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Testing a Multi-factor Capital Asset Pricing Model in the Jordanian Stock Market

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Abstract

A valid and accurate capital asset pricing model (CAPM) may help investors and mutual funds managers in determining expected returns which may lead to increase their profits and community resources. The problem is that the traditional CAPM does not accurately predict the expected rate of return. A more accurate model is needed to help investors in determining the intrinsic price of the financial asset they want to sell or buy. The purpose of this study was to examine the validity of the single-factor CAPM and then develop and test a multifactor CAPM in the Jordanian stock market. The study was informed by the modern portfolio theory and specifically by the single-factor CAPM developed by Sharpe, Lintner, and Mossin. The research questions for the study examined the factors that may explain the variation in the expected rate of return on stocks in the Jordanian stock market and the relationship between the expected rate of return and factors of market return, company size, financial leverage, and operating leverage. A causal-comparative quantitative research design was employed to achieve the purpose of the study by testing the listed companies on the Amman stock exchange (ASE) for the period from 2000 to 2015. Data were collected from the ASE database and analyzed using the multiple regression model and *t* test. The results revealed that market return, company size, and financial leverage are not predictors of the expected rate of return while operating leverage is a predictor

Keywords: capital asset pricing model, Amman stock exchange, financial leverage, operating leverage, size, multi-factor capital asset pricing model

1. Introduction

The stock returns are reduced when the investor buys a stock at more than its intrinsic price and when he or she sells the stock at less than that price, the problem is how stocks are or should be priced (Mossin, 1966). One model that can be used for pricing the stocks is the capital asset pricing model (CAPM) which was introduced by Sharpe (1964), Lintner (1965), and Mossin (1966). This single-factor model was tested by many researchers (Alqisie & Alqurran, 2016; Dajčman, Festić, & Kavkler 2013; Wu, Imran, Feng, Zhang, & Abbas, 2017) who concluded that the model is not able to accurately determine the expected rate of return on the financial asset. This inability of the single-factor CAPM represents the main problem in this study. This problem confronts many companies that use the model in their investments and capital budgeting decisions. The problem is important because most companies (85%) use the single-factor CAPM to estimate the cost of equity (Chawla, 2014) and because the trading value in the stock market of Jordan represents 40% of the gross savings of the country (Amman stock exchange, 2016; World Bank, 2016). Based on this, it may be very important to develop a model that can determine the expected rate of return more accurately than the single-factor model.

To increase its ability in predicting the expected rate of return, the single-factor model was extended by adding variables other than the market return to formulate new models including the model of Black, Jensen, and Scholes (1972), the zero-beta model (Black, 1972), Fama-French three-factor model (Fama & French, 1992), Carhart four-factor model (Carhart, 1997), and Liquidity-Augmented Fama-French CAPM (Chan & Faff, 2005). All these models were formulated by adding variables that are not derived from the theory of corporate finance. In this study, I developed and tested a CAPM model that contains variables derived from corporate finance theory following the model developed by Sharifzadeh (2005) who developed a model that consists of variables of market return, size, financial leverage, operating leverage, and implied volatility. The last variable is related to options market which does not exist in Jordan and thus, it was excluded from the proposed model.

To test the single-factor and the proposed model, five hypotheses were developed. The first hypotheses was about whether the market return does explain the greatest-variation in the expected rate of return on a stock while the hypotheses from two to four were about testing the relationship between the expected rate of return on a stock and variables of size, financial leverage, and operating leverage. The fifth hypothesis was developed to test the fitness of the extended model that contains all variables proved to be related to the expected rate of return based on the results of hypothesis two to four. To test these hypotheses, I employed a quantitative causal comparative design because the study is about the causes that results in the variation of the expected rate of return on the stock. The qualitative research, and consequently the mixed research method, does not fit here because the study is not about exploring, understanding, or interpreting of a phenomenon or a case (Yilmaz, 2013).

