Factors affecting the assessment of the acquisition performance of firms listed on the Tehran Stock Exchange using the generalized method of moments (GMM)

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ABSTRACT

Determining an effective approach to assessing portfolio performance is one of the most important modern topics in the field of investment management. Accordingly, evaluation criteria for an investment project cannot be selected only based on its high return. The models developed for evaluating portfolio performance in terms of both risk and return are not based on the fundamental approach to financial elements. Assessing the acquisition performance has been one of the most important issues in finance for a long time and many studies have developed models to determine the optimal portfolio. As the problems with these models have been detected over time, they have been replaced with new models. In this study, the generalized method of moments (GMM) was used to explore the factors affecting the portfolio performance of stock firms in terms of accounting and economic factors. The research sample included the most efficient firms listed on the Tehran Stock Exchange. The results of the study indicated that the economic approach is more efficient than the accounting approach with an explanatory rate of 0.82. Therefore, most investors consider the economic approach in their acquisition decisions.

Keywords:

Portfolio Performance, Accounting Approach, Economic Approach, the Generalized Method of Moments (GMM)

1. Introduction

The theoretical framework for forming an investment portfolio (allocation of capital among assets with different risks) in finance focuses on an approach that minimizes risks and maximizes returns. Accordingly, Markowitz (1952) used the modern portfolio theory to formulate his model (Thomson et al., 2018).

Markowitz's model and all studies conducted based on it have a fundamental assumption that stock returns are scholastic variables and the outcome of future stock market conditions. However, many non-scholastic factors affect the stock market. Thus, analyzing these factors using scholastic approaches is considered unreasonable (Ricky et al., 2017) Although Markowitz's model was the first to offer a combination of return maximization and risk minimization, it fails to address some of the constraints of real-world issues (Abraham et al., 2018). An important point in all models developed based on Markowitz's model is their function. The main purpose of these models is to minimize investment risks for a certain level of returns or to maximize the returns for a certain level of risks. These models can be divided into two general categories; single-objective and multi-objective models (Song et al., 2017). Thus, determining an effective approach to assessing portfolio performance is one of the most important modern topics in the field of investment management. Accordingly, evaluation criteria for an investment project cannot be selected only based on its high return. In selecting evaluation criteria, an investment project cannot be considered solely based on its highs return and without taking into its risks. Some models have been developed for evaluating portfolio performance by taking into account both risk and return. The focus of the present study is on using the generalized method of moments (GMM) to explore the factors affecting the portfolio performance of stock firms in terms of accounting and economic factors. The research sample included the most efficient firms listed on the Tehran Stock Exchange.

1.1. Theoretical framework of the study

The issue of selecting an optimal set of assets is the focus of capital market theories and is of particular importance in both micro and macroeconomic issues. The optimal investment decision maximizes the investor's expected utility from future consumption. To achieve this goal, the investor needs methods, tools, and criteria to identify and measure the potential value of each investment opportunity (Gour Sundar et al., 2018). These criteria must be sufficiently reliable for investors to make decisions based on them and to invest their capital in business activities. Risk and return are the criteria that determine the degree of utility gained by the investor in choosing a set of investment assets. The choice of a set of stocks is usually made based on the interaction between risk and return. Therefore, stock selection and portfolio management are the main areas of financial decision-making (Alufami et al., 2018). The process of building an optimal stock portfolio is done through two main steps: In the first step, the decision-maker, whether a natural or legal entity, must evaluate and select the existing stocks, which are considered as investment opportunities. Given the large volume of stocks traded on international stock markets, this step is necessary to focus the analysis on fewer of the best investment choices. The second step involves deciding on the amount of investment in each of the stocks selected in the first step. In this step, the investor must decide on the amount of investment in each of the stocks selected in the first step, and thus create a portfolio of selected stocks (Giuliano et al., 2017) Investors seek is an optimal choice from a variety of options. Accordingly, the focus of the present study is on specifying effective financial ratios and criteria based on a fundamental analytical approach and efficient market hypotheses to help investors select the best stocks. Besides, the selection of these financial ratios can help firms with better financial ratios provide better returns to the investor. Even if the value of a firm's stocks in the short term moves contrary to its financial ratios, the fundamental analysis hypothesis assumes that there will be a high correlation between the value expressed by the financial ratios and the stock market value in the long run (Seong et al., 2018).

