THE PRICE OF STOCKS IN LATIN AMERICAN FINANCIAL MARKETS: AN EMPIRICAL APPLICATION OF THE OHLSON MODEL

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ABSTRACT

The emergence of the Latin American market and its growing importance attract global investors to this region with an eye on profit opportunities. This attraction demands a reliable instrument for the calculation of future stock prices of regional companies. This study examined the reliability and validity of the Ohlson Model to predict Latin American stock prices through an empirical application of a panel data analysis of 1,112 companies from this region with data from 2002 to 2009. The findings identified the countries in Latin America where the model can be used successfully.

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KEYWORDS: Ohlson Model, Latin American, Stock Prices

INTRODUCTION

Calculating the value of a firm is of paramount importance; identifying and defining the broad spectrum of factors that influence the prices of stock has been a challenge for the scientific community. The purpose of this paper was to test a model based on accounting information to estimate stock prices for Latin American Markets. As stated in the work, Return to the Fundamentals by Penman (1992) "How does one assess how much to pay for a stock and what is the role of accounting in that assessment?"

The Ohlson Model determines the market value of a company´s stock from accounting data (Ohlson, 1995), such as book value and discounted future dividends. This model has attracted considerable attention (Ota, 2002) and has had considerable impact on the literature in recent years (Larrán & Piñero, 2005). It has an advantage over other models in that the accounting information is available for all the listed companies.

The importance of proposing and answering these questions resides in regional economic development potential. The United Nations (2011), through its statistic Division, estimated the combined midyear population of 2009 for Latin America and the Caribbean was 583.5 million people, of an estimated worldwide population of 6.82 billon. This implies that 8.6% of the world population lives in the Latin America region. Clearly Latin America is a region with great development potential.

Even though a great deal of research has been done using the Ohlson Model for the United States, Western European and Asian countries, no such exists concerning Latin America. There are two publications that have used Ohlson in México, "Value relevance of the Ohlson Model with Mexican data" (Durán, Valdés & Valencia, 2007) and "Ohlson Model by Panel Cointegration with Mexican Data" (Valdés & Durán, 2010). A research gap existed in the literature that offers the opportunity to use Latin American data to probe the validity and applicability of the Ohlson Model to stock markets from this region. This study answers the following research question: Can the Ohlson Model be used in all countries of Latin America?

The importance of this question resides in the relation between growth and financial structure presented in the work of Greenwood & Jovanovic (1990). These authors demonstrated that in mature economies financial structures were well developed which facilitated the income distribution among people. This is not the case in Latin America, however, as the financial structures are not yet fully developed, and therefore income is not well distributed among the people.

According to a report prepared by the staff of the Infrastructure and Financial Market Division (Wright, Chrisney & Vives, 1995) of the Inter-American Development Bank, there are great differences in domestic financial systems in the Latin American region, which have different economic, social, and political development strategies, highlighting important differences. This report states that the Inter-American Development Bank has been working for several years in the banking system of the region, but recommends that the bank focus on non-bank financial issues, such as the capital markets, with the inclusion of primary and secondary markets. It states that capital markets of the region are poorly developed and have liquidity and transparency problems, which makes them less attractive for domestic investors. This reduces domestic investment in favor of consumption or offshore investments. It is important, therefore, for shareholders and potential investors in the stock market of the countries of Latin America to know if the differences are a major influence in the way financial and operative results affect the price of stocks. In a broader spectrum, it is important for investors to know if there is a model that can be applied to determine the stock value for a specific market for the countries in this region.

Before the Ohlson Model was developed, there were many attempts to calculate the real value of stocks. Some, in accounting terms by simply subtracting liabilities from the assets, or technical analysis based on a graphical interpretation. A more complex method was fundamental analysis based on discounted cash flows. All of these methods have their application, but as Bernard (1995) stated, "the Ohlson Model (Ohlson, 1995) and the Feltham-Ohlson Model (Feltham-Ohlson,1995) stand among the most important developments in capital markets research in the last several years" and could be the foundation for very important research between firm value and accounting information. Ota (2001) argued that these studies have drawn a great deal of attention in the last few years. Many publications and empirical tests appeared after the publication in 1995 of both the Ohlson and the Ohlson-Feltham Models.