2. Literature Review

2.1 Capital Asset Pricing Model

The capital asset pricing model (CAPM) was introduced by Mossin (1966), Lintner (1965), and Sharpe (1964). As defined in this model, the expected rate of return E (R_i) is a function of: the risk-free rate of return (R_f), the expected return of the market [E (R_M)], and the sensitivity of the expected excess asset return to the expected excess market return (β_{iM}). This relationship can be expressed using the following equation:

$$E\ (R_i) = R_f + \beta_{iM}\ [E\ (R_M) - R_f] \tag{1}$$

Where E (R_i) is the expected rate of return on the stock i, R_f is the rate of return on the risk-free asset, and E (R_M) is the expected rate of return on the market. This model is called the single-factor model (Black, 1972) because it has only one independent variable which is the market excess return [E (R_M) – R_f] and in some studies it may be referred to as the traditional CAPM.

The validity of this model was tested by many researchers in many countries (Chaudhary, 2017; El-Mousallamy & El-Masry, 2016; Nyangara, Nyangara, Ndlovu, & Tyavambiza, 2016; Obrimah, Alabi, & Ugo-Harry, 2015; Saji, 2014; Sattar, 2017; Wu et al., 2017). Some researchers supported the validity of the model (Bajpai & Sharma, 2015; Bjuggren & Eklund, 2015; Lee, Cheng, & Chong, 2016; Novak, 2015) while others concluded that the model is invalid in estimating the expected rate of return on the financial asset (Alqisie & Alqurran, 2016; Alrgaibat, 2015; Chaudhary, 2017; Wu et al., 2017). In Jordan, however, many researchers concluded that the single-factor model is invalid (Blitz, Pang, & Van Vliet, 2013; Alqisie & Alqurran, 2016; Alrgaibat, 2015).

2.2 CAPM Extensions

Earliest studies that added more variables to the single-factor model include a study by Black et al. (1972). They concluded that the excess expected return on an asset is determined by another factor than its beta (Black, Jensen, & Scholes, 1972). They presented a two-factor model as follows:

$$E\ (R_i) = \beta_i\ [E\ (R_M)] + (1\text{-}\ \beta_i)\ [E\ (R_z)] \tag{2}$$

Where, E (Ri): the asset expected return, βi is the asset's beta, E (R_M) is the market expected return, and E (Rz) is the expected return of the other factor. The model implies that the expected return of the asset is derived from the market expected return combined with βi and another factor's expected return combined with 1- β_i.

2.2.1 Zero-Beta CAPM

Zero-Beta model was built by relaxing the CAPM assumption concerning the existence of riskless asset (risk-free asset) as discussed by Beaulieu, Dufour, and Khalaf (2013). Black (1972), claimed that for each portfolio in the efficient frontier there is a counterpart portfolio located in the inefficient part of the frontier. The counterpart portfolio is uncorrelated with the efficient portfolio and based on this, the name Zero-Beta portfolio is given to the counterpart portfolio; the equation for this model is as follows (Sharifzadeh, 2005):

$$E\ (R_i) = E(R_{Z(M)}) + \beta_{iM}\ [E\ (R_M) - E(R_{Z(M)}] \tag{3}$$

Where E (R_i) is the expected return on the stock i, E (R_M) is the expected return on the market, β_{iM} is the same beta of the traditional CAPM, and E($R_{Z(M)}$) is the expected return of the counterpart portfolio.

2.2.2 Fama-French Three-Factor Model

Two variables were selected by Fama and French (1992) to be added to the single-factor CAPM: size (the outstanding shares multiplied by the share's market price) and equity book value to its market value. According to Fama and French, the average rate of return is inversely related to the size and directly related to the ratio of book to market. The equation for this new version of the CAPM is as follows (Aldaarmy, Abbod, & Salameh, 2015):

$$R_{it} - R_{ft} = a_j + \beta_i(R_{mt} - R_{ft}) + \beta_i^S\ (SLL_t) + \beta_i^{bm}\ (HBMLBM_t) + e_i \tag{4}$$

Where the βi's are the sensitivity of the expected rate of return of stock i to each risk factor: market return (R_{mt} - R_{ft}), size (SLL_t), and book to market equity ($HBMLBM_t$).

