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Evaluation of stock characteristics on the Norwegian and Romanian stock markets

Navn: Andreea Madalina Vasilica

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Student Name : Andreea Madalina Vasilica

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Contents

Abstract

This master thesis evaluates the stock characteristics of two main asset-pricing models in both the Norwegian and Romanian stock markets with the addition of liquidity, momentum, beta and idiosyncratic volatility in order to:

- identify what factors best desribe the markets;
- suggest the relevant models best suited for the markets in question (developed vs developing);
- infer the possible roots of the differences (if any) between a developed stock market and a developing one on the basis of the analysis aforementioned.

This thesis is inspired by the paper "*Evaluating asset pricing models in the Korean stock market*" written by Soon-Ho Kim, Dongcheol Kim, Hyun-Soo Shin and published in the Pacific-Basin Finance Journal and the paper *"The Cross-section of Expected Stock Returns"* written by Jonathan Lewellen and published in the Critical Finance Review Journal. The stock characteristics used for evaluating the stock markets come from the asset models Fama and French APT five-factor model (2014) and Hou, Xue and Zhang four-factor model (2012). In addition to the stock characteristics that compose the aforementioned models, four stock characteristics are added to the models: liquidity, momentum, beta and idiosyncratic volatility.

These models will be evaluated through Fama-Macbeth cross-sectional regressions and the results will be compared by means of t-stats, p-values and R^2 measures. The stock return data are obtained from DataStream. Romania has monthly data from January 2007 to December 2016 while Norway has monthly data from December 2005 to December 2016. The Romanian sample contains 102 companies whilst the Norwegian sample contains 147 companies.

The results show that book-to-market equity ratio and ROE are important characteristics for the Romanian market. Norway on the other hand follows more or less the path of a mature market, whereby the majority of the traditional characteristics have explanatory power. Investments variable can be omitted in the analysis of both markets without much loss of information. In terms of the suitability of the models, models that incorporate book-to-market equity ratio and

ROE characteristics perform best in the Romanian case whilst the existing asset-pricing models can be used together for a better description of the Norwegian market. In terms of the differences between a developed and a developing market, the results of this thesis do not provide enough evidence for such an inference. Moreover, the results in this thesis should not be generalized especially across developing markets, due to the small stock sample size and the limited time horizon.

Introduction

Asset pricing models have a fairly extensive list of uses, from estimating equilibrium expected returns to the evaluation of performance of fund managers to the determination of the cost of capital for a particular company. The vast literature on this subject is thus unsurprising.

But despite this, there is no consensus on a common model that does not fail when empirically tested. Rather a multitude of additions and subtractions have been made in order to accommodate as best as possible the reality of finance to the positive predictions made by the theoretical frameworks such as CAPM and APT. And with the advent of behavioural finance, the common practice amongst professionals nowadays is to utilize both CAPM (and CAPM variant models) together with APT-models.

This thesis does not set out to identify a model that could bridge the existing gap between normative and descriptive models but rather to evaluate two asset pricing models through a characteristic-based approach on two distinct cases: a developed market and a developing one. Therefore, this thesis will focus on evaluting stock characteristics that are traditionally used in asset-pricing models, on both the Norwegian and Romanian stock markets, in order to:

- identify what factors best desribe the markets;
- suggest the relevant models best suited for the markets in question (developed vs developing);
- infer the possible roots of the differences (if any) between a developed stock market and a developing one on the basis of the analysis aforementioned.

This study is inspired by the paper "*Evaluating asset pricing models in the Korean stock market*" written by Soon-Ho Kim, Dongcheol Kim, Hyun-Soo Shin and published in the Pacific-Basin Finance Journal and the paper *"The Cross-section of Expected Stock Returns"* written by Jonathan Lewellen and published in the Critical Finance Review Journal. The stock characteristics used for evaluating the stock markets are the building blocks for the Fama and French APT five-factor model (2014) and Hou, Xue and Zhang four-factor model (2012) and they are: size, book-to-market ratio, ROE, operating profitability and investments. In addition to the stock characteristics that compose the aforementioned models, four stock characteristics are added to the models: liquidity, momentum, beta and idiosyncratic volatility.

The author does not imply that the findings of this study are applicable to all developed and developing markets. The study's truly focus is on the Romanian stock market, with the addition of a benchmark, the Norwegian stock market, which has been included in numerous studies with the scope of evaluating asset pricing models, but has not been in and of itself tested.

This thesis has the following structure: section I makes a quick introduction into the theory of asset pricing models, section II reviews the literature, section III presents the methodology, section IV explains the data and descriptive statistics, section V examines the results and section VI concludes.

I. Theory

Even though this master thesis will focus on the stock characteristics that form the Fama and French five-factor (2014) model and the Hou, Xue and Zhang (2012) four-factor model, a short introduction into CAPM both in the Theory section and in the Literature review section is mandatory in my view due to the following reasons:

- Beta, as a testable stock characteristic, has been derived using the CAPM model;
- It is the foundation of all asset-valuation techniques to this date. It would thus feel an incomplete of a master thesis if a short introduction of the model would not be included.

1.1 CAPM

CAPM was derived from the work done by Harry Markowitz, namely the development of the theory of portfolio choice presented in the article "Portfolio Selection", published in 1952 (Markowitz 1999). The theory of portfolio choice, broadly speaking, stipulates the benefits of diversification – a common observed behaviour of investors but until then not properly theorized. William Sharpe builds upon this theory and in 1964, the Capital Asset Pricing Model is published in the paper "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk" (Sharpe F. 1964). The theory also makes use of other key pieces such as Tobin's two-fund separation (Tobin 1958), whereby the process of investment choice can be separated into two funds: the market portfolio, which is the optimal portfolio that lies on the efficient set and a riskless asset, such as an asset that earns a risk-free interest rate (Sharpe F. 1964). One year later, in 1965, John Lintner, in his paper "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets" theorizes the Capital Asset Pricing Model using also, as his point of departure, Tobin's two-fund separation (Lintner 1965).

In its definition, Capital Asset Pricing Model states that the pricing of assets is performed under the basis of a trade-off between undiversifiable risk (measured by beta) and the expected returns of the assets. CAPM is built on several assumptions, including the efficient market hypothesis assumption and the fact that investors are rational expected utility maximizers.

