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Article

The Relevance of Using Accounting Fundamentals in the Mexican Stock Market

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ABSTRACT

This paper examines the value relevance of accounting fundamentals in the Mexican Stock Market ([BMV] – Bolsa Mexicana de Valores). The research question that motivated the paper was: Can accounting fundamentals provide relevant information to better understand firm value? More specifically, the paper examines whether the application of an accounting fundamental strategy to select stocks of a portfolio can systematically yield significant and positive excess market buy-and-hold returns after one and two years of portfolio formation. Based on valuation theory, accounting research and the maturity level of the BMV, a set of accounting fundamental signals is proposed that reflects information that influences security prices, but not necessarily in a timely manner.

Using quarterly financial and market data from 196 BMV stocks from 1991 to 2011, it is shown that after controlling for earnings, book-to-market ratio and firm size, the fundamental strategy proposed here provides value information relevant to investors. The relationship between the accounting fundamental signals proposed and the buy-and-hold market future return (one-year and two-year returns) is significant and positive considering the 1991-2011 period. Portfolios formed with high scores of these signals show an average of 1.62% market excess annual return between 1991 and 2011, and about 9% between 1997 and 2011. Besides the practical implication of the findings –e.g. the possibility mispriced securities– this paper contributes to the scarce accounting research in Latin American capital markets by furthering understanding of the "post-earnings" drift phenomenon in the BMV.

La relevancia de utilizar fundamentos de contabilidad en la Bolsa Mexicana de Valores

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RESUMEN

En este documento se examina la relevancia de los fundamentos de contabilidad en la Bolsa Mexicana de Valores (BMV). La pregunta de investigación que impulsó este documento fue: ¿pueden los fundamentos de contabilidad proporcionar información relevante para entender mejor el valor de empresa? De un modo más específico, en el documento se examina si la aplicación de una estrategia de fundamentos de contabilidad para seleccionar los valores de una cartera puede producir sistemáticamente rendimientos excedentes de mercado significativos y positivos tras uno o dos años desde la formación de la cartera. Basándose en la teoría de valoración, la investigación contable y el nivel de madurez de la BMV, se propone un conjunto de señales de fundamentos de contabilidad que refleja información influyente en los precios de los valores, aunque no necesariamente de un modo inmediato.

Utilizando datos trimestrales financieros y de mercado de 196 acciones desde 1991 hasta 2011, se demuestra que tras controlar las ganancias, el cociente *book-to-market* (valor de libros dividido entre valor de mercado de la empresa) y el tamaño de la empresa, la estrategia fundamental que aquí se propone proporciona información de valor relevante para los inversores. La relación entre las señales de fundamentos de contabilidad propuestas y la rentabilidad futura del mercado de compra y retención (rentabilidades a uno y dos años) de acciones es significativa y positiva teniendo en cuenta el período 1991-2011. Las carteras formadas con altas puntuaciones de estas señales muestran una media de 1,62% del rendimiento anual por arriba del mercado entre 1991 y 2011, y sobre 9% entre 1997 y 2011. Aparte de la implicación práctica de los hallazgos –por ejemplo, los valores fuera del valor intrínseco–, este documento es una aportación a la escasa investigación sobre contabilidad en los mercados de capitales latinoamericanos para entender mejor el fenómeno de deriva «posganancias» de la BMV.

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1. Introduction

This paper examines whether the application of a set of accounting fundamental signals can provide value relevance to investors in the Mexican Stock Market. The use of fundamental analysis has been shown to be successful in developed markets. However, in emerging markets there is little evidence of the use of fundamental analysis to better understand financial markets. Research on this relationship in developed markets is considerable (Ball & Brown, 1968; Kothari, 2001; Richardson, Tuna, & Wysocki, 2010). Growing evidence of temporary market mispricing –also known as earnings announcement drift or accounting anomalies– in developed markets (Abarbanell & Bushee, 1998; Piotroski, 2000; Piotroski, 2005) and the scarcity of research on this topic in developing markets (Aggarwal & Gupta, 2009; Lopes & Galdi, 2008) was a motivation to further examine this phenomenon in one of the most important Latin American markets, the Mexican Stock Market.

One contribution of this paper is to demonstrate the potential use of accounting fundamental signals to investors in an emerging market. According to valuation theory, accounting earnings are converted over time into free cash flow to investors, creditors and the firm, which constitute the main components for estimating the intrinsic value of the firm, as reflected in the stock price. Accounting fundamental analysis examines detailed accounting data –reported in financial statements– to improve understanding of how efficiently and effectively a firm generates earnings over time, as well as its potential to grow and convert these earnings into free cash flows. However, the way in which financial statement data can be used and how this is related to future earnings and future stock returns in Latin American markets is still not completely understood.

Besides the contribution to the existing literature on capital markets in Latin America, the findings of this paper can help investors not only to identify possible abnormal returns to an investment strategy, but also to increase the expected utility by using accounting data to construct hedge portfolios. As such, an optimal balance between expected return and market and country risk can be achieved.

Two scores constructed by changes in accounting signals are proposed in this paper. These scores are hypothesized to be positively related to future one-year and two-year stock returns. After an extensive literature review, these two scores –F-score and L-score– are developed based on two seminal papers, Piotroski (2000) and Lev and Thiagarajan (1993). These scores are constructed so that the higher the score, the more the likelihood of future one-year and two-year market excess returns. To further eliminate the alternative explanation that these scores might measure previous factors found in the literature that are consistently related to future returns, econometric models are designed to show how these scores add value relevance beyond the factors provided in the literature –book-to-market ratio, firm size, and earnings per share.