The Ohlson Model has proven to be a powerful tool in determining the value of a stock from available accounting information. It is therefore important to test the model in different countries. Globalization has linked the economies of countries in a way never before possible, but throughout history there has been a natural tendency to form economic groups to achieve a competitive synergy. As the European community has created an economic block, Latin America is trying to integrate into an economic region, and given the fact that there are new emerging economies in the region with growth potential, it would appear to be an interesting case for study.

In order to apply the Ohlson Model to the stock markets from Latin America, the Osiris Data base was used. First a pooled regression was completed and compared with the panel data analysis for several countries from this region from 2002 to 2009. This was done with fixed and random effects. According to the model, it was expected that the price for a stock would be a function of the book value and the abnormal earnings, both with a positive correlation. That is, the more book value and abnormal earnings a company has, the greater the market price of the stock should be. Abnormal earnings are those earnings which remain after subtracting the financial cost for the use of capital at a risk free rate. This should have been true for the model that included all countries or for individual counties. If it was not true, the failure could be attributed to institutional differences that affected those countries and rendered the model incapable of estimating the price of the stock with statistical certainty.

These differences can be explained due to the fact that not all countries have a developed stock market that acts on the basis of the free market without government intervention. Moreover, this model is based on accounting information, so in order for this model to work, standardized accounting data reporting should be well regulated by a centralized authority. All changes in assets and liabilities should pass through the income statement. If a company´s financial statements do not conform to this standard, the model financial data cannot estimate the price of the stock due to accounting distortions. It was expected that the Ohlson Model would work for most Latin American stock markets, with the exception of Venezuela.

The reminder of this paper consist of the Literature Review, which follows immediately, the method used, followed by the results obtained, and ends with the Conclusions, Limitations and suggestions for Future Lines of Research.

LITERATURE REVIEW

In 1932 Viner argued, from an economic point of view, the importance of cost and how equilibrium and rational behavior affect the price of goods and thereby set the basis for price theory. It must not be overlooked, as Milton Friedman stated in his "Price Theory" (2007), that the allocation of resources among different users sets the price of one item relative to another. This empirical generalization is at least two centuries old. From this theory it can be inferred that there are great allocations of resources in the stock markets that can move freely to other markets.

This price theory is important to the scientific community because of the economic implications for the stock market. Market is understood as a means to use, purchase, or sell a resource in order to define its allocation (Friedman, 2007). Other authors have developed models and theories in their efforts to explain asset pricing. For example, Sharpe (1964) developed the Capital Asset Pricing Model (CAPM), Ross (1976) offered the Asset Pricing Theory (APT), and Wei (1988) made an effort to unify these two. The first takes into consideration the risk free rate plus a premium for the specific beta risk, the second takes into account the arbitrage of the market.

There are other models based on dividends and on cash flow. Models that use dividends to calculate the intrinsic value of a stock have the difficulty of predicting future dividends and the rate at which these expected dividends must be discounted. This rate has to do with the firm's risk (Penman, 1992). There is also a discretionary component to the dividends, but not to accounting numbers.

Another well accepted method is based on discounted future cash flows (DCF's) that uses cash flows instead of earnings. This popular method comes as a solution to the intrinsic distrust in accounting information (Penman, 1992). It serves in instances where cash flows are real and accounting earning may not be so. This is not so, however, as free cash flows are distributions of wealth instead of the creation of wealth; they do not aggregate value to the stock. This is the main drawback for this commonly used method. As described by Penman (1992), cash flows can come from changes in cash, capital contributions, dividends paid, and net borrowings. Moreover, cash flows can also be affected by changes in accounts receivable, inventories, plant, equipment, and other assets, and to complicate matters, there is also the effect of depreciation, which has an effect on earnings, but not on cash flow.

