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Comparative analysis of the explanatory power of the CAPM and the Fama-French three-factor model on cross-sectional variation of returns on stocks trading on the Official market of the Macedonian Stock exchange

Fatmir Besimi, PhD.
Associate Professor, Faculty of Business and Economics, South East European University, Republic of North Macedonia
Minister of Finance of the Republic of North Macedonia
f.besimi@seeu.edu.mk

Ana Bisheva, Msc., CFA
Member of the Cabinet of the Minister of Finance
bishevaana@gmail.com

Abstract

The amount of literature on factors that explain the cross-sectional variation in average returns is vast, however, the majority of these papers attempt to explain the variation of returns in developed and emerging markets. In that sense, the literature lacks sufficient evidence regarding the variation of returns of frontier markets. The Republic of North Macedonia is considered to be a frontier market and in this paper we aim to empirically test the ability of the Capital Asset Pricing Model and the Fama-French Three Factor Model in explaining the cross-sectional variations of stock returns of securities trading on the Macedonian Stock Exchange. The empirical study is based on monthly returns from January 2011 to April 2021. Additionally, we use annual data obtained from the financial statements of the analysed companies included in this study. Using OLS time series regression we find that both models have limited explanatory power of the cross-sectional variation in expected returns on the Macedonian Stock Exchange. The study shows that only the size factor exhibits some limited explanatory power regarding stock returns. Based on the comparative analysis the Fama-French Three-Factor Model describes the variation of returns on the MSE much better than the Capital Asset Pricing Model.

Key words: Macedonian Stock Exchange, CAPM, Fama-French Three-Factor Model, cross-sectional variation, asset pricing

JEL classification: G12, G14,G11,G15

Introduction

Based on traditional financial theory, financial markets are assumed to be efficient. A market is considered efficient when prices fully incorporate all available information. This is the major thesis of the Efficient Market Hypothesis. The EMH has been the basis of much of the empirical work on financial market returns. The basis of the Efficient Market Hypothesis (EMH) is that market participants are rational economic beings. Namely, it is assumed that they are risk-averse and are not willing to accept additional risk without being adequately compensated. This leads to the conclusion that on aggregate, the population of investors is correct regarding pricing of financial instruments, even if no person is correct (CFA). Another assumption of the theory is that new information gets instantly incorporated into market prices which leads to market prices that incorporate all information including events that have already happened and events that markets expect to occur in the future. Finally, for the theory to hold it is expected that all information is available to all market participants. In this scenario, the market price of each security matches the security's intrinsic value and therefore, no market participant should be able to consistently earn excess returns. According to the Grossman-Stiglitz paradox (Grossman and Stiglitz, 1980), in equilibrium in an efficient market, returns should equal the cost of obtaining the information needed to achieve the given return. They conclude that a market is inefficient if, after subtracting such costs, an active management strategy is able to earn excess returns over the return of the market portfolio.

To address market efficiency, Fama (1970) proposed three forms of market efficiency defined on the basis of the amount of information incorporated into prices. Namely, if a market is weak-form efficient it is assumed that prices reflect all past market price and volume data, and as such, technical data cannot be used to generate excess returns. The second form of market efficiency, semi-strong-form efficiency assumes that in addition to information regarding past market price and volume data, market prices reflect all publicly available information. In this case, neither technical analysis nor fundamental analysis can be used to generate greater returns compared to the market. Finally, in a strong-form efficient market, prices incorporate not only market price, volume data and publicly available data, but also private information. If a market is strong-form efficient no one is expected to consistently earn excess returns, not even traders with inside information.

The strong assumptions of the efficient market theory have led to a considerable amount of disagreement amongst economists and as a result a vast amount of literature has covered this topic. A vast amount of studies have been published that support the theory, but there are also many studies that reject market efficiency in one of its forms. The studies that have found contradicting evidence of market efficiency focus on market anomalies, or deviations from the efficient market hypothesis (CFA). For a deviation to be considered an anomaly it must persist for a lengthy period of time. Empirical studies on anomalies can be grouped into studies on fundamental anomalies, technical anomalies and calendar anomalies.

Fundamental anomalies arise when an investor can use information on a stock's fundamentals to achieve excess returns. Such anomalies are the outperformance of small-capitalization stocks and value stocks compared to large-capitalization and growth companies. Despite the fact that these anomalies have been documented in many studies, Fama and French (2008) argue that the excess returns obtained while exploiting fundamental anomalies can merely be the result of model misspecification. Some of the more famous asset pricing models include the Single Index Model developed by Sharpe (1963), the Capital Asset Pricing Model developed by Treynor in 1961 and further developed by Sharpe (1974), Litner (1965) and Mossin (1966), Arbitrage Pricing Theory developed by Ross in 1966, the Fama-French Three-Factor Model (1992), Carhart Four-Factor Model (1997) etc..

