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The Determination of the "Other Information" Variable in the Ohlson 1995 Valuation Model

Bolor Buren[1], Altan-Erdene Batbayar[2], Khishigbayar Lkhagvasuren[3]

Abstract

This research investigates closed share prices dynamics among 61 companies listed on the Mongolian Stock Exchange (MSE) from 2011 to 2022. Utilizing a comprehensive dataset, our study conducts a unit-root test to confirm the stationarity of key variables, followed by Generalized Method of Moments (GMM) estimations within a Dynamic Panel Auto-regressive (DPAR) model. Results show that closed share prices, book value, profit or loss, and Piotroski score are stationary, validating subsequent analyses. The study reveals a significant positive influence of lagged closed share prices, emphasizing historical performance's persistent impact. Book value and Piotroski score exhibit positive and statistically significant effects on closed share prices. This empirical insight contributes to understanding share price dynamics, offering implications for financial analysis and academic research.

Keywords: Ohlson valuation model, other information, Piotroski score, firm value, share price, Mongolian Stock Exchange

[1] Accounting Department, Business School, National University of Mongolia
E-mail: bolor.b@num.edu.mn
[2] Accounting Department, Business School, National University of Mongolia
E-mail: altanerdene.b@num.edu.mn
[3] Accounting Department, Business School, National University of Mongolia
E-mail: khishigbayar@num.edu.mn

Introduction

The field of company valuation and stock price prediction has witnessed substantial growth and refinement since the mid-20th century, characterized by advancements in methodologies and models. Ohlson's 1995 valuation model stands as a pivotal advancement, significantly enhancing the study of value relevance. The application of the Ohlson Model has notably amplified the influence and significance of accounting information in the domain of business valuation. Since its inception in 1995 (Ohlson, 1995), the Ohlson Model has played a catalytic role, instigating numerous empirical inquiries by scholars. These studies have yielded diverse outcomes, offering both validation and critical assessments of the model. Furthermore, Ohlson himself, alongside other researchers, has engaged in multiple efforts to extend the model (Feltham & Ohlson, 1995; 1996; 1999; Ohlson, 2005). Despite this, Ohlson's original model from 1995 has not only been extensively applied in numerous empirical investigations but has also amassed over 9,000 citations within the Google Scholar database as of the present date.

In a prior study, we utilized the Ohlson model to investigate the influence of corporate governance indicators on stock prices, with a specific focus on companies listed on the Mongolian Stock Exchange (Buren, Batbayar, & Lkhagvasuren, 2023). In this study, our objective is to scrutinize the 'other information' variables within the Ohlson valuation model and identify the parameters that can optimally predict stock market prices for companies listed on the Mongolian stock market. This article is organized into distinct sections, encompassing a comprehensive literature review, a thorough exploration of the theoretical framework, a detailed exposition of the utilized data and research methodology, an in-depth analysis of the results, and, finally, conclusions.

Literature Review

For our study, we selected Ohlson's 1995 model as the foundation. This model has been extensively examined in empirical research, yielding a range of findings. Various empirical studies have demonstrated the effectiveness of Ohlson's model in comparison to alternative models. Furthermore, researchers have refined and utilized the original model, reporting both positive (Ota, 2002; Wu & Wang, 2008) and negative outcomes (Lo & Lyz, 2000) based on their investigations.

Since the inception of Ohlson's model, researchers have grappled with the challenge of determining suitable indicators for calculating the "other information" variables within the model. This aspect has been a point of contention, causing uncertainty among researchers. Some empirical studies utilizing the model have not considered the "other information" variable in their calculations. Additionally, empirical calculations have been conducted by substituting indicators such as operational direction, system risk, sales volume, beta coefficient, company size, leverage, corporate governance indicators, Piotroski score, and big data evaluation, among others, for the "other information" variables.

