Journal of Economics, Finance and Administrative Science 19 (2014) 104–107

JOURNAL OF ECONOMICS, FINANCE AND ADMINISTRATIVE SCIENCE

www.elsevier.es/jefas

Article

Effectiveness of corporate finance valuation methods: Piotroski score in an Ohlson model: the case of Mexico

Rocio Durán-Vázquez [a,*], Arturo Lorenzo-Valdés [b], Claudia E. Castillo-Ramírez [b]

[a] *Head of Finance and Accounting Department, Universidad de las Americas Puebla Puebla, San Andres Cholula, Mexico*
[b] *Universidad de las Americas Puebla, Puebla, San Andres Cholula, Mexico*

ARTICLE INFO

Article history:
Received 31 January 2014
Received in revised form 22 April 2014
Accepted 28 April 2014

JEL classification:
D53
C33
G11

Keywords:
Financial markets
Piotroski score
Ohlson model
Dynamic panel of econometric estimation

ABSTRACT

This study applied the Piotroski score for 63 selected companies of Mexico, for the period 2005 to 2011. The Piotroski score provides an evaluation on the historical financial performance of a company, with the evaluation of nine financial analysis ratios or criteria. We decided to add this score to the Ohlson Model (which was already tested in previous studies). It was found that the Piotroski score showed statistically significant results in the levels and differences variables.

Asymmetric signs were also found in the Piotroski-score variables (levels and lagged), both of them are consistent according to the behavior of the Mexican market.

The data were analyzed under a dynamic panel basis, with fixed effects, and the Sargan statistic for this analysis was fulfilled.

Efectividad de los métodos de valuación en finanzas corporativas: calificación de Piotroski en un modelo de Ohlson: el caso de México

Códigos JEL:
D53
C33
G11

Palabras clave:
Mercados financieros
Calificación de Piotroski
Modelo de Ohlson
Estimación econométrica de panel dinámico

RESUMEN

En este estudio se aplicó la calificación de Piotroski a 63 empresas seleccionadas de México, para el período 2005 a 2011. La calificación de Piotroski proporciona una evaluación sobre el desempeño financiero histórico de una empresa, empleando nueve razones financieras. Decidimos añadir esta calificación al modelo de Ohlson (ya probado en estudios previos). Se encontraron los siguientes resultados: la calificación de Piotroski es estadísticamente significativa en niveles y en diferencias.

También encontramos signos contrarios en las variables de Piotroski (en niveles y rezagada), ambas coherentes de acuerdo al comportamiento del mercado mexicano.

Analizamos los datos bajo la forma de panel dinámico con efectos fijos y el estadístico de Sargan, que para este análisis se cumplió.

1. Introduction

According with Piotroski (2002), the distribution of returns earned by an investor can be shifted (by a simple score under a fundamental analysis performance evaluation) when it is applied to a broad portfolio of high book-to-market firms. Is this score significant to the investors?, and does it has an explanation power over other accounting measures?

These are the questions that we figured at the beginning of this research. So we decided to focus on the Ohlson model, in order to describe the dynamic of the stock price. The reason is because the Ohlson model has been already tested with Mexican data, like in

* Corresponding author.
E-mail address: rocio.duran@udlap.mx (R. Durán-Vázquez).

http://dx.doi.org/10.1016/j.jefas.2014.04.003
2077-1886/

Duran, et al. (2007) under the short term basis, where the value relevance was operationalized using the Ohlson Model estimated under the panel-data analysis, and we found that the model was significant for the Mexican data and the variable of operative cash flow was identified as an "additional" variable for the model. In this paper we decide to add the Piotroski score as the third variable to the Ohlson model. Lorenzo & Duran (2010), tested the Ohlson model for Mexican data, under co-integration basis, where was found that the Ohlson model has a long term equilibrium.

The general idea of a successfully strategy in financial markets is based on the ability to predict future firm performance and the market's inability to recognize these predictable patterns. There are many models and evidence of the performance in each market. We decided to lag the Piotroski score for one year, and we found econometrical evidence that the Piostroski score brings significance to the Ohlson model criteria.

The fundamental information of the stocks has been frequently used by securities analysts and portfolio managers as well as academic researchers, so in this paper we merge the academic proposal (of the Ohslon model) with the practical proposal (of the Piotroski score) in one model; and found evidence of the relevance of both criteria for selected companies of Mexico.