Upon these assumptions and taking into consideration Tobin's two-fund separation, the Capital Asset Pricing Model is derived in the following mathematical form:

$$E(R_i) = Rf + (E(R_M) - Rf)*\delta_{iM}/\delta^2_M \text{ , where } \delta_{iM}/\delta^2_M=\beta_i \qquad (1)$$

Equation 1 states that the expected return on asset *i* is equal to the risk-free rate of return plus a risk premium. The risk premium is the price of the risk multiplied by the quantity of risk, where the price of the risk is the difference between the expected return of the market portfolio and the risk-free rate asset, and the quantity of the risk is β_i which measures the sensitivity of the asset's *i* return to variation of the market portfolio's return (Copeland, Weston and Shastri 2013). It is thus covariance that matters in the process of choosing the assets for building a portfolio. Beta, in other words, represents the quantity of undiversifiable risk that the investors are willing to accept given a certain price of risk, or risk premium: ($E(R_M) - Rf$), or the risk premium is simply proportional to the beta coefficient.

The ex post empirical equation is the following:

$$R'_{pt} = \gamma_0 + \gamma_1\beta_p + \varepsilon_{pt}, \qquad (2)$$

where $\gamma_1 = R_{mt} - R_f$ and R'_{pt} represents the excess return on portfolio $p = (R_{pt} - R_f)$ (Copeland, Weston and Shastri 2013)

Based on CAMP, the predictions of the aforementioned model are (Copeland, Weston and Shastri 2013):

- γ_0 approximately equals 0.
- Beta should be the only factor that influences the rate of return.
- The relationship should be linear;
- $\gamma_1 = R_{mt} - R_f$.

1.2 APT

CAPM is a simple model that links the expected return of an asset to its betas, or the systematic risks that naturally exist in an economy. In this respect though, CAPM is unidimensional. Beta is indeed a powerful yet simple factor measuring undiversifiable risk but it is hard to identify it empirically. One reason is that it requires the identification of the true market portfolio. It has not been theoretically defined and throughout the studies that will be further described in the next section the market portfolio was replaced by a proxy which, according to Brown and Walter (2013, 47) encounters two difficulties: "the proxy might be mean-variance efficient even when the true market portfolio is not" or the proxy might be altogether inefficient.

Moreover, even if the efficient market portfolio would be properly identified and measured, one would expect an asset's return to be influenced by more than its sensitivity to the overall portfolio risk. Factors such as inflation rate, business cycles, interest rate could impact an asset's return just as much as its sensitivity to aggregate market movements, or in some cases, even more. For this reason, there have been developed multifactor models that take into account specific factors that influence an asset's return. These models provide a point of departure for knowing the exact location of an asset's return relative to those factors and thus being able to manage the exposure properly and efficiently. The Arbitrage Pricing Theory (APT) is one of these multifactor models and it can be regarded as a multidimensional CAPM, or CAPM can be regarded as a special case of APT. (Bodie, Kane and Marcus 2014) (Copeland, Weston and Shastri 2013)

The Arbitrage Pricing Theory can be derived from the powerful relation stated in Ross (1977), where "if two riskless assets offer rates of return of ρ and $\rho^{`}$, then (in the absence of transactions costs):

$$\rho = \rho^{`}\text{"} \quad (3)$$

This is known as the Law of One Price. If the above condition is violated, then there exists an arbitrage opportunity and, as a consequence, it would indicate, according to Bodie, Kane and Marcus (2014,328) "the grossest form of market irrationality."

Furthermore, APT departs from the formation of an arbitrage portfolio, with weights $\Sigma w_i=0$ (no change in wealth), that the following excess return is given by:

$$R_P = E(R_P) + \beta_P F_k + \varepsilon_P \qquad (4)$$

where $\beta_P = \Sigma w_i \beta_{ik}$; $E(R_P) = \Sigma w_i E(R_i)$; $\varepsilon_P = \Sigma w_i \varepsilon_i$; F_k – a vector of expected returns of k factors are the weighted averages of the β_i, risk premiums of the n securities and the weighted average of the ε_i of the n securities (Bodie, Kane and Marcus 2014). Through diversification though ε_P becomes negligible and so equation 4 becomes: (Bodie, Kane and Marcus 2014)

$$R_P = E(R_P) + \beta_P F \qquad (5)$$

Furthermore, because there is no change in wealth ($\Sigma w_i=0$), then R_p, from a random variable, becomes equal to $E(R_p)$. This means that all systematic risk has been eliminated as well, so that a proper pure arbitrage portfolio has been formed. In other words:

$$R_P = \Sigma w_i E(R_i) = 0 \qquad (6)$$

If the equation 6 were not true, then by using no wealth one would be able to obtain a riskless return. Moreover, this riskless return could be maximized simply by scaling up the arbitrage portfolio. This is however incompatible with the no-arbitrage condition and the Law of One Price and as such, assuming a riskless rate of return Rf with zero beta, the arbitrage pricing theory is the following:

$$E(R_i) - Rf = \Sigma[F_K - Rf]\beta_{ik} \qquad (7)$$

APT does require that investors have a risk-averse utility function but its simplicity lies purely on the Law of One Price and no-arbitrage condition. It does not make any assumption about the distribution of asset returns; it does not require the entire universe of assets, and as such, there is no special place for the market portfolio, and it includes numerous factors. This last statement is a quality in and of itself due to its practicality for minimizing one's exposure against changes in one or multiple factors. It also helps explain, from a theoretical point of view at least, the factors that might, more or less, influence assets from an economy as whole. CAPM, as mentioned in the beginning, can be thought of as a special case of APT if one would use only one factor, and that is the market portfolio.

However a multifactorial APT is not only useful for the above reasons but also necessary as there have been discovered, over the years, multiple anomalies unaccounted for by CAPM. These anomalies will be more thoroughly revised in the following sector but a few are worth mentioning here as they can bridge the gap between a general multifactorial APT to a more concrete one, such as a five-factor model.

