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Investigation of the Role of Human Capital Factor in Explanation of Adjusted Returns Based on Market Factor, Size Factor and Value Factor in Tehran Stock Exchange

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ABSTRACT

The main approach to portfolio performance evaluation involves considering return on investment along with its accompanied risk. In addition, a criterion for superiority of portfolio performance is adjusted returns based on risk. In this process, risk explanation models development play an important role. The main target of the present research is to investigate the role of human capital factor in explanation of adjusted returns based on market factor, size factor and value factor in Tehran Stock Exchange over 2006-2011. Multifactor regression based on three-factor model was used in this research. Results showed that human capital value has a negative and significant relationship with stock returns, market value has a positive significant relationship with stock returns and company size has a negative and significant relationship with stock returns. Results also showed that there is a positive and significant relationship between book-to-market value and stock returns.
KEYWORDS: human capital, stock returns, three-factor model, book value.

INTRODUCTION

One of the important advances in financial theory within the past few decades is quantification of risk discussions. If we are able to measure financial and pricing risks correctly, we van valuate risk assets properly. This, in part, increases efficiency and optimum assignment of resources in financial system. Investors will be able to allocate their savings to different securities with different risks. On the other hand, managers will be able to make much of shareholders' investments (Erfani, 2014).

Harry Maqueetz (1952) propounded a model for capital assets pricing. In his model, an investor selects a portfolio at (t-1) time and acquires a random ROI at time t. this model assumes that investors are risk-averting and only pay attention to mean and variance of single-period ROI when selecting a portfolio. Consequently, investors select "efficient mean-variance" portfolios. Therefore, Marquitz's approach is usually called Mean-Variance (MV) model (Bagherzadeh, 2005).

Trainer, Sharp and Lintner added two main assumptions to Marquitz's model for identification of efficient mean-variance portfolio. The first assumption is that investors agree completely on distribution of return on assets since t-1 time. The second hypothesis is borrowing and lending with riskless rate. They introduced capital assets pricing model (CAPM) using these two assumptions (Kimiagari et al, 2007).

After introduction of CAPM model, many studies were conducted to explain expected stock returns and promote the model. Fama and French's studies (2014) are good examples of these attempts. In their three-factor model, they tried to add size factor and book-to-market value to the model and identify CAPM's inconsistencies in explaining expected stock returns. Despite challenges, this model was successful in different tests and it can be said that it is now beyond a research model and it is used by stock market experts for evaluation of portfolios performance based on alpha coefficient (Fama, 1996). There are different factors which affect company value and its ROI in pricing models. Productivity is one of these factors. In spite of the fact that, the impact of productivity on ROI has received a lot of attention in the recent foreign studies, internal financial studies have paid less attention to the influence of productivity on ROI. In its general and managerial concept, productivity has includes many indices. Productivity deals with the way of applying corporate resources. Human resource and capital are important corporate resources. In the present research, we consider human capital productivity and measurement of its impact on assets pricing (Pour Heidari, 2013).

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Research background

Before 1964, traditional financial theories viewed risk as a financial factor. In 1964, the first capital assets pricing model was introduced by William Sharp. In fact, he completed Marquitz's new portfolio theory and created a turning point in CAPM models. Sharp introduced his single-factor model by explaining sensitivity coefficient of stock returns to market returns (Beta coefficient) as risk factor. In this model, all securities are affected by general market variations and all risk resources are insignificant and considered as non-systematic risk except for market factor. Generalizability of this model was tested in different studies e.g. Black test, Jenson and Showelz's study and Fama and Macbeth's study (Chan, 1991). Studies showed that although there is a linear and direct relationship between systematic risk and stock returns, there are some other factors in addition to systematic risk resulted from market factor, which are related to stock returns changes and returns variations can be explained very well if we consider them. Therefore, Arbitrage's pricing theory was proposed in 1976 by Stephan Ross. In 1980T Ross and Richard Role tried to explain its features. Although Arbitrage's model as a multifactor model and explained stock returns sensitivity or portfolio's sensitivity to each factor but it did not provide any information about the nature of these factors and did not specify them. Therefore, characterization of these factors was a serious challenge in this theory (Chirstos, 2009).

It can be said that the most important multifactor model ever presented is Fama and French's three-factor model. In this model, market factor, value factor and size factor were considered as factors which determine expected stock returns. This model was successful in removing many returns inconsistencies which are not explained by CAPM model. In this model, the intercept (alpha) is zero and determination coefficient of the model is improved. Some criticisms concerning out-of-sample results challenged the three-factor model in studies like Black and McKienly (Fama, 1998). However, subsequent studies like Chan et al (1991), Kapal et al (1993), and Fama and French (1998) provided some evidence for rejecting the proposed criticism. Moreover, studies conducted by Rozenberg et al (1985), Laknishok et al (1994), Davis et al (2002), Kohen et al (2003), Jiang and Cooler (2007) and Penman et al (2007) verified presence of value in this model (Penman, 2007).