Findings suggest that both L-score and F-score provide value relevant information for investors when forming portfolios. A significant relationship was found between the scores and one-year and two-year stock returns and excess market returns. A further sensitivity analysis shows that simple equally-weighted portfolios constructed with high F-score stocks can yield consistent positive returns.[1]

1. It is important to note that in the BMV, the annual average market returns between 2004 and 2011 were close to 20% average annual return, and so very difficult to beat with financial portfolios created from either fundamental or technical analysis.

2. Theoretical perspectives

Most of the research on accounting fundamental analysis in capital markets has used archival data and econometric models based on multiple regression models, sometimes complemented with time-series analysis for forecasting. The main independent variables of these models are accounting signals that are usually based on percentage changes from one period to another. The main dependent variables of these models are contemporary earnings and returns, future earnings and future returns, and analyst forecasting of returns. The main theoretical perspective of this literature is valuation theory and market efficient hypothesis.

Valuation theory suggests that the value of the firm is the present value of future free cash flows that the firm is expected to generate. In order to estimate these cash flows, it is necessary to estimate future earnings. To estimate future earnings, one must examine present and past financial statements, which form the components from which earnings are calculated. It is assumed that earnings are converted –sooner or later– into free cash flow to investors –the dividends.

The efficient market hypothesis suggests that developed capital markets incorporate into the stock price all available public and private information about present and past operational performance of the firm. An important body of research in the last two decades and recent and growing research in emerging markets suggest that the efficient market hypothesis does not always consistently hold (Aggarwal & Gupta, 2009; Richardson et al., 2010; Sloan, 1996; Xie, 2001). Some explanations of this finding are: a) the fact that investors do not always behave in a rational way; b) the fact that investors do not weigh with the same magnitude a gain versus a loss, c) increasing number of speculative investors, and d) the decrease in quality of reported financial statements in the last decade. An extensive literature review on the testing of this hypothesis can be found in (Fama, 1998). Most researchers would agree that the more developed a capital market, the closer to market efficiency it is. Then, for emerging markets it is likely that prices do not efficiently incorporate all available information into stock prices in a timely and accurate manner. Most of the research on fundamental analysis in capital markets has used valuation theory and efficient market hypothesis as the main theoretical perspectives. Relevant research is examined in the next section.

One of several lines of research spurred by the lack of evidence for the efficient market hypothesis is accounting fundamentals in capital markets. One argument for the lack of market efficiency is that investors do not completely incorporate the information disclosed in the fundamental measures (Abarbanell & Bushee, 1998). Abarbanell and Bushee (1997) find evidence that sophisticated analysts systematically underestimate accounting signals in their earnings forecast, so it is likely that stock prices can temporarily be underestimated. Fundamental analysis uses information in current and historical financial statements along with industry and macroeconomic information to estimate a firm's intrinsic value (Kothari, 2001).

Following the efficient market hypothesis, valuation theory and fundamental analysis, it is likely that the less efficient a market is, the more valuable and relevant the use of accounting fundamental analysis to identify temporary mispriced securities will be. Then, fundamental analysis would produce better results in less efficient markets than in developed markets. Nonetheless, there is little, albeit promising, empirical evidence to support this argument. In the next section relevant research is examined.

3. Literature review

Table 1 illustrates the independent and dependent variables, the theoretical perspective and the main findings of selected literature.

Table 1
Relevant literature on fundamental analysis

Paper	Theoretical perspective	Dependent Variable(s)	Independent variables(s)	Country/ Market	Main findings
(Piotroski, 2000)	Valuation theory and market under-reaction of high BM ratio firms: Markets do not incorporate historical financial information into prices in a timely manner	Future returns	Accounting fundamentals, BM ratio, size, accruals.	US market	Mean return earned by a high book-to-market investor can be increased by at least 7.5% annually through selection of financially strong high BM firms
(Lev & Thiagarajan, 1993)	Valuation theory and fundamental analysis	Earnings response coefficient and future earnings growth	12 accounting signals, earnings per share	US market	More than earnings, the 12 fundamental signals proposed add approximately 70%, on average to the explanatory power of earnings with respect to excess returns
(Richardson et al., 2010)	Literature review on accounting anomalies and fundamental analysis	Future earnings and future stock returns	Accounting information	Mainly US market	Accounting anomaly and fundamental analysis literature demonstrate the usefulness of accounting information in forecasting future earnings and stock returns. Anomalous return patterns are commonly concentrated in a subset of small and less liquid firms with high risk
(Lev, Li, & Sougiannis, 2010)	Valuation theory: When there is quality in financial information, and it is not compromised, it should be reflected by the prediction of enterprise cash flows and earnings	Future cash flows and future earnings	Accounting fundamentals	US market	Accounting estimates beyond those in working capital items (excluding inventory) do not improve the prediction of cash flows. Estimates do, however, improve the prediction of the next year's earnings, though not of subsequent years' earnings
(Abarbanell & Bushee, 1998)	Valuation theory: Fundamental analysis should yield abnormal returns as earnings are realized in the future if contemporaneous stock price reactions to the signals are incomplete	Future abnormal return	Contemporaneous earnings change, Beta and accounting fundamentals	US market	An average 12-month cumulative size-adjusted abnormal return of 13.2 percent is earned according to a fundamental strategy based on Lev and Thiajaran. A significant portion of the abnormal returns is generated around subsequent earnings announcements
(Drake, Rees, & Swanson, 2011)	Analysts tend to positively recommend stocks with high growth, high accruals, and low book-to-market ratios, despite these variables having a negative association with future returns	Stock returns	11 independent variables from accounting fundamentals	US market	Short interest is significantly associated in the expected direction with all 11 variables examined. There are abnormal returns from a zero-investment strategy that shorts firms with highly favorable analyst recommendations but high short interest, and buys firms with highly unfavorable analyst recommendations but low short interest
(Elleuch & Trabelsi, 2009)	Valuation theory: Firm's fundamental or intrinsic value is correctly determined by information reflected in financial statements. Sometimes, stock prices do not reflect in a timely manner and/or correctly all this information and thus deviate from fundamental values	Future returns	Accounting fundamentals and accruals	Tunisian market	Fundamental accounting signals can be used to discriminate from an overall sample generated over a 15-month holding period negative returns of −11,6%, a winner portfolio generating positive return of 1,9% from a loser one generating negative return of −22,9% over the same holding period
(Swanson et al., 2003)	Valuation theory and macroeconomic impact. When an economic shock occurs current earnings cannot be extrapolated to the future	Future return and future cash flows	Earnings per share and 12 accounting signals based on Lev and Thiajaran	Mexican market	Earnings in the year of the devaluation lose value relevance, while some fundamentals such as selling and administrative expenses and gross margin changes retain considerable explanatory power
(Durán Vázquez et al., 2007)	Ohlson valuation model: the intrinsic value of the firm reflected in the stock price is a function of the book value of the firm, subsequent earnings and discounted cash flows	Stock price	Book value of assets, earnings, cash flows and accruals	Mexican market	Book value, earnings and accruals are statistically significant in the model. These variables are significantly related to stock price, so they can provide valuable information to investors
(Aggarwal & Gupta, 2009)	Same as Piotroski (2000)	Future returns	Accounting fundamentals, BM ratio, size, accruals.	India market	The Piotrosky strategy can separate winners from losers for two-year returns after portfolio formation. It generates 98.6% annual return for portfolios with high F-score and 31.3% annual return for portfolios with low F-score
(Lopes & Galdi, 2008)	Same as Piotroski (2000)	Future returns	Accounting fundamentals, BM ratio, size, accruals.	Brazil market	The Piotrosky strategy can separate winners from losers for two-year returns after portfolio formation. It generates 52% annual market-adjusted return between 1994 and 2006