Based on empirical research conducted by Chan and Chen (1991), cited in Fama and French (1996, 56) that revealed covariation in returns related to relative distress not captured by the market return, and Huberman and Kandel (1987), cited in Fama and French (1996, 56) that also surfaced covariation in the returns of small stocks not fully explained by the market return, Fama and French (1996) introduced a three-factor model using HML (high minus low – the difference between the returns of a portfolio of high book-to-market stocks and the returns of a portfolio with low book-to-market stocks) and SMB (small minus big – the difference in the returns of a portfolio of small stocks to that composed of large stocks as measured by their market capitalization) proxy factors for the relative distress in returns. As such, the expected excess return on portfolio *P* is,

$$E(R_p) - R_f = b_p[E(R_M) - R_f] + s_pE(SMB) + h_pE(HML) \quad (8)$$

where $[E(R_M) - R_f]$, $E(SMB)$ and $E(HML)$ are expected premiums and b_p, s_p and h_p are the factor sensitivities in relation to the return of the portfolio. The five-factor model that will be tested in this thesis is simply an extension of the three-factor model that incorporates profitability and investment. According to Fama and French (2014, 2) “much of the variation in average returns related to profitability and investment is left unexplained” by the three-factor model aforementioned. From this perspective, the two factors added to the above equation are RMW (a proxy factor that consists in the difference between the returns on portfolios composed of high and low profitability) and the CMA (a proxy factor that consists in the difference between the returns of portfolios composed of stocks of low and high investment companies). (Fama and French 2014) Equation 8 takes the following form:

$$E(R_p) - R_f = b_p[E(R_M) - R_f] + s_pE(SMB) + h_pE(HML) + r_pE(RMW) + c_pE(CMA) \quad (9)$$

1.3 Hou, Xue and Zhang's four-factor model

Another recent model is the Hou, Xue and Zhang's four-factor model, introduced in 2012. It is based on the q-theory of investment and it has the following mathematical form:

$$E[r^i] - r^f = \beta^i_{MKT}E[MKT] + \beta^i_{ME}E[r_{ME}] + \beta^i_{\Delta A/A}E[r_{\Delta A/A}] + \beta^i_{ROE}E[r_{ROE}] \quad (10)$$

where *MKT* is the market excess return, r_{ME} "is the difference between the return on a portfolio of small-market equity stocks and the return on a portfolio of big-market equity stocks", $r_{\Delta A/A}$ "is the difference between the return on a portfolio of low-investment stocks and the return on a portfolio of high-investment stocks" and r_{ROE} "is the difference between the return on a portfolio of high ROE stocks and the return on a portfolio of low ROE stocks" and β^i_{MKT}, β^i_{ME}, $\beta^i_{\Delta A/A}$, β^i_{ROE} are the factor loadings. (Hou, Xue and Zhang 2012)

In Hou, Xue and Zhang (2012), the new factor-model is compared against the Fama-French three-factor model and the Carhart (1997) four-factor model and overall it performs similarly or better than the latter models, especially in explaining anomalies.

II. Literature review

Before considering the numerous empirical studies done on CAPM, there needs to be a brief introduction in the Efficient Market Hypothesis (EMH), which states that the current price of an asset is close to its intrinsic value. According to Statman (2005), the EMH is the second building block of the standard finance that describes economic agents as rational beings that always prefer more to less, are mean-variance maximization-driven and regard an increase in their wealth in the same way, regardless of its origin. EMH has three forms: weak, semi strong and strong. The weak EMH states that the market prices incorporate all market information, the semi strong EMH underlies the fact that the market prices incorporate all publicly available information, always adjusting to absorb new information, and the strong EMH refers to the fact that market prices reflect all information, both public and private.

2.1 CAPM

CAPM is closely related to EMH due to the fact that, in order to test the second form of EMH, one would need a model that could adjust for the differences in risk among stocks, in other words, one would need a variable that could explain the returns of the asset not in terms of standard deviation but in terms of covariance. As such, CAPM’s beta came in great use. One such example that tested EMH using CAPM is related in Basu (1977). In this study, it is tested whether low P/E ratio portfolios tend to have larger returns than high P/E ratio portfolios. If this were the case, then both CAPM and EMH would be violated. The study focused on over 1400 industrial firms that traded on NYSE during the period September 1956 – August 1971 and it showed that low P/E portfolios have, on average, higher returns compared to those of high P/E portfolios. In addition, there was a delay in the ascription of new information into the market prices suggesting that EMH, even though not completely amiss, might need some adjustments. This study however focuses on EMH using CAPM. But there are numerous other studies which their main focus is the empirical performance of CAPM.

One of the first studies that questioned the validity of CAPM is Friend and Blume (1970). The paper tests the one-parameter performance measures to risk measure of 200 random portfolios selected from 788 common stocks that traded on NYSE during the period January 1960 – June 1968. The performance measures were Sharpe ratio, Treynor's ratio and Jensen's ratio, while the risk measure was beta.

Until this paper, CAPM had been tested on performance of portfolios in such papers such as Sharpe (1966), Jensen (1968) and Lintner (1965) cited in Friend and Blume (1970, 574), but only Friend and Blume's study questioned the validity of CAPM as it found out a bias in the performance measures relative to beta. In addition, throughout the paper, Friend and Blume question the assumptions underlying CAPM and in doing so, they try to explain this biasness through the unrealistic characteristics of the assumptions, one such assumption being the ability of the investors to borrow and lend unlimited quantities at the same risk-free rate. Black (1972) would, later on, replace the risk free rate with a portfolio R_z that has zero-beta with the market portfolio and it is, like the risk free rate, the minimum variance portfolio. By doing so, CAPM would thus introduce restricted borrowing which is much closer to reality. However, even with one assumption relaxed, CAPM still underperformed when tested.

As such, numerous studies had been further produced in order to discover if there were any other factors that could explain returns better than beta. Banz (1981,14) suggested that CAPM was specified incorrectly, lacking a factor (or multiple) that would otherwise take into consideration the size effect, where "on average, small NYSE firms have had significantly larger risk adjusted returns than large NYSE firms over a forty year period.". In the same line of thinking is Reinganum (1981a), where E/P anomaly discovered by Basu (1977) is overtaken by the size effect; it also concludes that this size effect is not due to a market anomaly but rather due to a misspecification of CAPM.