The determination of the value of a stock from available information is known as fundamental analysis, and according to Penman (1992) was the primary tool for research in investment analysis by the end of the 70´s. Since this period, however, research has been redirected away from fundamental analysis and from accounting measurement theory, for the lack of theoretical foundations. This shift has turned research towards the study of price; that is, towards the technical analysis.

According to Walker (1997), there was an open rejection to the income measurement perspective, and three major lines of research became popular: market-based accounting, information economics, and positive accounting theory. The Ohlson Model uses market based accounting basic principle of using income measurement theory, where there is a relation between accounting numbers and stock market valuation.

Ohlson´s work has caused academic researchers to return to the fundamental analysis perspective (Walker, 1997). The Ohlson Model can be regarded as a breakthrough, with price based on expected future earnings (Penman, 1992), and with the condition of the use of clean surplus accounting. That is, that all the changes in equity are due to dividends, retained earnings, and capital contributions and must go through the income statements.

The Ohlson Model is presented by James Ohlson in "Earnings, Book Value and Equity Valuation" (1995), and later in "Valuation and Clean Surplus Accounting for Operating and Financial Activities" by Feltham and Ohlson (1995). The models developed in both works relate accounting information to firm value. Basically they assumed the value of a stock can be calculated from the book value and the net present value of the abnormal earnings; that is, the earnings a company makes above the cost of the money used to make them, discounted at a risk free rate, in an accounting system that is based on clean surplus. This means that all changes in assets and liabilities unrelated to dividends must pass through the income statement (Ohlson, 1995).

The Ohlson Model takes into consideration the work of Franco Modigliani and Merton Miller (1958); "The Cost of Capital, Corporation Finance and the Theory of Investment", in which the irrelevancy proposition stated that stock price is unrelated to observed dividends. Dividends reduce value dollar for dollar, and dividends reduce future value (Miller & Modigliani, 1961). The work of Peasnell (1981) argued that there is a relationship between discounted cash flow methods and accounting performance measures, such as the abnormal earnings used in Ohlson´s Model.

According to Walker (1997), the principal advantages of the Ohlson Model are that this model tries to explain value directly and refocuses on fundamental valuation, as seen by Penman (1992). This model has provided a solid theoretical framework for market-based studies through the clean surplus approach. This approach indicated that market value will be equal to book value plus the discounted present value of expected abnormal profits which tend to zero in a competitive market unless their innovation is permanent. It also takes into consideration the impact of retained earnings in future earnings.

The literature currently contains several important empirical research studies based on the Ohlson Model. The study written by Ota (2001) had a very clear mathematical development of the Ohlson Model and showed great concern with the difficulty in estimating the factor for other information variables that affect the future performance of a firm. A study by Duran et. al. (2007) attempted to validate the application of the model to Mexico´s companies, but used net income instead of abnormal earnings in its testing.

Lundholm (1995) provides insight into the Ohlson and Feltham-Ohlson Models by describing the model, how it worked, and by answering several other researchers' questions such as one by Ota (2001) that concerned the "other information" that affects the price of the stock and the difficulties that it carries when it is incorporated into the Ohlson Model. Ota (2001) concluded that the model has been tested empirically and gives rigor to these tests. It is a good representation of the valuation method from accounting. Larrán & Piñero (2005) made an interesting study for a case involving dirty surplus, which is any variation in net equity due to any cause except those that affect the retained earnings (Larrán & Piñero, 2005). Callen & Segal (2005) showed the Feltham-Ohlson Model can be a good estimator of price, when other information factors are added.

