IS MARKET RATIOS REFLECTED IN STOCK PRICES?

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ABSTRACT
The most fascinating thing in the stock market world is forecasting stock prices. Almost all players in the stock market race to find the best method for forecast stock prices. After years of researching and practicing, we can divide all methods into two main methods, fundamental and technical analysis. Fundamental analysis based its forecasting method on macroeconomic factors, industry analysis, and company internal factors, while technical analysis is based on studying financial accounting numbers and stock price trends in the past and present. This study will be focusing on the uses of technical analysis in forecasting stock prices. There are many ways in technical analysis to forecast stock prices. Investors and analysts usually use stock price trends or financial ratios to do that. The latest is the most simple and powerful tool that almost everyone can use, regardless of its limitations. When it comes to using financial ratios, there is a lot of contradicting results that make its users need to make a comparison between ratios and make a decision. This paper tries to use another solution to overcome those problems by using composite indicators. The composite indicator will be compared with another market ratio to find out which method is the best for forecasting stock prices. The result is composite indicator is the best method for forecasting stock prices compared with the price to sales ratio, price to book value ratio, price to earnings per share ratio, and price to operating cash flow ratio.

Keywords: Stock price forecasting, ratio analysis, technical analysis, market ratios, composite measurements.

JEL Classification: G230

INTRODUCTION
Forecasting stock prices is one of the most attractive things about investing in the world. Both investors and speculators are trying to find the best method for predicting stock prices. The main problem arises from the many methods of doing this. Broadly speaking, there are two main methods used to forecast stock prices, namely fundamental and technical analysis (Nguyen, et al., 2015). According to Hu et
al., (2015), there are three main basic aspects of fundamental analysis, namely macroeconomic factor (e.g. Gross Domestic Product and Consumer Price Index), industry analysis that estimates company value based on industrial status and prospects, and company internal factors that review the company's operating and financial status to analyze the company's internal value. Empirical fundamental analysis can be used to carry out the financial status and performance of a company by analyzing a company's historical and financial statements such as company's profit, earnings, expenses, assets and liabilities, management experience, and industry dynamics (Muhammad and Ali, 2018). While analysts use technical analysis by predicting future stock prices by studying stock price trends in the past and present (Nti, et al., 2019).

This study will measure stock prices using fundamental analysis, because Barak, Arjmand, and Ortobelli (2017) argued that technical analysis recognizes price movements only and ignores the company's fundamental factors, so technical analysis approaches as a short-term approach in analyzing the market. While the research uses long-term data, measuring stock prices using fundamental analysis is more precise.

Fundamental analysis is carried out by evaluating the numbers in the financial statements. These numbers can have an impact on investor confidence in the company's performance in the financial market. Naturally, investors will always be looking for a possibility to invest in the most efficient markets. Every investor will focus on stock prices in investment decisions because stock prices reflect all the information contained in an efficient capital market (Arkan, 2016).

Analysis of the figures in financial reports has been carried out by performing ratio analysis. The stock prices and financial ratios relationship has been examined extensively in the kinds of literature starting with the research of Ball and Brown (1968). In the research, the sign-test method used to examine stock prices for one year before accounting information is published and for 6 months after publication, using a sample of 216 companies selected from the New York Stock Exchange. The conclusion indicates a positive relationship between trends in changes in financial information and changes in stock prices. In the same year, Beaver (1968) studied changes in trading volume related to earnings information for 506 firms. Beaver found that volume information can increase stock prices.

After that, in 1979, Beaver, Clarke, and Wright tried to divide 276 companies into 25 portfolio groups to examine whether there was a relationship between unsystematic returns and the magnitude of the profit estimation error. The results found that there is a positive reciprocal relationship between stock returns and profit estimation error which is significant as indicated by the Spearman rank correlation coefficient of the percentage forecast errors is equal to 0.75.