BM, Bolsa Mexicana.
Fuente: Elaboración propia.

According to the findings of the aforementioned literature, accounting fundamental signals have successfully predicted future earnings and future stock returns. Also, fundamental signals have the potential to identify temporary abnormal returns, specifically right after earnings are announced and in some cases one year after the announcement or disclosure.

The literature on US markets has shown strong empirical evidence of the value relevance of fundamental analysis in explaining future market returns. The literature presented in Table 1 for US research is just a representation of the literature, but the amount of research is considerable. However, in Latin American markets the related literature is very scarce. Some results from the Mexican market are highlighted below.

Swanson, Rees, and Juárez-Valdés (2003) examine the relation of fundamental signals to future returns in the BMV. They found that after the 1994 currency devaluation in Mexico, earnings did not provide valuable information to investors, while accounting fundamentals based on Lev and Thiagarajan (1993) provided relevant information for investors, since these measures were significantly related to one-year future returns.

Durán Vázquez, Lorenzo Valdés, and Valencia Herrera (2007) studied the value relevance of accounting information in the BMV based on the Ohlson model (Ohlson, 1995). They found that changes in the book value of the firm and changes in earnings were significantly related to changes in stock prices. They added changes in operational cash flow to the original Ohlson model and found that earnings and book value of the firm had more explanatory power than cash flow variable. They attributed this result to the accruals considered in earnings.

Based on valuation theory, accounting fundamental analysis aims to find important signals that should be related to future earnings and future stock prices changes. If the Mexican market is not as efficient as the US market, then the expectation is that there are more frequent temporary mispricing of stocks in the BMV than those in the US market. An important factor to consider in the BMV is the low level of ownership diversification that might affect how stock prices are valued in the market. In this context it should not be surprises to the market since most investors would learn about important information before it is published. External or "minority" investors might experience information asymmetry that could make the use of accounting fundamentals irrelevant. However, it might be possible that internal investors –those who hold significant percentage of the shares– under-react to important accounting signals that sooner or later will impact the future value of the firm.

According to the literature, accounting fundamental analysis has the potential to predict future earnings and future returns at least in a one-year horizon (Abarbanell & Bushee, 1997; Elleuch & Trabelsi, 2009; Piotroski, 2000). As relates to the BMV, only two studies provide evidence about the use of accounting measures to predict future returns. In this study two fundamental scores were generated for the BMV firms based on previous research. It is argued that these scores should be related to future returns.

4. Construction of fundamental scores

Two fundamental scores are proposed: F-score and L-score. F-score is based on the 9 fundamental signals of Piotroski (2000), while the L-score is based on 12 fundamental signals proposed by Lev and Thiagarajan (1993). Piotroski (2000) proposes an F-score composed of 9 accounting measures. The F-Score is a composite score that conveys information about annual improvements of firm profitability, financial leverage, and inventory turnover. High F-scores imply potential abnormal positive returns and future growth. The F-score originally was developed for firms with high book-to-market ratio. However, it has been found to be robust across different levels of financial health. The F-score measure has been found to be significantly associated with future firm financial performance (Piotroski, 2000), asset growth and future market value (Fama & French, 2006) and has been useful in differentiating "winners" from "losers" for firms with a great variety of historical profitability levels (Piotroski, 2005) and in emerging markets such as India (Aggarwal & Gupta, 2009) and Brazil (Lopes & Galdi, 2008). F-score can range from 0 (low signal) to 9 (high signal). Large F-scores are posited to be associated with better future financial performance. Details of how the F-score is constructed are specified in Appendix A.

The L-score is constructed based on the fundamental signals proposed by Lev and Thiagarajan (1993). These signals measure percentage changes in inventories, accounts receivables, gross margins, selling expenses, capital expenditure, gross margin, sales and administrative expenses, provision for doubtful receivable, effective tax rates, order backlog, labor force productivity, inventory method, and audit qualifications. These 12 fundamental signals have been shown to be consistently related to contemporary and future returns (Abarbanell & Bushee, 1998; Swanson et al., 2003). In the case of the BMV, Swanson et al. (2003) used five of these signals to examine the relevance of fundamentals in the 1994 currency devaluation in Mexico. In this paper, six of these twelve signals are estimated for the L-score since there is no sufficient publicly available information in the Mexican market. These six signals are related to inventory, accounts receivables, gross margin, selling and administrative expenses, and effective tax rate and capital expenditure. Margin to cost ratio and working capital signals were added as an operational efficiency measures. Then, L-score is composed of eight fundamental signals. The rationale for how each signal was computed is explained below.