2.1. Literature Review

Wu and Zheng (2020) examined the spillover effect of financial information in mergers and acquisitions. They also investigated whether and how corporate investment activities are affected by the financial information of acquired firms in acquisitions. Focusing on changes in acquisition performance to measure efficiency, they concluded that there was a positive relationship between post-acquisition accounting

functions. They also found that the spillover effect was different in terms of the characteristics of both the acquiring and acquired firms. The effect is stronger when the acquired firms are larger, not smaller, and have poorer accounting performance than before the acquisition. Naveen et al. (2020) assessed the financial performance of merged banks in India using the DuPont model. They examined the financial performance of three banks before and after the merger in terms of net profit margin, asset turnover, financial leverage, return on assets, and return on equity. They used independent samples t-test to determine if the performance of the banks improved after the merger. Their findings showed that although mergers lead to synergies and economic benefits, firms should not expect immediate improvements in all aspects of their performance indicators. Rasool and Raychaudhuri (2019) explored the impact of cross-border acquisition on financial performance and the strategic outcome of acquiring firms in the Indian pharmaceutical industry. Cross-border and domestic mergers and acquisitions are considered as fastest means of growth and survival. Focusing on the key financial ratios, pre-merger and post-merger financial performances of Indian pharmaceutical firms were compared to find whether the merger has affected their performance. An analysis of these multiple financial ratios showed no improvement in the profitability after the merger. The main motives of the mergers and acquisitions like cost reduction, risk spreading, etc. were compared to the financial results. It was shown that the overall motives more or less were achieved by the firms keeping internal factors of acquiring firms constant.

Gupta et al. (2017) examined the impact of the acquisition on financial performance in selected firms in India. They compared financial performances three years before and after the acquisition of firms. The sample size included seven different industries selected under the influence of acquisitions from 2006 to 2012. Given the need for data from three years before and after the acquisition, the data for 2000 to 2015 were also collected. Different financial ratios were considered to assess profitability and liquidity ratios. The results showed no improvement in the financial performance of the acquired firms after the acquisition. Besides, the profitability and liquidity ratios of the sample firms were worse. Carmichael et al. (2015) examined the unification of portfolio diversification measures using Rao's quadratic entropy.

They found that previous measures based on normal distribution were not completely satisfactory. Besides, the developed models made no distinction between negative and positive correlations. Therefore, they did not take into account the benefits of negative correlation; It can be calculated when the stock portfolio risk is measured by its variance or fluctuations, i.e. when the return on capital has a normal distribution. Therefore, the development of an ideal tool to measure stock portfolio diversity is a suitable research field in investment management. Khakbiz et al. (2017) developed a model to maximize returns and diversity and minimize non-systematic portfolio risk. Given that the proposed model was nonlinear and fell under NP-hard polynomial functions, a genetic algorithm was used to solve the model. The results of implementing the two-objective (return and diversity) and three objective (return, diversity, and non-systematic risk) model in multiple iterations showed that the average return of portfolios selected via the proposed model was higher than the desired level. An analysis of portfolio performance indicators also showed the efficiency of the two-objective (return and diversity) model. In his doctoral dissertation entitled "A survey of corporate acquisition performance in Iran", Arefi (2016) used five indicators including sales growth, shareholder return, asset return, operating cash flow, and stock return to examine the acquisition and merger performance in acquiring and target firms in three years before and after the acquisition. The results showed that of the above five indicators, only operating cash flow was improved after the acquisition of the target firms and the other four indicators did not have any improvement.