Two research studies have used Mexican data applying the Ohlson Model. Duran, Valdés & Valencia, (2007) provide empirical evidence of the ability of the Mexican accounting system to predict stock prices using the Ohlson Model from 166 companies, from 1991 to 2003, with panel data analysis utilizing book value and earnings. Their results were statistically significant and therefore relevant. The other study (Valdés & Durán, 2010), was a panel analysis by economic sector (food & beverage, commercial and construction) on a quarterly basis from 1997 to 2008, also using the Ohlson model. The study proved to be relevant only in the commercial and the food & beverages sectors.

Another study by Giner & Íñiguez (2006) corroborated the predictive ability of the Ohlson (1995) and Feltham Ohlson (1995) Models from future earnings. For their study, they took non-financial companies from the Madrid stock market from 1991 to 1999, using book value and earnings. The simplifications they used were the same as those used by Duran, et. al. (2007), using earnings instead of abnormal earnings and discarding financial companies without a proper justification.

METHODOLOGY

In order to apply the Ohlson Model to the stock markets from Latin America, the Osiris Data base was used. First a Pooled Regression was made and compared with the panel data analysis for several countries from this region from 2002 to 2009. We expected the model to be statistically valid to predict the value of stock prices in most of countries; with the exception of Venezuela. More than 23,000 observations for 2,912 listed companies in 34 countries in Latin America were used.

Market value depends on future expected dividends, under a clean surplus accounting system, and has positive correlation with abnormal earnings; that is, the earnings above the cost of equity at a risk free rate. The Ohlson Model rests, in the neoclassical view, on the assumption that the price of a stock is a function of present value of the expected dividends discounted at a risk free rate.

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

Where

P_t *was the price of the firm´s equity at date t*

d_t= net dividends paid at date t and

r_f= the risk free rate

$E_t[d_{t+\tau}]$*the expected dividendes at time t*

If x_t=earnings from t-1 to t and y_t= net book value at t

Then, in using the Modigliani & Miller (1958) principle $y_{t-1} = y_t + d_t - x_t$

Where y_{t-1} is the net book value in t-1. If a clean surplus accounting is present, the abnormal return could be expressed as:

$$x_t^a \equiv x_t - r_f \cdot y_{t-1} \quad (2)$$

And the price of the stock could be expressed as:

$$P_t = y_t + \sum_{\tau=1}^{\infty} \frac{E_t[x^a_{t+\tau}]}{(1+r_f)^{\tau}} \quad (3)$$

So that after some algebraic manipulation the linear expression was:

$$P_t = y_t + \alpha_1 x^a_t + \alpha_2 \gamma_t \quad (4)$$

Adopting the Ohlson Model used by Collins et al. (1999), and taking the model:

$P_t = y_t + \alpha_1 x^a_t + \alpha_2 \gamma_t$ with a few notation changes; that is, $y_t = BV_t$ and $x^a_t = AE^a_t$

The sub index i for each company, we arrived at:

$$P_{it} = \alpha_0 + \alpha_1 BV_{it} + \alpha_2 AE^a_{it} + \alpha_3 \gamma_{it} + \varepsilon_{it} \quad (5)$$

For this model, P_{it} was taken from the "MarketCap0atclosingdatethUSD" variable, which was the total value of a company at the closing. The Book Value BV_{it} was taken from the Osiris data base from the variable, "ShareholdersFundsthUSD", and the Abnormal Earnings was estimated by the variable "NetIncomethUSD" as was seen in Duran, et al, (2007). The term γ_{it}, which stands for other information that affects the price, was neglected due to the difficulties in estimating this parameter, (Ota, 2001). These variables were expressed in thousands of US dollars.

With this model, a panel data analysis, or cross sectional time series was made because of the considerable advantages that it offered (O´Connell, 2007), such as the control of unobservable firm-specific effects that are difficult to measure. O´Connell (2007) also points out the reduction in the impact of omitted variables due to correlation, and the fact that it was useful to determine whether a particular parameter varies over time or country. The panel data analysis had the advantage of allowing the identification of countries where accounting conservatism was different (O´Connell, 2007). This advantage was used to analyze what countries had a restriction for the application of the Ohlson Model.