The inventory signal is positive when the changes in sales from one period to the next are bigger than the changes in inventory. An inventory of finished goods that grows faster than sales might indicate low asset turnover or difficulty in complying with sales and inventory cost objectives. If the changes in accounts receivables are greater than the changes in sales then the firm might have difficulty collecting cash that might affect daily operations. However, changes in sales that are greater than changes in accounts receivable indicate operational efficiency. If changes in the capital expenditure of the firm are greater than changes in the capital expenditure of the industry, then this is considered a positive signal. If the changes in gross margin are greater than the changes in sales, this indicates that the firm's net profit is growing faster than sales, indicating cost efficiency. If the changes in sales and administrative expenses are greater than the changes in sales, then the firm might experience productivity problems. A declining effective tax rate might indicate that earnings will not persist at current levels affecting future performance.

Besides these six signals based on Lev and Thiagarajan (1993), two operational efficiency signals are added: margin to cost ratio and working capital. A significant increase in the margin to cost ratio is considered as a positive signal since the firm generates more earning dollars for each unit of cost. This ratio is a measure of efficient internal generation of resources. For Mexican companies resources obtained from internal operations are preferred to those from external financing due to high interest rates. A decrease in working capital is usually considered a negative signal. This signal of operational efficiency is added to gauge the changes in the ratio of sales to working capital.

For the eight fundamental signals and for each firm quarter, eight binary variables are created. If the signal is positive, 1 is assigned; if otherwise, 0 is assigned. The binary signals are then added to construct the L-score.

Lev and Thiagarajan (1993) use annual data. In this paper quarter data is used to compute the accounting signals. Using more granularity in the data provides more complete information about financial statements. To avoid abrupt changes from quarter to quarter, the changes in signals are computed quarter by quarter, but compared to the same quarter from the previous year. For each firm i and quarter t the accounting signals are computed in the same way. Appendix B shows the accounting signals proposed by Lev and Thiagarajan (1993) and also provides an example of how the inventory signal is computed.

Table 2
Sample description

Panel A.
Firms in the BMV by Industry

NAICS Industry Classification	Number of firms listed in any period from 1991 to 2011	Percent	Number of active firms as of 2011	Median market capitalization as of 2011 (in US dlls)
Accommodation and Food Services	7	3.57%	2	$77,574.41
Administrative and Support and Waste Management	1	0.51%	1	$109,922.40
Agriculture, Forestry, Fishing and Hunting	4	2.04%	1	$1,364,199.00
Arts, Entertainment, and Recreation	2	1.02%	1	$278,499.30
Construction	17	8.67%	14	$1,490,841.00
Finance and Insurance	34	17.35%	22	$660,326.40
Health Care and Social Assistance	1	0.51%	1	$239,358.55
Information & Telecommunications	17	8.67%	10	$5,447,118.00
Manufacturing-Metal-Hardware-Machinery-Computer-Electronics-Motor-Furniture	16	8.16%	6	$1,057,934.00
Manufacturing-food-beverages-textile-footwear	26	13.27%	16	$760,093.30
Manufacturing-wood-paper-petroleum-coal	20	10.20%	12	$535,056.71
Mining	5	2.55%	4	$12,176,814.01
Other Services (except Public Administration)	4	2.04%	1	$7,564,637.20
Professional, Scientific, and Technical	3	1.53%	2	$1,242,702.25
Real Estate and Rental and Leasing	1	0.51%	0	$0.00
Retail Trade-general	8	4.08%	6	$2,535,446.21
Retail Trade-specialized	12	6.12%	6	$580,759.22
Transportation and Warehousing	8	4.08%	5	$1,668,056.71
Wholesale Trade	10	5.10%	5	$494,755.21
Total	196	100.00%	115	$900,750.60

Panel B.
Listed firms in the BMV per year

Year	Listed firms
1991	23
1992	40
1993	46
1994	67
1995	67
1996	83
1997	108
1998	133
1999	127
2000	117
2001	110
2002	101
2003	104
2004	104
2005	106
2006	108
2007	105
2008	102
2009	106
2010	112
2011	115

BMV, Bolsa Mexicana de Valores; NAICS, North American Industrial Classification System.

5. Research design

5.1. Econometric models

As benchmark models, the following regression equations are proposed to test the earnings effect on firm returns with and without the control variables of book-to-market ratio and firm size:

$$Rit = \alpha + \beta_1 \times EPS_{it} + \varepsilon_{it} \quad (1)$$

Where R_{it} represents the 12-month excess firm returns over the market index for firm *i* at year *t*. R_{it} is computed three months after the end of the fiscal year, which is December for all firms in the BMV. EPS_{it} are earnings per share deflated by price at the beginning of year *t* for firm *i*.

