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A THREE-FACTOR MODEL AND EXCESS RETURN IN AN EMERGING MARKET: A CASE STUDY OF LISTED COMPANIES ON TEHRAN STOCK EXCHANGE (TSE)

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Abstract: *The primary function of an efficient and deep capital market is to provide a context for supply of high-quality and transparent information and to create reasonable liquidity by eliminating information asymmetry, minimising transaction costs, and speeding up transactions. In this research, a three-factor model is proposed based on which the effect (the explanatory power) of three variables market risk (beta), disclosed accounting information quality, and stock liquidity on stock return is investigated. Using time series method, the financial information of 72 TSE-listed companies over a 7-year period (2007-2013) was examined. The stock excess return was found to be significantly associated with market excess return, stock liquidity and accounting information quality. The results, in addition, indicated higher explanatory power of the 3-factor model (beta, information quality, and liquidity) relative to the CAPM single-factor model and the 2-factor model (considering beta and liquidity) in predicting the excess return on TSE.*

Keywords: *Information Quality, Liquidity, Beta, Information Asymmetry*

JEL Classification: G1

INTRODUCTION

Every investor for operating in any market requires relevant and reliable information and relative certainty about the market high liquidity and its entry and exit at desired time.

The continuous changes in business environment place increasing demands on financial and accounting systems for supply of still more complete and higher quality information. Disclosure of high quality information allows investors to timely receive their required information for economic and financial decision-making purposes at minimum costs and in the shortest possible time and with the least error. In addition, market liquidity reduces the risk of asset selling, so as the more liquid a market is the quicker an asset can be sold.

The CAPM, which is derived from Markowitz (1952) mean-variance based optimal portfolio theory, departs from the assumption of efficient individual portfolios in terms of expected return and risk (standard deviation), and from efficiency of individual portfolios, it suggests efficiency of market portfolio. Efficiency of market portfolio implies that the difference in the expected return of individual securities or portfolios is explainable only by difference in their market beta. This excludes the likely role of other variables in explaining or determining the expected return of securities (Fama & French, 2004). The CAPM model basically assumes fully liquid markets, while in reality the markets (especially emerging markets) are not so and are exposed to various types of risk such as illiquidity risk, and have low information efficiency which may affect the investor's current and expected return.

To date, a large number of studies have been conducted for assessment and prediction of stock return in capital markets of different countries at various intervals. A group of researchers by focus on the capital asset pricing model (CAPM) proposed and explained by Sharpe (1964), Lintner (1965), and later on by Black (1977) suggested market risk factor and its correlation with stock risk as the most salient determinant of stock valuation. Another group of scholars considered the mere reliance on market risk as inadequate and began to define and try out other measures or factors which were likely to influence capital assets valuation.

While the early empirical experiments with CAPM supported its core prediction of a linear relationship between systematic risk (beta) and stock return (e.g. by Block & Schulz, 1972;

Fama & Macbeth, 1973); from 1970s on, various studies (e.g. by Block, Jensen, & Schulz, 1972; Fama & Macbeth, 1973; Blum & Friend, 1975; Francis, 1983) demonstrate that the single-factor CAPM model lacks the explanatory power for prediction of expected return. More recent studies suggest that apart from beta, there are other variables (not considered within the CAPM framework) which contribute to stock return, such as firm size (Banz, 1981; Kim, 1983), earnings-price (E/P) ratio (Basu, 1977; Ball, 1978; Basu, 1983), book-to-market ratio (Stattman, 1980; Rosenberg et al., 1985), financial leverage (Bhandari, 1988), information quality and market information efficiency (Ng, 2011; Lambert, Leuz, & Verrechia, 2006), and liquidity (Amihud, 2002; Pastor & Stambaugh, 2003; Liu, 2006; Sadka, 2011).

The Three-Factor Model: Definition and Structure

Fama and French (1993), Pastor and Stambaugh (2003), Acharya and Pedersen (2005), Liu (2006), Lischewski and Voronkova (2012) and others, adding one or more independent variables to the capital asset pricing model, proposed models which they showed to be superior to the original CAPM in explaining return sensitivity.

This study, based on the prior empirical researches, provides a theoretical model for explanation of stock excess return. More specifically, in this study, the factor financial information quality is added to the two-factor model of Liu (2006) which is a liquidity-adjusted capital asset pricing model (L-CAPM). Applying this model to the financial information obtained from the TSE, we intend to demonstrate superiority of the proposed model in this study relative to the CAPM and L-CAPM in explanation of the excess return.

Liquidity

Liquidity is generally described as the ability to trade large quantities quickly at low cost with little price impact. This description indicates four liquidity dimensions: trading quantity, trading speed, trading cost, and price impact (Liu, 2006).

High liquidity in an exchange indicates the exchange success in information transparency and approximation of security prices to their intrinsic value. Highly liquid stocks normally involve lower holding risk because of their high rate of conversion into cash. Therefore, investors, given their risk-averse nature, tend to choose highly liquid stock (Saeedi & Dadaar, 2009).