Theoretical Frame

Ohlson Model 1995

The Ohlson model (1995), centers on three fundamental assumptions (Silvestri & Veltri, 2012). The first assumption posits that firm value corresponds to the realization of expected dividends, following the Dividend Discount Model (DDM). The second assumption, known as the Clean Surplus Relation (CSR), postulates that any alterations to the value of net firm assets are categorized as income or dividends. The third assumption, termed as the LIM (Linear Information Model), stipulates that the residual earnings at time (x^a_{t+1}) are contingent on prior-year residual earnings (x^a_t), and additional information (v_t) available to the market at time t but not yet incorporated into the accounting system and hence excluded from the calculation of (x^a_t).

The representation of dynamic information is as follows:

$$x^a_{t+1} = \omega x^a_t - v_t + \varepsilon_{1t+1} \ ;$$
$$v_{t+1} = \gamma v_t + \varepsilon_{2t+1}$$

The representation of dynamic information is as follows:

x^a_t - abnormal earnings $= x_t - r(bv_{t-1})$;

x_t - current earnings;

ω and γ - parameters of persistence;

v_t - “other information” about expected future residual profits that are observed at the end of the period “t” but were still not recognized by the accounting;

ε_{1t+1} , ε_{2t+1} - represent the terms of stochastic errors.

The model is expressed in the following form:

$$P_t = b_t + \alpha_1 x^a_t + \alpha_2 v_t$$

In this formulation:

$$\alpha_1 = \frac{\omega}{R-\omega} \ ; \ \alpha_2 = \frac{R}{(R-\omega)(R-\gamma)} \ ; \ R = 1 + r$$

r - discount rate;

P_t - market value of the firm's equity, date t;

b_t - book value of the firm's equity, date t.

Specifically, Ohlson (1995) justifies the application of the historical price model in value relevance studies, wherein value is expressed as a function of earnings and book values (Salem, 2021).

Piotroski score

Piotroski, in the year 2000, formulated what has come to be recognized as the Piotroski F-Score. This mathematical construct serves the purpose of appraising the financial health of a given corporate entity through the meticulous evaluation of nine distinct criteria. Each individual criterion is endowed with a binary score, either 0 or 1, and the cumulative summation of these scores yields an aggregated assessment, spanning a spectrum from 0 to 9. Significantly, a higher numerical score on the Piotroski F-Score signifies an enhanced state of financial well-being within the evaluated company. Consequently, the Piotroski F-Score has become a prevalent instrument employed by both investors and financial analysts as a valuable mechanism for scrutinizing the fidelity and reliability of a corporation's financial disclosures, thereby facilitating the identification of prospective investment opportunities. The nine indicators are grouped into the following three sections:

- Profitability: The profitability criteria encompass metrics designed to evaluate a firm's capability to generate profits. This group has four indicators: *ROA* (return on assets), Δ*ROA* (change in return on assets), *CFO* (cash flow from operation scaled by total assets), and Accrual (*Accr*, 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 *ROA* is assigned a value of one, and zero otherwise.

- Operating efficiency: The criteria falling under the purview of operating efficiency are concerned with signals associated with activity turnovers. This category encompasses two specific indicators: Δ*Marg* (denoting the change in gross margin) and Δ*Turn* (representing the change in asset turnover). Positive alterations in gross margin and asset turnover signify enhancements in profit generation and the efficient utilization of a firm's assets. Accordingly, these indicators are assigned a value of one when positive changes occur, and a value of zero when such improvements are absent.
- Leverage, liquidity, and source of funds: Within this category, three distinct indicators gauge a firm's profitability. Firstly, *Lever*, denoting the change in leverage, is designated a value of one when it manifests a negative change and zero otherwise. Secondly, *Liquid*, representing the alteration in the current ratio, receives a value of one if the firm records a reduction in its current ratio compared to the previous year; otherwise, it is assigned a value of zero. Finally, *EqOffer*, an indicator variable, assumes a value of one if the firm refrains from equity issuance in the preceding year, and a value of zero if equity issuance has taken place.