The following regression equations are used to test the value relevance of the fundamental signals:

$$R_{it} = \alpha + \beta_1 \times EPS_{it} + \beta_2 \times BMR_{it} + \beta_3 \times SIZE_{it} + \varepsilon_{it} \quad (2)$$

To provide evidence of the value relevance of the fundamental signals, it is expected that the coefficients β_3 and β_4 in models (3), (4) and (5) are positive and statistically significant.

$$R_{it} = \alpha + \beta_1 \times EPS_{it} + \beta_2 \times BMRit + \beta_3 \times SIZE_{it} + \beta_4 \times Fscore_{it} + \varepsilon_{it} \quad (3)$$

$$R_{it} = \alpha + \beta_1 \times EPS_{it} + \beta_2 \times BMRit + \beta_3 \times SIZE_{it} + \beta_5 \times Fscore_{it} + \varepsilon_{it} \quad (4)$$

$$R_{it} = \alpha + \beta_1 \times EPS_{it} + \beta_2 \times BMRit + \beta_3 \times SIZE_{it} + \beta_4 \times Fscore_{it} + \beta_5 \times \times Lscore_{it} + \varepsilon_{it} \quad (5)$$

5.2. Data collection and the Mexican stock market

Market adjusted prices and financial data are collected quarterly from Economatica for all active firms in the Mexico's stock market from 1991 to 2011. Daily and quarterly data for the market index is used to compute market returns. Table 2 provides the sample description by industry and year.

The Bolsa Mexicana de Valores –Mexico's stock market– started operations more than a hundred years ago. As of 2011 the BMV had 115 listed firms and a total market capitalization of $408.7 billion dollars (Bank, 2012). The market index –Índice de Precios y Cotizaciones– (IPyC), is constructed with 36 liquid firms and represent about 85% of the total market capitalization. The BMV is the second largest capital market in Latin America after Brazil's stock market and followed by Chile's stock market. From 2008 to 2012 the BMV market capitalization grew more than 120% (Bank, 2012). Descriptive statistics and correlation matrix are shown in Tables 3 and 4.

The correlation matrix shows that the F-score is significantly correlated with returns, earnings per share and size. However, the

Table 3
Descriptive statistics

Variable	Firm-year observations	Mean	Std.Dev.	Min	Median
R	1731	−0.0901	0.453	−1.547	−0.065
EPS	1693	−0.043	2.094	−15.42	0.252
BMR	1817	2.513	4.017	0.00189	1.122
Size	2380	15.18	2.009	4.691	15.23
F-score	1886	4.216	1.3	0	4
L-score	1393	4.052	1.424	0	4

BMR, book-to-market ratio; EPS, earnings per share; R, 12-month excess market return; Size, log of total assets; Std.Dev., standard deviation.

Table 4
Correlation matrix (N=1272)

	R	EPS	BMR	Size	L-score
R	1				
EPS	0.163***	1			
BMR	−0.104***	−0.240***	1		
Size	0.105***	0.0695**	−0.0276	1	
F-score	0.131***	0.0581**	0.0096	0.106***	
L-score	0.0631**	0.0068	0.0191	−0.0057	1

BMR, book-to-market ratio; EPS, earnings per share (deflated by price); R, 12-month excess market firm returns (continuously compounded); size, log of total assets.
Statistical significance: *** = p-value<0.01; ** = p-value<0.05; * = p-value<0.10.

Table 5
Value relevance of earnings vs. value relevance of accounting fundamentals

	Model 1: Earnings response coefficient		Model 2: Benchmark		Model 3: Value Relevance of F-score		Model 4: Value Relevance of L-score		Model 5: Value Relevance of Fundamentals	
Variable	Coef.	t	Coef.	t	Coef.	t	Coef.	t	Coef.	t
Earnings per share	0.023***	4.18	0.021***	3.76	0.012**	2.07	0.017***	2.87	0.015**	2.52
Book-to-market ratio			−0.000	−0.14	−0.002	−0.57	−0.002	−0.52	−0.002	−0.67
Firm size (log of assets)			0.024***	3.62	0.024***	3.38	0.023***	3.11	0.020***	2.68
F-score					0.059***	6.04			0.054***	5.32
L-score							0.024***	2.74	0.016*	1.81
Intercept	−0.08***	−7.17	−0.451***	−4.31	−0.73***	−6.15	−0.56***	−4.44	−0.709***	−5.55
Number of observations	1,636		1,516		1,347		1,269		1,256	
Adjusted R^2	0.010		0.017		0.041		0.019		0.040	

Statistical significance: *** = p-value<0.01; ** = p-value<0.05; * = p-value<0.10.

correlations among all the independent variables in Model 5 does not represent a multicollienarity problem.[2] Interestingly, size is positively correlated to returns, something quite different from findings in the capital market literature. Small firms usually provide higher expected returns on average in the US market (Fama & French, 1992; Fama & French, 1995).

Instead of using annual data, quarterly data is used in order to capture richer detail of financial performance of the firms. However, data from the fourth quarter is used to test the regression models, since it is expected that investors are more aware of the fiscal year-end results than other quarters' results.

6. Results

Table 5 provides the OLS regression results for the five proposed models.

In Model 1 and Model 2, earnings provide value relevance to investors since Earnings per share is statistically significant and positively related to 12-month market-excess firm returns after 3 months of the fiscal year-end, even after controlling for book-to-market ratio and firm size.

Models 3, 4 and 5 show evidence of the value relevance of the fundamental signals. Beyond the value relevance of earnings, book-to-market ratio and firm size, the F-score and L-score are statistically significant at the 0.01 level. In Model 5, when including both the F-score and the L--score, the L-score becomes marginally significant at the 0.10 level.

Model 5 shows evidence of the additional explanatory power of F-score and L-score after controlling for earnings per share, book-to-market ratio and size. The coefficient of F-score indicates that one unit increase in F-score is associated with an increase in subsequent annual return of about 5.4%, keeping earnings per share, book-to-market ratio and size constant. On the other hand, one unit increase in L-score is associated with an increase in subsequent annual return of about 1.6%.

Ordinary least square regressions (OLS) using pooled cross-sections were tabulated in this study. The homoscedasticity assumption can be violated when using OLS with panel data structure. To correct for heteroscedasticity problems, all models were estimated using random effects regression with robust errors.[3] In addition, in these models dummy variables for years were included to control for time effect. Not tabulated results using random-effect regressions suggest the same conclusions obtained with the tabulated OLS models. Even the OLS results were more conservative since the random effect regressions show a slightly higher explanatory power for both F-score and L-score, and lower explanatory power for earnings per share.