The market capitalization variable was used as the company market price for the Ohlson Model. Shareholders' Funds were used as book value. Net income was used as an approximation of abnormal earnings (Duran et al., 2007)). The use of US dollars in every country gives the advantage of easy comparability, and the cost of money would be the same for all the countries.

Observations with no market capitalization or negative market capitalization values were eliminated from the study, the latter category because it contained the companies that were technically bankrupt. Countries that had less than 5 companies left after this adjustment were also discarded. With this elimination, only 13 countries remained, with a total of 1,112 companies, as shown in Table 1, for a total of 8,896 observations.

The Variables used for this analysis were: "MarketCap0atclosingdatethUSD", the dependent variable is the market capitalization value at the end of each year for every company taken into consideration in this study. All values are in thousands of US Dollars. "ShareholdersFundsthUSD" was an independent variables; "NetIncomethUSD" was the other independent variable and measures net income. For the purpose of this study, it will be considered as the abnormal earnings, Duran, et al (2007)

Table 1: Observations by Country

Counties	2002	2003	2004	2005	2006	2007	2008	2009	Total
ARGENTINA	60	60	60	60	60	60	60	60	480
BERMUDA	312	312	312	312	312	312	312	312	2496
BRAZIL	212	212	212	212	212	212	212	212	1696
CAYMAN ISLANDS	197	197	197	197	197	197	197	197	1576
CHILE	147	147	147	147	147	147	147	147	1176
COLOMBIA	44	44	44	44	44	44	44	44	352
EL SALVADOR	6	6	6	6	6	6	6	6	48
HONDURAS	8	8	8	8	8	8	8	8	64
JAMAICA	12	12	12	12	12	12	12	12	96
MEXICO	45	45	45	45	45	45	45	45	360
PANAMA	9	9	9	9	9	9	9	9	72
PERU	53	53	53	53	53	53	53	53	424
VENEZUELA	7	7	7	7	7	7	7	7	56
Total	**1,112**	**1,112**	**1,112**	**1,112**	**1,112**	**1,112**	**1,112**	**1,112**	**8,896**

This Table shows the observations for each country from 2002 to 2009 after the elimination of the companies with zero or negative market capitalization value or had less than 5 observations.

The first analysis was a pooled OLS (Ordinary Least Squares) regression, which allows a simple analysis. Pooled OLS may not be appropriate if the parameters differ over time and/or across firms due to heterogeneity (O´Connell, 2007). For this reason we use panel data estimation and compared the results with pooled OLS regression results. As it was important to determine if the Ohlson Model was valid for the prices in the stock markets from the region through several years, panel data seemed appropriate. To establish validity, a panel analysis with random effect was tested, to determine if this analysis was better than the pooled regression. The test used was formulated by Breusch and Pagan, and is known as the Lagrangian Multiplier test for random effects. The panel analysis with fixed effects was tested and compared with the F value. If both of these analyses are better than the pooled regression, a Hausman test would be used to determine which of the two was better.

RESULTS

This pooled Regression OLS model was: $$Y_{it} = \alpha + \beta_1 X_{1it} + e_{it} \quad (6)$$

Where i was the company and t was time (year). The results are presented in Table 2. From Table 2 with this pooled regression OLS, the R square value of the determination coefficient was 0.6931, and the overall F test was displayed with a 0.0000 value, which allowed rejection of the null hypothesis, and therefore it could be concluded that the model was valid. The p values for the t test for the individual coefficients, the constant, and the independent values were shown to be statistically significant, with values of 0.0000 in each case. All the coefficients were positive, and this was consistent with the theoretical expected values for the Ohlson Model. Therefore, the effect of net income and book value (Shareholder) had a positive and significant effect on the price of the stock (MarketCap), as expected.