2.2.3 Carhart Four-Factor Model

Carhart (1997) added one factor to Fama and French three-factor CAPM. The added variable was the one-year momentum; the effect of the price momentum on the return is that stocks with high return in the last period of time tend to have higher return than average expected in the next period. The model can be depicted mathematically as follows (Garyn-Tal & Lauterbach, 2015):

$$R_{it} - R_{ft} = a_j + \beta_i(R_{mt} - R_{ft}) + \beta_i^{S}(SLL_t) + \beta_i^{bm}(HBMLBM_t) + \beta_i^{om}(OYPM_t) + e_i \quad (5)$$

Where the β_i's are the sensitivity of the expected rate of return of stock i to each risk factor: market return (R_{mt} - R_{ft}), size (SLL_t), book to market equity ($HBMLBM_t$), and one-year price momentum ($OYPM_t$).

2.2.4 Liquidity-Augmented Fama-French CAPM

Following the methodology of Fama and French in adding more variables to the single-factor capital asset pricing model, Chan and Faff (2005), added the factor of illiquidity to Fama-French model to introduce the liquidity-augmented Fama-French model. The equation for this new CAPM is as follows (Chan & Faff, 2005):

$$R_{it} - R_{ft} = a_j + \beta_i(R_{mt} - R_{ft}) + \beta_i^{S}(SLL_t) + \beta_i^{bm}(HBMLBM_t) + \beta_i^{il}(Imv_t) + e_i \quad (6)$$

Where all variables are the same as in the Fama-French model and the liquidity factor is denoted (Imv_t).

2.3 Size, Financial Leverage, and Operating Leverage

One of the variables included in the Fama-French three-factor model was the size or the market equity for the company. Fama and French (1992) measured size by multiplying the total outstanding shares of the firm by the market price of the share. Most studies that tested the Fama-French model measured the size variable by the same method. Fama and French concluded that the stock returns were negatively related to the size of the company. The same conclusion was reached by Sharifzadeh (2005) but the size was measured by the market value of total assets and not the market value of the equity alone which is the same measure used in this study. Another variable considered by the investors as an indicator of the risk level of a stock is the financial leverage (Tan, Chua, & Salamanca, 2015). Because of its high financial risk, investors consider stocks with high financial leverage to be more risky while they consider stocks with low financial leverage as less risky (Sharifzadeh, 2005). The degree of operating leverage may affect the operating risk that companies bear. This risk is priced by investors and eventually translated into a higher stock return (Lee & Park, 2013). In this study, the model I tested was developed using the same methodology followed to develop the models discussed in the CAPM extensions by adding more variables to the single-factor CAPM. This proposed model can be depicted as follows:

$$R_{jt} - R_{ft} = aj + \beta_j^{M}(R_{mt} - R_{ft}) + \beta_j^{S}(SLL_t) + \beta_j^{FL}(HFLLF_t) + \beta_j^{OL}(HOLLO_t) + e_{jt} \quad (7)$$

Where the β_j's are the sensitivity of the expected rate of return of stock j to each risk factor of: market return (R_{tm} - R_{ft}), size (SLL_t), financial leverage ($HFLLF_t$), and operating leverage ($HOLLO_t$).

2.4 Hypotheses

To test the proposed CAPM model, I developed five hypotheses: the first one was to test the single-factor model, hypotheses two to four to test the relationship between each independent variable with the expected rate of return, and the last hypothesis was developed to test the model in Equation 7. The research hypotheses were as follows:

H1: Market rate of return does explain the greatest-variation in the expected rate of return on a stock.

H2: A company's size is predictor of rate of return of the stock of that company

H3: A company's financial leverage is predictor of rate of return of the stock of that company.

H4: A company's operating leverage is predictor of rate of return of the stock of that company.

H5: The company's expected rate of return is linearly dependent on the factors of: the market return, company's size, financial leverage, and operating leverage.

3. Method

3.1 Research Data

The population of this study included all public companies listed on Amman stock exchange(ASE), the only stock market in Jordan. The unit of analysis for this study was each company listed and continue to be listed on the ASE for the period from 2000-2015, the total number of these companies is 109. Banks were excluded from the study because they did not disclose fixed assets and long term debt as a separate line for the end of 1999.

