported under IFRS with that under Greek Accounting Standards. They also analysed firm size and its effect on book value. The results of their study reveal that firm size and fixed assets significantly influence the value relevance of book value. This means that the effects of transition to IFRS may be different for all firms. Likewise, Tsalavoutas, André and Evans (2012) studied the value relevance of book value of equity and net income before and after IFRS adoption in Greece. However, they found no significant differences between those two periods.

The work by (Kwon, 2018) investigated the change in the value relevance of book value after the mandatory adoption of IFRS by Korean listed firms, for which the author collected data for a three-year period before and after such adoption. Such work provides sufficient evidence of significant changes in the value relevance of accounting information. Ji (2017) also obtained similar results in a study conducted in Korea based on 10,720 observations during the five years before and after the adoption of IFRS. Said results show that the introduction of such standards enhances the usefulness of accounting information as well as its credibility.

Moreover, Der, Masri and Abubakari (2018) studied the value relevance of book value, earnings, and dividends in firms listed on the Ghana Stock Exchange from 2005 and 2014. These authors considered financial and nonfinancial firms in their research and found that, for the former, both book value and earnings are value relevant, while, for the latter, only earnings are value relevant.

Agostino, Drago and Silipo (2011) examined the market valuation of accounting information in the banking industry in Europe before and after IFRS adoption. They applied panel methods to a multiplicative interaction model, where the implementation of IFRS proved to improve the information on earnings and book value for financial institutions recognised for their transparency. Conversely, this improvement was not found to be significant for less transparent financial institutions.

In conclusion, studies into the value relevance of book value are numerous in developed economies but scarce in developing economies such as that of Colombia. Furthermore, there is no consensus in the literature regarding the effects of IFRS adoption on the value relevance of accounting information.

### 3. Methodology

#### 3.1. Sample and variables

The data under analysis correspond to three monthly time series (book value per share, earnings per share, and stock price) of the eight banks listed on the Colombian Stock Exchange (BVC) from January 2001 to December 2018. Stock prices were taken from the BVC website; and the financial information, from the webpage of the Financial Superintendence of Colombia. Until December 2014, banking institutions presented their financial statements under COLGAAP, and, from January 2015 onwards, they started to report them under IFRS. All the banks considered in this study were not listed on the stock market during the period between January 2001 and December 2018. For example, Colpatría was acquired by GE Money (a subsidiary of General Electric) in 2007 and due to this it ceased to be listed on the Colombian Stock Exchange. This means that in the graphs the time scale is not the same for the entire sample, particularly in the cases of Colpatría and Davivienda. Table 1 shows from and to what date the market prices of the shares of each bank were taken.

Table 1. Dates on which the market prices of the shares of each bank were taken.

Bank	From	To
BOGOTA	1/01/2001	1/12/2018
VILLAS	1/04/2001	1/12/2018
DAVIVIENDA	1/07/2010	1/12/2018
OCCIDENTE	1/04/2001	1/12/2018
POPULAR	1/10/2010	1/12/2018
BANCOLOMBIA	1/01/2001	1/12/2018
BBV	1/01/2001	1/12/2018
COLPATRIA	1/07/2005	1/10/2007

Source: Authors' elaboration.

Figures 1, 2, and 3 illustrate the historical behaviour of the three-monthly time series (stock price, book value of equity, and earnings per share) of the eight banks under analysis. From such figures, we observe that, for all banks, stock price and book value exhibit a positive trend, while earnings do not show a clearly defined trend.