Secondary markets liquidity is crucial to success of initial public offerings (IPOs), reducing the costs of underwriters and market-makers. Besides, there would be a reduction in the cost of investors because of reduced trading amplitude and transaction costs. Hence, from a macro perspective, presence of liquid capital markets is necessary for efficient capital allocation.

Liquidity is a concept of multiple dimensions, and since there is no single measure to capture all its dimensions, several individual measures have to be used, each of which covering one aspect thereof. Various alternative indicators have been introduced so far for liquidity, including trading value, trade frequency, trading volume, turnover ratio, percentage of trading days during one year, and bid-ask spread (Eslami-Bidgoli & Sarandj, 2011).

Liquidity risk refers to the potential decline in (an asset) liquidity and illiquidity ratio indicates stock price degree of sensitivity to each unit change in its trading volume in one particular day. Illiquidity occurs when stock price has significant changes in reaction to low trading volume (Hasbrouck & Seppi, 2001).

Information Quality

According to financial and accounting literature, higher quality of financial information disclosure by firms helps better identification of investment opportunities by managers and investors and reduces information asymmetry (between them) and thereby promotes and improves firm's economic performance and increases shareholder return.

Increased cost of capital significantly reduces economic efficiency. Therefore, poor information quality in the first place has adverse consequences for the company itself and subsequently for the capital market and the whole national economy.

According to the theoretical concepts of financial reporting, the purpose of financial statements is to provide useful, summarised, and classified information on enterprise financial position, performance, and flexibility to a wide range of users for economic decision making. To realise this purpose, the provided information should, firstly, be relevant and reliable and secondly, be intelligible and comparable. In view of some experts, ignoring the importance of accounting information quality causes the following problems:

1. Increased uncertainty (ambiguity);
2. Higher risk as a result of increased uncertainty;
3. Demanding a higher rate of return by investors as a result of higher risk; and
4. Rise in cost of capital and decline of stock prices due to increased investor demand.

Increased cost of capital significantly reduces efficiency of the economy. Thus, poor quality of information would, in the first place, negatively affect the enterprise itself and subsequently, the whole economic system (Dianati, 2009).

RESEARCH LITERATURE AND THEORETICAL BACKGROUND

Empirical testing of the capital asset pricing model indicated that market risk was not the only factor contributing to expected rate of return. Over 1980s, economists turned their attention to the factors which questioned market efficiency and other assumptions of the CAPM. The non-conventional factors included both accounting information and market information. Investors accept assets with higher risk when it provides them a higher return. Hence, one of the factors associated to asset risk is its liquidity. The lower the stock liquidity is, the less attractive it becomes (to the investor). Liquidity risk is a return-related risk arisen from price impact of the order flow which is added to market risk in a model based on lack of perfect competition and cannot be diversified away (Ng, 2011).

Liquidity of an investment is low when its fair price is not quickly obtained. Stock liquidity degree is of influence in decisions of investors on construction of investment portfolios. In other words, investors demand a higher risk premium for a share with lower liquidity and their expected return for such stock will be higher. Hence, there is a negative relationship between stock liquidity and return at the level of small structures, because lower liquidity is equal to higher risk and higher risk is accompanies with greater return. However, at the macro level and countrywide, higher stock liquidity is likely to contain new information for gradual stock changes which will result in increased rate of return (Bortolotti, De Jong, Nicodano, & Ibolya, 2006).

The results of subsequent researches by Amihud (2002) indicated a negative relationship between the stock expected return and liquidity. In his researches, he demonstrated that part of the stock excess return is the compensation for the expected market illiquidity. The studies by Amihud and Mendelson (1986), Brennan and Subrahmanyam (1996), Datar et al. (1998), Jacoby, Fowler, and Gottesman (2000), Marshall (2006) suggest a negative association between asset liquidity and expected return.

Acharya and Pedersen (2005) provide a capital asset pricing model in which the relationship between market expected return and a share expected liquidity. They suggest that simultaneous effect of liquidity on stock return in short term is small and in long term is greater.

Deuskar (2006) provides a model for study of stock liquidity behaviour and price volatility. In this model, investors predict recent price changes. He suggest a high risk premium with high price volatility, and a low return on risk-free assets with low asset current return and the market will not be liquid. On the other hand, illiquidity boosts supply shock.

Martinez, Nieto, Rubio, and Tapia (2005) investigated three different liquidity measures in relation to mean return on the Spanish stock market. According to their findings, none of the liquidity indicators represented systematic liquidity risk in Spain.

Lam and Tam (2011), applying 9 liquidity measures, investigated the role of liquidity factor in asset pricing on Hong Kong stock market and found a four-factor model comprising market excess return, size, book-to-market ratio, and liquidity explains the best stock return behaviour on this market.

Kaniel, Ozoguz, and Starks (2012) investigated risk premium in 41 countries and found that risk premium was not a result of systematic differences in risk or liquidity. Their findings did not indicate any significant relationship between size of the market risk premium and liquidity indicator (i.e. stock turnover ratio) and attributed the size of risk premium to firm- and country-specific characteristics.