Although the three-factor model had acceptable results, there are still many studies dedicated to finding factors which affect expected stock returns in addition to the three common factors: market, size and value. For instance, Al-Hourani Pop and Stark (2003) showed that addition of R&D factor to the three-factor model can increase explanatory power of this model significantly (Fama, 1993).

Productivity is also a factor the impact of which on companies 'returns has received a lot of attention. Campbel and SHaler (2001) dealt with productivity concept and its relationship with ratios predicting corporate value. They investigated human resource productivity in their research and considered product to person-hour ratio like the definition presented in Robert Gordon's research (2000). They introduced productivity as another index for explanation of corporate value (Campbell, 2001). Helman et al (2002) also found a positive relationship between stock returns and productivity indices and showed that stock returns has a relationship with productivity until two years after improvement of reduction of productivity.

Loujang (2005) investigated the influence of productivity and its change on value and growth stock returns. He showed that differences in companies' productivities can determine a share's growth or value characteristic. Further, difference in productivity results in difference in risk and expected stock returns. He also emphasized that productivity has a direct impact on growth or value stock investment rate and growth companies are more productive. Finally, Jang stated that productivity can be used as an estimator of future stocks prices. Kohen, Palk and Weltinahou (2003), companies were ordered based on book-to-market value ratio and the produced returns difference was called value margin.

Studies conducted by fadayee Nejad and Eivazlou (2006), Tarami (2006), Kimiagari et al (2006), Agha Beigi (2006), Bagher Zadeh (2005), Raee abd Shoukhi Zadeh (2006) and ISlami Bidgoli and Khojasteh (2008) investigated Fama and French's three-factor model in Tehran Stock Exchange. Some contradictions can be observed in the results of the mentioned studies. For example, Eivazlou and fadayee Nejad (2006) verified that a value portfolio has a higher returns with respect to growth return. However, Raee and Shoukhi Zadeh (2006) verified that growth ROI is more than value ROI.

Eslami Bidgoli and hojasteh (2008) used ROIC (ratio of invested capitals) as a capital productivity criterion in companies. They concluded that inclusion of productivity factor in the three-factor model can increase the model's explanation abilities and improve adjusted determination coefficient and explain inconsistency of additional returns resulted from capital productivity (Eslami Bidgoli, 2008).

Research hypothesis

Human capital factor has a significant impact on determination of companies' values.

Market factor has a significant relationship with expected stock returns.

Size factor has a significant relationship with expected stock returns.
Value factor has a significant relationship with expected stock returns.

METHODOLOGY

Statistical population of the research included all member companies in Tehran Stock Exchange. The statistical sample included the following companies (considering research limitations and based on common models):

1. Companies admitted to Tehran Stock Exchange since beginning of 2004.
2. Companies whose stocks have been transacted enough over a year (at least 100 days).
3. In order to determine the independent variable concerning human capital factor, we need information about the number of employees in companies in any year. To this end, we must either refer to notes attached to financial statements of the companies or gather this information via field study (survey). Therefore, some companies may be removed from the investigated sample.

We used t test for investigation of significance of each of the coefficients. If t test statistic is situated in critical area, it can be concluded that zero hypotheses which are defined concerning coefficients are not rejected.

It must be noted that if model coefficient defined for human capital factor is non-zero, we conclude that this factor has a relationship with returns and positivity or negativity of the coefficient specifies the type of relationship.

Data analysis was conducted by means of EXCEL 2007 software. Statistical tests were conducted by means of MATLAB or EVIEWS.

Limer's F test

Limer's F test was used for identification of Pool and Panel. In order to use this test, the model should be estimated using constant effects. Therefore, the estimation should be conducted via OLS. In this test, H0 involves model's use of Pool data and H1 involves use of Panel data.

Table 1: F test

Effects test	statistic	df	Sig.
Cross-section F	35.375702	(14,51)	0.0000
Cross-sectionChi-square	177.845183	14	0.0000

Since significance level of Limer's F test is less than 0.01, use of panel data is preferred to Pool data.

In order to investigate equality of intercepts statistically, Chaw test was used. Results have been summarized in table 2. As it can be seen, H0 (equality of intercepts) is rejected. Therefore, constant effects are selected as preferable model in this step.