The focus of this study is on the effectiveness of the Capital Asset Pricing Model (CAPM) and the Fama-French Three-Factor Model in explaining the cross-sectional variation of returns of stocks trading on the Macedonian Stock Exchange. The proposed models are built on the idea that market return variation can be attributed to a given factor. In the CAPM this factor is defined as the market risk premium and the return of a stock depends on the sensitivity of the stock to the risk factor. On the other hand, Fama and French propose a three-factor model which identifies two more risk factors considered to provide better explanation for market returns. The risk factors included in this model are

the market risk premium like in the CAPM, the market capitalization of a stock and the book to equity ratio. We aim to test two hypothesis:

1. Can the CAPM be used to explain the variation in market returns on the selected stocks trading on the Macedonian Stock Exchange?
2. Does the Fama-French Three-Factor Model outperform the CAPM in the Republic of North Macedonia?

The Macedonian stock exchange is a small market characterized by a low level of share turnover and low liquidity. It consists of several market segments, for this study we will use only stocks quoted on the official market. The securities quoted on this market segment are obligated to provide regular and timely material information necessary for stock valuation by investors. For that reason we include all stocks traded on this market for the period starting December 2010 to April 2021. Given the characteristics of the MSE, for this study we include only the most frequently traded stocks on the market. In general, these include the stocks that have been a part of the MSE index, MBI 10 over the previous decade. We use the methodology provided by Fama and French (1993, 1996, 2012) to set up the empirical study of our two hypothesis. However, unlike the methodology of Fama and French (1993,1996), who propose the exclusion of financial sector companies due to the high amount of leverage, in our analysis we include these financial sector companies as they represent a significant portion of the Macedonian stock exchange (MSE).

The remainder of the paper is organized as follows: Section 2. Literature Review; Section 3. Methodology; Section 4. Results of Empirical Study; Section 5 Conclusion and Scope for Additional Research.

Literature Review

Capital Asset Pricing Model

Despite many studies that have contradicted the validity of the Capital Asset Pricing model, it remains one of the basics of Asset Pricing Theory. This model has been widely used for evaluating financial decisions and the required rate of return (Fletcher 2000). The model was developed by Sharpe (1964), Lintner (1965) and Mossin (1966) and it is based on the works of Markowitz on diversification and Modern portfolio theory. The model focuses on the assumption that securities are priced based on their sensitivity to systematic risk, defined as market beta. The theory is that the investors can diversify away idiosyncratic risk and remain exposed only to the non-diversifiable risk, market risk (Perold, 2004).
The CAPM

$$R_{i,t} = R_f + \beta_{i,MKT} MKT_T + \varepsilon_{i,t}$$

The CAPM is most frequently criticized for its simplicity in using only one variable to explain all the variation in returns. It is based on a set of strict assumptions which stray far from real world conditions which open the model to further criticism. One of these is the definition of the perfect market portfolio, a portfolio containing all assets in the world which is impossible to construct in practice and cannot be theoretically observed. Nevertheless, many empirical studies confirm the model efficiency in explaining the returns on risky assets and considering that the model is economically grounded and relatively objective it has been widely used in valuation.

The dominance of the CAPM as the most accurate asset pricing model was challenged in the mid 1980s when a number of papers were published identifying a number of price anomalies on the US stock market. These were based on certain fundamental values which could be used to outperform the market and can be considered as risk factors. These fundamental anomalies include the size factor, where many papers have found that firms with low market capitalization tend to outperform large cap stocks (Banz, 1981, Fama, French, 1992). Others focused on the outperformance of value stocks over growth stocks, or put in another way, stocks with high book-to-market ratio outperform stocks with low book-to-market ratio (Fama,French, 1992; Stattman, 1980; Rosenberg, Reid and Lanstein, 1985;

Chan, Hamao and Lakonishok, 1991; Basu, 1983; Capaul, Rowly and Sharpe, 1993; Chen and Zhang, 1998). Other factors found to provide additional return include a company's price-to-equity ratio (Ball 1978; Basu 1983; Jaffe, Keim, and Westerfield 1989; Chan, Hamao, and Lakonishok 1991; and Fama and French 1992).