Hsieh et al. (2012) examined the factors potentially contributing to changes in stock price of the New York Stock Exchange (NYSE) and National Association of Securities Dealers Automated Quotations (NASDAQ) and identified liquidity factor and the effect of stock movement trend as the most significant factors associated to stock price, whereas stock market value and book-to-market ratio had no part in stock price changes.

Pastor and Stambaugh (2003) demonstrated that in the standard asset pricing theory, stock expected return is systematically related to return sensitivity (beta) which is indicator of the variables with significant impact on overall welfare of investors. They estimated covariance of a company's stock return to unexpected changes in total liquidity (liquidity beta) and then, presented this model which included liquidity risk with the three-factor model of Fama and French (1993) (Ng, 2011).

Lang and Maffett (2011) suggested that companies with higher information transparency (quality) experience lower liquidity volatility.

Liu (2006) believes that the capital asset pricing model and the three-factor model of Fama and French are not able to adequately explain the effect of liquidity premiums on stock returns. Including liquidity factor in the CAPM, he addresses the effect of liquidity and market risk on the investor expected return using the monthly data of NASDAQ, NYSE, and AMEX from January 1964 to January 2003. He finds that the two-factor model (i.e. liquidity and market risk) better than the CAPM and the Fama and French three-factor model in explaining the cross-sectional returns. The Liu's model is expressed as follows (Liu, 2006):

$$E(r_i) - r_f = \beta_{m,i} \quad E(r_m) - r_f \quad + \beta_{L,i} E(LIQ)$$

Marshall and Young (2006) examine the relationship between common stock excess return on the Australian market and such factors as risk (beta), firm size, the offered buying and selling (bid-ask) price, turnover ratio, and illiquidity ratio. Their results indicated that from among the various illiquidity measures, the proposed ratio by Amihud explained the stock excess return the best.

In his research, "The Effect of Information Quality on Liquidity Risk", Ng (2011) examined stock return sensitivity to unexpected changes in market liquidity. The results indicated that information high quality reduces liquidity risk, and with high changes in market liquidity, there is a negative relationship between information quality and stock liquidity risk. Jeffrey Ng summarises quantification of accounting information quality into three categories:

1. Earnings precision;
2. Accruals quality; and
3. Analyst consensus.

For the first category, he assumes the lower the volatility of the announced earnings by financial statements is, the higher the probability of their relative precision is. To measure volatility, he made use of standard deviation, hence, the smaller the standard deviation of the announced earnings is, the higher the earnings quality and information quality will be.

Also for estimation of the other two categories, standard deviation is used. In all three instances, a lower standard deviation of the obtained values is indicative of higher accounting information quality.

In his study of Liquidity Risk and Accounting Information, Sadka (2011), focusing on the financial and economic crisis of 2008-2009, investigated the relationship of accounting information quality, liquidity and stock return and concluded an evident and significant relationship between quality of accounting information and liquidity. He showed that with reduction of the associated risks to accounting information which is effectuated by increased accounting information quality and reliability, the company's share will become attractive, eventually leading to increased stock liquidity (Haghighat, Nemati, & Alavi, 2014).

Salavei (2011), in study of the 'Quality of Financial Information and Liquidity', examined the relationship between stock liquidity and financial information quality. He found a positive relationship between information quality and stock liquidity (Forooghi & Ghajavand, 2012).

Mouselli, Jaafar, and Hussainey (2012) examined accruals quality versus disclosure quality and their effect on return. The results indicated that high information risk or low accruals quality raises risk of stock return.

Lischewski and Voronkova (2012) inquired into the issue as whether stock liquidity together with firm size and value exercise a significant influence in stock return. The results, contrary to expectation, showed that stock return compared to stock value and firm size did not have any significant effect on stock return (Haghighat et al., 2014).

Hussainey and Mouselli (2010) examined the relationship of disclosure quality and stock return in England. Their study primarily concerned the role that transparency of financial reporting could play in enhancing investors' ability to better predict future earnings. The results suggested financial disclosure quality a crucial factor for the firm cost of capital, so as the companies with poor disclosure quality relative to the ones with high disclosure quality incur higher cost of capital (Khajavi &d Momtazian, 2013).

Researches Inside the Country

GhalibafAsl and Eghbali (2013) applied the two-factor model of Liu (2006) to Tehran Stock Exchange (TSE). Having examined the information of 42 companies during eight financial years, they suggested that the two-factor model (market risk and liquidity) was superior relative to the CAPM in explaining stock return of the TSE-listed companies.

Forooghi and Ghajavand (2012) examined the effect of information quality on stock liquidity of 104 TSE-listed companies in the period 2001-2010 and found a significant relationship between information quality and stock liquidity.

Setayesh et al. (2011) investigated the relationship of information quality with stock liquidity and cost of capital in 105 sample companies from TSE and did not find any significant association between disclosed information quality and stock current and future liquidity in the understudy firms.

RESEARCH HYPOTHESES

As was stated earlier, the purpose of this research is to provide a three-factor model for explanation of stock annual excess return on Tehran Stock Exchange (TSE). At the hand of the proposed model, we are going to test the three following hypotheses:

H1: The three-factor model composed of the factors market, liquidity, and information quality is able to explain stock excess return of the listed companies on TSE.