More recent research conducted by Mussalam (2018) analyzed the relationship between financial ratios and stock returns of Qatari companies to see whether, before portfolio structure selection, firm performance and value could be reflected in financial ratios. Ma et al., (2019) argue that fundamental analysis can be used as an investment tool effectively in the context of transitional economies. Their study also suggests that accounting information is not synchronized for a fundamental analysis-based prediction in China. Hence, they also indicate that accounting information illustrates the economic reality well enough since financial reports in every different industry can disclose a part of stock value information in line with the economic situation of the industry under consideration.
So far - as is done in many practices – a set of financial ratios is the earliest and most simple and practical analysis used in evaluating and planning company performance. Financial ratios that developed in the mid-19th century were widely used by accountants and financial analysts, as well as internal and external users to make their economic actions, including making investment decisions and evaluating performance evaluations. In the last few decades, many financial and accounting models have been developed, however, financial ratios are still fundamentally maintained as models or as other important supporting analyzes for financial and investment analysis and planning (Arkan, 2016).

The use of accounting numbers and financial ratio analysis to forecast stock price changes has been carried out in many studies and it can be concluded that academics and financial analysts agree that the use of financial ratio analysis can largely be associated with changes in stock prices.

Ball and Brown's (1968) study was an early study that examined the correlation between annual report earnings and stock prices. After using empirical testing, the researchers suggest that when the company obtains excess income, investors can get an abnormal return. The findings show the relationship between income and share price.

Beaver (1966) tries to look at it from another point of view. He argues that the company's financial reporting and accounting information can affect share prices. He also concluded that investors would use published accounting information when trading stocks.

Bernard and Stober, Dechow (1994) also researched the effect of income information on stock prices, and Sloan (1996) also empirically studied the effect of operating cash flow information on stock prices. The result found that income information has a relatively better correlation, although this is not absolute.

Musallam (2018) conducted an empirical test using Weighted Least Square and showed that dividend yield ratio, earnings yield ratio, and earning per share relating significantly and positively with stock returns, while the relationship between net profit margin, dividends earnings ratio, price to earnings ratio, return on equity, return on assets and market to book value ratio and stock returns did not have a significant result.

From the practitioner's point of view, it also shows the importance of numbers in financial reports in predicting stock prices. Interviews conducted by Monash University in Australia (CPA Australia, 2018) provide evidence that supports the consistent view of many stakeholder groups that financial reports are the basis for making investment decisions and are an important source of analysis in predicting company performance in the future, which will come.

In line with this, the Integrated International Reporting Council (2017) also identifies that in making investment decisions, investors expect several important things, namely (i) measurable cost and risk factors (ii) a clear relationship between the organizational environment, activities social and other intangible investments and expectations of the company's future performance or risk, (iii) comparisons between companies in the same field, and (iv) a sustainable competitive advantage. All of these things can be seen from the financial statements of a company.

For this reason, this study will analyze the use of the company's financial statement analysis in predicting the company's stock price, namely by using financial ratios. There are a lot of financial ratios that can be used to analyze stock prices, but this study will focus on market ratio analysis, namely price to earnings ratio, price to
sales ratio, price to cash flow ratio, and Price to book ratio (Young, 2010), and a new measurement called composite measurement.

Composite measures have been used in several studies evaluating changes in several aspects of accounting. As in Nicholls (2015), who carried out a composite measure of the cost of equity by finding the average of four cost equity models that have been used in various forms over the past few years in accounting research. In this study, the composite measurement is obtained by finding the mean of the four market ratios commonly used to measure stock prices, that are Price to Sales Ratio (PS), Price to Book Value Ratio (PBV), Price to Earnings per Share Ratio (PEPS), and Price to Cash Flow Ratio (PCF).

**LITERATURE REVIEW**

Stock market forecasting is a difficult problem to solve because its complexity is closely related to several factors that can influence stock prices. Academicians and practitioners from various fields have attempted to take the challenge, to the point that many analytical teams have formed consisting of mathematicians, data scientists, philosophers, and financial analysts. This environmental heterogeneity has led to essential steps in shaping market theories (Picasso et al., 2019). The ability to forecast stock changes in the capital market remains an integral part of a successful investment process (Murekachiro et al. 2020).