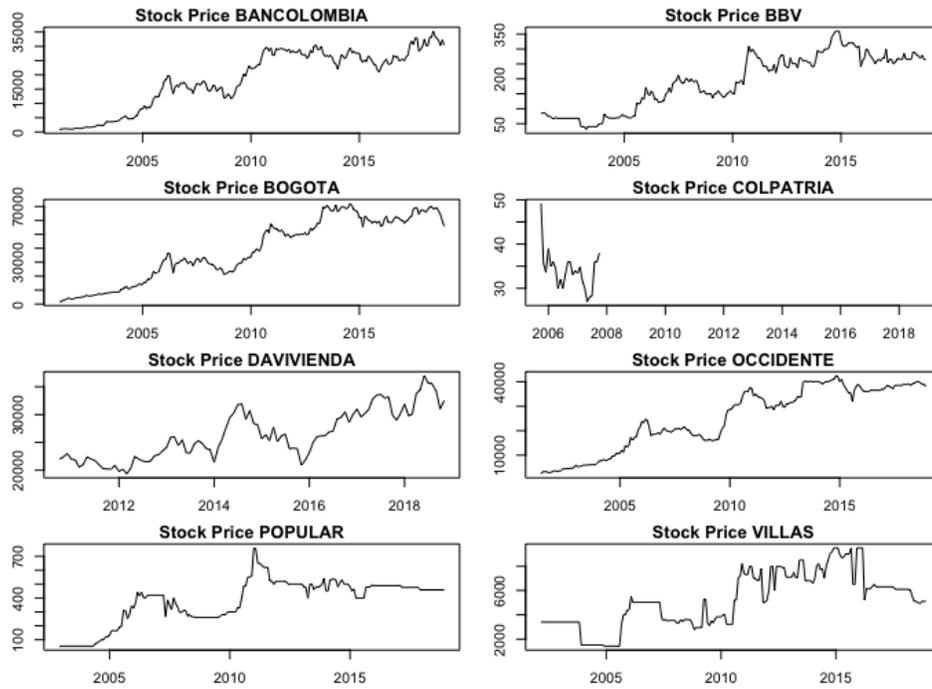


Figure 1. Historical behaviour of each bank's stock prices.

Source: Authors' elaboration.

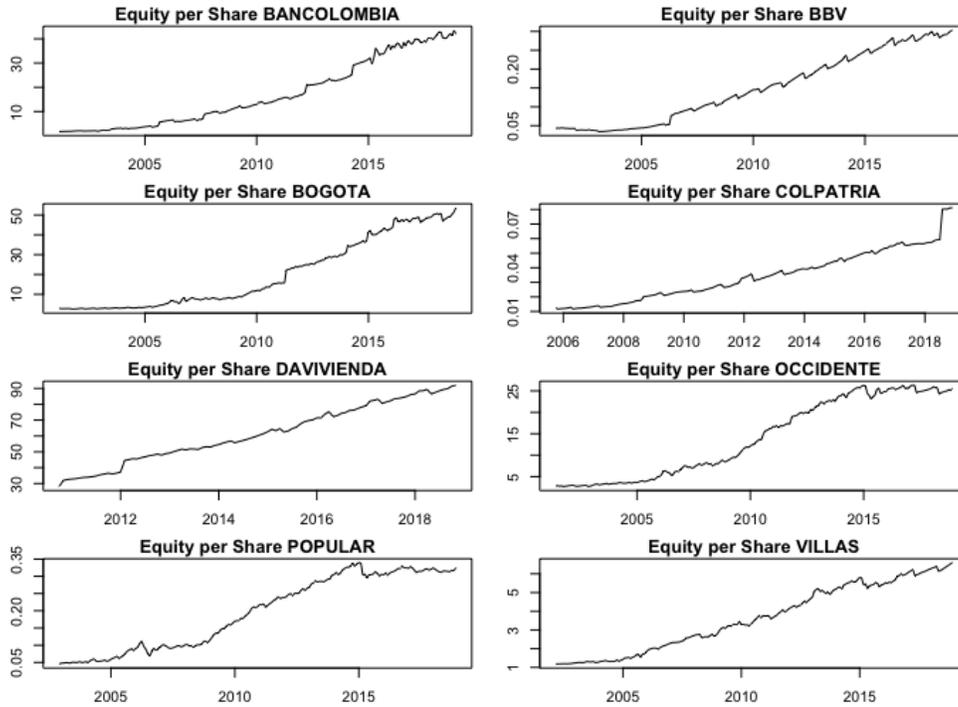


Figure 2. Historical behaviour of each bank's equity per share.