The size effect continues in more recent times to appear in papers testing CAPM, one such example being Campbell and Vuolteenaho (2004) whereby they characterized beta as either good or bad and suggested that the poor performance of CAPM is largely due to the fact that growth stocks are described by good betas.

In a Miller-Modigliani world, dividend yields would have no effect whatsoever on the returns of the stocks. However, Litzenberger and Ramaswamy (1979) acknowledged the fact that there exists a positive relation between dividend yields and expected returns; they also pointed out to the clientele effect, whereby some economic agents impacted by high taxes prefer stocks with low dividend yields whereas those that have low taxes or no taxes at all (not-for-profit organizations) prefers stocks with high dividend yields.

Following upon the results published in Litzenberger and Ramaswamy 1979 paper and after the discovery of seasonality in stock returns – so-called January effect whereby most of the excess return is generated in one month, as reported in Keim (1983)– Keim (1985) argued that even though there seems to exist a positive relation between dividend yields and stock returns, this relation has more statistical significance in January and cannot be solely attributed to the clientele effect, suggesting thus a different phenomenon, such as size effect, that might be more relevant.

However, Roll (1981) argued that one possible explanation of the discovery of the size effect lies in the autocorrelation of the portfolio returns due to infrequent trading. This autocorrelation would cause the sample observations used in the studies aforementioned not to be independently distributed. With regards to the dividend yield however, the results are mixed. As stated in Roll (1981, 887), "perhaps the mixed evidence on dividend yield is due partly to a complex relationship between dividend yield and trading frequency with a correspondingly complex relationship between yield and the bias in risk measures."

Dimson (1979) proposed some estimators to replace beta estimates in order to eliminate the bias that conventionally arises when analysing data based on stocks that are infrequently traded, while Gibbons (1982) argued that a new approach, called multivariate statistics, is better suited to test CAPM (and other asset pricing models as well) due to the fact that some methodological problems are neatly avoided (such as the errors-in-the-variable problem). However, one of the most prominent papers with regards to the discovery of econometric issues when testing CAPM (and not only), is Roll's paper (1977) which firmly implied that there is a severe limitation to evaluating asset pricing models such as CAPM due to the fact that the true market portfolio is not properly defined (Roll 1977). In addition, he adds that using a proxy for the market portfolio might render the test to fall into either of the two aforementioned fallacies: that either the proxy is mean-variance efficient while the true market portfolio is not, or vice versa.

Following upon the aforementioned limitations in testing CAMP, Stambaugh (1982) tested both Sharpe-Lintner CAPM and Black's CAPM using a variety of assets (stocks, bonds, preferred stocks) and a multivariate test analysis. Upon these changes, he argued that Sharpe-Lintner CAPM is rejected using the inclusive set of assets while Black's CAPM is not; on the other hand, he pointed out to the fact that a different composition of a set of assets could conclude in different results, such as a rejection of Black's CAPM and not of Sharpe-Lintner CAPM.

Other than the size effect, seasonality or the sensitivity of the CAPM to the formation of the market factor proxy, Chan, Hamao and Lakonishok (1991) argued that, upon studying the returns of the Japan's stock market in relation to earnings yield, size, book to market equity ratio and cash flow yield (as what they referred to as "fundamentals"), there is a significant positive relation between the book to market equity ratio and cash flow yield relative to the expected returns.

As reported in Fama and French landmark paper (1992,450), Stattman (1980) and Rosernberg, Reid and Lanstein (1985) derived the same positive relation implied by Chan, Hamao and Lakonishok (1991) study on the Japanese stock market between book to market equity ratio and expected returns on the U.S. stock market.

With all these market anomalies discovered during the years and with the growing influence of behavioural finance looming over ((Kahneman and Tversky 1979), (De Bondt and Thaler 1985)), Fama and French (1992) set out, in their paper, to establish whether the market is inefficient or the CAPM model is lacking in explanatory power. Unlike the aforementioned papers, they used a large database, stretching from 1963 to 1990 for NYSE and AMEX stocks, and adding NASDAQ stocks from 1973 to 1990. Firstly they separated size and beta in order to escape the correlation implicit between these variables, and in so doing they formed portfolios based on size and based on beta. The results showed that when portfolios are formed on size, there exists a positive relation between returns and beta whilst when portfolios are formed on beta alone, the link between returns and beta disappears. In addition, they ran multiple regressions with the individual stock return as the dependent variable and show that book to market equity ratio and size are the factors that explain best the returns. As a consequence, Fama and French introduced in 1993 a three-factor model.

2.2 APT

However, before the introduction of the three-factor model by Fama and French, there had been some empirical investigations on APT. One such paper is Roll and Ross (1980), whereby they explore the existence of factors and the number of factors that could explain the returns. They concluded that there are at least three factors in the model. The specification of the factors however could not be determined through factor analysis but Roll and Ross (1980) argued that if an alternative variable is statistically significant in explaining the expected return then APT could be rejected. They tested whether the standard deviation is such an alternative variable and discovered, albeit the high correlation between returns and the standard deviation, it does not bring "explanatory power to that of the factor loadings." (Roll and Ross 1980, 1073)

Reinganum (1981b), on the other hand, contended that the firm size effect is still existent and statistically significant even when APT risk is tested with a three-, four- or five-factor model. N.-F. Chen (1983) however, using the data of Reinganum, supported the findings of Roll and Ross (1980), whereby the standard deviation did not add explanatory power to the returns and rejected the findings of Reinganum (1981b), where firm size effect adds explanatory power to the returns. He also proposed that an economic interpretation of the common factors should represent the implicit direction of future research on APT, whereby macro factors explaining realized returns are to be determined empirically. And this is what Chen, along with Roll and Ross set out to examine three years later.