Accurate prediction of stock price movements is essential for developing trading planning (Nevasalmi, 2020) and for hedging against potential market risks that will allow speculators to profit by trading in the stock index (Poženel and Lavbič, 2019). However, on the other hand, stock price prediction has also proved difficult, since the stock market is a complex, very dynamic system with high specifications and non-linearity that needs attention (Shan et al., 2015; Sanjeev, 2015) and have relationships that sometimes cannot be predicted (Li and Hou, 2014). Therefore, economists build two theoretical theories to explain market behavior, namely the Efficient Market Hypothesis (EMH) and the Adaptive Market Hypothesis (AMH) (Lo, 2004).

The Efficient Market Hypothesis (Fama, 1991) states that the current market price describes all emerging news. This causes new information to affect stock prices. Thus, price changes can occur independently of new information or news and are not related to pre-existing information. Theoretically, since the news cannot be predicted in nature, the price of stocks must follow a very random pattern so that the best predictions for the price after are the current price. The Efficient Market Hypothesis concludes that it is impossible to beat the market because their fair value consistently values stocks, therefore, purchasing stocks that are undervalued and/or selling them at excessive prices is the worst act in the trading market. However, market predictions contradict the financial theory of the market hypothesis which states that investors cannot constantly beat the stock market, hence a theory called the Adaptive Market Hypothesis emerges (Obalade and Muzindutsi, 2020). This theory links the rational, Efficient Market Hypothesis with financial principles that have irrational behavior. The Adaptive Market Hypothesis applies the evolutionary and behavioral principles of financial interactions, which are incorporated into financial behavior, and then tries to explain stock market anomalies through psychology-based theories. According to the
Adaptive Market Hypothesis, investors can exploit the disadvantages in the market efficiency hypothesis to get again from the stock portfolio.

Judging from the concept, the Adaptive Market Hypothesis, which comes from the principles of evolution. As a new version of the Efficient Market Hypothesis, the main components of the Adaptive Market Hypothesis consist of the following sequence of ideas: Investors behave for their benefit (I1), investors make mistakes (I2), investors learn and adapt (I3), Competitions will encourage investor adaptation and innovation (I4), natural selection will shape the market ecology (I5), and ultimately this evolution will determine market dynamics (I6) (Lo, 2004).

The Efficient Market Hypothesis and the Adaptive Market Hypothesis have the same origin in I1, but the two behavioral paradigms will be separated in the presence of I2 and I3. In an efficient market, investors are assumed to have made no mistakes, so that learning and adaptation will not emerge because the market itself is stable and constantly in balance. In the Efficient Market Hypothesis point of view, mistakes must occur, and in response to these mistakes, individuals can earn from their own mistakes and adjust their behavior. However, I4 argues that the adaptation process does not happen solely by market forces, but is also controlled by primary competition, such as the drive to survive. The reciprocal action between different individuals as market participants is ruled by natural selection and I5 states that the latest market characteristics are the product of this natural selection process. I6 states that the total sum of these components - selfish individuals, competition, natural selection, environmental conditions, and adaptation - is what we called as market dynamics.

The Adaptive Market Hypothesis has several practical implications. First, the risk-reward relationship will adapt over time due to population preferences in the market. Second, past price movements influence the likelihood of selecting current actions, and hence the Adaptive Market Hypothesis concludes that weak forms of market efficiency due to past prices are meaningless. Third, in an adaptive market, it cannot be denied that arbitrage opportunities do exist from time to time. This is in line with the evolutionary perspective, which states that profit opportunities will continue to be created and disappear. This will create a need for an investment strategy that must always be adapted to market conditions. This means that the Adaptive Market Hypothesis implies complex market dynamics requiring active portfolio management. Fourth, innovation is something that needs to be done to survive and the Adaptive Market Hypothesis suggests adapting to ever-changing market conditions to ensure that the expected rate of return will be obtained consistently (Hiremath and Kumari, 2014).