Table 6
Exploratory factor analysis

Panel A. Factors and eigenvalues			
Factor	Eigenvalue	Proportion of the variance explained by factor	Cumulative proportion
Factor 1	1.2785	0.2557	0.2557
Factor 2	1.1695	0.2339	0.4896
Factor 3	0.9905	0.1981	0.6877
Factor 4	0.8113	0.1623	0.85
Factor 5	0.75	0.15	1

Panel B. Rotated factors loadings (varimax rotation)			
Variable	Factor 1	Factor 2	Uniqueness of the variance
Earnings per share	0.7699	0.0933	0.3986
Book-to-market ratio	−0.7656	0.1041	0.403
Size	0.2497	0.3754	0.7967
F-score	0.0477	0.7713	0.4029
L-score	−0.1215	0.6592	0.5507

To further examine the additional explanatory power of F-score and L-score an exploratory factor analysis was performed. Results of the factor analysis using principal-component factor method are shown in Table 6.

Only two factors have eigenvalues greater than one, so two latent variables or orthogonal dimensions are suggested. Interestingly both L-score and F-score nicely load in factor 2, where earnings per share has a high load for factor 1 and size has a lower load in factor 1. Having two clear orthogonal factors and their loadings suggest that both L-score and F-score are measuring something similar, but uncorrelated with the dimension measured by earnings per share and size. A regression model using these two factors as explanatory variables and future returns as the dependent variable (results are not tabulated) shows that the coefficient of factor 2 is about the double of that of factor 1. Although we can suggest that factor 2 is measuring a financial strength that is temporarily underestimated by investors, further research is needed to understand this factor composed of F-score and L-score.

These results show evidence of the potential use of fundamental signals to advance understanding of future returns in the BMV. To further provide indication of the potential use of these signals, firm-year observations are classified according to F-score and one-year and two-year raw returns and market-excess firm returns are analyzed. Since the econometric models show positive and significant correlation between the F-score and returns, it is possible to use F-score to discriminate between growth stocks and value stocks –those risky stocks with little potential to provide positive abnormal returns. The following section analyzes this approach.

2. Variance inflation factor fluctuates between 1.02 to 1.07.

3. Although fixed effect regression was suggested by the Hausman test, random effect regressions were performed mainly due to theoretical reasons. Unobserved factors were assumed not to be correlated with the independent variables. Both fixed effects and random effects regressions show similar explanatory power of F-score and L-score.

Table 7
Buy-and-hold 12-month returns by F-score

Panel A. Raw returns							
F-score	Mean	N	Min	Max	25%	Median	75%
0	.	0	.	.	.	.	.
1	−22.43%	15	−87.90%	88.33%	−38.25%	−15.04%	5.56%
2	−0.71%	83	−85.69%	366.93%	−29.60%	0.19%	49.78%
3	14.91%	259	−95.33%	3728.28%	−10.24%	20.32%	51.59%
4	4.56%	395	−93.23%	900.41%	−18.86%	11.52%	46.96%
5	7.56%	346	−86.36%	532.18%	−19.75%	10.05%	48.74%
6	4.91%	207	−85.50%	299.88%	−20.71%	9.50%	44.92%
7	19.84%	49	−67.53%	331.03%	−11.57%	23.74%	62.42%
8	110.85%	1	110.85%	110.85%	110.85%	110.85%	110.85%
Low F-score	−4.39%	98	−87.90%	366.93%	−30.37%	−5.05%	39.93%
High F-score	21.17%	50	−67.53%	331.03%	−11.57%	25.23%	66.86%
High-Low	25.56%		20.37%	−35.90%	18.80%	30.28%	26.93%
t-Stat	2.42***						
Total	7.19%	1355	−95.33%	3728.28%	−19.10%	11.40%	48.59%
Panel B. Market excess firm returns							
0	.	0	.	.	.	.	.
1	−40.07%	15	−80.95%	24.23%	−51.23%	−35.85%	−23.43%
2	−19.83%	83	−85.43%	189.21%	−42.07%	−17.55%	12.30%
3	−9.07%	259	−96.51%	2052.04%	−26.14%	−5.00%	17.23%
4	−10.42%	395	−94.73%	462.38%	−27.96%	−7.63%	15.37%
5	−7.58%	346	−87.82%	323.76%	−25.62%	−5.15%	17.12%
6	−9.00%	207	−84.23%	191.54%	−26.29%	−2.61%	21.41%
7	1.31%	49	−57.64%	300.68%	−18.45%	5.14%	22.02%
8	18.53%	1	18.53%	18.53%	18.53%	18.53%	18.53%
Low F-score	−23.28%	98	−85.43%	189.21%	−42.88%	−22.59%	8.93%
High F-score	1.62%	50	−57.64%	300.68%	−18.45%	5.36%	22.02%
High - Low	24.90%		27.79%	111.47%	24.43%	27.94%	13.09%
t-Stat	3.46***						
Total	−9.79%	1355	−96.51%	2052.04%	−27.89%	−5.45%	17.12%

Notes:
- The 12-month returns begin 3 months after the fiscal year-end, which is December for all firms
- For the means of returns, geometric means of returns are computed
- The means are calculated using the fourth quarter of each year between 1993 and 2010

Statistical significance: *** = p-value<0.01; ** = p-value<0.05; * = p-value<0.10.

6.1. Buy-and-hold returns for an investment strategy based on F-scores

Each fourth quarter observation is grouped according to its corresponding F-score. For each of the 9 groups, one-year and two-year subsequent raw returns and market-excess firm returns[4] are computed. Multi-period returns are continuously compounded. Buy-and-hold returns are presented in Table 7 and Table 8. The 12-month returns reported are from January to December of year t+1, and the respective F-score is at year t. The 24-month returns reported are from January at t+1 to December at t+2, and the respective F-score is at year t.