Table 2: Chaw test

Prob.	d.f.	Statistic	Effects Test
0.0000	(5,927)	15.108423	**Period F**
0.0000	5	73.326805	**Period Chi-square**

Now we should test constant effects model against random effects.

In order to identify constant or random effects, Hassman's test was used. In this test, H0 involves model's use of random effects and H1 involves use of constant effects.

Table 3: results of Hassman's test

Test summary	(Chi-Sq) Test statistic	df	Sig.
Cross-section random	152.114390	4	0.0000

Considering the above table, the significance level is smaller than 0.1. Therefore, results verify constant effects.

Table 4: model's estimation (place constant effects test)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.906710	0.327455	-5.822806	0.0000
BM	3.158778	0.370757	8.519815	0.0000
SIZE	-2.70E-07	7.22E-08	-3.741407	0.0002
EVHC	-1.993310	0.324038	-6.151472	0.0000
RM	0.458519	0.053191	8.620309	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.373662	Mean dependent var		0.906089
Adjusted R-squared	0.245386	S.D. dependent var		4.334502
S.E. of regression	3.765319	Akaike info criterion		5.643895
Sum squared resid	11214.50	Schwarz criterion		6.474386
Log likelihood	-2529.138	Hannan-Quinn criter.		5.960260
F-statistic	2.912942	Durbin-Watson stat		2.177350
Prob(F-statistic)	0.000000			

T statistic shows that both intercept and angle coefficient are significant in (0.05) significance level and coefficient sign matches the theory. Total F statistic also verifies this matter. Therefore, H0 is rejected and research first hypothesis (presence of a positive and significant relationship between book-to-market value (BM) and sample companies returns) is supported. RM has a positive and significant relationship with sample companies returns. Further, the size and additional value of human capital has a significant and negative relationship with sample companies' returns. Adjusted R^2 with a value equal to 0.24 shows that only 24% of variations in sample companies' returns can be predicted by means of book-to-market value, size, additional value of human capital and RM. Durbin-Wattson statistic (equal to 2.17) also verifies the absence of autocorrelation in the model.

Conclusion

After collecting necessary data, human capital factor's role in explanation of adjusted returns was investigated based on Fama and French's three-factor model in Tehran Stock Exchange. Further, the ability of size, book-to-market value, human capital additional value factors to explain market returns of the companies admitted to Tehran Stock Exchange was measured by means of Fama and French's model and addition of human capital additional value. In the following sentences, results of the hypotheses analyses are investigated.

First hypothesis: human capital factor has a significant impact on determination of companies' values.

Results showed that human capital value has a negative and significant relationship with stock returns.

Lajili and Zegal (2005) found that employee-related costs increase companies stocks value while it reduces human force productivity.

Becker (1993) and Rost (2001) found that "employees' costs" is an important element in companies' huma capital evaluation both in corporate and market levels.

Second hypothesis: market factor (Rm-Rf) has a significant relationship with expected stock returns.

Results of the present research analyses showed that market value has a positive and significant relationship with stock returns and an increase in the independent variable results in an increase in the dpendent variable (Fama and French (1996, 1993, 1992, 2004), Charito (2001), Allen and Kleiri (1998), Daniel and Konestantindein (2004), Kanour and Sigaltitman (1997)). Relationship between book-to-market value ratio was also investigated in several studies in Tehran Stock Exchange. For example, results of studies conducted by Ahmed Makarem (2007), Bagher Zadeh (2005), and Taremi (2006) also verified the positive relationship between these two factors. However, relationship between these two factors is positive in the present research. Different studies also verified the positive and direct relationship between these two variables.

Third hypothesis: size factor (SMB) has a significant relationship with expected stock returns.

Results of the analyses showed that company's size has a negative and significant impact on stock returns. In other words, an increase in company's size results in a decrease in stock returns and vice versa.

Studies conducted by Fama and French (1996, 1993, 1992, 2004), Kanour and Sea Gall (2001), Davis, Fama and French (2000), Bartoldi and Peer (2002), Allen and Kleiri (1998) and … also verified the presence of a significant relationship between size and stock returns. According to the results of the present research, relationship between company's size and stock returns is reverse.

Fourth analysis: Value factor (HML) has a significant relationship with expected stock returns.

Results of the present research showed that book-to-market value has a direct relationship with stock returns. Rozenberg et al (1985) believe that there is a positive relationship between average companies' returns and book-to-market value ratio. As a result of this belief, Behandri (1988) investigated CAPM by adding lever degree and company's market value. He believed that this can increase CAPM model's validity because these variables play an important role in explaining stock returns and only Beta can decrease the model's validity. Baso (1988) believes that besides company's size and stocks beta, earning to price ratio is also important in returns.

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