Source: Authors' elaboration.

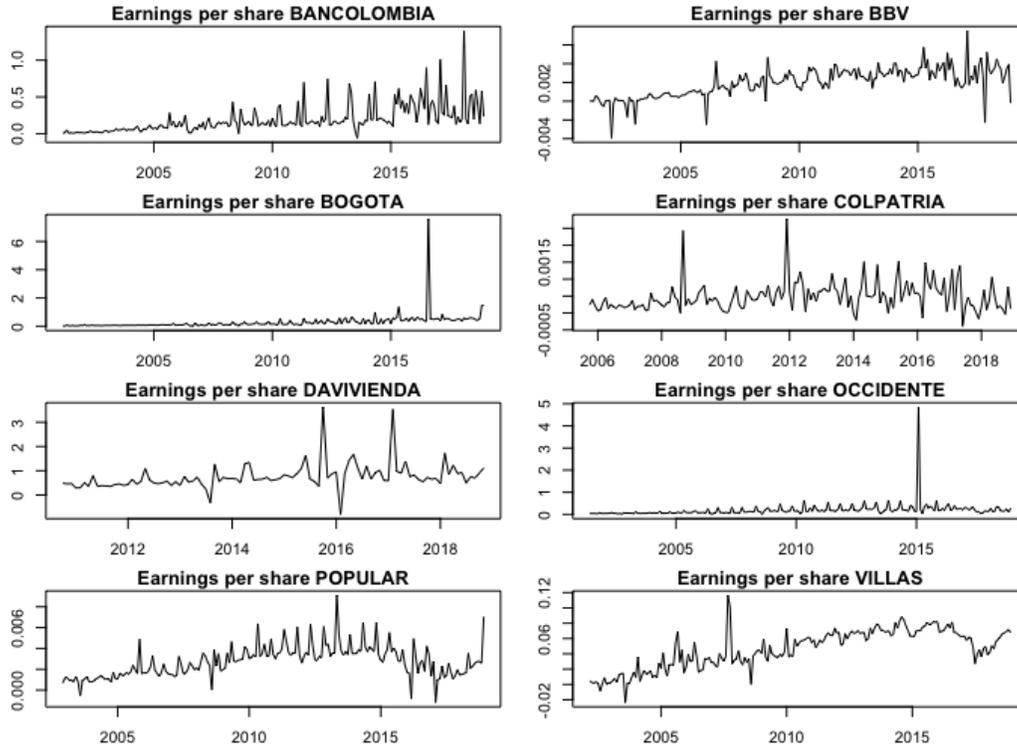


Figure 3. Historical behaviour of each bank's earnings per share.

Source: Authors' elaboration.

Table 2. Correlations

	Stock Price	Equity	Earnings
Stock Price	1.00	0.71	0.48
Equity	0.71	1.00	0.64
Earnings	0.48	0.64	1.00

Source: Authors' elaboration.

Table 3. Descriptive statistics

Stock Price	Equity	Earnings
Min.: 27	Min.: 0.01167	Min.: -0.801340
1st Qu.: 270	1st Qu.: 0.17502	1st Qu.: 0.002314
Median: 5325	Median: 3.13372	Median: 0.049562
Mean :14205	Mean :11.77961	Mean: 0.151655
3rd Qu.:26040	3rd Qu.:15.87590	3rd Qu.: 0.160320
Max. :72214	Max. :91.97847	Max.: 7.603167

Source: Authors' elaboration.

Table 2 reports the correlation between stock price, equity, and earnings per share from January 2001 to December 2018. As can be seen, the correlation between equity and stock price is greater than that between stock price and earnings. Table 3 presents the descriptive statistics of the variables stock price, equity and earnings.