After excluding banks, total number of companies included in the study is 90 companies. Data used in the study were the monthly closing prices for all companies included in the study for the period January- 2000 to December- 2015. In addition, data included information about total assets, total liabilities, and long term debt for each company during the period covered. Multiple-linear regression and *t*-test were used to analyze the collected data.

3.2 Research Design

This study is a quantitative, causal-comparative study to test the possible causes of the variation in the dependent variable. The dependent variable in the study is the expected rate of return on the stocks of the listed companies on the Jordanian stock market. The independent variables include the expected rate of return on the overall stock market, size of the stock, financial leverage, and operating leverage.

3.3 Variables Definitions

Company's size: is the average of the market value of the total assets of the company for the study period; it was estimated by finding the market value of the total assets of the company at the first year of the study period and at the last year of the period then divide the total by 2. The market value of the total assets was calculated by adding the market value of the outstanding shares to the liabilities of each company.

Financial leverage: is a measure for the degree of using debts by the company. Financial leverage is defined as the percentage of long term debt to the total assets of the company. The average of this leverage for the first and last year was used to measure this variable.

Market rate of return: is the rate of return achieved in the market during the holding period of one month; the ASE price index is used in this study to represent the market. This return was calculated at time t using the following equation (Alqisie & Alqurran, 2016):

$$R_{mt} = (I_t - I_{t-1}) * 100 / I_{t-1} \tag{8}$$

Where I_t is the ASE index closing price at time t and I_{t-1} is the index closing price at time t-1.

Operating leverage: this term represents the level of the company's fixed costs compared to its total costs. It was measured as the percentage of fixed assets to the total assets. The average of this leverage for the first and last year was used to measure this variable.

Realized rate of return: is the rate of return actually gained on the stock during the holding period; this return was calculated at time t using the following equation (Alqisie & Alqurran, 2016):

$$R_{jt} = [(P_{jt} - P_{jt-1})*100] / P_{jt-1} \tag{9}$$

Where P_{jt} is the closing price of the stock j at time t, $P_{jt-1}$is the closing price of the stock j at time t-1. This variable represents the dependent variable in the proposed model

4. Results

4.1 Descriptive Statistics

The included companies belong to three different sectors in the ASE: industrial companies, financial companies, and services companies. About 49% of the included companies were from the industrial sector, 21% from the financial sector, and 30% were from the services sector. Descriptive information about size, financial leverage, and operating leverage for these companies are illustrated in Table 1.

Table 1. Descriptive statistics for variables of: size, financial leverage, and operating leverage

Variable	Mean	Median	Min	Max
Size	63 255 159	15 651 911	1 802 694	1 202 152 790
Financial leverage	.049	.018	0	.767
Operating leverage	.343	.310	.003	.891

4.2 Hypotheses Testing

4.2.1 Hypothesis One

Hypothesis one includes testing two regression models:

$$R_{jt} - R_{ft} = a_i + \beta_j (R_{Mt} - R_{ft}) + e_{jt} \tag{10}$$

$$\overline{R_j - R_f} = \lambda_0 + \lambda_1 b_j + \lambda_2 \sigma^2 (e_j) + e'_j \tag{11}$$

The null and alternate hypotheses for the first regression model can be expressed as:

H_0: a_i , $\beta_j = 0$

H_1: a_i , $\beta_j \neq 0$

And for the second regression:

H_0: $\lambda_0 = 0$, $\lambda_1 = \overline{R_M - R_f}$, $\lambda_2 = 0$

H_1: $\lambda_0 \neq 0$, $\lambda_1 \neq \overline{R_M - R_f}$, $\lambda_2 \neq 0$

Where ai is the intercept of the line of the asset excess return (Rjt - Rft), $\overline{R_j - R_f}$ is the average monthly risk premium on stock j during the period of the study, $\overline{R_M - R_f}$ is the average monthly risk premium on the market portfolio during the period of the study, e_{jt} is the error term of the rate of return of stock j during the month t, and σ^2 (e_j) is the variance of stock j error term during the period of the study.