Chen, Roll and Ross (1986) proposed several economic variables that had been considered potent factors in explaining the expected returns. Upon these economic variables, they derive the following state variables: industrial production, change in expected inflation, unexpected inflation, risk premium, term structure, a value-weighted index, real per capita consumption and an index of oil price changes. Amongst these variables, only the first five factors were found to be statistically significant in explaining the stock returns, while the other three variables added no explanatory power whatsoever. In the meantime, other papers suggested that only few factors are sufficient in explaining expected returns. One such example is Brown and Weinstein (1983) whereby using a bilinear paradigm, they rejected a five – and a seven-factor model and concluded that few economic factors might appear to be integrated in APT. Shanken (1982) argued that APT is not truly testable unless the true market portfolio's returns are incorporated.

Despite such mixed empirical results, Fama and French (1993) introduced a three-factor model. In 2014, the three-factor model will have been updated with two factors: RMW (the difference between stocks with robust and weak profitability) and CMA (the difference between stocks of low and high investment companies). The 2014 Fama and French five-factor model was tested internationally in Fama and French (2015) both on a regional and a global basis. Due to the poor performance of the global three- and five-factor models on regional portfolios, they concentrated their analysis locally. There were some difference amongst the regions (North America and Canada; Japan; Asia Pacific; Europe) such as the investment factor having no explanatory power in Europe and Japan, but the striking result, common to all regions, was that portfolios of small stocks but with high investment but low profitability wreak havoc on asset pricing models. The five-factor model, in words of Fama and French (2015,22) "captures the troublesome average returns in some sorts, but not in the Size-Op-Inv sorts that best isolate stocks of firms that invest a lot despite low profitability."

However, despite the imperfectness of the model, Fama and French (2015) suggested that the five-factor model is quite appropriate for the evaluation of portfolio manager or the selection of a portfolio itself. A comparative study was performed by Hou, Xue and Zhang (2016), whereby they tested several classic and also new asset pricing models, including the Hou, Xue and Zhang (2012) q-factor model and the Fama and French five-factor model (2014), against a series of hundreds of anomalies. Their large study drew two major conclusions: 1) when controlling for stocks with small market capitalizations, a large number of anomalies become statistically insignificant; 2) amongst the statistically significant anomalies, the Hou, Xue and Zhang (2012) q-factor model and the Fama and French five-factor model are the best performing models.

2.3 Hou, Xue and Zhang's q-factor model

The four-factor model introduced by Hou, Xue and Zhang (2012) is a by-product of all the empirical research conducted over the years since the appeareance of CAPM and APT. As it was previously shown, Sharpe-Lintner CAPM was consistently underperforming from an empirical standpoint and as such Black (1972) introduced CAPM with restricted borrowing, whereby the riskfree interest rate would be replaced by a zero-beta, minimum-variance asset. Merton (1973, 868) developed an intertemporal CAPM, whereby the limitations of the static CAPM have been expanded to include "a changing investment opportunity set." Consumption CAPM had been introduced by Breeden (1979), in which assets are traded continuously and beta is measured relative to the aggregate real consumption growth rather than the market. Later on, Mankiw and Shapiro (1986) tested the consumption versus the market beta and reported that the market beta incorporates more information regarding its return than the consumption beta. One possible explanation for this is that not all consumers are active participants in the stock market. As such, CAPM has been constanly modified and changed in order to incorporate "the market anomalies" and a more realistic approach towards the pricing of assets.

APT, on the other hand, even though is not regarded as an equilibrium model but more as an arbitrage model, has had its share of modifications. At first, APT seemed promising due to the fact that returns were not linked only to one risk factor but multiple ones. However, as it was previously shown, the discovery of those multiple risk factors has been more "trial and error". As such, Fama and French introduced a three-factor model in 1993. Carhart (1997) expanded the three-factor model with a fourth one, called momentum in stock returns and found that it improved the mean absolute error of the three-factor model. D. Kim (2006) provided a risk-based asset pricing model for the January effect by suggesting a two-factor model that contains a market factor and an earning informations uncertainty factor.

Chen, Marx-Novy and Zhang (2011) replaced the two factors from Fama and French three-factor model with investment and ROE as these factors have an effect on discount rates and further on, an impact on stock returns. Later on, Fama and French (2014) introduced a five-factor model that is different from the five-factor model proposed in 1993, with market, size, book-to-market ratio, profitability and investment in order to capture the variation of average returns relative to profitability and investment, while the three-factor model of Chen, Marx-Novy and Zhang (2012) is updated with a size factor.

Hou, Xue and Zhang (2012) proposed a new factor model, called the q-factor model due to its linkage with the q-theory of investment, whereby the two most prominent explantory factors are investment and ROE, while size is more of an adjustment factor. They tested it against Fama and French three-factor model and Carhart (1997) four-factor model in explaining various anomalies such as earnings surpirse or financial distress, and their results suggest that it outperforms the two models aforementioned and can be thus considered, according to Hou, Xue and Zhang (2012,35) "a new workhorse model for academic research and investment management practice."

2.4 International attempts

On an international level, there has been a growing debate on whether there exists some common global or sector factors that explain asset returns due to the rapid integration and liberalization of markets around the world. Fama and French (1998) argued that a one-state-variable international CAPM or a two-factor APT (a world market and a world book-to-market equity) explain international stock returns. However, Griffin (2002) pointed out the fact that Fama and French (1998) study is somewhat flawed as they failed to compare the world factor model to country-specific models. In turn, Griffin (2002) found out that when comparing a world three-factor model to country-specific models, the country-specific models add more explanatory power to time-series variation in portoflio and individual stock returns than the world model. As a results, Griffin (2002) suggested that asset pricing, performance evaluation and risk analysis is better conducted on a country-specific basis than on a global basis.

Other proponents of Griffin's results are Koedijk and van Dijk (2004) that measured whether global risk factors are better in computing cost of capital. Koedijk and van Dijk (2004) conducted the analysis on a sample of 3300 stock from nine industrialized countries (from Europe as well) and proved that global risk factors add no power to the cost-of-capital computation. Chen, Bennett and Zheng (2006) examined whether sector effects (industry effects) in both developed and emerging markets have a more dominant influence than country-specific factors. The analysis was conducted on 23 developed countries (including Norway) and 26 emerging countries (excluding Romania) on the period January 1994 through May 2005. The results suggested that sector effects are more relevant in developed markets whilst country effects are more relevant in developing countries when explaining returns. Bekaert, Hodrick and Zhang (2009), when examining international stock return correlations on 23 developed countries (including Norway), found out that, despite the fact that Fama-French (1998) model explained the data quite accurately, there is still a great predominance of country-specific factors over industry-specific factors.