Fama-French Three-Factor Model

In their works, Fama and French (1992,1993) present the Three-Factor Asset Pricing Model which is built on the older and simpler CAPM. In their model, in addition to the market risk factor used in the CAPM they employ two additional factors expected to improve the explanatory power of the CAPM. Namely, they add the market capitalization factor and the book-to-market ratio. This resulted in the Fama-French Three-Factor Model:

$$R_{i,t} - R_f = \beta_{i,MKT} MKT_T + \beta_{i,SMB} SMB_T + \beta_{i,HML} HML_T + \varepsilon_{i,t}$$

The size factor is proxied by the difference between the return of a portfolio of small capitalisation stocks and a portfolio of large capitalisation stocks, on average, small firms have historically had positive size betas, due to the higher risk premium they contain when compared to large capitalization stocks. The book-to-market factor or the value factor is calculated as the difference between the return of a portfolio of stocks with a high book-to-market ratio and a portfolio of stocks with a low book-to-market ratio. Based on historical evidence, value stocks have a positive exposure to this factor implying a higher risk premium compared to growth stocks.

Based on empirical tests, it can be concluded that the three-factor model has a greater explanatory power of the variation of cross-sectional returns (Fama & French, 1992; Charitou and Constantinidis, 2004; Gaunt, 2004 for Australian Stock Exchange). However, more recent studies have confirmed that this model can further be improved by the addition of more variables. Some of these improvements include the Carhart Four-Factor Model which adds a variable capturing the momentum of returns, Fama-French five-factor model include variables that capture exposure to profitability and investments.

As mentioned earlier the study will focus on the strength of the CAPM and the Fama-French three-factor model leaving scope for further future analysis of additional factors which can be used to explain cross-sectional variations.

Methodology

Data

The study is based on the 19 most liquid stocks actively trading on the official market of the Macedonian Stock exchange for the period between December 2010 and April 2021.The data was obtained by the official daily price list of the MSE and the financial statements provided to the stock exchange by the analysed companies. As a proxy for the risk-free asset, we used the 1-month Treasury bill issued by the National Bank of the Republic of North Macedonia. The rates on the 1-month Treasury bills were then transformed to monthly returns for comparability with the return data of the analysed stocks. The market return is proxied by the return on the Macedonian stock exchange index MBI 10. The variables used in this study include share price, the price to book ratio, firm capitalization. The calculations are based on excess return compared to the risk free rate, in our case the rate on the 1-month Treasury bill.

Methodology

We use the methodology provided by Fama and French (1993,1996, 2004, 2012) to set up the empirical study of our two hypotheses. Namely, in an attempt to offer more precise estimates of betas, Fama and French propose the use of diversified portfolio betas whose precision is greater than estimates of individual security betas. Using this approach, the critical errors of the variables are reduced. The frequency of data is monthly based on the methodology of Fama and MacBeth (1973) in an attempt to reduce the inference problem caused by the correlation of the residuals. To examine

whether an identified factor can be used to infer statistically significant information, the means and the intercepts of the time-series are used (Fama and French, 2004). However, unlike the methodology of Fama and French (1993,1996), who propose the exclusion of financial sector companies due to the high amount of leverage, in our analysis we include these financial sector companies as they represent a significant portion of the Macedonian Stock Exchange (MSE). Namely, shares of commercial banks account for more than half of the daily trading on the MSE, and make up a significant portion of the market capitalization of the market.

As mentioned above using the Fama-French methodology we cross classified stocks on two dimensions – size (measured by market capitalization) and value (measured by the ratio of book value per share to market value per share). In their model Fama and French divide their sample based on these two variables. By size the market is divided into two groups: Big which includes securities above the median value and Small containing securities below the median line. The book-to-market ratio is divided into three groups: Low containing the stocks with book-to-equity below the 30th percentile, medium portfolio containing stocks with a value of book-to-equity between the 30th and 70th percentile and high with stocks with a value of book-to-value ratio above the 70th percentile. Based on this classifications we can obtain six portfolios which fall in the corresponding categories based on size and book-to-market ratio. The portfolios are Big/Low, Small/Low, Big/Medium, Small/Medium, Big/High, and Small/High.

The monthly return of the portfolios is calculated on a value-weighted basis of the stocks contained in each of the six portfolios. As mentioned above, the three-factor model contains three risk factors; the excess market return, the size factor and the book-to-equity factor. The market factor is calculated as the difference between the monthly return of the MBI10 index and the 1-month Treasury bill issued by the National Bank of the Republic of North Macedonia. The remaining two factors are obtained using the weighted average returns on each of the six portfolios created. Namely, these factors are not tradeable so zero investment portfolios are created.