### 3.2. Theoretical and econometric model

According Mattesssih (2002), the theoretical model of firms' market value derives from the historical clean surplus (closely related to the statement of comprehensive income) and dirty surplus (related to the income from current operations) accounting theory, which emerged at the end of the XIX century and has evolved in the accounting practice. This was especially analysed and developed in the works of Ohlson (1995) and Feltham and Ohlson (1995), who proposed a model that was named after one of the authors: Ohlson's model (Equation 1).

$$P_t = y_t + \sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[x_{t+\tau}^a] \quad (1)$$

where

- $P_t$  = Firm's equity or firm's market value at period  $t$
- $y_t$  = Equity at time  $t$
- $R_f$  = Risk-free rate plus one
- $x_{t+\tau}^a$  = Abnormal earnings from time  $t + \tau - 1$  to time  $t + \tau$
- $E_t[.]$  = Conditional expected value operator at period  $t$

Mattesssih (2002) defines "clean surplus" as a profit that is calculated by comparing the book value of the firm's net worth at the beginning of an accounting period with that at the end of the period (after having eliminated owners' withdrawals of capital or new contributions). In this sense, such concept is properly related to the all-inclusive income, which, in accounting standard terms, refers to the statement of comprehensive income adopted by the two main accounting standard-setters worldwide (the IASB and the FASB) at the end of the last century. (Sousa Fernández, 2008) indicates that the clean surplus approach makes it possible to have an income statement more linked to market prices and exchange rates, as compared to the dirty surplus approach. This latter is exclusively associated with the traditional income statement which reflects the net income based on the realisation principle<sup>1</sup>.

Since clean surplus is linked to market values, some authors have favoured the "present value" approach in accounting; for instance, Mattesssih (2002), cites Ciompa (1910), Kempin (1910), Heina (1925), and Rieger (1928). However, this approach has not been fully accepted by the accounting community. In fact, some authors have proposed a type of accounting information oriented toward investors and another one toward other user. Despite this, economic value is recognised, although subjectively, in accounting to compare it with market value. Mattesssih (2002) points out that the clean surplus theory proposed by Ohlson is a more objective way of applying present value.

Based on the model developed by Ohlson (1995), which has a deterministic component ( $y_t$ ) and a random component ( $\sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[x_{t+\tau}^a]$ ), we propose the following unbalanced panel data model:

$$P_{it} = \alpha_0 + \alpha_1 BVPS_{it-3} + \alpha_2 EPS_{it-3} + u_{it} \quad (2)$$

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1. It states that economic events shall be recognised when they cause a change in the firm's resources.

where:

$P_{it}$  = Market price per share of bank  $i$  at time  $t$

$BVPS_{it-3}$  = Book value per share of bank  $i$  at time  $t - 3$  (lagged three months from the market price per share variable)

$EPS_{it-3}$  = Earnings per share of bank  $i$  at time  $t - 3$  (lagged three months from the market price per share variable)

$\alpha_o$  = Intercept of the model

$\alpha_1$  and  $\alpha_2$  = coefficients of  $BVPS_{it-3}$  and  $EPS_{it-3}$  respectively.

$u_{it}$  = Random error of the model of bank  $i$  at time  $j$  containing other relevant information [refers to the present value of the expected residual income, which, corresponds to the firm's goodwill according to Ohlson (2001)].

We established an additional model to that of Equation 2 because some authors, such as Clarkson *et al.* (2011), Agostino, Drago and Silipo (2011), Odoemelam, Okafor and Ofoegbu (2019) and, Chen, Chen and Su (2001), include interactions between accounting information variables that are significant.

$$P_{it} = \alpha_o + \alpha_1 BVPS_{it-3} + \alpha_2 EPS_{it-3} + \alpha_3 BVPS_{it-3} * EPS_{it-3} + u_{it} \quad (3)$$

Finally, information was processed in Software R using the plm package to estimate the panel data models (Croissant & Millo, 2008).