2. Literature review

The beginning of the fundamental analysis for the share price valuation started with Graham & Dodd (1996). The second important step was the contribution of the dividend discount model of Gordon (1962), then the extension of the discount model was prepared by Ohlson (1995) using a residual income valuation model in order to express the share prices in terms of the contemporaneous book value and earnings per share. Besides these studies, the fundamental analysis was analyzed by calculating certain multiples for a set of benchmark firms and finding the implied value of the firm of interest by these like in the works of Ou & Penman (1989); Kaplan & Ruback (1995) or in Liu, Nissim, & Thomas (2001).

According with Cheng-Few, et al. (2010), there are main references of the fundamental analysis approach: the Ohlson model (Ohlson, 1995) uses linear information of book value and the period net result per share of the company to estimate the stock prices. Other group of analysis were focused on some of the financial statement information, as inventory, account receivables, and gross margin, for example, on the works of Ou and Penman (1989); Abarbanell and Bushee (1997); Lev and Thiagarajan (1993). The difference of those works and the Piotroski (2000) paper is that, Piotroski prepared an aggregated measurement to examine overall performance of the firms, and let to identify the portfolio consisting of financially healthier firms, i.e. firms with higher score, outperform those consisting of low scores firms up to two years after the portfolios are formed. Since both technical information (past returns and past trading volume) and fundamental information (firm-specific financial statement information) have been documented to identify winners and losers, for example in the works of Reza (2008) or Bushman, Piotroski, & Smith (2011).

According with Jegadeesh and Titman (1993) the market behavior of the public companies that are the best or the worst of the market, (over a 3 to 12 months period) they usually be likely to perform the same way, over the subsequent period of analysis. This behavior is common in the stock market results in several contries, that's why we focus the analysis by using the Piotroski score, in order to identify the companies that are winners from the losers.

Dorantes (2013) emphasize about the relevance of accounting variables in the Mexican Stock Market, and the explanation power of them, in the firm value. Particularly he found that the companies can use the accounting variables in fundamental analysis, as one of the strategies in order to bring return excess in one or two years, from his study of 196 companies in the Mexican Stock Market from 1991 to 2011.

2.1. Piotroski score

Piotroski (2000) prepared an evaluation scale about the historical financial performance in order to separate winners (with the highest score: 9) from losers (with the lowest score: 0), this score is one way to proceed when we want to assess a company, in terms of the "financial attractiveness".

Prior to Piotroski, several papers present evidence of how the returns to a high book-to-market investment strategy (e.g., Rosenberg, Reid, & Lanstein 1984; Fama & French, 1992; and Lakonishok, Shleifer, & Vishny 1994). In those studies, the success of that strategy relies on the strong financial performance of a few firms, while tolerating the poor performance of many deteriorating stocks.

The contribution of Piotroski score is the evaluation from a simple, financial statement-based heuristic ratios, that when area applied to these out-of-favor stocks, can discriminate between firms with strong prospects and those with weak prospects. And also found evidence that the positive market-adjusted return earned by a generic high book-to-market strategy disappears in rapid information-dissemination environments (large firms, firms with analyst following, high share-turnover firms). The evidence of his study resulted on the effectiveness of the fundamental analysis strategy to differentiate value firms is greatest in slow information-dissemination environments.

The score provides evidence on the trend of analysis about good and bad news (under the financial behavioral signs on performance, such as Hong, Lim, & Stein (2000) or in Daniel, Hirshleifer, & Subrahmanyam 1998.

Besides the score that Piotroski (2000) prepared, Mohanram (2005) developed other kind of fundamental indicators, like was identified as Gscore in which firm specific information has been employed in evaluating value stocks and growth stocks respectively.

This scale is used to determine what actions have more financial strength according to specific criteria found in the financial statements of companies. The score included the evaluation of 9 criteria for financial performance; the low qualification is 0 and the highest is 9. The 9 criteria signals to proxy measure the overall financial health of the high book-to-market firms and they can be categorized in three groups: profitability criteria, operating efficiency criteria, and change in solvency/liquidity criteria.