The nature of the Adaptive Market Hypothesis sounds quite abstract and very qualitative as has been presented above. However, several concrete implications can give surprisingly clear evidence for the concept of the Adaptive Market Hypothesis. The first implication is that, if there is a risk-reward relationship, the relationship will not have stability over time. Some relationships are determined by measures and preferences of individual populations in market environments, as well as institutional factors such as tax laws and regulations. As these factors change over time, the risk-reward relationship also tends to be affected.

The second implication is that the equity risk profile also varies over time. Strictly speaking, this is not as revolutionary as it was when it first appeared - but it is already stated in the context of the rational expectation's equilibrium model, that is, if risk preferences change over time, the risk profile for equity will also vary.
The third obvious implication of the Adaptive Market Hypothesis is that aggregate risk preference is not a commonly used constant, but is shaped by the forces of natural selection. For example, several years since the beginning of the tech bubble era has influenced investors' current risk preferences. In this context, natural selection determines who is involved in market interactions. The investors who suffered heavy losses due to the emergence of the technology bubble may have left the capital market, leaving the investor population different when compared to the previous four years (Obalade and Muzindutsi, 2020).

Besides, this research is also based totally on Dow's theory which states that market price moves can be regulated using trends. Thus, practitioners have developed strategies for forecasting market trends which sooner or later result in the emergence of two wide streams of analysis, specifically technical and fundamental analysis. Technical analysts trust that previous prices can explain market actions as a whole; therefore, their approach is primarily based on previous stock prices and several mathematical measurements that can be calculated, such as the RSI, moving averages, and Bollinger bands. They perform time-series analysis by extracting technical patterns from Candlestick charts and analyzing linear techniques such as auto-regressive integrated moving averages (Box, et al., 2016), which subsequently became one of the most popular models in time-series forecasting. Based on Dow's theory, the researcher found a statistical measure that was once used to classify time-series, and this proved beneficial in understanding market behavior. That statistical measurement is called the Hurst exponent. Research conducted through Raimundo and Okamoto Jr. (2018) determined that when Hurst's exponent is calculated primarily based on price values, it affords a measure for trend prediction.

If in the technical analysis the strategy is carried out only based on a series the price of a stock over some time, in the fundamental analysis (Abarbanell & Bushee, 1998), trading decisions are made based on the company's financial condition and macroeconomic indicators such as income, net income, dividend yields, as well as various financial ratios, such as EBITDA, Price to Earning, and others. Therefore, fundamental analysts will decide to buy (sell) stocks when the intrinsic value is greater (lower) than the market price; however, proponents of the Efficient Market Hypothesis argue that the intrinsic value of stock always equals its current price (Efat et al., 2018).

**Valuation Ratio (Market Value Ratio)**

The market value ratio group aims to show the market value of a company's shares by using company fundamental measures such as earning/price ratio, book value, earnings per share, return on equity, and dividends. These ratios are the ratios that investors are looking for basic and will change each time the stock price changes. This ratio also allows investors to make comparisons of a company with other companies in the same industry, and it also allows investors to compare the company's performance in different periods for the same data with other companies.

Although financial ratios are the method most often used in practice, the use of financial ratios is not without some limitations. The first limitation is the level of fairness of financial information that varies for each company. Users of external financial reports, especially investors and financial analysts, can only rely on the fairness of financial reports issued by companies. As a result, the financial ratios obtained from the financial information are limited by the quality and accuracy of the
data contained in the published financial statements. Therefore, the analysis results obtained from these financial ratios will also contain the deficiencies of the published financial reports. Some of the problems that usually arise from the lack of quality and accuracy of the data include inadequate disclosure and lack of comparability on financial reports between companies.

The second limitation is the accuracy of forecasting financial statements. Forecasting financial statements in the future using financial ratios using financial data and past economic events. But in reality, some future financial behavior for certain variables, such as stock prices, is influenced by other variables, such as fuzzy variables or variables that cannot be controlled.