The fitted model would be: MarketCAP= 391,529+ .6502Shareholder+ 2.000 NetIncome

In the Ohlson Model terms: Price=391,529+ .6502 Bookvalue+ 2.000 Abnormal Earnings

Table 2: Pooled Regression OLS

Number of Observations	Prob> F	R-Square	Adj. R-Square
5,376	0.0000	0.6931	0.6929
MarketCap	Coef.	95% Conf. Interval	
Sharehoder	0.6502***	0.6150	0.6854
NetIncome	2.000***	1.819	2.182
Const.	391,529***	335,341	447,717

*This table shows the result of the Pooled Regression OLS, the statistical significance of the Model, the determination coefficients and the coefficient values.***,**,* indicate the significance at 1, 5, 10 percent respectively.*

The cross sectional time series, also known as panel data analysis, consisted of the observation on the i units (companies) over t periods of time t (years). This allowed control of each company. In this second step, the Generalized Least Square (GLS) random effects estimator was analyzed so that the model assumed that each unit (company) had a different constant in order that the previous equation could be expressed as:

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + e_{it} \quad (7)$$

Where $\alpha_i = \alpha + u_1$ this equation could be rewritten as: $Y_{it} = \alpha_i + \beta_1 X_{1it} + u_{i+} e_{it}$ (8)

The results are presented in Table 3. The results show the R square within, that is, the explained variation within companies, was less predictable with this model, which was 0.5064. This can be defined as the squared correlation between deviations of Y_{it} values from the company mean ($y_{it} - \bar{y}_i$), and deviations and predicted values from companies mean predicted values.

The R square between was the variation explained among the companies. The results show the model did a very good job of explaining these variations with a overall R Square of almost 0.70; this was a very good overall value.

The Chi square p value was 0.0000; showing that the coefficients were zero and the null hypothesis could be rejected. This gave the statistical validity of the model and showed that both independent variables were positive and statistically significant, which again was consistent with the theory behind the Ohlson Model. The maketCap variable, or price, increased 0.7393 for each additional dollar of shareholder or book value increase, holding net income constant. On the other hand, if the shareholder value remained constant, the market capitalization increased 1.482 dollars for each dollar net income increased, which approximated abnormal earnings. On the lower right side, the standard deviations of the common residuals u_i and the unique residual e_i were shown as 1,428,042 and 1,422,318 respectably. And rho was a fraction of unexplained variance due to difference among companies.

To determine which of the two previous models, pooled regression or random effects, was better, a statistical probe of the null hypothesis could be performed. If in equation (8) the variance of u_i was zero; that was, if $\sigma_u^2 = 0$ then there was no difference between equations (6) and (8) or between the two models. A test formulated by Breusch and Pagan, known as the Lagrangian Multiplier test for random effects, was be conducted to make this determination. The result of this test indicate the null hypothesis was rejected, given that the P value of the Chi Square was 0.000. Therefore, the random effects are relevant, and that the random effect model is better that the pooled regression model.

Table 3: Random-Effect GLS Regression

Number of Observations	**Number of Groups**	**Prob> Chi²**	**R-Square** Within	Between	Overall
5,375	819	0.000	0.5064	0.7317	0.6913
MarketCap	Coef.	95% Conf. Interval			
Shareholder	0.7383***	0.7049	0.7716	Sigma_u	1,428,042
NetIncome	1.482***	1.306	1.658	Sigma_e	1,422,318
Cont.	376,389	268,552	484,357	Rho	0.5020

*This table shows the result of the Random-effect regression, the statistical significance of the model, the R– Square values, the Coefficients of the independent variables, the confidence level and the standard deviation of u, e and the value of the fraction of the variance due to u_i Rho. ***,**,* indicate the significance level at 1,5,10 percent respectively*