I. The profitability criteria-signals are those to measure firm's ability to generate profits. This group has four indicators: *ROA* (return on assets), *ΔROA* (change in return on assets), *CFO* (cash flow from operation scaled by total assets), and *Accrual* (difference between *ROA* and *CFO*). *ROA* and *CFO* are assigned a value equal to one if they are positive, zero otherwise. Similarly, if firms experience positive change in return on assets, the variable *ΔROA* is assigned a value of one, and zero otherwise.
II. The operating efficiency criteria-signals are those related to the activities turnovers. This group has two indicators: *ΔMargin* (change in gross margin) and *ΔTurn* (change in asset turnover). Positive changes in gross margin and asset turnover represent improvement in generating profits and efficient employment of firm's asset, and are assigned a value of one if positive, and zero otherwise.
III. The change in solvency/liquidity criteria-signals are those related to the leverage and liquidity. This group has three indicadors: *ΔLever* (change in leverage) is assigned a value of one if negative and zero otherwise, *ΔLIQUD* (change in current ratio)

is assigned a value of one if the firm decreases its current ratio from the last year and zero otherwise, and *EQOFFER* (equity issuance) which is indicator variable equal to one if the firm had no equity issuance in the previous year and zero otherwise.

With the measure of these nine signals, Piotroski (2000) prepares a score to assess the financial performance of a firm. The sum of these nine indicator variables ranges from zero to nine with nine (zero) indicating a firm with more (less) good signals.

$$\text{Piotroski score} = ROA + \Delta ROA + CFO + Accrual + \Delta Margin + \Delta Turn + \Delta Lever + \Delta LIQUID + EQOFFER \quad (1)$$

Each of the nine criteria are very important for companies because they are calling the most important factors for the investor as it rests on these decisions, for example how profitable or will not be investing. Then it is said that if a company is qualified with a 7, or more, of the 9 criteria, it will be worthy of belonging to an investment portfolio, but in the event that, after the study of the recurrent financial statements publications, the company is qualified with a 7 or below its score, it is not feasible fruitful investment according to the study.

2.2. The Ohlson model

As we mentioned in Duran, Lorenzo & San Martin (2012), the Ohlson model is the one with the largest number of research papers in the international accounting literature, with different interpretations emphasizing its utility or reflecting about its structural and methodological constraints. And it means a crucial reference for the market analysis based on financial accounting research, because the financial information was considered and identified as a component of value. And it allows the link of relevance of accrual financial information with the response of the stock market.

The Ohlson model (1995) evaluates the significance value relevance of the companies, on the share price (three months later, as a response of the market), by two accounting measures: the value of the net investment in it (book value) and the present value of the benefits period (income) that brings together the "net assets" shareholders equity value concept.

We are following the Collins-Maydew-Weiss (1997) historical criteria for the earnings variable. So, the original considerations of the Ohlson model, in this study are:

$$P_{it} = \beta_1 BV_{it} + \beta_2 E_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where: P_{it}: share price of the firm i three months later of the end of fiscal year t. BV_{it}: book value of firm i, in the period t, E_{it}: profit or loss of the company i, in the period t, μ_i: the fixed effect of firm i, and

ε_{it}: other relevant information of firm i in the period t, being orthogonal to the independent variables.

There are several applications and analysis of the Ohlson model in many countries, from the Latin-American market, the work of Martinez Prior & Riapl (2012) brought an overview of the stock prices behavior. In this study we add to the analysis the test of the relevance of the Piotroski score.

3. Methodology

The specification of the static fixed-effects traditional panel is improved by including auto-regressive coefficients. For our study we consider the dynamic panel auto-regressive model of order one below:

$$P_{it} = \rho P_{it-1} + \beta_1 BV_{it} + \beta_2 E_{it} + \beta_3 PIO_{it} + \beta_4 PIO_{it-1} + \mu_i + \varepsilon_{it} \quad (3)$$

The variables BV_{it} and E_{it} represent book value and earnings for firm i in year t respectively, PIO_{it} is Piotroski FSCORE for the firm i in year t. All of these three are strictly exogenous variables. P_{it} is the shares price of the firm i three months later of the end of fiscal year t. The coefficient μ_i represents the fixed effect of firm i and ε_{it} is the innovation term.

In equation (3) we are adding the Piotroski FSCORE variable to the Ohlson model, as a determinant of the value relevance, that we specify here, as the price of the stocks. We are mixing two focuses on the fundamental analysis studies: the one that emphasizes under the accounting variables information that are available in the financial statements (three months prior) and the financial performance evaluated under the Piotroski FSCORE (as a grade that classifies the results of each company).

The advantages of using dynamic panels are that they take into account the autocorrelation of the residuals and reduce the possibility of spurious regressions that could lead to biased and inconsistent estimates and incorrect inferences. In our context, static models would lead to an overestimation of the parameters of the exogenous variables, especially for the Ohlson model (*BV* y *E*). The coefficient of the lagged variable, indicates the annual relationship stock price.