Hou, Karoly and Kho (2011) set out to specifically pinpoint the factors that might explain stock returns, bridging thus the gap between whether country-specific factors or global factors are more relevant. They examined size, dividend, earnings yields (dividend to price ratio, earnings to price ratio), cash flow–to –price ratio, book-to-market equity ratio, leverage, and momentum for 27000 stocks from 49 countries (including Norway but excluding Romania), stretching from period 1981 to 2003. Three lines of analysis are followed in this analysis and these are: 1) which factors are most relevant in the explanation of variation in global stock returns; 2) whether the factors discovered precedently are derived from a country perspective or from a global perspective, or a mix of both; 3) and whether these factors result from firm-level characteristics or from the covariance structure of returns that is related to them.

Their analysis revealed that cash flow-to-price ratio and not size and book-to-market ratio is relevant in explaining stock returns and a global cash flow-to-price portfolio together with a global factor-portfolio and a global market portfolio is the most appropiate model to explain stock returns. On the second point though, there seems to be a predominance of local components over the global component especially regarding emerging markets. On the third inquiry, not only is the cash flow-to-price ratio related to a global covariance risk factor, but it also reinforces the first point, where book-to-market ratio and size are rejected as explanatory factors linked to covariance risk.

Notwithstanding the vast literature on developed countries regarding the evaluation of asset pricing models, there has not been a somewhat similar effort regarding emerging markets. There are though some papers worth mentioning. Buckberg (1995) investigated the complete integration of emerning stock markets with the global market and discovered that prior to 1984 International CAPM is rejected, but on a second analysis conducted on a sample dated 1984 – 1991, there is strong evidence that emerning markets were integrated with the world market. Harvey (1995), on the other hand, argued that stock returns of emerging markets are influenced more by local variables rather than global ones pinpointing either to a segmentation of emerging markets from the world market or to a time variation in the risk exposures of emerning markets. Moreover, there has been in recent years a movement towards the analysis of emerging markets from an asset-pricing perspective on a singular basis, rather than coupled with other emerging markets or developed ones, as in Mateev and Videv (2008), Pieleanu (2012), Bontaș and Odăgescu (2011).

In light of this, this thesis will focus on the evaluation stock characteristics that are currently used for the construction of the main asset-pricing models discussed above, in both the Norwegian and Romanian stock market, in order to:

- identify what factors best desribe the markets;

- suggest the relevant models best suited for the markets in question (developed vs developing);
- infer the possible roots of the differences (if any) between a developed stock market and a developing one on the basis of the analysis aforementioned.

III. Methodology

This thesis will test the stock characteristics of Fama and French five-factor model (2014) and Hou, Xue and Zhang's four-factor model (2012) on the Norwegian and Romanian stock markets. The characteristics will be evaluated through cross-sectional regressions and the results will be compared by means of t-stats, p-values, R^2 and adjusted R^2 measures.

In addition to the stock characteristics specific to the aforementioned model, namely size, book-to-market equity ratio, ROE, operating profitability and investments, I also add four more stock characteristics that are highly documented throughout the literature, including in the Lewellen paper (2015) and Bessembinder, Cooper and Zhang (2016) paper, namely liquidity, momentum, beta and idiosyncratic volatility. The construction of the characteristics is described in section 4.1.

3.1 Characteristic-Based Model

In order to identify which factors best describe the markets, the Fama and MacBeth (1973) cross-sectional regression method will be employed. The cross-sectional regression equation employed to estimate the monthly betas for each characteristic is:

$$R_{It} = \alpha_{0t} + \hat{\beta}_{kI,t} fk_{I,t-1} + \ldots + \hat{\beta}_{KI,t} fK_{I,t-1} + \varepsilon_{It}, \quad t = 1,\ldots,T \qquad (12)$$

$$i = 1,\ldots I$$

$$k = 1,\ldots K$$

f – stock characteristic

For every month *t*, the log returns are regressed on the stock characteristics *t-1*. First, the log returns are regressed on the stock characteristics that traditionally belong to Fama – French (2014) and Hou, Xue and Zhang (2012) models. Afterwards, to each of these models, one more characteristic will be added from the additional characteristics, namely liquidity, return momentum, beta and idiosyncratic volatility. I also test three large models that include all the characteristics from Fama and French (2014) model plus the additional characteristics, all the characteristics from Hou, Xue and Zhang (2012) model plus the additional characteristics, and the last model that is composed of all the characteristics tested in this thesis.

Afterwards, I also test the predictive ability of the models in question by regressing, for every month t, the actual log returns on the estimates of expected stock returns derived from a firm's t-1 characteristics and slopes from the FM cross-sectional regressions (averaged with a one-year rolling window).

3.2 Discussion on the Characteristic-Based Model

The method is identical to the method employed in the Lewellen paper. (2015), namely the characteristics-based method. The reason why I don't test the models themselves and thus limit myself only to the stock characteristics lies in the small number of companies both in the Romanian and the Norwegian stock markets. (Romania: 102, Norway: 147). Moreover, the power of the method was exemplified not only in the Lewellen paper (2015) but also in the paper written by Bessembinder, Cooper and Zhang (2016) which employs the method to demonstrate that the apparently abnormal returns after events such as credit rating and analyst recommendation downgrades, are reduced or even eliminated and to conclude that a five-characteristic model composed of size, book-to-market ratio, profitability, asset growth and return momentum is the most relevant in explaining the returns; or Haugen and Baker (1996) paper which uses the characteristic-based model to reveal that the determinants (stock characteristics) of expected stock returns are common to the globally major equity markets.

The method is simple yet powerful enough to identify which stock characteristics are appropriate for the markets I examine, to infer the possible roots of differences between a developed market and a developing one on the basis of the statistical and economic significance of the explanatory stock characteristics and to pinpoint towards the relevant model that employ the stock characteristics that are found significant.