The size factor or SMB (small minus big) is the simple average return of three small portfolios minus the simple average return of the three big portfolios. For each month represents the difference between each month average returns of small market capitalization group and big market capitalization group:

$$SMB = \frac{S/_L + S/_M + S/_H}{3} - \frac{B/_L + B/_M + B/_H}{3}$$

Following this logic, the book-to-equity factor, HML (High minus low) is constructed as the difference between the average returns of the two portfolio classified as having high book-to-equity and the two portfolios classified as having low book-to-equity. HML for each month represents the difference between each months average returns rate of high book-to-equity group and low book-to-equity group:

$$HML = \frac{S/_H + B/_H}{2} - \frac{S/_L + B/_L}{2}$$

Table 1. Sample characteristics, MSE 2011-2021

P	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Average
B/L	4	3	4	3	3	4	5	4	4	5	3	4
S/L	2	3	2	3	3	2	1	2	2	1	3	2
B/M	3	5	4	4	5	4	4	3	4	4	6	4
S/M	4	2	3	3	2	3	3	4	3	3	1	3
B/H	3	4	2	3	2	2	2	3	2	2	1	2
S/H	3	2	4	3	4	4	4	3	4	4	5	4

Source: Author's own calculation

B/L - all stocks in the big market capitalization group that are also in the low book-to-equity group

S/L - all stocks in the small market capitalization group that are also in the low book-to-equity group

B/M - all stocks in the big market capitalization group that are also in the medium book-to-equity group

S/M - all stocks in the small market capitalization group that are also in the medium book-to-equity group

B/H - all stocks in the large market capitalization group that are also in the high book-to-equity group

S/H - all stocks in the small market capitalization group that are also in the high book-to-equity group

From Table 1 we can observe that the companies in our sample classified as Big predominantly fall in the categories of low and medium book-to-equity. On the other hand, the largest number of companies with a small market cap fall in the category of high book-to-equity. This observation is consistent with economic theory in the sense that high book-to-market values signal distress in companies. In that sense, it is logical that smaller companies more frequently fall into this category compared to big companies which are expected to continue to produce favourable results in the future. One observation has to be pointed out that the number of securities included in our study is significantly less than the number of securities used in other papers with similar research topics. As mentioned earlier this is due to the fact that the Macedonian stock exchange is a small exchange characterised with low market turnover and therefore not many stock prices are priced efficiently. This is confirmed by Angelovska (2018), who finds that the Macedonian stock exchange is not weak form efficient.

Table 2.Summary Statistics of Variables

Variable	Mean	St. dev.	Min	Max
B/L	0.54%	0.56%	-28.36%	19.19%
S/L	0.95%	0.42%	-25.75%	24.51%
B/M	-0.22%	0.43%	-18.26%	11.38%
S/M	-0.02%	0.65%	-47.49%	23.36%
B/H	-0.28%	0.64%	-25.72%	21.27%
S/H	0.38%	0.62%	-16.16%	27.30%
Rm	0.43%	0.47%	-25.62%	20.72%
SMB	0.42%	0.34%	-15.65%	7.66%
HML	-0.69%	0.39%	-11.06%	13.92%

Source: Author's own calculation

Table 2 presents the summary statistics of the six portfolios, more specifically the mean, standard deviation, minimum and maximum value of the excess returns of the portfolios. When analysing table 2 several observations can be made regarding the statistics of the factor variables. Namely, the market factor (Rm) has a positive mean suggesting that during the analysed period the stock market was in a bullish market leading to positive returns. Additionally, we can observe that the size factor SMB has a positive value which is contrary to literature documenting the decline of this factor ever since its discovery in the 1980s (Czapkiewicz, Wójtowicz, 2014; Abeysekera and Don Nimal, 2017; Valsamis 2012). The book-to-equity factor has a negative mean which also contrasts to the findings of Fama and French (2012) who find positive values for the North American and the Japanese market.

This indicates the presence of a value factor on average. The results need to be taken with a dose of caution as normality tests reject the assumption of normality in all the presented variables.

Table 3. Correlation between Risk Factors

	Rm	SMB	HML
Rm	1		
SMB	-0.02661	1	
HML	-0.0341	0.16468	1

Source: Author's own calculation

In Table three we show the correlation between the defined risk factors, where it is evident that none of the pairwise correlations indicate a significant amount of co-movement. The market factor has a negative correlation with both the size factor and the value factor. The weak correlation between the factors suggests that the Fama and French extension to the CAPM model, i.e. we find the absence of multicollinearity.