H2: The three-factor model (market, liquidity, and information quality) performs better than the CAPM in predicting stock excess return in the TSE-listed companies.

H3: The three-factor model (market, liquidity, and information quality) performs better than the two-factor model (market and liquidity) in predicting stock excess return in the TSE-listed companies.

DATA

The statistical population of this research includes all listed companies on Tehran Stock Exchange with active trading record during 2007 through to 2013. From this population, after exclusion of the investment and financial firms and the companies whose data was not available for the understudy period and considering the active companies whose shares within at least 100 days and over at least 9 months a year had been traded, 72 companies were finally selected as the research sample.

THE REGRESSION MODELS

For test of the hypotheses, three regression models are applied. The first model deals with the relationship of the market excess return and the company excess return which is derived from the capital asset pricing model.

1[1]. $$R_{i,t} - R_{f,t} = \alpha + \beta_m \times (R_{m,t} - R_{f,t})$$

The second model is the two-factor model composed of market and liquidity factors which is proposed by Liu (2006):

2. $$R_{i,t} - R_{f,t} = \alpha + \beta_m \times (R_{m,t} - R_{f,t}) + \beta_l \times LIQ_{i,t}$$

The third model is the three-factor model consisting of market, liquidity, and information quality factors which is presented in this research and is assumed to be more efficient and effective than the single-factor and two-factor models. Considering the most essential needs of the operators on stock exchanges, that is, having accurate, updated, transparent, and reliable financial information, capable of logically predicting future cash flows (information quality), as well as the possibility of trading in the shortest possible time with the least transaction cost (liquidity), based on the on the capital asset pricing model (CAPM) and drawing on the prior research by Amihud (2002), Pastor and Stambaugh (2003), Liu (2006), Ng (2011), Sadka (2011), and GhalibafAsl and Eghbali (2014) in Iran, the following model is proposed to examine the effect of information quality, liquidity, and systematic on stock excess return:

3. $$R_{i,t} - R_{f,t} = \alpha + \beta_{MKT} \times (R_{m,t} - R_{f,t}) + \beta_{LIQ} \times LIQ_{i,t} + \beta_{IQ} \times IQ_{i,t}$$

where,

$R_{i,t}$: stock return of firm i in year t

$R_{f,t}$: risk-free return in Iran in year t

$R_{m,t}$: mean market return in year t

$LIQ_{i.t}$: liquidity of firm i in year t

$IQ_{i,t}$: accounting information quality of firm i in year t

THE METHODS

In the regression model of this research, five variables are used. The research models are assessed applying time series method to the financial information of 72 listed companies on TSE during a 7-year period (from 2007 through to 2013). The annual excess returns of the companies which is the dependent variable is obtained from the company's annual return minus the risk-free return during the understudy years. And the variable market excess return is the difference between the market return and the risk-free return. The independent variables are market factor (beta), liquidity factor, and information quality which in the following will be separately discussed.

Independent Variable

Market Excess Return

CAPM as the most frequently applied model today is actually used for a wide range of purposes in the field of financial and investment management, such as estimation of cost of equity, estimation of discount rate for long-term investment projects, etc. The CAPM model is particularly attractive for the equilibrium condition that it establishes between risk and asset expected return.

$$E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

In which,
$E(R_i)$: expected rate of return on security i
R_f: Risk-free rate of return
β_i: Systematic risk of security i
$E(R_m)$: expected rate of return on market portfolio

1 For such exchanges as New York Stock Exchange (NYSE) and London Stock Exchange (LSE) with greater number and diversity of the traded stocks and fewer public holidays, 200 hundred days are set as the minimum working days. However, this differs in each country, given its specific condition. For example, minimum days by Amihud are considered 200 days, by Marshall 150 days, and by Gallus 100 days (Khorramdin, 2008).

2 Proposing an innovative measure called standard turnover ratio based on the number of days with zero trading volume by emphasising on trading speed, Liu (2006) provides his definition of liquidity (Abzari et al, 2013). However, in this study, it is made use of the defined measure by Amihud (2002), in which trading volume and stock return at time periods were used as liquidity measure.

Statistically speaking, beta is covariance of the security return with market portfolio return divided by variance of the market portfolio return:

$$\beta_i = \mathrm{Cov}(R_i, R_m) / \mathrm{Var}(R_m)$$

Hence, for calculation of excess return, we have:

$$R_i - R_f = \beta(R_m - R_f)$$

For calculation of market return (Rm), it is made use of Tehran Stock Exchange all-share price and return index during the understudy years as follows:

$$R_m = \mathrm{TEDPIX}_t - \mathrm{TEDPIX}_{t-1} / \mathrm{TEDPIX}_{t-1}$$

In which, TEDPIX_t represents all-share price index in year *t* which is calculated based on the obtained information from TSE and the rate of the government bonds announced by the Central Bank of Iran used as the risk-free return.