IV. Data

The stock return data are obtained from DataStream. Romania has monthly data from January 2007 to December 2016 while Norway has monthly data from December 2005 to December 2016. The Romanian sample contains 102 companies whilst the Norwegian sample contains 147 companies. Financial firms and companies with negative book equity and missing values for current assets and current liabilities are not included in the sample.

4.1 The construction of characteristics

The study follows the approach of the characteristic-based model presented in the Lewellen paper. (Lewellen 2015) Before construction, the variables have been winsorized at 2.5% level, except the monthly returns. The variables are constructed as follows:

- LogReturn: $\ln[(\frac{P_{t+1}}{P_t} - 1) + 1]$ for each month;[1]
- Size: $\ln(MarketCapitalization_{t-1})$, as in Lewellen (2015);
- Book to Market: $\ln(BookToEquity_{t-1})$, as in Lewellen (2015);
- Operating Profitability: $\frac{OperatingIncome_{t-1}}{BookEquity_{t-1}}$, as in Fama and French (2014)

[1] t = Month or Monthly;

- Investments: $\frac{\overline{TotalAssets_{Y-2} - TotalAssets_{Y-1}}}{\overline{TotalAssets_{Y-2}}}$[2], as in Fama and French (2014)
- ROE: $\frac{IncomeBefExtraItems_{t-1}}{OneQuarterLaggedBookEquity}$, as in Hou, Xue and Zhang (2012)
- Liquidity: $\ln(\frac{CurrentAssets_{t-1}}{CurrentLiabilities_{t-1}})$;
- Momentum: LogReturn from t-12 to t-2;
- Beta: market beta estimated from monthly log returns regressed on the Romanian BET index for the Romanian beta market and on the Norwegian OSEAX index for the Norwegian beta market;
- Idiosyncratic volatility: $\frac{\sigma_{Annualized;Company} - \beta_{market} * \sigma_{Annualized;Index}}{\sqrt{12}}$;

The above methodology has been utilized for both Romania and Norway.

4.2 Descriptive statistics

The averages and the standard deviation of the characteristics across the samples are quite similar. The market capitalization of Norwegian companies is much higher than that of the Romanian companies, which is to be expected considering the maturity of the market. Furthermore, the Romanian market is more heavily described by value stocks than the Norwegian market. ROE, although similar in the mean, is quite distinct in the standard deviation.

The mean of the operating profitability for Norway is of the same magnitude but with a different sign than the Romanian mean and the standard deviation, just like ROE, is higher than the Romanian standard deviation. This implies a wider spread in the overall monthly values of both ROE and operating profitability, suggesting that the Norwegian stock market is more active and diverse than the Romanian counterpart.

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[2] Y = Year or Yearly;

One last remark can be drawn with regards to the homogeneity of the stock markets shown by the standard deviation, whereby the Norwegian one is much more homogeneous in its returns than the Romanian market, indicative of the maturity of the Norwegian market relative to Romania. This is supported by the liquidity characteristics as well, whereby incipient stock markets, such as Romania, are more heavily described by liquidity needs than the more mature ones, such as Norway. However, the differences are not quite as large as one would assume.

Table 1: Descriptive statistics

Description: The sample includes all common stocks on Data Stream, except financial companies and companies with negative book equity and missing values for current assets and current liabilities. The numbers represent the time-series averages of the cross-sectional mean ('Mean'), standard deviation ('Std.Dev') and sample size ('N') for each variable.

	Romania (2007 - 2016)			Norway (2006-2016)		
	Mean	Std. Dev	N	Mean	Std. Dev	N
Return (Log %)	-0.40%	17.79%	102	-0.59%	12.54%	147
LogSize	9.234	3.964	102	10.910	5.917	147
LogBM	0.532	0.878	102	-0.273	0.839	147
ROE	0.018	0.289	102	-0.101	0.964	147
Op Profitability	0.038	0.319	102	-0.038	0.903	147
Investments	-0.057	0.459	102	-0.304	1.446	147
Liquidity	0.667	0.959	102	0.436	0.831	147
Momentum	-0.004	0.179	102	-0.006	0.124	147
Beta	0.501	0.289	102	0.569	0.483	147
Idiosyncratic Vol.	0.134	0.078	102	0.090	0.055	147

V. Empirical Results

119 cross-sectional regressions have been performed for Romania, from January 2007 to December 2016, and 132 cross-sectional regressions for Norway, from December 2005 to December 2016. The difference in the starting years is explained by the lack of sufficient accounting data for Romania from January 2007

backwards. First, the regressions were performed on the traditional characteristics of the models. Afterwards, other characteristics such as liquidity, momentum, beta and idiosyncratic volatility have been added as explanatory variables to the existing models.

I also test three large models that include all the characteristics from Fama and French (2014) model plus the additional characteristics, all the characteristics from Hou, Xue and Zhang (2012) model plus the additional characteristics, and the last model that is composed of all the characteristics tested in this thesis. Serial correlation was not accounted for and thus the t-statistics are biased downwards. (Petersen 2009)

Afterwards, I test the predictive ability of the models in question by regressing, for every month *t*, the actual log returns on the estimates of expected stock returns derived from a firm's *t-1* characteristics and slopes from the FM cross-sectional regressions (averaged with a one-year rolling window). The null hypothesis refers to the fact that the slopes of the stock characteristics are indistinctive from zero while the alternative hypothesis suggests the slopes of the stock characteristics are distinctive from 0.

5.1 Cross-Sectional Regressions (Fama and French Characteristics)

Table 2 reports average slopes, R^2, adjusted R^2 as well as t-statistics, p-values and sample sizes for 119 monthly cross-sectional regressions for Romania and 132 cross-sectional regressions for Norway. The monthly log returns were regressed on the lagged models' characteristics.