#### 4. Analysis and discussion of results

Table 4 shows the results of the unbalanced panel data models (pooling) for the data series reported under COLGAAP (from January 2001 to December 2014), the data series post-IFRS (from January 2015 to December 2018) and the complete data series (from January 2001 to December 2018), with and without interaction between book value and earnings.

Table 4. Results of the panel data models

Model without interaction between book value per share (BVPS) and earnings per share (EPS)						
	COLGAAP		Post-IFRS		Total	
	Estimate	Pr(> t )	Estimate	t-value	Estimate	Pr(> t )
<b>Intercept</b>	4616.801	2.00E-16	6666.22	2.98E-10	6083.594	<2e-16
<b>Equity</b>	877.137	2.00E-16	553.227	2.20E-16	662.909	<2e-16
<b>Earnings</b>	7840.565	0.02529	1747.706	0.2446	1964.323	0.0975
<b>R<sup>2</sup></b>		0.54		0.52		0.51
Model without interaction between book value per share (BVPS) and earnings per share (EPS)						
	COLGAAP		Post-IFRS		Total	
	Estimate	Pr(> t )	Estimate	t-value	Estimate	Pr(> t )
<b>Intercept</b>	639.708	0.04197	3036.44	0.0007396	2806.958	2.20E-16
<b>Equity</b>	1238.042	2E-16	755.426	2.20E-16	845.821	2.20E-16
<b>Earnings</b>	77436.609	2.00E-16	36492.206	2.20E-16	48304.655	2.20E-16
<b>Equity *Earnings</b>	-2385.869	2.00E-16	-728.717	2.20E-16	-999.374	2.20E-16
<b>R<sup>2</sup></b>		0.7376		0.67074		0.67205

Source: Authors' elaboration.

In the model without interaction between book value per share (BVPS) and earnings per share (EPS), BVPS and EPS are positive and significant in the COLGAAP model, while, in the post-IFRS model, although both are positive, only BVPS is significant. These results are consistent with those of (Halim Kadri, Abdul Aziz and Halim Kadri, Abdul Aziz and Kamil Ibrahim (2009). In the model that takes the complete data series, BVPS and EPS are significant, but the parameter values are below those in the COLGAAP model. The coefficient of determination (R2) in the post-IFRS model is lower than that in the COLGAAP model.

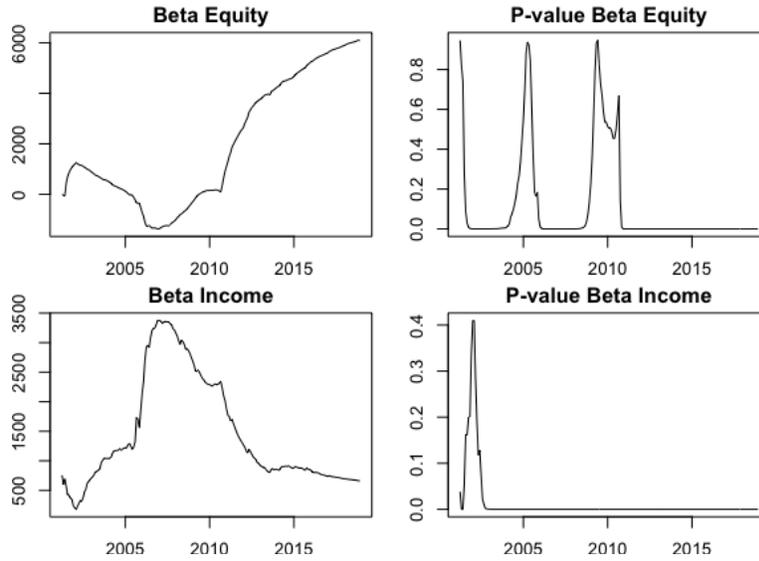


Figure 4. Parameter recursive estimation for the model without interaction.

Source: Authors' elaboration.