Table 1: Risk-free and Market Rate of Return

Year	2007	2008	2009	2010	2011	2012	2013
R_f	16%	16%	12%	14%	17%	17%	22%
R_m	2.7%	-21%	57.4%	85.8%	11.2%	46.8	100%

Source: Central Bank of Iran

The Model Measuring Financial Reporting Quality

Accounting literature adopts several alternative and interrelated approaches to measurement of accounting information quality.

Methods based on Corporate Accounting Information

The earliest writing on quality of accounting information is focused on earnings management and managerial manipulation of account as the main cause of reduced accounting information quality. Subsequent studies refer to such factors as uncertainty regarding company's activities. Dechow and Dichev (2002) assessed accounting information quality in terms of firm size, operational life cycle, sales and cash flows volatility, loss succession, and the amount of accruals. These measures are based on two main factors: uncertainty and management authority in manipulation of earnings items (Lee Gemma, 2008).

Methods based on Market Information

Second group of researches applies methods for quantification of accounting information quality. For instance, a number of studies in this area assess quality of the published accounting information based on the impression they make on decisions of the users, especially investors. In these researches, accounting information quality is determined based on the degree of statistical relationship between price and published accounting measures. The researches by Lee Gemma (2008) and Dechow(1996) belong to this group of studies (Rahmani, Yousefi, & Robaat, 2012).

Another group of studies is focused on information quality and its impact on performance of management decision making system. These studies are internally oriented and rely on detailed information on the business unit, and in definition of qualitative make mostly use of non-financial information and lay the stress on decision support systems.

In line with Dechow and Dichev (2002), Francis et al. (2005), Verdi (2006), Kim et al. (2008), Rajgopal and Venkatachalam (2010), Ng (2011), Sadka (2011), Nekrasov (2012), Moon and James (2014), Lyle (2014), and in Iran, Saghafi et al. (2013), Rahmani et al. (2012), Modarres et al. (2010), and Rastegar Moghaddam (2011), in this study, accruals quality is used as an indicator of financial information quality.

The first proxy of accruals quality (DD) is based on the model of Dechow and Dichev (2002) which was modified by Francis et al. (2005). The relationship between accruals and cash flows is expressed by the DD-model as follows:

$$\mathrm{TCA}_{it} = \varnothing_0 + \varnothing_1 \mathrm{CFO}_{it-1} + \varnothing_2 \mathrm{CFO}_{it} + \varnothing_3 \mathrm{CFO}_{it+1} + \nu_{it}$$

The DD measure is based on the idea that accruals map into past, present, and future cash flows. Firms with greater errors in this mapping process are considered to have lower-quality earnings and thus lower IQ (Lyle, 2014).

Francis et al. (2005) modified the DD-model by controlling for two important determinants of accruals, viz. growth in revenues and the level of property, plant and equipment (Rajgopal and Venkatachalam, 2010).

$$\mathrm{TCA}_{it} = \varnothing_0 + \varnothing_1 \mathrm{CFO}_{it-1} + \varnothing_2 \mathrm{CFO}_{it} + \varnothing_3 \mathrm{CFO}_{it+1} + \varnothing_4 \Delta\mathrm{REV}_{it} + \varnothing_5 \mathrm{PPE}_{it} + \nu_{it}$$

Regression residual which comprises discretionary accruals is used as the indicator of financial reporting quality in test of the hypotheses, i.e. accruals quality is equal to standard deviations of the estimated residuals of company j in year t so as the greater its value is, the lower the accruals quality will be.

$$\text{Accrual Quality}_{j,t} = \delta(\nu_{j,t})$$

The theoretical basis of the above model is that accruals should be explained by cash flows of previous, current, and next periods. The errors values resulting from accruals regression implies that accruals are irrelevant to identification of cash flows. Therefore the smaller the error values resulting from this model (vj,t) are, the higher the quality of accruals and thus, the quality of financial reporting will be (Modarres & Hessarzadeh, 2008).

The operating cash flow is calculated from the following relation:

$$CFO_{i,t} = NI_{i,t} - \left(\Delta CA_{i,t} - \Delta C_{i,t}\right) - (\Delta CL_{i,t} - \Delta STD_{i,t})$$

In which,

$NI_{i,t}$: net income of firm i between t -1 and t

ΔCA: change in the firm's current assets

ΔC: change in the firm's cash holding

ΔCL: change in the firm's current liabilities

ΔSTD: change in the firm's accounts payable and short-term debts

The second accrual-based indicator, (AV) follows from Tucker and Zarowin (2006) and Rajgopal and Venkatachalam (2010) and is based on the modified Jones cross-sectional model (1991). Like DD proxy for IQ, the AV proxy uses the variance of discretionary accruals as an estimate of IQ (Lyle, 2014).