Another model tested was a panel data analysis with fixed effects. This model assumed the differences within companies were constant, and the intercept u_i for each company should be estimated. This could be accomplished by using a vector of dichotomic variables for each company γ_1 with the following model:

$$Y_{it} = \gamma_i + \beta_1 X_{1it} + u_{i+} e_{it} \quad (9)$$

From Table 4, the R square values were very similar to the random effects model, and the p value for the F test was 0.0000. It could be assumed that this was a valid model. The values for Sharehoder and Net Income variables were positive and statistically significant, so it was necessary to determined which model was better, this or the pooled regression model for equation (6). The bottom line of the output shows the null hypothesis that; $\gamma_1 = \gamma_2 = \ldots = \gamma_i = 0$, and that the F value was 0.000, which allows rejection of the null hypothesis. This indicates the fixed effect model was better than the pooled regression.

The next step was to identify which of the last two models was better: the random model or the fixed effect model. To make this determination, an analysis was done of the possible correlation between the individual error u_1 and the variables. The random effect model assumed that this correlation was zero, but if u_1 and the X variables were somehow correlated, then if u_1 was not included in the model, a shift would occur on the omitted variable in the X coefficients.

Hausman demonstrated the difference between the fixed and the random coefficients $(\beta_{fe} - \beta_{re})$ could be used to test the null hypothesis: that u_1 and the X variables were not correlated and therefore the random effects model was better. If Ho was rejected, the estimators differ and the fixed model was better. If the null hypothesis could not be rejected, it was preferable to use the random effect model because it was more efficient. The Hausman Test gave a 0.0000 p value for the Chi Square, the null hypothesis was rejected, so the fixed effect model should be used.

Table 4: Fixed-Effect GLS regression

Number of Observations	**Number of Groups**	**Prob> Chi²**	**R-Square** Within	Between	Overall
5,375	819	0.0000	0.5080	0.7214	0.6879
MarketCap	Coef.	95% Conf. Interval			
Shareholder	0.8142***	0.7767	0.8516	Sigma_u	1,665,606
NetIncome	1.143***	0.9489	1.336	Sigma_e	1,422,318
Cont.	358,778	314,649	402,907	Rho	0.5783

*This table shows the result of the Fixed-effect regression, the statistical significance of the model, the R–Square values, the Coefficients of the independent variables, the confidence level and the standard deviation of u, e and the value of the fraction of the variance due to u_i Rho. ***,**,** indicate the significance level at 1,5,10 percent respectively.*

A dichotomic variable could be added to the model to see if there were common events for all the companies during a specific year, so that our equation was now:

$$Y_{it} = \gamma_i + \eta_1 + \beta_1 X_{1it} + e_{it} \quad (10)$$

To see if the Ohlson Model could be applied to each Country, a vector of dichotomic variables η_1 was used. Tests were done under the fixed effect scope because of the result of the Hausman test. In Table 5 the results of this analysis was presented.

In Table 5 El Salvador, Honduras, and Jamaica were omitted because of the lack of observations or collinearity problems. Furthermore, from the F test p values, the Ohlson Model did not explain the stock prices for the cases of Venezuela and Argentina; also the R square value for Venezuela was low with 1% of the variance being explained by the model. In these two countries the independent variables were not significant. In the case of Argentina the price of the stock had a negative factor in the shareholder variable, and in the case of Venezuela, the NetIncome variable was also, although none were statistically significant in both cases.

Table 5: Panel Data Analysis with Fixed effect by country

Country	Constant	Shareholder	NetIncome	R^2	F
Argentina	823,033***	-0.0505	1.2358	0.7319	1.03
Bermuda	198,927***	0.8419***	1.5339***	0.7045	589.23***
Brazil	508,540**	0.8801***	0.4197	0.7670	295.20***
Cayman Islands	34,709	1.3938***	3.0931***	0.4925	232.72***
Chile	-110,718	1.5961***	3.0733***	0.8069	305.74***
Colombia	-1,616,491*	5.0383***	-21.007**	0.1686	18.680***
Mexico	700,538**	.6397***	5.4558***	0.6316	84***
Panama	-59,122	-1.767	19.6347**	0.7868	10.690**
Peru	-497,206***	3.5599***	1.441	0.7116	101.97***
Venezuela	395,628	0.2255	-1.1718	0.0105	0.9100

This table shows results for the panel data analysis with fixed effect, separated by country, El Salvador, Honduras and Jamaica where eliminated due to collinearly or lack of observations. ***, **,* indicate significance at 1,5,10 percent respectively.