The third limitation is the inability of financial ratios to provide answers. Financial ratio analysis is not the endpoint of analysis, although novice analysts often ignored this. The results of financial ratios will raise the important "why?". As an example, if a ratio analysis shows a decrease in the company's liquidity, the analyst needs to answer the question of why liquidity is decreasing.

When these questions are answered, only then will financial ratios provide investors with a better position to determine their next investment move in the future. Financial ratios won't give you a black or white yes or no answer. Ratio analysis aims to provide direction and not solve problems. Therefore, we need to look further into ratio analysis, namely the interpretation of ratios, the most important thing in financial ratio analysis (Arkan, 2016).

**Composite Measurement**

To overcome the problems that often arise in the use of financial ratios as a method of measuring company financial performance, the researcher tries to propose the use of a composite measurement method.

In a comparative analysis of the performance of countries in the world, the OECD uses composite indicators that compare country performance and is increasingly accepted as a useful analytical tool in conducting public communication and policy analysis. The number of composite indicators around the world continues to increase from year to year. The combined indicators are used to provide simpler comparisons. They can be used to describe complex and sometimes difficult to understand problems in various fields, for example, economics, technological development, or even the environment in different countries.

To the general public, it seems easier to interpret composite indicators than to identify a phenomenon with many separate indicators. Composite indicators have also proven useful in measuring the performance of a country (Blasco et al., 2020), policy analysis (Marozzi, 2020), and public communication (Horan, 2020). However, on the other hand, composite indicators may provide inaccurate conclusions if the analysts fail to developed the indicators or misinterpreted them. The results of the analysis in the form of a global picture will allow users to draw fairly simple analytical conclusions or decisions. The composite indicator must be looked like an attempt to initiate discussion and stimulate public interest. Its relevance must be measured concerning the constituents affected by the composite index (OECD, 2008).
Table 1. Advantage and Disadvantage of Composite Indicators
(modified from OECD, 2008)

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are easier to depict than a bundle of many individual indicators.</td>
<td>1. May lead to simplified conclusions.</td>
</tr>
<tr>
<td>2. Able to check the development of the subject from time to time.</td>
<td>2. May send ambiguous messages if poorly developed or misinterpreted.</td>
</tr>
<tr>
<td>3. Able to summarize complex and multi-dimensional facts that support</td>
<td>3. There are possibilities to wrongly applied those indicators if the</td>
</tr>
<tr>
<td>decision-makers’ point of view.</td>
<td>construction process lacks clear conceptual and/or statistical principles</td>
</tr>
<tr>
<td>4. Scale down a set of indicators’ visible size without reducing the</td>
<td>or the process is not transparent.</td>
</tr>
<tr>
<td>elemental information bases.</td>
<td>4. The choice of indicators and weights could be causing a dispute.</td>
</tr>
<tr>
<td>5. Helping lay and educated audiences to understand the information</td>
<td>5. If the process of making a construct is not transparent, it can cause</td>
</tr>
<tr>
<td>needed</td>
<td>significant failings in several dimensions and make it difficult to identify</td>
</tr>
<tr>
<td>6. Allows users to effectively comparing complex dimensions</td>
<td>appropriate corrective actions.</td>
</tr>
<tr>
<td>promote better communication with the common public (i.e. media, citizens,</td>
<td>6. May lead to improper conclusions if variables’ dimensions that are not</td>
</tr>
<tr>
<td>etc.) and may lead to accountability promotion</td>
<td>easy to measure are avoided.</td>
</tr>
</tbody>
</table>

The Human Development Index (HDI) is the best known socio-economic composite index, measuring social progress. It includes variables such as life expectancy, educational attainment, and income in one index. It can be seen as a complement to the usual measure of GDP, and may not always show the same pattern. Rich communities may not always have the best conditions from an individual point of view. By combining information from the two measures, it will be possible to show a broader perspective on the current situation of society. Because the input data for multi-purpose indicators, GDP and HDI can be applied to compile composite indicators, this provides the possibility to make a specific objective measure of current development (Edberg, 2017). Several studies that use composite measurements to measure company performance include Gadanecz and Jayara, 2008; Desta, 2016, to measure the cost of equity, Nicholls, 2016);

Empirical evidence illustrates that the use of financial ratios independently produces results that are inconsistent with stock price forecasting. It might not be appropriate to signal a change in price if the financial ratios were independent. The composite indicator consists of many financial ratios. It helps to forecast stock changes holistically taking into account more financial ratios.