Empirical Results

As mentioned the aim of this study is to analyse the ability of the two models in explaining the cross-sectional variation of returns on stocks trading on the Macedonian Stock-Exchange. To run the regressions, first we defined 7 portfolios to act as the dependent variables. These portfolios are formed on the same basis as the variables needed to construct the risk factors. Namely, the assets in the sample are divided based on size and book-to-equity with the size factor having two groups, big and small, and the book-to-equity factor having three groups, low, medium and high. The explanatory variables are defined earlier and they are the risk factors defined earlier. Namely, for the CAPM, the only risk factor is the market risk defined as the excess return of the Macedonian Stock Exchange index MBI10 over the risk free rate, the rate on the 1 month Treasury bill issued by the National Bank of the Republic of North Macedonia. The Fama-French Three Factor extends the CAPM and includes two additional risk factors, the size factor, SML defined as the average return of small minus big companies, and the book-to-equity ratio, HML defined as the average return of companies with high minus low book-to-equity ratio.
Table 4 presents the results of the CAPM regression:

$$R_{i,t} - R_{f,t} = \alpha + \beta_1\left[R_{m.t} - R_{f,t}\right] + \varepsilon_{i,t}$$

$R_{i,t}$ = average monthly return of portfolio i in time t

$R_{f,t}$= average monthly risk free rate

$R_{m.t}$= average monthly return of the market portfolio proxied by the MBI10 index

β_1= sensitivity to market factor

$\varepsilon_{i,t}$= error term

The results show that this Asset Pricing Model has a low explanatory ability for the cross-sectional variation of returns of stocks trading on the MSE. This can be seen by the negative values for adjusted R^2, where the average adjusted R^2= -0.00581. The fact that α is positively significant for one of the portfolios at the 5% level of confidence indicates that the model underestimates the returns for this portfolio. A negatively significant intercept would have indicated that the model. The market factor coefficients are all close to zero and none are statistically significant confirming the low fit of this model for explaining the cross-sectional variation of returns. This evidence contradicts most findings on this topic for developed markets, emerging markets and frontier market where it is usually found to have a value greater than 0.5.

Table 4 Year 2011-2021 regression results for the 6 portfolios sorted on size and BE/ME factor and MBI10 index. The results of the CAPM regression Rit-Rft=α+ β_1[Rmt-Rft] + eit
*,**,*** = 1%, 5%, 10% significance level

CAPM			
Portfolio	α	(Rm-Rf)β1	R^2
B/L	0.0050	0.02980	-0.00756
S/L	0.0096 **	-0.05236	-0.00476
B/M	-0.0022	-0.00850	-0.00811
S/M	0.0003	-0.11022	-0.00177
B/H	-0.0023	-0.01026	-0.0024
S/H	0.0037	0.02322	-0.00788
MBI10	0.0039	0.00186	-0.00819
		Average	-0.00581

Source: Author's own calculation

Table 5 presents the results of the Fama-French 3-factor regression:

$$R_{i,t} - R_{f,t} = \alpha + \beta_1\left[R_{m.t} - R_{f,t}\right] + \beta_2 SMB + \beta_3 HML + \varepsilon_{i,t}$$

$R_{i,t}$ = average monthly return of portfolio i in time t

$R_{f,t}$= average monthly risk free rate

$R_{m.t}$= average monthly return of the market portfolio proxied by the MBI10 index

β_i= factor sensitivities

SMB = Small minus big (proxy for size premium)

HML = High minus low (proxy for value premium)

$\varepsilon_{i,t}$= error term

The results show a clear improvement in the explanatory power of this model compared to the CAPM. This is evident by the increase in the adjusted R^2 parameter, which for the Fama-French Model is equal to 0.165. Despite the clear improvement, this model's fit to the data remains relatively low. In fact, most of the empirical studies on this model find the adjusted R^2 parameter to have values ranging from 0.5 to 0.9. Nonetheless, we can still make some statistical inferences based on the results of the regression. In line with the results from the CAPM regression, we can conclude the market factor has no explanatory power with regard to the cross-sectional return variability. We find that the size factor is statistically significant at the 1% level for all portfolios except the portfolio containing small market capitalization stocks with low book- to-equity ratio. In line with published evidence, this factor is positive for portfolios containing small stocks and negative for those containing large stocks. All of the small stock portfolios have positive coefficients and two out of three are statistically significant at the 1% level. This signals a direct relationship between the portfolio returns of the small stock and the excess portfolio returns (Osagie & Osamwonyi, 2017). The negative coefficients on the big size portfolios indicate that the returns of these portfolios are inversely related to that of the excess market returns. These findings are consistent with Fama and French (1996) who show that small firms load positively and big firms load negatively on SMB factor. The book-to-equity is statistically significant at the 5% level for three of the portfolio and at the 1% level for one of the portfolios. Additionally, we can notice that this factor increases when going from growth to value stocks (Czapkiewicz, Wójtowicz, 2014). Portfolios with higher book-to-equity are riskier than portfolios with a lower ratio. From the data we can see that the values of the HML beta's for the low book-to-market equity portfolios or the growth portfolios is negative.