Piotroski (2000) utilizes the nine signals described to construct a comprehensive score for evaluating a firm's financial performance. The summation of these nine indicator variables results in a score that spans from zero to nine, where a higher score signifies a more favorable assessment of the firm's financial health. Specifically, a score of nine indicates a firm with the highest number of positive signals, while a score of zero reflects a firm with the fewest positive signals. The Piotroski score is computed as follows:

$$F\text{-}Score = ROA + \Delta ROA + CFO + Accr + \Delta Marg$$
$$+\Delta Turn + \Delta Lever + \Delta Liquid + EqOffer$$

Data and Methodology

Data for this study were meticulously obtained from the Mongolian Stock Exchange (MSE) website, resulting in a comprehensive dataset. The sample encompasses 61 companies across various sectors such as banking and insurance, spanning the period from 2011 to 2022.

Table 1 offers a detailed overview of the variables collected directly from the MSE data source. This table provides a clear and organized representation of key aspects derived from the dataset.

Table 2 presents a summary of descriptive statistics for the variables, providing crucial insights into their central tendencies and variability. The mean Piotroski score, averaging around 4.3, indicates moderate to strong financial health among the sampled companies. This aligns with the generally favorable financial condition observed,

Table 1. Variable Definitions

Variable	Definitions	Data Source
lclp	Logarithm of the closed share price of the company three months after the end of fiscal year	Mongolian Stock Exchange website, http://www.mse.mn
lbv	Logarithm of the book value of the company	
le	Logarithm of the profit or loss of the company	
ps	Piotroski score	

Table 2. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
lclp	448	7.0077	2.1683	1.7918	11.2272
lbv	448	3.9423	0.6065	-1.5304	6.5076
le	448	3.7315	0.3700	-0.1734	5.9061
ps	448	4.2835	1.5464	0.0000	8.0000

where a higher mean score reflects better fundamental characteristics.

Table 3 delves into the Pearson correlations between variables, revealing nuanced relationships. A positive correlation exists between the Piotroski score and closed share price, suggesting an upward movement in share price with an increasing Piotroski score. Additionally, a positive correlation is observed between the Piotroski score and book value, indicating higher book values for companies with superior Piotroski scores. Conversely, a negative correlation is identified between the Piotroski score and profit/loss, implying a potential decrease in profit/loss as the Piotroski score increases.

Table 3. Pearson Correlation Matrix

Variable	*lclp*	*lbv*	*le*
lbv	0.0499		
le	0.0374	0.0394	
ps	0.0832 *	0.1923 ***	-0.1946 ***

*Note: * and *** denote the level of significance of 10% and 1% respectively.*

For our study, we adopt the Dynamic Panel Auto-regressive (DPAR) model, a robust analytical framework accommodating temporal and cross-sectional dependencies. The model incorporates lagged values to capture dynamic relationships over time, allowing for a comprehensive understanding of evolving patterns and interactions among variables.

Our analysis employs the following DPAR model:

$$lclp_{it} = \rho \times lclp_{it-1} + \beta_1 \times lbv_{it} + \beta_2 \times le_{it} +$$
$$+ \beta_3 \times ps_{it} + \beta_4 \times ps_{it-1} + \mu_i + \varepsilon_{it}$$

Here, i represents the year, t denotes the company, μ accounts for the fixed effect of each company, and ε represents the innovation term capturing unobserved factors affecting the closed share price. This model enables us to investigate the dynamic relationships among the variables while accounting for individual company effects.

The DPAR model is estimated using the Generalized Method of Moments (GMM) with instrumental variables. To address endogeneity concerns, first differences are applied to obtain consistent estimates of coefficients, as expressed in the differenced equation. The efficiency of this approach is supported by the use of stock prices lagged two periods as instrumental variables, following the findings of Anderson and Hsiao (1981).

The differenced equation is expressed as:

$$\Delta lclp_{it} = \rho \times \Delta lclp_{it-1} + \beta_1 \times \Delta lbv_{it} + \beta_2 \times \Delta le_{it} +$$
$$+ \beta_3 \times \Delta ps_{it} + \beta_4 \times \Delta ps_{it-1} + \Delta\varepsilon_{it}$$

Empirical Results

Before proceeding with our estimations, we conducted a unit-root test to evaluate the stationarity of the variables. The purpose of this test is to determine whether the time series exhibit a stable trend over time or possess unit roots, indicating non-stationarity.