Hypotheses Development

This research will focus on finding the best method in predicting stock prices by using four market ratios, namely Price to Earnings Ratio, Price to Sales Ratio, Price to Book Ratio, and Price to CFO Ratio, plus one additional measurement, namely the composite measurement, which is believed to give better results than the other measurements. Edberg (2017) states that in measuring the socio-economic development
of a country, the composite measurement will provide a better understanding when compared to other indicators. The Composite measurements are also used in practice. Gadanez and Jayara (2008) state that the Swiss National Bank (SNB), the Hong Kong Monetary Authority (HKMA), and the Czech National Bank (CNB) and use a composite measurement in the form of a mean measurement to see the stability or fragility of banks. Hair et. al (2020) attempted to compare construct measurements using exploratory factor analysis, confirmatory factor analysis, and confirmatory composite analysis. The conclusion given is that confirmatory composite analysis is a new concept that is quite important to be considered by researchers in developing and assessing the measurement model's quality. Confirmatory composite analysis has become an alternative for the application of confirmatory factor analysis in the measurement scale's development, adaptation, and confirmation. The confirmatory composite analysis is also very useful in the development of new measurements, and also more favorable over other approaches in confirming measurement models that consist of linear composites.

Desta (2016) stated that in his research related to banking financial performance, in previous studies, measurements using Return on Assets, Return on Equity, and Net Interest Income Margin showed inconsistent results, while the measurement of banking performance used the CAMEL ratio, which is a composite measurement, can be applied to all three ratios, so that it will give more consistent results.

H1: Composite measurement is a better measure in predicting stock prices compared to Price to Sales Ratio, Price to Book Value Ratio, Price to Earnings per Share Ratio, and Price to Cash Flow Ratio

METHODS

This study will be conducting using companies listed on the Indonesian Stock Exchange which is an example of an emerging market because most of the previous studies were conducted in developed countries companies in all sectors for the years between 2005–2017. The data collected from Datastream and I/B/E/S database. The study population consists of 582 companies and 214 firms are selected as sample based on data consistency and availability over 13 years. So, this research has 2,782 firm-year observations. The variables used in this study are stock price (P) as an independent variable, and other market ratios, namely Price to Sales Ratio (PS), Price to Book Value Ratio (PBV), Price to Earnings per Share Ratio (PEPS), Price to Cash Flow Ratio (PCF) and a composite ratio, which is the average of the four market ratios above (AVG), as the dependent variable.

Table 2. Definition of variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>The stock price is measured using the average of the stock price at the each of closing days of the market for a year.</td>
</tr>
<tr>
<td>PS</td>
<td>The price to sales ratio is measured by dividing sales revenue by market price.</td>
</tr>
<tr>
<td>PBV</td>
<td>The price to book value ratio is measured by dividing the value of books per share by market price, where BV per share is measured by subtracting total liabilities with total assets, then divided it by the number of shares issued.</td>
</tr>
</tbody>
</table>
Variables | Definition
---|---
PEPS | Price to earnings ratio is measured by dividing earnings per share by market price, where EPS is measured by dividing profit after tax by the number of shares issued.
PCF | The price to cash flow ratio is measured by dividing the operating cash flow by the market price.
AVG | Composite measurement is measured using the average of all dependent variables.

Statistical analysis was used to test the main hypothesis which focused on finding which one of each ratio has the best predictability power in estimating stock price trends, using STATA at 0.05 confidence level. The research method used in this study is the stepwise regression method to find the best ratio that can predict stock prices. We can use an automatic procedure to choose the alternative of predictive variables to fit the regression model. In statistics, we call this method a stepwise regression. In every step, we decide which variable to add or subtract from explanatory variables set based on some predetermined criterion.