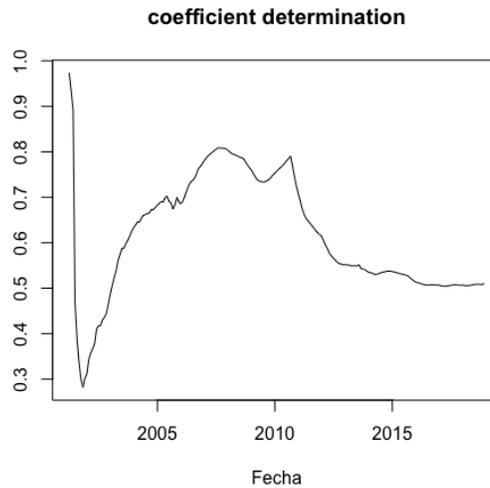


Figure 5. Recursive estimation of the coefficient of determination.

Source: Authors' elaboration.

Figure 4 illustrates the recursive estimation of the parameters that link book value per share and earnings per share to price per share using a model without interaction. The significance (p-value) of the relationship between book value of equity and market value (Beta - Equity) stabilises and shows an increasing trend from 2011 onwards, while that of the relationship between earnings and market value stabilises from 2003 onwards, exhibiting an increasing trend until the beginning of 2007 when it changes and begins to decrease. This is supported by the findings of Qu & Zhang (2015), who examined the value relevance of earnings and book value from 1991 to 2010 in China and found that the value relevance of earnings tends to decrease, while that of book value increases significantly. Additionally, there is no evidence that convergence to IFRS enhances the value relevance of book value. Figure 5 presents the recursive estimation of the coefficient of determination, and it shows that since 2013 the value of  $R^2$  stabilized around a value of 0.51.

## 5. Conclusion and avenues for future research

In this study, we compared the value relevance of the accounting information of the eight banks listed on the Colombian Stock Exchange (BVC) before and after IFRS adoption. The results reveal that such relevance is significant, but there is no evidence of a change driven by the implementation of IFRS. Contrary to what was expected based on the working hypothesis, when we contrasted the estimated parameters that measure the value relevance of accounting information, we found that those calculated with data prior to IFRS adoption are higher than those estimated with data after IFRS adoption. This suggests that the information contained in the expected value of abnormal earnings (excess income) in the post-IFRS model is more relevant to explain the market value of the financial entities under analysis than that in the pre-IFRS model, where we observed that the explanatory power of accounting information is greater.

Moreover, including the effects of the interactions between book value of equity and earnings becomes relevant to explain the share's market value and the increase in the coefficient of determination of the models with interactions, as it enhances the explanatory power of the accounting information.

The recursive estimation results show that the value relevance of book value of equity has increased in recent years, while that of earnings has lost explanatory power over the share's market value. The estimated p-values of the parameters in the recursive estimation indicate that, in some time intervals, book value of equity is no longer relevant.

In general, the coefficient of determination suggests that the accounting information's ability to explain market value has decreased since 2008, which coincides with the beginning of the global financial crisis.

This study is a contribution to address the issue of the quality of accounting information in a comprehensive manner. However, it is necessary to advance in the study of other important factors related to the country and the type of companies, in particular with respect to the incentives for reporting and the legal system (Pășcan, 2015). The latter, in terms of quality of legal enforcement, alignment of financial accounting with tax accounting, accrual rules in accounting, securities regulation and minority investor protection, and capital market structure (Burgstahler et al., 2006).

Regarding the economic crisis produced by the Covid-19 pandemic, it could be inferred that the relevance of the book value may have increased, as occurred in the economic crisis of 2008-2009. Several studies show an increase in the value in books after the crisis (Bepari, 2015; Al-Hares et al., 2012; Devalle, 2012; Tama-Sweet & Zhang, 2015). Bepari (2015) suggests that during the crisis period, the real management of companies may dominate over the earning management, given that auditors and regulators tend to be more cautious in the observance of accounting standards. It is suggested that futures work on the relevance of book value during Covid-19 crisis in developing countries, even compared to developed countries.