The model is estimated using the Generalized Method of Moments (GMM) using instrumental variables first differences so to estimate the coefficients of equation (3) differences are used as follows:

$$\Delta P_{it} = \rho \Delta P_{it-1} + \beta_1 \Delta BV_{it} + \beta_2 \Delta E_{it} + \beta_3 \Delta PIO_{it} + \beta_4 \Delta PIO_{it-1} + \Delta \varepsilon_{it}. \quad (4)$$

In this case we use stock prices lagged two periods as instrumental variables. It can be proved (Anderson & Hsiao, 1981) that these are efficient estimators.

4. Empirical results

The Mexican Stock Exchange, in 2013 is composed by 124 active companies listed. The CPI (Index of Prices and Quotations) is the main indicator of the Mexican Stock Exchange.

We followed the criteria of Collins, Maydew & Weiss (1997) methodology by considering the independent variables using historical data published in financial reports and consider the lagged independent variable at a time (in a quarter after the date of each independent variable), we found 63 companies that fulfill this criteria, for the period of annual basis of 2005 to 2011, from Economatica Data Base.

Estimation results of (3) are presented in Table 1. The entire coefficient estimated is statistically significant. The serial correlation

Table 1
Estimation results for equation (4).

Parameter	Coefficient	Standard error	Prob.
ρ	0.66784	0.06448	0.00000
β_1	1.32939	0.32655	0.00007
β_2	4.66739	0.41487	0.00000
β_3	12.35091	4.47177	0.00633
β_4	−13.27890	6.38711	0.03901
	Statistic		Prob.
m_1	−2.18654		0.02878
m_2	1.09110		0.27523
Sargan Test	10.1086 (10)		0.43102
Wald Test	10647.09 (5)		0.00000

Where: m_1 and m_2 are Arellano and Bond auto-regressive statistics. Degrees of freedom of Sargan and Wald tests are reported in parenthesis.
Own calculation.

statistics of first and second order proposed by Arellano & Bond (1991) as a serial correlation test method are suitable. If the disturbances are independent and identically distributed is expected that the first-order statistic is significant and second-order is not. It is confirmed in our case.

The Sargan statistic confirms that we do not reject the null hypothesis that the model is well specified (the over identifications restrictions are valid). The Wald test specifies for the model joint significance under the null hypothesis that all coefficients are zero. In this case it is found that the model is significant.

This result of equation (3), means that is a well specified model and the variables that we add to the Ohlson model: level and lagged Piotroski FSCORE are both relevant with power explanation on the stock prices in Mexico, in the period of 2005-2011.

The practical application of the results may let the financial analysis to consider the elements of the Piotroski FSCORE, as a determinant of the value relevance measured in this case, by the price three months later. This is a financial tool to use in terms of evaluate the past-present performance of a company, and as a proxy for the future performance in the stock market. In the same way, the chief financial officers of any company have elements to improve their financial performance, in order to be more attractive to the stakeholders in the market.

5. Conclusions

A general conclusion of this paper is that the Ohlson model seems to provide explanation power for the Mexican data. According with prior studies, like in Lorenzo & Duran (2010) this model is relevant in the fundamental analysis area, because all the firms have a long-run equilibrium. It is important to highlight that even the signs and the significance of the independent variables (book value and earnings) is fulfilled in the Mexican case, as in other developed countries.

In this study we decide to change the econometric approach of analysis, from panel data to dynamic panel data, in order to have unbiased and efficient parameter estimations, and the model brings a very well specification.

Besides the significance of the Ohlson model, under the dynamic panel data, we found significance of the two variables that were tested: the FSCORE of Piotroski under level and lagged basis.

The signs obtained on equation (3) refer that there are assymetric behavoir of the added variables of Piotroski:

- On the level variable, we found a positive sign, that means that the classification that the FSCORE brings (about if one company is from the winners or losers group) has a direct effect on the stock price. And the range of that classification (in terms of the size of the FSCORE evaluation) gives the dimension of change on the dependent variable.

- On the lagged variable, we found a negative sign, that means that the prior classification of the change of FSCORE brings an increment on the annual change of the price.

These results are important, because they mean that in the short term the Piotroski score (FSCORE) is significant, under econometrics terms for the Mexican data. That means that this variable contributes to the Ohlson model in a positive way (under the level and lagged presentation). And is an empirical evidence of the significance of the academic and no academic approach of analysis, by the addition to the Ohlson model, with the two variables considered of Piotroski.