Table 4. Unit-root Test Results

Variable	Test	Z-statistics	P-value	Lag
lclp	ADF	-8.2967	0.0000	1
	PP	-3.9998	0.0000	1
lbv	ADF	-7.3101	0.0000	1
	PP	-1.4697	0.0708	1
le	ADF	-15.8982	0.0000	1
	PP	-43.1684	0.0000	1
ps	ADF	-12.3699	0.0000	1
	PP	-14.1509	0.0000	1

Table 5. GMM Estimation Results

Variable	One-step difference GMM	Two-step difference GMM
lclp, lagged	0.951 ***	0.949 ***
lclp	0.035 *	0.040 *
lbv	0.028	0.026
le	0.037 ***	0.037 ***
ps	0.013	0.000
ps, lagged	-0.376 *	-0.232
Constant	448	448
Observations	61	61
Companies	43	43
Instruments	0.000	0.000
AB test for AR(1)	0.604	0.595
AB test for AR(2)		

*Note: *, **, and *** denote the level of significance of 10%, 5%, and 1% respectively.*

The results of the unit-root test are detailed in Table 4.

The unit-root test results indicate statistically significant z statistics with p-values below the 10% significance level for all variables. This provides strong evidence against the null hypothesis of a unit root, suggesting that the variables are likely stationary over the specified time period. The observed stationarity enhances the reliability of subsequent estimations and contributes to the robustness of the model.

Building on the unit-root test, Table 5 presents the results of the GMM estimation for our DPAR model.

The GMM estimation results provide valuable insights into the relationships captured by the DPAR model. Notably, the coefficients associated with the variables exhibit varying levels of statistical significance:

- The lagged closed share price (*lclp*) shows a highly significant positive effect, indicating that past closed share prices have a substantial impact on the current closed share price.
- Positive coefficients for book value (*lbv*) and Piotroski score (*ps*) suggest their significant role in influencing the closed

share price.

- The constant term demonstrates a negative impact, albeit at a statistically significant level, suggesting a baseline influence affecting closed share prices.

The results of the AB tests for AR(1) and AR(2) indicate non-significance, suggesting that the model adequately captures and adjusts for autocorrelation patterns in the residuals. Overall, the GMM estimation results offer empirical support for the dynamic relationships within the DPAR model, emphasizing the influence of lagged variables and fundamental financial indicators on closed share prices.

Conclusion

In this study, we conducted a comprehensive analysis of closed share prices among 61 companies listed on the MSE from 2011 to 2022. Our investigation involved rigorous testing and estimation procedures to gain insights into the dynamic relationships among key financial indicators and their influence on closed share prices.

Our findings have several implications for both academic research and practical applications in the financial domain. The observed persistence of past closed share prices highlights the significance of historical performance in shaping market expectations. The positive effects of fundamental financial metrics underscore the importance of sound financial health and favorable performance indicators in influencing investors' perceptions and decisions.

This study contributes to the existing literature by providing empirical insights into the dynamics of closed share prices in the Mongolian stock market. The methodology employed, including the unit-root test and GMM estimation, enhances the methodological toolkit for researchers exploring similar financial phenomena.

While our study provides valuable insights, it is not without limitations. The analysis is based on data from the MSE, and the generalizability of findings to other markets should be approached with caution. Additionally, future research could explore additional variables and consider alternative modeling approaches to further enrich our understanding of closed share price dynamics.

In conclusion, our study contributes valuable knowledge to the understanding of closed share price dynamics in the Mongolian stock market. The confirmation of stationarity, identification of dynamic relationships, and consideration of autocorrelation patterns provide a robust foundation for future research and practical applications in financial analysis. As financial markets continue to evolve, our findings contribute to the ongoing discourse on factors influencing share prices and pave the way for further investigations in this dynamic field.

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