Data required to test this hypothesis were the treasury bills returns (risk-free asset), the ASE index monthly closing prices (market returns) and the monthly closing prices of each company of the 90 companies included in the study for the period from December 1999 to December 2015. The first regression was used to find the parameter β for each stock and then use these parameters in the second regression. If the single-factor CAPM is true, λ_0 should not be significantly different from zero, λ_1 should equal the average market excess return ($\overline{R_M - R_f}$), and λ_2 should not be significantly different from zero. The calculated average market excess return was -0.055% which represents the hypothesized value for λ_1.

The results of the second regression and *t* statistic are summarized in Table 2. Based on information provided in Table 2 and using the significance level of 5%, the null hypothesis that λ_0 =0 can be rejected which means that the value of λ_0 was significantly different from zero, $t(89) = -4.721$, $p < .001$. The null hypothesis that $\lambda_1 = \overline{RM - Rf}$ = -0.055% can be rejected, t(89) = 2.211, $p = .015$ and thus, $\lambda_1 \neq -0.055\%$. Finally, null hypothesis that λ_2 = 0 can be rejected, $t(89) = 7.069$, $p < .001$ which means that λ_2 value was significantly different from zero.

Table 2. *t* Statistic and *p* values for hypothesis one- second regression

Details	λ_0	λ_1	λ_2
Coefficient	-0.576	0.279	0.304
Hypothesized value	0.000	-0.055	0.000
Standard error	.122	.151	.043
t statistic	-4.721	2.211	7.069
p value	<.001	.015	<.001
Adjusted R squared .389			

4.2.2 Hypothesis Two

The null and alternate hypotheses here can be expressed as:

H_0: $\mu(\overline{R_j}^S) \leq \mu(\overline{R_k}^L)$

H_1: $\mu(\overline{R_j}^S) > \mu(\overline{R_k}^L)$

Where $\mu(\overline{R_j}^S)$ is the mean of all small companies' stocks' average rate of return and $\mu(\overline{R_k}^L)$ is the mean of all large companies' stocks' average rate of return. Data required to test this hypothesis were the average rate of return and size for each stock included in the study. The size for each stock was calculated by averaging total market value of the company's assets at the beginning and the end of the study period. The median of the sizes was calculated and the companies lower than the median were labeled *small size* while other companies were labeled *large size*.

One-tailed *t* test cannot be conducted using SPSS software, the software includes only two-tailed test. Because of that, I conducted the two-tailed test first and then I divided the resulted significance value by 2 to get the significance for one-tailed test. From information provided in Table 3, the significance value is greater than 5% and thus, the null hypothesis that the average rate of return for stocks with small size is less than or equal to that for stocks with large size cannot be rejected, $t(88) = 0.887$, $p = .189$. This means that the rate of return for small size stocks is not higher than the big size stocks as hypothesized.

Table 3. Results of one-tailed *t* test for hypothesis two

Details		Mean rate of return %	Standard deviation
Small size		0.721	.831
Large size		0.583	.632
t-statistic	0.887		
P value (one-tailed)	.189		

4.2.3 Hypothesis Three

This hypothesis can be expressed as:

$H_0: \mu(\overline{R_j}^{HFL}) \leq \mu(\overline{R_k}^{LFL})$

$H_1: \mu(\overline{R_j}^{HFL}) > \mu(\overline{R_k}^{LFL})$

Where $\mu(\overline{R_j}^{HFL})$ is the mean of all high financial leverage companies' stocks average rate of return, and $\mu(\overline{R_k}^{LFL})$ is the mean of all low financial leverage companies' stocks average rate of return.