Stepwise regression will be used in stages to determine the most appropriate estimation method in explaining the model, whether the pooled least square, fixed effect, or random effect method. After obtaining the most appropriate estimation method, panel data regression testing will be carried out to test which dependent variables are most appropriate in explaining the independent variables.

RESULTS

The first stage in stepwise regression is to determine what estimation method will be used in conducting panel data regression testing. The first step is to perform the Chow test to determine a choice between Pooled Least Square and Fixed Effect. The results of the Fixed Effect Panel regression can be seen in Table 3.

| Table 3. Chow Test results |
|---|---|
| Fixed-effects (within) regression | Number of obs = 2,360 |
| Group variable: companynum | Number of groups = 214 |
| R-sq: within = 0.0175 | Obs per group: |
| between = 0.0084 | min = 1 |
| overall = 0.0126 | avg = 11.0 |
| F (5,2141) = 7.64 | max = 13 |
| corr (u_i, Xb) = 0.0126 | Prob > F = 0.0000 |

<table>
<thead>
<tr>
<th>P</th>
<th>Coef.</th>
<th>Std. Err.</th>
<th>t</th>
<th>P &gt;</th>
<th>t</th>
<th>[95% Conf. Interval]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS</td>
<td>143113</td>
<td>2232089</td>
<td>0.64</td>
<td>0.521</td>
<td>-2946156</td>
<td>5808423</td>
</tr>
<tr>
<td>PBV</td>
<td>4.214888</td>
<td>2.585789</td>
<td>1.63</td>
<td>0.103</td>
<td>-8506315</td>
<td>9.285807</td>
</tr>
<tr>
<td>PEPS</td>
<td>-0.0398719</td>
<td>0.0342177</td>
<td>-1.17</td>
<td>0.244</td>
<td>-1069753</td>
<td>0.272315</td>
</tr>
<tr>
<td>PCF</td>
<td>31985.61</td>
<td>134539.3</td>
<td>0.24</td>
<td>0.812</td>
<td>-231855.8</td>
<td>295827</td>
</tr>
<tr>
<td>LNAVAG</td>
<td>356.7655</td>
<td>62.85557</td>
<td>5.68</td>
<td>0.000</td>
<td>233.5011</td>
<td>480.0298</td>
</tr>
<tr>
<td>_cons</td>
<td>1267.296</td>
<td>102.5711</td>
<td>12.36</td>
<td>0.000</td>
<td>1066.146</td>
<td>1468.445</td>
</tr>
<tr>
<td>sigma_u</td>
<td>3583.989</td>
<td>111.1111</td>
<td>32.00</td>
<td>0.000</td>
<td>3362.788</td>
<td>3805.191</td>
</tr>
<tr>
<td>sigma_e</td>
<td>2602.368</td>
<td>2602.368</td>
<td>1.00</td>
<td>0.316</td>
<td>-5190.23</td>
<td>10414.97</td>
</tr>
</tbody>
</table>
From Table 3, can be seen that the P-value is smaller than 0.05, so $H_0$ can be rejected, so the best choice is to use the Fixed Effect.

The second step is to test the Fixed Effect method and the Random Effect method using the Hausman Test, and the regression results can be seen in Table 4.

**Table 4. Hausman Test results**

<table>
<thead>
<tr>
<th>Coefficients</th>
<th>(b)</th>
<th>(B)</th>
<th>(b-B)</th>
<th>Sqrt(diag(V_b-V_B))</th>
<th>Diff.</th>
<th>S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS fe</td>
<td>1431144</td>
<td>1322808</td>
<td>108324.0</td>
<td>258281.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBV re</td>
<td>4.214888</td>
<td>4.799483</td>
<td>-.5845953</td>
<td>.1978251</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEPS</td>
<td>-.0398719</td>
<td>-.0416771</td>
<td>.0018052</td>
<td>.0027355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCG</td>
<td>31985.61</td>
<td>29957.4</td>
<td>2028.212</td>
<td>4494.248</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LNAV G</td>
<td>356.7655</td>
<td>351.4267</td>
<td>5.338776</td>
<td>13.80727</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Test:** $H_0$: difference in coefficients not systematic

$$\text{Chi2}(2) = (b-B)' \left( V_b - V_B \right)^{-1} (b-B) = 0.37$$

$$\text{Prob > Chi2} = 0.8306$$

From Table 4, can be seen that P Value $> \alpha 0.05$, then $H_0$ cannot be rejected, which means that the best choice is RE rather than FE.