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**Appendix: Ohlson's model demonstration**

Ohlson's model (1995) regards the firm's market value as the expected value of future dividends, as follows:

$$P_t = \sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[d_{t+\tau}] \quad (1)$$

where

$P_t$  = Firm's equity or firm's market value at period  $t$

$d_t$  = Dividends at period  $t$

$R_f$  = Risk-free rate plus one

$E_t[\cdot]$  = Conditional expected value operator at period  $t$ .

This model allows negative values for  $d_t$  because this latter denotes the net dividends after contributions are discounted. In addition, it depends on the value of the accounting data and varies depending on earnings, book value, and current dividends.

Furthermore, such model assumes that the change in equity between two periods equals earnings minus dividends, as follows:

$$y_t = y_{t-1} + x_t - d_t \quad (2)$$

After solving for equity of the previous period in (2), we have

$$y_{t-1} = y_t + d_t - x_t.$$

The notations  $x_t$  and  $y_t$  correspond to

$x_t$  = earnings from time  $t - 1$  to time  $t$

$y_t$  = equity at time  $t$

According to Ohlson (1995), Equation (2) can be used to express  $P_t$  in terms of expected future earnings and book value rather than in terms of dividends, as follows:

$$x_t^a \equiv x_t - (R_f - 1)y_{t-1} \quad (3)$$

After solving for earnings of the current period in (3), we obtain

$$x_t \equiv x_t^a + (R_f - 1)y_{t-1}$$

where  $x_t^a$  denotes the abnormal earnings because normal earnings should be related to the return on normal capital invested at the beginning of the period  $(R_f - 1)y_{t-1}$ .

After solving for dividends of the current period in (2), we get

$$d_t = x_t + y_{t-1} - y_t.$$

By substituting (3) in (2)

$$d_t = x_t^a + (R_f - 1)y_{t-1} + y_{t-1} - y_t$$

and simplifying, we obtain

$$d_t = x_t^a - y_t + R_f y_{t-1}. \quad (4)$$

By breaking down the sum in (1),

$$P_t = R_f^{-1} E_1[d_{t+1}] + R_f^{-2} E_2[d_{t+2}] + R_f^{-3} E_3[d_{t+3}] \dots + R_f^{-\tau} E_\tau[d_{t+\tau}]$$

$$P_t = R_f^{-1} d_{t+1} + R_f^{-2} d_{t+2} + R_f^{-3} d_{t+3} \dots + R_f^{-\tau} d_{t+\tau}$$

substituting (4) in (1),

$$P_t = R_f^{-1} (x_{t+1}^a - y_{t+1} + R_f y_t) + R_f^{-2} (x_{t+2}^a - y_{t+2} + R_f y_{t+1}) + R_f^{-3} (x_{t+3}^a - y_{t+3} + R_f y_{t+2}) \dots + R_f^{-\tau} (x_{t+\tau}^a - y_{t+\tau} + R_f y_{t+\tau-1})$$

$$P_t = R_f^{-1} x_{t+1}^a - R_f^{-1} y_{t+1} + R_f^{-1} y_t + R_f^{-2} x_{t+2}^a - R_f^{-2} y_{t+2} + R_f^{-1} y_{t+1} + R_f^{-3} x_{t+3}^a - R_f^{-3} y_{t+3} + R_f^{-2} y_{t+2} \dots + R_f^{-\tau} x_{t+\tau}^a - y_{t+\tau} + R_f^{-\tau} y_{t+\tau-1}$$

and generalizing, we have

$$P_t = \sum_{\tau=1}^{\infty} R_f^{-\tau} [x_{t+\tau}^a] - R_f^{-\tau} y_{t+\tau} + y_t.$$

Since  $\frac{E_t[\tilde{y}_{t+\tau}]}{R_f^\tau} \rightarrow 0$  because  $\tau \rightarrow \infty$ , then

$$P_t = y_t + \sum_{\tau=1}^{\infty} R_f^{-\tau} E_t[x_{t+\tau}^a].$$