Data required to test this hypothesis were the average rate of return and the financial leverage for each stock (company) included in the study. The financial leverage variable for each company was calculated by averaging its financial leverage at the beginning and at the end of the study period. Financial leverage at the beginning and at the end of the study period was measured by dividing total long-term debt by total assets of each company. The statistical test used to test this hypothesis was Mann-Whitney *U* test because after testing data for normality assumption, I found that this assumption was violated and thus, the statistical test was changed from *t*-test to Mann-Whitney *U* test as recommended by Green and Salkind (2014). To conduct Mann-Whitney *U* test, companies with financial leverage higher than the median financial leverage for all companies were assigned to group labeled 1(high financial leverage) while companies with financial leverage lower than the median were assigned to group 2 (low financial leverage).

The result of this test is summarized in Table 4. The table includes the test results after converted to one-tailed by dividing the two-tailed p value by two. Based on the results of Mann-Whitney *U* test, the null hypothesis that the average rate of return for stocks with high financial leverage is less than or equal to that for stocks with low financial leverage cannot be rejected, $z = -0.835$, $p = .202$. This means that the hypothesized relationship between financial leverage and the rate of return does not exist.

Table 4. Results of Mann-Whitney *U* test for hypothesis three

Group		High financial leverage	Low financial leverage
Average rank		47.8	43.2
N		45	45
P value (one-tailed)	.202		

4.2.4 Hypothesis Four

The null and alternate hypotheses here are:

$H_0: \mu(\overline{R_j}^{HOL}) \leq \mu(\overline{R_k}^{LOL})$

$H_1: \mu(\overline{R_j}^{HOL}) > \mu(\overline{R_k}^{LOL})$

Where $\mu(\overline{R_j}^{HOL})$ is the mean of all high operating leverage stocks' average rate of return and $\mu(\overline{R_k}^{LOL})$ is the mean of all low operating leverage stocks' average rate of return.

The operating leverage variable for each company was calculated by averaging its operating leverage at the beginning and at the end of the study period. Operating leverage at the beginning of the study period was measured by dividing fixed assets on total assets for each company as on 31/12/1999. The same calculations were made to measure the operating average at the end of the study period (31/12/2015). To prepare data for conducting *t* test, each company was assigned to group of high operating leverage (HOL) or low operating leverage (LOL). Companies were assigned to these groups by calculating the median of operating leverage of all companies first and then assign companies with operating leverage higher than the median to the high operating leverage group and companies with operating leverage lower than the median to the group of low operating leverage.

Because the one-tailed *t* test cannot be conducted using SPSS software, I conducted the two-tailed test first and then I divided the resulted significance value by 2 to get the significance for one-tailed test. The results for one-tailed *t* test are summarized in Table 5. As can be seen in Table 5, the significance value is less than 5% and thus, the null hypothesis that the average rate of return for stocks with high operating leverage is less than or equal to that for stocks with low operating leverage can be rejected, t(88) = 2.042, p = .022. This means that the expected average rate of return for stocks with high operating leverage is greater than the average rate of return for stocks with low operating leverage as hypothesized.

Table 5. Results of one-tailed *t* test for hypothesis four

Details		Mean	Standard deviation
High operating leverage		0.808	.800
Low operating leverage		0.496	.641
t-statistic	2.042		
P value (one-tailed)	.022		

4.2.5 Hypothesis Five

Because the tests of variables of size and financial leverage yielded insignificant results, this hypothesis was modified to include only two variables: market return and operating leverage. Based on this, there are two regression equations for this hypothesis:

$$R_{jt} - R_{ft} = a_j + \beta_j^{M}(R_{mt} - R_{ft}) + \beta_j^{OL}(HOLLO_t) + e_{jt} \quad (12)$$

$$\overline{\mathrm{Rj} - \mathrm{Rf}} = \lambda_0 + \lambda_1 \mathrm{b}_j^{M} + \lambda_2 \mathrm{b}_j^{OL} + \mathrm{e}_j \quad (13)$$

Where,

$R_{jt} - R_{ft}$: excess return of stock j during the month t

$R_{mt} - R_{ft}$: excess return of the market during the month t (the variable of market return)

$HOLLO_t$: the difference between average rate of return of high operating leverage companies and the average rate of return of companies with low operating leverage during the month t. This variable was measured by subtracting the average return of all companies in high operating leverage group during month t from the average return of all companies in the low operating leverage group during the same month.