In this research, we use the modified Jones model as the proxy of information quality which is obtained from the following equation:

$$TA_{it} = \beta_0 + \beta_1 \times {}^{1}\!/_{AveAssets_{it}} + \beta_2 \Delta REV_{it} + \beta_3 PPE_{it} + \beta_4 ROA_{it} + \upsilon_{it}$$

The Calculation Model of Stock Illiquidity

Liquidity is an elusive concept. It is not observed directly but rather has a number of aspects that cannot be captured in a single measure (Amihud, 2002). In the recently conducted researches on liquidity some of which has been referred to in section research literature, in total, 15 measures within two transactional (transaction-based) and informational (order-based) approaches have been applied whose operational definitions are as follows:

Transactional Measures

1. **Number of Trading Days:** It refers to number of days in which within a specific time interval share trading occurs.
2. **Trade Frequency:** It measures how frequently a stock trades in a year.
3. **Trading Volume:** It s the number of share traded during a given period of time.
4. **Trading Value:** It is the product of share trading price multiplied by trade volume.
5. **Percentage of Free Float (floating shares):** It is the portion of the company's outstanding shares (in the hands of public investors) available for trading.
6. **Share Turnover (ratio):** It indicates volume of (the company's) traded shares divided by number of outstanding shares within a specific time period.
7. **Float Turnover:** It is obtained from dividing volume of traded shares by number of floating shares.
8. **Average Waiting Times:** It refers to the time difference between two successive trades in a share which is often calculated on average within a specific time period. Due to calculation of this measure on an annual basis, the number 240 representing the number of tradable days is placed on numerator.
9. **Flow ratio:** It is obtained from trading value divided by trade waiting interval.
10. **Amihud Illiquidity Ratio:** The shares in which Amihud illiquidity ratio is high has significant price change against small trade volume. This ratio is expressed as absolute return value divided by trading volume within a specific time interval.
11. **Amivest Liquidity Ratio:** It measures trading value of a share by each percent change in its price, given in a time period, and is calculated as a share trading value divided by absolute return absolute.
12. **Liquidity Rating:** This rating is calculated and reported by one of the investment consultation firms. The greater the number of rating is, the lower the share liquidity is.

Informational or Order-based Indicators

Informational measures, unlike transactional measures that are calculated annually, require daily data at specific hours.

13. **Rial depth:** It is obtained from number of the shares ordered for buying times the offered buying (bid) price plus number of the shares offered for sale times the offered selling (ask) price.
14. **Absolute Gap between Offered Buying and Selling Price:** It is the difference of the offered buying and selling prices (bid-ask spread).
15. **Relative Gap between Offered Buying and Selling Price:** It is the offered buying and selling price difference (bid-ask spread) divided by the average quoted prices (Rahmani, Hosseini, & Rezapour, 2010).

In present research, given the earlier researches by Acharya and Pedersen (2004), Marcello et al. (2006), Liu (2006), Marshall and Young (2006), Lang and Maffett (2011), Sadka (2011), and Kerr et al. (2013), Amihud measure was used as

the proxy of liquidity (illiquidity) factor.

Amihud illiquidity ratio for stock i in year y is calculated from the relation below:

$$ILLIQ_{i,y} = \frac{1}{D_{i,y}} \times \sum_{t=1}^{D_{i,y}} \frac{|R_{iyd}|}{VOLD_{ivyd}}$$

Here, illiquidity is defined as the mean ratio of the realised daily returns on stock i to the total trading volume in that day.

Diy: number of days on which information of stock i in year y is available

Riyd: return on stock i on day d and in year y

VOLDivyd: stock annual trading volume

The intuition behind this illiquidity measure is as follows. A stock is illiquid—that is, has a high value of ILLIQit, if the stock's price moves a lot in response to little volume (Acharya & Pedersen, 2005).

Dependent Variable

Dependent variable in this research is stock excess return in the understudy companies which is the difference of the company annual return and the annual risk-free return in Iran. The return on stock iis calculated from the formula below:

$$R_{i,t} = P_{i,t} - P_{i,t-1} + D_{i,t} / P_{i,t-1}$$

in which, $R_{i,t}$ is return on stock *i* in month *t*, $P_{i,t-1}$ and $P_{i,t}$ are prices of stock i in the beginning and end of the period, respectively, and $D_{i,t}$ dividend of each stock during period *t*. It should be noted that the benefits from increase of the firm's capital are considered as part of the stock return which are not included in this study and only cash return and price return were focused on.

The three-factor model used in this research is made up of the Jensen's alpha, market beta, Amihud's liquidity model and modified Jones IQ model as presented below:

$$R_{i,t} - R_{f,t} = \alpha + \beta_{MKT} \times (R_{m,t} - R_{f,t}) + \beta_{LIQ} \times LIQ_{i,t} + \beta_{IQ} \times IQ_{i,t}$$

where,
$R_{i,t}$: stock return of firm i in year t
$R_{f,t}$: risk-free return in Iran in year t
$R_{m,t}$: mean market return in year t
$LIQ_{i,t}$: Amihudliquidity of firm i in year t
$IQ_{i,t}$: modified Jones information quality of firm i in year t

THE MODEL ANALYSIS

The results of the descriptive statistics are presented in the appendices at the end of this article. For the proposed model in this research, the Durbin-Watson (D-W) statistic (2.217) confirms absence of autocorrelation between the residuals (Table 2). In addition, the results of F test with 95 percent confidence confirm significance of the relationship between the independent variables and dependent variable. Therefore, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) on presence of a statistically significant relationship between the independent variables and the dependent variable is confirmed. The results of the model analysis are summarised in Table 2.