2. Research Methodology

The present study used the generalized method of moments (GMM) to assess the factors affecting the portfolio performance of stock firms in terms of accounting and economic factors. The research sample included the most efficient firms listed on the Tehran Stock Exchange. Assessing the acquisition performance has been one of the most important issues in finance for a long time and many studies have developed models to determine the optimal portfolio. As the problems with these models have been detected over time, they have been replaced with new models. One of the main problems with the proposed models

was that they did not address the problems associated with fixed or random-effects models as the possible correlation between error terms and lagged variables can lead to inconsistent estimations or bias. When in a mixed-data model, the dependent variable appears as a lag in the right side of the model, OLS estimates will no longer provide consistent results. Therefore, the generalized method of moments (GMM) is a powerful estimator that, unlike the maximum likelihood estimation (MLE), does not require accurate data on the distribution of error terms (Hemmati Asiaberaki et al., 2015). The present study is an applied study in terms of its objectives. Besides, since independent and dependent variables are not manipulated and attempts are made to discover the relationships between them in the real world, it uses a descriptive-correlational design to asses, the existence, extent, and type of relationships between the variables in question. The time horizon of this study covers the period from late March 2011 to late March 2019. The firms listed in the Tehran Stock Exchange were considered as the research population. Besides, the firms in the research sample were selected using systematic elimination (screening) using the following criteria:

Table 1: The firms in the research sample

Industry type	Number
Financial intermediaries, investment and holding	4
Cement, lime, gypsum, and extraction of metal ores	4
Automotive and base metals	6
Food and chemical products	5
Pharmaceutical materials and products	2
Other industries	9
Total	30

2.1. Research model and variables

The studies on the criteria for evaluating the acquisition performance have identified two approaches to acquisition performance criteria:

The accounting approach

This approach was developed based on the accounting information system and financial reports providing important information for users. Relying on accounting reporting, investors evaluate the firm's performance and make their predictions accordingly.

Managers also use financial reporting data to plan the firm's future policies and strategies. In the accounting model, performance appraisal is a function of financial ratios. Under this approach, figures in financial statements such as profit and loss statements and balance sheets are used to evaluate performance (American Institute of Certified Public Accountants; AICPA[1], 2016). Financial ratios are performance appraisal criteria that are of high importance for investors, shareholders, managers, creditors, and analysts. Securities are very important. Financial ratios that are calculated on an accrual basis are considered to be one of the most important performance benchmarks by many researchers (e.g. Lehn & Makhija, 1997; Chen & Dodd, 1997; Worthington & West, 2001).

The economic approach

Based on this approach, which has been developed using economic concepts, the performance of a business firm is evaluated in terms of the profitability of the firm's assets and according to the rate of return and the cost of capital used. Economic value-added, adjusted economic value-added, and market value-added are some performance appraisal criteria (Cullen & Cooler, 2015). To address the problems with performance appraisal models as a result of using accounting data, researchers (e.g. Suojanen, 1954; Stewart, 1991; Bacidore et al., 1997; Bausch et al., 1997) sought to provide a new benchmark for performance appraisal. With the emergence of theories of economic profit or residual profit, some models were proposed to calculate economic profit. In these models, net operating profit after tax and capital expenditure is defined as economic profit or residual profit. Therefore, the criteria such as economic value added, market value-added, and residual economic profit in their evolutionary course are used to address the behavioral complexities of managers, evaluate their performance, moderate the conflict of interests, and explain the information contained in stock prices and returns (Mackenzie et al., 2015).

According to the analytical literature, the following models are assumed:

$$\text{Tobinsq}_{i,t} = \gamma_0 +_1 CR_{i,t-1} + \gamma_2 QR_{i,t-1} + \gamma_3 Assetstll_{i,t-1} + \gamma_4 DebtsR_{i,t-1} + \gamma_5 DebtsE_{i,t-1} + \gamma_6 EPS_{i,t-1} + \gamma_7 \text{Tobinsq}_{i,t-1} + \varepsilon_{i,t}$$

$$\text{Tobinsq}_{i,t} = \gamma_0 + \gamma_1 ROA_{i,t-1} + \gamma_2 EVA_{i,t-1} + \gamma_3 RE_{i,t-1} + \gamma_4 EVM_{i,t-1} + +\gamma_5 \text{Tobinsq}_{i,t-1} + \varepsilon_{i,t}$$