References

Abarbanell, J. S., & Bushee, B. J. (1997). Fundamental analysis, future earnings and stock prices. *Journal of Accounting Research*, *35*(1), 1–24.

Anderson, T. W., & Hsiao, C. (1981). Formulation and estimation of dynamic models using panel data. *Journal of Econometrics*, *18*, 47–82.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, *58*, 277–297.

Bushman, R. M., Piotroski, J. D., & Smith, A. J. (2011). Capital allocation and timely accounting recognition of economic losses. *Journal of Business Finance and Accounting*, *28*(1-2), 1–33.

Cheng-Few, L., Wei-Kang, S., & Hong-Yi, C. (2010). Technical, fundamental, and combined information for separating winners from losers. Available at http://ssrn.com/abstract=1590460

Collins, D. W., Maydew, E. L., & Weiss, I. S. (1997). Changes in the value-relevance of earnings and book values over the past forty years. *Journal of Accounting and Economics*, *24*(1), 39–67.

Daniel, K., Hirshleifer, D., & Subrahmanyam, A. (1998). Investor psychology and security market under and over reactions. *Journal of Finance*, *53*, 1839–1885.

Dorantes, C. A. (2013). The relevance of using accounting fundamentals in the mexican stock market. *Journal of Economics, Finance and Administrative Science*, *18*(Special Issue), 2–10.

Duran, R., Lorenzo, A., & Valencia, H. (2007). Value relevance of the Ohlson model with Mexican data. *Revista de Contaduria y Administracion*, *1*(223, UNAM), 33–52.

Duran, R., Lorenzo, A., & San Martin, J. M. (2012). Relevance of Discretionary Accruals Information (DAI) in Ohlson model: the case of Mexico, *Journal of Entrepreneurship. Management and Innovation*, *8*, 22–34.

Fama, E., & French, K. (1992). The cross-section of expected stock returns. *Journal of Finance*, *47*(June), 427–465.

Gordon, M. J. (1962). The investment, financing, and valuation of the corporation, Irwin, Homewood, Illinois.

Graham, B., & Dodd, D. (1996). *Security analysis: The Classic 1934 Edition*. New York, NY: McGraw-Hill.

Hong, H., Lim, T., & Stein, J. (2000). Bad news travel slowly: Size, analyst coverage, and the profitability of momentum strategies. *Journal of Finance*, *55*(February), 265–296.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance*, *48*, 65–91.

Kaplan, R., & Ruback, R. (1995). The valuation of cash flow forecasts: an empirical analysis. *Journal of Finance*, *50*(4), 1059–1093.

Lakonishok, J., Shleifer, A., & Vishny, R. (1994). Contrarian investment, extrapolation, and risk. *Journal of Finance*, *44*(December), 1541–1578.

Lev, B. R., & Thiagarajan, S. R. (1993). Fundamental information analysis. *Journal of Accounting Research*, *31*(2), 190–215.

Liu, D., Nissim, D., & Thomas, J. (2001). Equity valuation using multiples. *Journal of Accounting Research*, *40*(1), 135–172.

Lorenzo, A., & Duran, R. (2010). Ohlson model by panel co-integration with Mexican data. *Revista de Contaduria y Administracion*, *1*(232, UNAM, septiembre-diciembre), 131–142.

Mohanram, P. S. (2005). Separating winners from losers among low book-to-market stocks using financial statement analysis. *Review of Accounting Studies*, *10*(2-3), 133–170.

Martinez, P., Prior, D., & Rialp, J. (2012). The price of stocks in Latin American financial markets: An empirical application of the Ohlson model. *Global conference on business and finance proceedings*, *7*, 96–100.

Ohlson, J. A. (1995). Earnings, books values and dividends in equity valuation. *Contemporary Accounting Research*, *11*(2), 661–687.

Ou, J. A., & Penman, S. H. (1989). Accounting measurement, price-earnings ratio, and the information content of security prices. *Journal of Accounting Research*, *27*(3), 111–144.

Piotroski, J. D. (2000). Value investing: The use of historical financial statement information to separate winners from losers. *Journal of Accounting Research*, *38*(3), 1–41.

Reza, T., Reza, R., Arach, F., & Mohsen, R. (2008). Separating winners from losers among iranian investment companies during the years 2004 to 2005. *International Journal of Economic Perspectives*, *2*, 12–23.

Rosenberg, B., Reid, K., & Lanstein, R. (1984). Persuasive evidence of market inefficiency. *Journal of Portfolio Management*, *11*, 9–17.