Table 2: The Results of the Three-factor Model Analysis

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029487	0.027170	-1.085279	0.2784
LIQ	1670.147	204.4208	8.170146	0.0000
IQ	0.089708	0.111470	0.804771	0.4214
RM_RF	0.854189	0.055152	15.48792	0.0000
Weighted Statistics				
R-squared	0.528339	Mean dependent var	0.276745	
Adjusted R-squared	0.447483	S.D. dependent var	1.094415	
S.E. of regression	0.820661	Sum squared resid	282.8634	
F-statistic	6.534313	Durbin-Watson stat	2.217010	
Prob(F-statistic)	0.000000			

Source: Research findings

As it can be seen in Table 2, the p-value (0.0000) from F (prob (F-statistic)) confirms significance of the whole regression model at 99 percent confidence. The adjusted coefficient of determination (R2 = 0.447) indicates that nearly 45% of changes in the dependent variable can be explained by the model variables.

SUMMARY AND CONCLUSION

In this research, drawing on the literature and the recent empirical findings in the area of financial markets, a regression model was proposed to examine the role of the three independent factors, i.e. risk premium (beta), disclosed financial information quality, and securities liquidity, in explaining the listed stock excess return on TSE using time-series method. Three hypotheses were made for test of which, three regression models using financial data from TSE were analysed and estimated. The results of the analysis which are summarised in Table 3 will be discussed in the following paragraphs.

Table 3: The Obtained Results from Analysis of the Research Models

	R2	Adjusted R2	Prob
CAPM	45.5%	36.4%	0.0000
Two factors	52.3%	44%	0.0000
Three factors	52.8%	44.7%	0.0000

Source: Research findings

For the first hypothesis:

Based on the obtained results from data analysis, at 99% confidence (Prob), none of the coefficients of the independent variables is zero, indicating affectability of stock return premium from liquidity and information quality. In addition, the adjusted R-squared (44.7%) indicates that the three-factor model proposed in this study is able to explain up to about 45 percent of the changes in return premium of the listed stocks on TSE.

For the second hypothesis:

Based on the obtained results from data analysis, at 99% confidence (Prob), none of the coefficients of the independent variables is zero, indicating affectability of stock return premium from market return premium. Therefore, the CAPM ability in explaining dispersions of the listed stock return during the understudy period can be accepted. This result is consistent with the results of Tang and Shum (2005), Rezayee Moghaddam (2010) and GhalibafAsl and Eghbali (2013). Also, considering the higher adjusted R2 than that of the single-factor model CAPM, it can be concluded that the three-factor model consisting of market return premium, liquidity, and information quality relative to the CAPM can better explain changes in stock excess return, hence the second hypothesis is confirmed.

For the third hypothesis:

Based on the obtained results from data analysis, at 99% confidence (Prob), coefficients of the independent variables market return premium and liquidity are non-zero, indicating affectability of stock return premium from market return premium and liquidity. Comparison of the adjusted R-squared of single-factor model and two-factor model reveals greater explanatory power of the two-factor model relative to the single-factor model (CAPM). These results are consistent with the results of Acharya and Pedersen (2005), Liu (2006), and GhalibafAsl and Eghbali (2013). Similar to the proof of the second hypothesis, as presented in Table 3, from comparison of the adjusted R-squared of the two models, the superiority of the three-factor model relative to the two-factor model in explanation of the dispersions in stock excess return on TSE can be inferred, though the difference is small. Hence, the third hypothesis is confirmed as well.

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APPENDICES

RESEARCH RESULTS

First, the descriptive statistics are provided and then, based on the explained statistical testing procedures, the research data is analysed for variance heteroscedasticity and the assumed correlations. Next, by analysis of the developed regression model and verifying significance of the model and coefficients of the variables, the research hypotheses were tested.

Table A presents the summary statistics of the used variables in this research. The reported summary statistics comprises the measures of central tendency, i.e. mean and median, and dispersion, i.e. standard deviation and variance of the understudy variables.

Table A: Summary Statistics of the Research Variables

Variables of the Modified Jones Model of Information Quality

	TAC	_1_ASS	REV_ASS	PPE_ASS
Mean	0.107037	1.92E-06	0.231765	0.273795
Median	0.054647	1.28E-06	0.172958	0.230839
Maximum	1.281450	1.18E-05	1.709636	0.838575
Minimum	-0.911024	3.02E-09	-0.980671	0.018639
Std. Dev.	0.256285	1.98E-06	0.394307	0.177466
Skewness	1.382951	1.809233	0.636263	0.986829
Kurtosis	6.682099	7.092419	4.709138	3.679416
Jarque-Bera	439.1836	617.9615	94.02569	90.22471
Probability	0.000000	0.000000	0.000000	0.000000
Sum	53.19723	0.000956	115.1870	136.0761
Sum Sq. Dev.	32.57831	1.94E-09	77.11720	15.62114
Observations	497	497	497	497