In equations in which the estimation of the invisible effects specific to each firm and the existence of the lag of a dependent variable interval in the explanatory variables is a major problem, the generalized method of moments (GMM) estimator is used, which has been developed based on dynamic panel models (Khodadadi et al., 2013). To estimate the model by this method, it is necessary to first determine the instrumental variables used in the model. The consistency of the GMM estimator depends on the validity of the hypothesis is that there is no serial correlation between error terms and tools, which can be tested by two tests specified by Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). The first is the Sargan test that measures predetermined constraints and tests the validity of instruments. The second is the M_2 statistic, which tests for the existence of a second-order serial correlation in first-order differential error terms. If the null hypothesis of both tests is not rejected, it provides evidence for the assumption of no serial correlation and validity of the instruments. The GMM estimator is consistent if there is no second-order serial correlation in the error terms in the first-order differential equation. Since in the research model represented by the following relation, the dependent variable appears as a lagged variable on the right side of the equation, there is a dynamic panel data model.

In this study, the Sargan test was used to evaluate the consistency of the GMM estimator and Eviews10 software was used for statistical analysis and econometrics.

2.2 Research variables

The research variables are detailed as follows:

Table 2: The operational definition of the research variables

Variable	Type	Operational definition
Tobin's q	Dependent	Considering some problems in accounting, economic and market data to evaluate the performance of corporate acquisitions, mixed data are used for performance appraisal. One of the most important of these criteria is Tobin's q ratio which is measured as follows: $$\mathbf{Tobinsq_{i,t}} = \frac{\mathbf{Equity_{it}}}{\mathbf{MV_{it}}}$$ Equity: the total equality of firm *i* in year *t* MV: The total market value of firm *i* at the end of year *t*
		Accounting performance criteria
Current ratio	Independent	$$CR_{i,t} = \frac{CAssets_{it}}{Short-term\ debt_{it}}$$ Short-term debt: The total short-term debt of firm *i* at the end of year *t* CAssets: The total current assets of firm *i* at the end of year *t*.
Quick ratio	Independent	$$QR_{i,t} = \frac{(CAssets - -Inventory)_{it}}{Short-term\ debt_{it}}$$ Short-term debt: The total short-term debt of firm *i* at the end of year *t* CAssets: The total current assets of firm *i* at the end of year *t*. Inventory: The inventory of firm *i* at the end of year *t*.
Asset turnover	Independent	$$Assetstll_{i,t} = \frac{Sale_{it}}{Assets_{it}}$$ Nsales: The total short-term debt of firm *i* at the end of year *t* Asset: The total current assets of firm *i* at the end of year *t*. Inventory: The inventory of firm *i* at the end of year *t*
Debt ratio	Independent	$$DebtsR_{i,t} = \frac{Debts_{it}}{Assets_{it}}$$ Assetstll: Total assets to debts of firm *i* at the end of year *t* Debt = The total debt of firm *i* at the end of year *t* Assets: The total assets of firm *i* at the end of year *t*
Debt to equity		$$DebtsE_{i,t} = \frac{Debts_{it}}{Equity_{it}}$$ Assetstll: Total assets to debts of firm *i* at the end of year *t* Debt = The total debt of firm *i* at the end of year *t* Assets: The total assets of firm *i* at the end of year *t*