After conducting the Chow test and Hausman test, the conclusion is the best estimate for the model in this study is using the Random Effect method.

**DISCUSSION**

For hypotheses testing, the panel data will be regress using Random Effects, the results of which can be seen in Table 5.

**Table 5. Panel data regression using random-effects**

<table>
<thead>
<tr>
<th>Random-effects GLS regression</th>
<th>Number of obs</th>
<th>2,360</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group variable: companynum</td>
<td>Number of groups</td>
<td>214</td>
</tr>
<tr>
<td>R-sq:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>within</td>
<td>0.0175</td>
<td></td>
</tr>
<tr>
<td>between</td>
<td>0.0090</td>
<td>11.0</td>
</tr>
<tr>
<td>overall</td>
<td>0.0130</td>
<td>13.0</td>
</tr>
<tr>
<td>corr (u_i, Xb)</td>
<td>0 (assumed)</td>
<td></td>
</tr>
<tr>
<td>Obs per group:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>min</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>avg</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>max</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Wald Chi2 (5)</td>
<td>40.03</td>
<td></td>
</tr>
<tr>
<td>Prob &gt; chi2</td>
<td>0.0000</td>
<td></td>
</tr>
</tbody>
</table>
From the panel data regression's results with the random-effects method in table 5, it can be seen that the only variable with a P-value below 0.05 alpha is only the AVG variable (p-value = 0.000), which is the composite variable, so that H<sub>0</sub> can be rejected, which means that the composite measurement is a variable that can be more describes the share price compared to other measurements.

Composite measurement has been studied in several recent research (e.g. Edberg, 2017; Hair et. al., 2020) in many fields with a persistent result. In predicting stock prices in Indonesia, this research suggests the usage of composite measurement instead of single ratio measurement. Composite measurement can be a better indicator because it comprises of all measurement observed, and that creates a more comprehensive indicator.

The result of this study is consistent with other studies (Gadanecz and Jayara, 2008; Desta, 2016; Edberg, 2017; and Hair et. al., 2020). Although those studies used different proxies and concepts for composite measurement, the results are the same, that composite measurement is better than any other measurements.

**CONCLUSION**

With a variety of measurement methods to predict stock prices, we do no doubt that investors are trying to find the best predictors to make these predictions. Previous studies have explained the use of fundamental and technical analysis (Nazário et al., 2017 and Renu and Christie 2018).

This research focuses on measurement using fundamental analysis, specifically market ratios. The main issue in this research is whether a composite measure of market ratios can explain stock prices better than market ratios themselves.

Using a sample of all listed companies in the Indonesia Stock Exchange from 2005 to 2017, the result is that the composite measurement, which is the average of four market ratios that are widely used to explain stock prices, turns out to be a better measurement than the ratio- another market ratio.

Then, this study also has several limitations. First, a composite measurement consisting of an average of four market ratios to predict stock prices may not be effective, considering that many other market ratios can be used to form a composite measurement.

Second, because in the composite measurement, subjective assessment is also carried out, apart from quantitative ratio analysis.
From these limitations, several suggestions emerged that might be used in future research. First, the expansion of the market ratios that can be used to construct a composite measure by developing an assessment of all market ratios and given the appropriate weights for each ratio so that the composite measurements can be relatively more objective.

The second is that further researchers can also expand the research sample, especially in terms of industrial segmentation so that they can get more specific results for each industry and make the comparability of the research better.

REFERENCES


Nevasalmi, L. (2020). Forecasting multinomial stock returns using machine learning


Tan Kwang En