Table 5 Year 2011-2021 regression results for the 6 portfolios sorted on size and BE/ME factor and MBI10 index. The results of the Fama-French regression Rit-Rft=α+ β_1[Rmt-Rft] + β_2SMB + β_3HML + eit.*,**,*** = 1%, 5%, 10% significance level

Fama-French 3-factor model							
Portfolio	α	(Rm-Rf)β_1	(SMB)β_2		(HML)β_3		R^2
B/L	0.0064	0.014887	-0.5274	***	-0.1669		0.109
S/L	0.0080	-0.05953	-0.0046		-0.2489	**	0.032
B/M	0.0006	-0.01482	-0.4762	***	0.1021		0.122
S/M	-0.0031	-0.09873	0.6897	***	-0.0658		0.110
B/H	0.0062	-0.10148	-0.9217	***	0.6671	***	0.330
S/H	0.0083	0.056842	0.3897	***	0.9171	***	0.406
MBI10	0.0061	-0.00257	-0.3662	***	0.0937		0.046
						Average	0.165

Source: Author's own calculation

Conclusion and Scope for Further Research

The empirical analysis of this study reveals a number of findings regarding the Macedonian Stock Exchange. The first thing to note is that the low level of turnover and liquidity of the Macedonian Stock Exchange limit the statistical significance of any time-series analysis. This is also confirmed by the identified weak market inefficiency of this market identified by Angelovska (2018). This creates the opportunity of investors earning excess returns as asset pricing models will over- or underestimate the price of securities trading on this market. This is evident from the low levels of variation explained by the models in our study, both for the CAPM and the Fama-French Three Factor Model. An additional limitation of the Macedonian Stock Exchange for running this type of analysis is the small amount of stocks which can be used for the analysis. This is a characteristic of many emerging and frontier markets (Osagie & Osamwonyi, 2017).

With regard to the results we can note that during this period the market portfolio proxied by the MBI10 index provided better returns when compared to the risk free asset which can be seen by the positive mean value of the excess market return variable. This can be the result of the general bullish market environment on global financial markets following the Global financial crisis as well as the positive developments concerning the Republic of North Macedonia. These include the accession of the country to NATO, the Prespa Agreement with Greece, the relatively stable dividend policies of the companies included in the index and the agreement between the Republic of North Macedonia, Bulgaria and Croatia to create a link between the stock markets of the three countries in order to provide the investors access to each of the markets. Only one of the factors from the CAPM regression provides a 5% level of significance but we can conclude that the overall ability of the model to explain variation is low, more specifically negative indicating a bad fit to the data. On the other hand, the results from the Fama-French Three Factor Model show significance of the size factor for the majority of the portfolios and statistical significance of the book-to-equity portfolio for three of the portfolios. This means that the model provides some statistically significant information compared to the CAPM which can be seen by the increase in the adjusted R^2 parameter. The justification for extending the CAPM for the Macedonian Stock Exchange market can additionally be inferred by the low level of correlation between the factors included in the mode which means that the additional two explanatory factors are independent and should be included in the pricing of excess portfolio returns in the MSE.

Further research can be conducted on the topic of asset pricing models for the Macedonian Stock Exchange. This can include using a greater number of stocks quoted on the MSE, implementation of other pricing models to help identify a model that would be a better fit of the data provided. Additionally, different time frames can be examined to identify whether the statistics can be improved

by using data that is more stationary. In conclusion, the scope for further analysis on the Macedonian Stock Exchange is vast as the literature concerning this market is currently very limited. An increase in research of this market can help increase the transparency of prices and will help increase the efficiency of the market which will have positive implications on the allocation of resources. In turn, this can help increase the interest of foreign investors for stocks listed on the Macedonian Stock exchange and for the economy in general.

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