Variable	Type	Operational definition
Earnings per share		$$EPS_{i,t} = \frac{EBIT_{it}}{Equity_{it}}$$ EPS: Earnings per share of firm i at the end of year t EBIT: Earnings before interest and taxes Assets: The total assets of firm i at the end of year t
		Economic performance criteria
Return on assets	Independent	$$ROA_{i,t} = \frac{EBIT_{it}}{Assets_{it}}$$ ROA: Return on assets EBIT: Earnings before interest and taxes Assets: The total assets of firm i at the end of year t
Economic value added	Independent	$EVA = NOPAT_{adj} - (WACC \times IC_{adj})$ EVA: Economic value-added $NOPAT_{adj}$: Net operating profit after adjusted tax WACC: Weighted average of capital cost IC_{adj}: Invested capital
Market value-added	Independent	$$RE_{i,t} = MV_{i,t} - Equity_{i,t}$$ Equity: the total equality of firm i in year t MV: The total market value of firm i at the end of year t
Residual income	Control	$$RE_{i,t} = \frac{EF_{it}}{Nshar_{it}}$$ Nshar: Number of shares of firm i at the end of year t EF: Net earnings minus the interest rate on investment in firm i at the end of year t RE: Residual income of firm i at the end of year t

3. Empirical results

3.1 The correlations between the research variables

To check if the model has the colinearity problem or not, it necessary to run the correlation test. Table 3 shows the correlation matrix between the variables:

Table 3: Correlations between the independent and control variables in the first model

Variables	Current ratio	Quick ratio	Asset turnover	Debt ratio	Debt to equity	Earnings per share
Current ratio	1					
Quick ratio	0.35	1				
Asset turnover	-0.13	-0.15	1			
Debt ratio	-0.23	0.25	0.21	1		
Debt to equity	0.32	0.33	-0.14	-0.24	1	
Earnings per share	0.06	0.09	-0.06	0.007	0.004	1

Table 4: Correlations between the independent and control variables in the second model

Variables	Return on assets	Economic value added	Residual income	Market value-added
Return on assets	1			
Economic value added	0.19	1		
Residual income	0.11	0.37	1	
Market value added	0.26	0.30	0.19	1

In the present study, the Pearson correlation coefficient was used to investigate the collinear relationships. The results showed that there are weak correlations between all independent variables, indicating the lack of collinearity between the independent variables.

3.2 Unit root tests

In this study, the LLC test (Levin et al., 2002) and IPS test (Im, Pesaran, & Shin, 2003) were used.

Table 5: The results of the LLC test (Levin et al., 2002)

Unit root test	Statistic	Probability
LLC	-7.83	0.00

As shown in the table above, the evidence from the LLC stationary test does not indicate the existence of a unit root at the 95% confidence level for the variables. Therefore, the basic assumption of the Levin-Lin-Chu (LLC) test for the existence of a unit root process between sections is not confirmed at a 95-level confidence level and there is no unit root process between the sections.

Table 6: The results of the IPS test

Root test	Statistic	Probability
IPS	-13.37	0.00
Current ratio	-5.08	0.00
Quick ratio	-5.10	0.00
Asset turnover	-3.43	0.00
Debt ratio	-4.99	0.00
Debt to equity	-5.33	0.00
Earnings per share	-6.84	0.00
Return on assets	-4.94	0.00
Economic value added	-5.42	0.00
Residual income	-5.28	0.00
Market value-added	-3.82	0.00
Tobin's q	-5.02	0.00

(Im, Pesaran, & Shin, 2003)

3.3. Cointegration test

In this study, to investigate the cointegration in the models, the method presented by Cao (1991) was used. The results of Cao cointegration test using ADF statistic for the estimation model are shown in Table 7:

Table 7: The results of Cao cointegration test

Unit root test	Statistic	Probability
Cao	-11.41	0.00

As can be seen in the table above, the null hypothesis is not confirmed at the 95% confidence level for the model. Therefore, according to the ADF statistic, cointegration is established in all models and there will be no false regression problem in the research models.

3.4. Model estimation using the accounting approach

Following the generalized method of moments (GMM), the validity of the instrumental variables defined in the model was assessed and confirmed using the Sargan test. In the next step, the degree of autoregression in the error terms was tested. The value of the Sargan test (16.87) indicated that the null hypothesis is not rejected and the instrumental variables defined in the model are valid as the Sargan test shows that the instrumental variables are not correlated with the error terms and, thus, the defined instrumental variables are valid.