Variables of the Three-Factor Model

	RI_RF	RM_RF	LIQ	IQ
Mean	0.263059	0.252299	4.61E-05	1.43E-07
Median	-0.064184	0.298424	8.83E-06	-0.022429
Maximum	6.679510	0.857101	0.002098	0.974361
Minimum	-1.849168	-0.369780	-0.000243	-1.360176
Std. Dev.	1.007799	0.424237	0.000158	0.236647
Skewness	2.496728	0.004764	6.925124	0.592450
Kurtosis	11.90467	1.610214	74.59332	7.422058
Jarque-Bera	2158.383	40.00013	110115.2	434.0174
Probability	0.000000	0.000000	0.000000	0.000000
Sum	130.7401	125.3924	0.022924	7.13E-05
Sum Sq. Dev.	503.7670	89.26873	1.24E-05	27.77689
Observations	497	497	497	497

Analysis of the Nature and Characteristics of Research Variables

In present research, the variables are measured in ratio scale, and linear relationship is assumed between the independent and dependent variables. To determine the linear relationship between the variables, the overall regression coefficient is used. Finally, to examine the effect of the independent variable on the dependent variables regression analysis is performed.

Analysis of the Frst Model (the CAPM single-factor model)

Test of autocorrelation: To verify absence of autocorrelation in the model, Durbin-Watson test is performed. Given the obtained D-W statistic in table D(2.23), there is no autocorrelation between the residuals.

Test of significance of the fixed effects method: For this purpose, F-test and Hausman test are performed.

Table B: The Results of F-test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.097828	(70,425)	0.0277

Table C: The Results of Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.723290	1	0.0004

Given the obtained significance values (Prob) from F- and Hausman tests which are both smaller than the predefined significance level of 0.05, fixed effects method should be used in the regression model.

Results of Test of the First Model

Table D: The Results of the Analysis of the Single-Factor Model (CAPM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.022108	0.028235	0.782995	0.4341
RM_RF	0.955022	0.057246	16.68271	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.455240	Mean dependent var		0.294436
Adjusted R-squared	0.364234	S.D. dependent var		1.120862
S.E. of regression	0.899608	Sum squared resid		343.9504
F-statistic	5.002264	Durbin-Watson stat		2.230461
Prob(F-statistic)	0.000000			

As it can be seen in Table D, significance level of the CAPM single-factor model is smaller than 0.05, and the hypothesis of a statistically significant relationship between the independent variables and the dependent variable with 99 percent confidence is accepted. The adjusted coefficient of determination (R2 = 0.3642) indicates that about 36 percent of changes in the stock excess return is explained by the market risk premium. This result is consistent with most of the prior studies on relationship of market risk with excess return.

Analysis of the second model (the two-factor model comprising market and liquidity factors)

Test of Autocorrelation

Test of significance of the fixed effects method: For this purpose, F-test and Hausman test are performed.

Table E: The Results of F-Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	5.223164	(70,420)	0.0206

Table F: The Results of Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.649378	2	0.0007

Given the obtained significance values (Prob) from F- and Hausman tests which are both smaller than the predefined significance level of 0.05, fixed effects method should be used in the regression model.

Results of Test of the Second Model

Table G: The Results of the Analysis of the Two-Factor Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.036455	0.026823	-1.359125	0.1748
RM_RF	0.840002	0.053906	15.58259	0.0000
LIQ	1673.301	201.0377	8.323323	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.523219	Mean dependent var		0.297742
Adjusted R-squared	0.440938	S.D. dependent var		1.152588
S.E. of regression	0.868644	Sum squared resid		319.1716
F-statistic	6.358900	Durbin-Watson stat		2.244507
Prob(F-statistic)	0.000000			

As it can be seen in Table G, relationship between the independent variables and the dependent variable is significant at 99 percent confidence. The adjusted coefficient of determination (R2 = 0.4409) indicates that about 44 percent of changes in the stock excess return is explained by the market risk premium.

Analysis of the third model (the three-factor model comprising market, liquidity and information quality)

Test of Autocorrelation

Test of significance of the fixed effects method: For this purpose, F-test and Hausman test are performed.

Table H: The Results of F-Test

Test cross-section fixed effects			
Effects Test	Statistic	d.f.	Prob.
Cross-section F	3.196901	(70,423)	0.0473

Table I: The Results of Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	14.616411	3	0.0022

Given the obtained significance values (Prob) from F- and Hausman tests which are both smaller than the predefined significance level of 0.05, fixed effects method should be used in the regression model.

Results of Test of the Third Model

Table J: The Results of the Analysis of the Three-Factor Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.029487	0.027170	-1.085279	0.2784
LIQ	1670.147	204.4208	8.170146	0.0000
IQ	0.089708	0.111470	0.804771	0.4214
RM_RF	0.854189	0.055152	15.48792	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.528339	Mean dependent var		0.276745
Adjusted R-squared	0.447483	S.D. dependent var		1.094415
S.E. of regression	0.820661	Sum squared resid		282.8634
F-statistic	6.534313	Durbin-Watson stat		2.217010
Prob(F-statistic)	0.000000			