From Table 5, Bermuda, Cayman Islands, Chile, and Mexico had positive and significant values, as expected from the Ohlson Model. In the case of Peru and Brazil, both values were also positive, but in the case of NetIncome variable they were not significant.

Colombia had a statistically good model with a 0.0000 p value for the F test, but the R square factor was 0.1686, which means that it is a poor estimator of the variance. In addition, the value for the net income variable was negative with more than 95% statistical significance, meaning that there had to be a difference that did not allow the Ohlson Model to predict the stock value. As a result, as the NetIncome variable increased, the stock price dropped. In the case of Panama, the p value was lower than 0.05, and the R square was 0.7868, which means that the Ohlson Model gave a good explanation of the variance, but the shareholder variable was negative, although it was not significant.

CONCLUSIONS

The goal of this paper was to test the validity of the Ohlson Model as a price estimator for stock prices in Latin America. Several statistical methods were used. First a Pooled Regression OLS was conducted, followed by a Random and then a Fixed Effect panel data analysis. It was determined that the Fixed Effect was the best, so this was applied to each country through a dichotomic variable by country.

The Ohlson Model was found to be a good price estimator for stock prices in Bermuda, Cayman Islands, Chile, and Mexico, due to the fact that the variable coefficients were both positive and statistically significant. In the case of Brazil and Peru, both variables were positive, but the coefficient for the NetIncome was not significant. According to the F value, all Ohlson Models were good with p values of 0.0000 except for the case of Panama, which had a p value smaller than 0.05, and Shareholder value, which was negative even though it was not significant. Colombia had a good model with a low R square, and the NetIncome variable was statistically significant but negative, which was contrary to the theory.

In the cases of Argentina and Venezuela, the Ohlson Model did not work due to the fact that the F test showed that models were not statistically correct. For Argentina, the R square value was fair with a value of 0.7319, but the only significant value was that of the constant, and there was a negative value in the shareholder variable. In the case of Venezuela, the Ohlson Model did not work, as expected. The R square value was 0.0105, which was the percentage of variance explained by the model. The F test p value was not significant for all of the variables and the model constant.

We conclude the Ohlson Model is a powerful tool to predict the price of stocks for most Latin American stock markets, with the exception of Venezuela, Argentina, and Colombia. In the case of Brazil, Peru, and Panama the model worked, but at least one of the variables was not statistically significant or had a negative coefficient.

A limitation of this research was the lack of examination of the different regulatory frameworks for each county and institutional differences. Another was the use of the US dollar, which simplified the analysis but could have impacted the results of the Ohlson Model application, due to possible currency devaluation.. Some other limitations of the present study included scale problems, autocorrelation, or heterocedastisity, which could be present. Therefore, a more sophisticated analysis is required. Another limitation was the use of net income as a proxy for abnormal earnings.

A future line of investigation might replicate this analysis by economic sector to determine if there are functional differences by economic sectors that can be detected. In several works, such as Ota (2001) and Duran (2007), it is interesting that they eliminated from their analysis "a priori" the financial sector, without further empirical research.

An additional suggestion for further study would be to study the effect of bull and bear markets in each country of this region, and the relationship to the US and Canadian markets, given that, for geographic reasons, these countries should be viewed as from the same economic block. An important modification to the model can be made by estimating the factor, "Other Information", with different suppositions to see if the model improves

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