Table 8: Assessing the first model's fit using the accounting approach

Dependent variable: Tobin's q	Coefficient	t-value	Probability
Current ratio	1.60	15.68	0.91
Quick ratio	1.78	18.03	0.92
Asset turnover	11.34	1.13	0.00
Debt ratio	15.35	111.13	0.89
Debt to equity	4.05	2.18	0.03
Earnings per share	0.02	0.008	0.04
Sargan value	16.87		
Durbin-Watson value	1.80		
Coefficient of determination	0.68		

As can be seen, the value of the Durbin-Watson value is 1.80 indicating the lack of serial correlation in the research model. Besides, the coefficient of determination (R^2) is 0.74 showing the correlation between the real value of the dependent variable and its fitted value. Besides, the table above shows the t-values for the current ratio (t = 0.91), quick ratio (t = 0.92), total asset turnover (t = 0.00), debt ratio (t = 0.89), debt to equity ratio (t = 0.03) and earnings per share ratio (t = 0.04) at a 95% confidence level.

3.5. Model estimation using the economic approach

The Sargan test was run to assess the validity of the matrix of the instruments. The null hypothesis of the test indicates the instruments are correlated with error terms. The value of the Sargan test is 20.32, which confirms the null hypothesis and the validity of the instrumental variables defined in the model. Accordingly, it can be concluded that the instruments used for estimation are valid.

As can be seen, the value of the Durbin-Watson value is 1.82 indicating the lack of serial correlation in the research model. Besides, the coefficient of determination (R^2) is 0.82 showing the correlation between the real value of the dependent variable and its fitted value. Besides, the table above shows the t-values for return on assets (t = 0.02), economic value added (t = 0.03), residual income (t = 0.04), and market value added (t = 0.00) at a 95% confidence level.

Table 9: Assessing the second model's fit using the economic approach

Dependent variable: Tobin's q	Coefficient	t-value	Probability
Return on assets	113.65	12.66	0.02
Economic value added	0.02	0.004	0.03
Residual income	1.46	3.04	0.04
Market value added	0.03	6.004	0.00
Sargan value		20.320	
Durbin-Watson value		1.82	
Coefficient of determination		0.82	

4. Conclusion and suggestions

According to portfolio theory, the portfolio investor chooses their acquisition strategy based on the expected returns. If the securities have higher expected returns, the main task of any investor is to determine the set of securities with the highest utility. This means to select an optimal portfolio from the total possible portfolios, which is called the acquisition portfolio selection problem. An assessment of the proposed approaches through the generalized method of moments (GMM) showed that asset turnover, debt to equity ratio, earnings per share, return on assets, economic value-added, residual income, and market value-added have a positive and significant relationship with Tobin's q as a proxy for acquisitions in the listed firms. Accordingly, to decide which accounting and economic approaches can more effectively measure the acquisition performance in firms listed on the Tehran Stock Exchange it can be suggested that the economic approach is more efficient than the accounting approach with an explanatory power of 0.82 (see Tables 8 and 9). Therefore, investors should pay more attention to the economic approach in their acquisition decisions. Besides, the insights from this study indicate that the proposed model can be used by investment firms to optimize their portfolio based on fundamental variables such as asset turnover, debt to equity ratio, earnings per share, return on assets, economic value-added, residual income, and market value-added. Furthermore, the economic approach can be used for the acquisition of various firms listed on the Tehran Stock Exchange. Moreover, different levels of risk aversion of investors should be determined when selecting a portfolio. The results also indicate a rigorous analysis of securities and focus on the changes in their financial ratios in the

long run. It can be achieved through optimal owning to reduce the risk. Therefore, based on the results of this research it is suggested: use of accounting approach to ownership of different companies in Tehran Stock Exchange as well as implementation of the problem analysis model presented for investment companies to optimize the portfolio and optimize portfolio of investment companies with the approach of accounting approach and other models . Therefore, finally, investment firms can use the accounting approach and other variables to optimize their portfolios.

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Note

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