As expected, for both 12-month and 24-month returns observed after portfolio formation, both raw returns and market-excess firm returns increase as the F-score increases. The higher the F-score, the higher the future returns. For all tables, the average return difference between the portfolio of high F-score and low F-score is positive and very significant, which demonstrates the explanatory power of the F-score. Interestingly, the average of one-year market-excess firm returns for the high F-score portfolio between 1993 and 2011 is only 1.62%, and the average of two-year returns is negative. This suggests that the fundamental strategy is more efficient for predicting returns one year ahead.

Since a premium is expected for the high-average portfolios' one-year returns, a further analysis is performed (not tabulated in the paper). An investment strategy is simulated selecting high F-score (values of 7, 8 and 9) observations year-by-year, beginning in 1993. For the selected observations, the corresponding one-year buy-and-hold returns are for the following year. Then, the process repeats until the year 2010. The returns of this investment strategy for the period 1993-2010 are 952%. The average annual buy-and-hold returns for the period are about 14.7%. The returns using the market index based on the IPyC for the same period 1993-2010 are 651%. The average annual buy-and-hold return for the period with the market index strategy is about 12.6%. Although the differences are not big,[5] the accounting fundamental investment strategy is still superior compared to the market index investment strategy. Further research should examine more sophisticated investment strategies based on fundamental analysis; for example, the simple application of portfolio theory to minimize risk and maximize expected returns. Finally, it may be possible to predict financial crises or recessions since the BMV experienced strong volatility in those periods.

7. Conclusion

This paper find evidence of the value relevance of accounting fundamental signals in the BMV. The proposed F-score and L-score show extra explanatory power to explain future returns beyond traditional factors such as book-to-market and size factors. Further analysis shows that an investment strategy using accounting fundamental scores is stronger than a traditional market index investment strategy.

4. Equally weighed portfolios are used to estimate future returns.

5. When excluding the currency devaluation period from 1993 to 1995, an important significant difference between these investment strategies is found. With the accounting fundamental investment strategy from 1996 to 2011 the return is 1390%, compared to 489% return using the market index investment strategy.

Table 8
Buy-and-hold 24-month returns by F-score

Panel A. Raw returns							
F-score	Mean	N	Min	Max	25%	Median	75%
0	.	0	.	.	.	.	.
1	−27.24%	14	−90.39%	136.32%	−62.66%	−20.86%	40.21%
2	−3.18%	68	−96.36%	642.61%	−46.10%	−0.42%	99.17%
3	21.77%	236	−98.61%	5031.59%	−16.89%	32.98%	101.38%
4	12.08%	355	−94.64%	749.94%	−24.95%	23.24%	82.03%
5	18.41%	301	−91.13%	467.46%	−17.06%	22.88%	90.22%
6	20.20%	184	−90.86%	437.63%	−26.51%	36.89%	100.17%
7	43.05%	38	−54.52%	396.79%	−16.39%	36.89%	84.97%
8	106.06%	1	106.06%	106.06%	106.06%	106.06%	106.06%
Low F-score	−7.80%	82	−96.36%	642.61%	−48.52%	−5.00%	98.38%
High F-score	44.34%	39	−54.52%	396.79%	−16.39%	38.54%	101.78%
High - Low	52.14%						
t-Stat	2.72***						
Total	16.18%	1197	−98.61%	5031.59%	−21.81%	24.86%	90.22%
Panel B. Market excess firm returns							
0	.	0	.	.	.	.	.
1	−52.38%	14	−95.30%	65.37%	−71.26%	−38.43%	−16.39%
2	−36.11%	68	−97.77%	344.60%	−59.67%	−25.92%	3.62%
3	−16.97%	236	−98.95%	2295.08%	−39.65%	−9.88%	25.36%
4	−19.18%	355	−94.81%	296.70%	−43.62%	−11.93%	22.51%
5	−15.30%	301	−94.05%	238.38%	−37.12%	−10.15%	20.80%
6	−14.62%	184	−90.72%	303.09%	−37.00%	−8.43%	28.79%
7	−0.88%	38	−66.04%	424.88%	−34.03%	−0.46%	27.00%
8	−3.88%	1	−3.88%	−3.88%	−3.88%	−3.88%	−3.88%
Low F-score	−39.23%	82	−97.77%	344.60%	−60.47%	−28.75%	2.33%
High F-score	−0.96%	39	−66.04%	424.88%	−34.03%	−1.82%	27.00%
High - Low	38.27%						
t-Stat	3.17***						
Total	−18.13%	1197	−98.95%	2295.08%	−40.49%	−11.04%	22.14%

Notes:
- The 24-month returns begin 3 months after the fiscal year-end, which is December for all firms
- For the means of returns, geometric means of returns are computed
- The means are calculated using the fourth quarter of each year between 1993 and 2010

Statistical significance: *** = p-value<0.01; ** = p-value<0.05; * = p-value<0.10.

This study contributes to capital market research in Latin America. First, findings about the value relevance of accounting fundamentals provides insight about the form of market efficiency in Latin America. Second, the striking results using a fundamental strategy to form portfolios has practical implications for investors. Regarding the type of market efficiency according to Fama (1970), results do not support the semi-strong form of efficiency. In a semi-strong efficient market, security prices reflect all information that is publicly available. Results suggest at least a temporal mispricing of securities that can last from one quarter up to a year. Further research is needed to evaluate whether the value relevance of accounting fundamentals is an important signal of market inefficiency.