β_j^{M}: sensitivity of the stock j return to the market risk variable

β_j^{OL}: sensitivity of the stock j return to the operating leverage risk variable

bj's: are estimates of βj's calculated from Equation 12 regression.

λ_0: represent the intercept of the regression

λ_1: the expected value of the average market excess return

λ_2: the expected value of the excess average return of companies with high operating leverage over average return of companies with low operating leverage

The null and alternate hypotheses for the first regression of this hypothesis can be expressed as:

H_0: a_i , βj^{M}, $\beta j^{OL} = 0$

H_1: a_i , β_j^{M}, $\beta_j^{OL} \neq 0$

Where the β_j's are the sensitivity of the expected rate of return of stock j to each risk factor of: market return ($R_{tm} - R_{ft}$) and operating leverage ($HOLLO_t$).

And for the second regression in Equation 13:

H_0: $\lambda_0 = 0$, $\lambda_1 = \overline{R_M - Rf}$, $\lambda_2 = \overline{HOLLO}$

H1: $\lambda 0 \neq 0$, $\lambda 1 \neq \overline{RM - Rf}$, $\lambda 2 \neq \overline{HOLLO}$

The first regression was conducted to find the estimates for *bj's* in the second regression. The average monthly excess return for the market $(\overline{R_M - R_f})$ was -0.00055 and the average monthly excess return for operating leverage variable $\overline{HOLLO}$ was 0.312. Thus, the hypothesized value of λ1 and λ_2 were -0.055% and 31.2% respectively. The results of the second regression and *t* statistic are summarized in Table 6. Based on information provided in Table 6 and using the significance level of 5%, the null hypothesis that $\lambda_0 = 0$ cannot be rejected which means that the value of λ_0 was not significantly different from zero, *t*(89) = -1.172, *p* = .122. The null hypothesis that $\lambda_1 = \overline{R_M - R_f}$ = -0.055% can be rejected, *t*(89) = 2.287, *p* = .012 and thus, $\lambda_1 \neq$ -0.055%.

Finally, null hypothesis that $\lambda_2 = \overline{\text{HOLLO}} = 0.312$ cannot be rejected, $t(89) = -0.009$, $p = .496$ which means that λ_2 value was equal to the average excess return caused by operating leverage variable.

Table 6. *t* Statistic and *p* values for hypothesis five- second regression

Details	λ_0	λ_1	λ_2
Coefficient	-0.156	0.359	0.311
Hypothesized value	0.000	-0.055	0.312
Standard error	.133	.181	.101
T statistic	-1.172	2.287	-0.009
p value	.122	.012	.496
Adjusted R squared .115			

4. Discussion

The results of hypotheses testing revealed the single-factor capital asset pricing model is invalid in the Jordanian stock market. This conclusion is in line with the results of studies of many researchers who reached the same conclusion about this market (Alqisie & Alqurran, 2016; Alrgaibat, 2015; Blitz et al., 2013) and about many other countries (Dajčman et al., 2013; Dzaja, & Aljinovic, 2013; Li, Gan, Zhuo, & Mizrach, 2014; Nyangara et al., 2016; Obrimah et al., 2015; Saji, 2014; Wu et al., 2017). The hypothesized relationship between the expected rate of return and variables of size, financial leverage, and market rate of return was found to be insignificant ; the expected rate of return for a stock is directly related to the operating leverage of the stock.

Because the study included all listed companies in the ASE and not only a sample, its results can be generalized for stock markets in Jordan and other emerging markets that have similar attributes despite the existence of some limitations. These limitations include using the ASE index as a proxy for the market, the unavailability of the required data related to the banks listed on ASE, and measuring independent variables in a way different from that used in the previous studies. Further research may be conducted to include more variables other than tested in this study to enhance the explanatory power of the model. In addition, the single-factor model may be tested in the Jordanian stock market using different methods. For example, the model may be tested using portfolios' returns instead of the returns of individual stocks to overcome measurement errors and correlation between nonsystematic risk and beta similar to the approach of Black et al. (1972).

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