Practical implications of the study for practitioners and researchers are important. Many financial analysts in Latin American markets should expect a low level of value relevance of accounting signals mainly due to apparent lack of transparency when reporting financial statements.[6] However, this study provides strong evidence that accounting fundamental signals can provide important insight information to investors –individuals and institutions– when making decisions about resource allocation. Further research in emerging markets should explore this approach, provide alternative explanations for the value relevance of fundamentals and investigate whether other strategies can predict periods of financial stress. This line of research would help policy makers to design improved legal and technological infrastructures in Latin American markets, with increased transparency and the potential to generate wealth.

6. Analysts might not consider 100% transparency in financial statements due to high concentration of ownership in Latin American markets.

The study has several limitations. First, the econometric models do not include important macroeconomic variables –such as inflation rates, economic depression– or variables related to important regulatory changes in the market. Second, only secondary data was used based on models developed in developed markets. Primary data collected from local analysts might provide different fundamental signals with better justification for a Latin American market.

APPENDIX A

Piotroski accounting signals

Piotroski (2000) considers nine discrete accounting fundamental measures at time t (F1, F2, F3, F4, F5. F6, F7, F8, F9) as follows:

- *If* $ROA_{(t)}>0$, *then F1=1; 0 otherwise*
- *If* $CFR_{(t)}>0$, *then F2=1; 0 otherwise*
- *If* $\Delta ROA>0$, *then F3=1; 0 otherwise*
- *If* $\frac{CFT_{(t)}}{Assets_{(t-1)}} > ROA_{(t)}$, *then F4=1; 0 otherwise*
- *If* $\Delta\left(\frac{LTDebt}{AvgAssets}\right)<0$, *then F5=1; 0 otherwise*
- *If* $\Delta\left(\frac{CurrentAssets}{CurrentLabilities}\right)<0$, *then F6=1; 0 otherwise*
- *If* $\Delta Equity>0$, *then F7=1; 0 otherwise*

• *If* $\Delta\left(\frac{GrossMargin_{(t)}}{Assets_{(t-1)}}\right)>0$, *then F8=1; 0 otherwise*

• *If* $\Delta\left(\frac{Sales_{(t)}}{Assets_{(t-1)}}\right)>0$, *then F9=1; 0 otherwise*

Then F-Score= F1+F2+F3+F4+F5+F6+F7+F8+F9

Where:

$Assets_{(t-1)}$ = *Total Assets at the beginning of the period*

$ROA_{(t)}$ = *Return on Assets at t*

$ROA_{(t)} = \frac{NBID_{(t)}}{Assets_{(t-1)}}$

$CFR_{(t)}$ = *Cash flow from operations at t*

$\Delta ROA = ROA_{(t)} - ROA_{(t-1)}$

LTDebt = Long term debt

$ROA_{(t)} = \frac{Assets_{(t-1)} + Assets_{(t)}}{2}$

Δ*Equity = Change in common share outstanding (if the firm issued equity at t, this variable will be greater than zero)*

$$\Delta\left(\frac{GrossMargin}{Assets_{(t-1)}}\right) = \frac{GrossMargin_{(t)}}{Assets_{(t-1)}} - \frac{GrossMargin_{(t-1)}}{Assets_{(t-2)}}$$

$GrossMargin_{(t)} = Sales_{(t)} - COGS_{(t)}$

NIBD = Net Income Before Interest, Taxes and Depreciation

$NIBD_{(t)} = Sales_{(t)} - COGS_{(t)} - SGAE_{(t)}$

SGAE = Selling, General, and Administrative Expenses

COGS = Cost of Goods Sold

APPENDIX B

Lev & Thiagarajan (1993) accounting signals

Accounting Signal		Based on:
1.	Inventory	ΔInventory – ΔSales
2.	Accounts Receivable	ΔAccounts Receivable – ΔSales
3-4.	Capital Expenditure	ΔIndustry Capital Expenditures or R&D – ΔFirm Capital Expenditures (R&D)
5.	Gross Margin	ΔSales – ΔGross Margin
6.	Sales and Administrative Expenses	ΔSales & Administrative Expenses – ΔSales
7.	Provision for Doubtful Receivables	ΔGross Receivables – ΔDoubtful Receivables
8.	Effective Tax	PTEt × (Tt-1 – Tt) PTE_t = pretax earnings at t, deflated by beginning price T= effective tax rate
9.	Order Backlog	ΔSales – ΔOrder Backlog
10.	Labor Force	((Sales t/No of Employees t–1) – (Sales t/No. of Employees t))/(Sales t–1/No. of Employees)
11.	LIFO Earnings	0 for LIFO; 1 for FIFO LIFO=Last Incomes First Outcomes FIFO= First Incomes First Outcomes
12.	Audit Qualification	1 for Qualified; 0 for Unqualified based on audit opinion

Here is an example of how the inventory signal is computed in this paper:

$$InventoryChange_{i,t} = \frac{[Inventory_{i,t} - E(Inventory_{i,t})]}{E(Inventory_{i,t})} - \frac{[Sales_t - E(Sales_{i,t})]}{E(Sales_{i,t})}$$

$InventorySignal_{i,t} = 1$ *if* $InventoryChange_{i,t} < 0$; 0 *otherwise*

$E(Inventory_{i,t}) = \frac{Inventory_{i,t-4} + Inventory_{i,t-8}}{2}$

$E(Sales_{i,t}) = \frac{Sales_{i,t-4} + Sales_{i,t-8}}{2}$

Where:
$InventoryChange_{i,t}$ = Percentage change in inventory minus percentage change in Sales of firm *i* in quarter *t*
$InventorySignal_{i,t}$ = Binary signal indicating a positive (1) or not positive (0) signal of firm *i* in quarter *t*
$E(Inventory_{i,t})$ = Last two-year average of inventory for the corresponding quarter, which includes the average of inventory for quarter $t-4$ and $t-8$
$E(Sales_{i,t})$ = Last two-year of sales value for the corresponding quarter, which includes the average of sales for quarter $t-4$ and $t-8$.

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