The computation of the statistics was performed as follows:

- Average Slopes: $\bar{\gamma}_i = \frac{1}{T}\sum_{t=1}^{T}\gamma_{it}$ [3];

[3] i = each characteristic

- t-statistics: $t - stat_i = \frac{\overline{\gamma_i}}{S.E._i}$

- R^2: $\overline{R^2} = \frac{1}{T}\sum_{t=1}^{T}(1 - \frac{SSR_i}{SST_t})$

- Adjusted R^2: $\overline{AdjR^2} = \frac{1}{T}\sum_{t=1}^{T}(1 - \frac{(1-R_t^2)*(n-1)}{(n-k-1)})$

There are several interesting key points worth mentioning. In the Romanian case, book to market ratio is statistically significant across all the models at 1% level. Even with the addition of the other characteristics, it still remains highly significant. Operating profitability and liquidity are two other statistically significant characteristics considering the fact that serial correlation was unaccounted for. All the other characteristics are not statistically significant, implying that on average they are indistinctive from zero. This is more readily observed in the model 1 with all characteristics, whereby book to market ratio is the only statiscally significant variable, all the others losing their explanatory power.

In terms of the fit of the model, model 1 with Beta and model 1 with all characteristics have the highest adjusted R^2, implying that these models are the most appropiate in explaining and determining Romanian monthly returns. However, one key observation should be included here and should be taken into consideration moving forward through the thesis. As in Lewellen (2015), the R^2 and adjusted R^2 do not provide information about the predictive ability of the characteristics, but only explain the contemporaneous volatility of the returns.

Regarding Norway, all the characteristics are more or less statistically significant. Unlike Romania with one characteristic outlier, Norwegian returns seem to be explained by all the characteristics formed in the models up to the final one. Indeed, in the final model, none of the characteristics remain statistically significant even though the fit of the model has a large improvement in its adjusted R^2 measurement. Another interesting aspect which is common to Romania as well is that the high statistically significant intercept would suggest the existence of other variables with more explanatory power than the existing ones, especially in model 1, model 1 with Liquidity, model 1 with Momentum and Beta; and if one takes into account the fact that serial correlation was not adjusted for, then in model with all characteristics as well.

However, one can see that the Norwegian stock market follows more or less the path a developed market would follow, by having its stock returns explained by the majority of the traditional stock characteristics, like size, book to market, operating profitability, momentum, liquidity and idiosyncratic volatility. Romania on the other hand seems to be explained in its majority only by book to market ratio. This is observable both in terms of statistical significance (more characteristics with higher values for t-stats) and goodness of fit (higher R^2 and adjusted R^2 values).
In terms of slopes, they are quite similar across models both in the Romanian and Norwegian case.

In conclusion, the null hypothesis is proven wrong for both the Romanian and Norwegian market. The Romanian market, so far, seems to be heavily described by the book to market ratio and in a smaller measure the operating profitability and liquidity characteristics, while the results for the Norwegian market suggest that the traditional characteristics are highly important when determining the stock returns. However, there are two key points that need to be addressed: 1) there seems to exist another characteristic/other characteristics missing from the models in both the Norwegian and Romanian markets; 2) all characteristics mixed together do not seem to disprove the null hypothesis in the Norwegian case in favor for the alternative hypothesis. The analysis from the forward sections will address these issues.

Table 2: Cross-sectional Regressions - FF Characteristics

Description: This table summarizes cross-sectional regressions when monthly log returns are regressed on firm characteristics. T-stats are based on the time-series variability of the slopes. The goodness of fit measurements R^2 and adjusted R^2 are averaged. Only the Fama and French characteristics with the additional explanatory characteristics are summarized in this table. For model 1, the slopes have been derived by regressing the monthly log returns on the one-month lag firm characteristics from Fama and French (2014) model, namely size, book to market, operating profitability and investments. This process is repeated with the addition of the other explanatory firm characteristics, such as liquidity, momentum, beta and idiosyncratic volatility. In the end, all the Fama and French characteristics + the additional characteristics have been utilized for the derivation of the slopes. Superscripts ***, ** and * refer to the statistical significance at the 1%, 5% and 10% levels, respectively.

	Romania			(2007 -2016)		Norway			(2006 - 2016)	
	Slope	t-stat	p-value	R^2	Adj. R^2	Slope	t-stat	p-value	R^2	Adj. R^2
Model 1				5.65%	0.74%				5.97%	2.63%
α	-0.020	-3.236	0.002***			-0.010	-4.223	0.000***		
Size	0.000	0.836	0.405			0.000	1.445	0.151		
Book to Market	0.020	6.685	0.000***			0.004	1.968	0.051*		
Op Profitability	0.009	1.664	0.099*			0.006	2.557	0.012**		
Investments	-0.001	-0.217	0.829			0.002	1.219	0.225		
N	102					147				
Model 1 with Liquidity				6.98%	1.11%				7.09%	3.10%
α	-0.021	-3.392	0.001***			-0.010	-4.477	0.000***		
Size	0.000	0.578	0.564			0.000	1.176	0.242		
Book to Market	0.020	6.844	0.000***			0.004	2.101	0.038**		
Op Profitability	0.009	1.546	0.125			0.006	2.711	0.008***		
Investments	-0.001	-0.224	0.823			0.002	1.683	0.095*		
Liquidity	0.004	1.656	0.100*			0.004	2.451	0.016**		
N	102					147				
Model 1 with Momentum				8.16%	2.35%				8.78%	4.87%
α	-0.018	-3.087	0.003***			-0.009	-4.144	0.000***		
Size	0.000	0.624	0.534			0.001	1.961	0.052*		
Book to Market	0.020	6.590	0.000***			0.006	2.761	0.007***		
Op Profitability	0.009	1.523	0.130			0.005	2.206	0.029**		
Investments	0.000	-0.052	0.959			0.002	1.402	0.163		
Momentum	0.002	0.141	0.888			0.055	3.236	0.002***		
N	102					147				

(table 2 continued)

	Romania			(2007 -2016)		Norway			(2006 - 2016)	
	Slope	t-stat	p-value	R^2	Adj. R^2	Slope	t-stat	p-value	R^2	Adj. R^2
Model 1 with Beta				8.75%	2.98%				8.87%	4.96%
α	-0.016	-2.903	0.004***			-0.008	-3.502	0.001***		
Size	0.001	1.412	0.161			0.001	4.860	0.000***		
Book to Market	0.020	6.685	0.000***			0.004	1.880	0.062*		
Op Profitability	0.007	1.298	0.197			0.005	2.360	0.020**		
Investments	-0.004	-0.751	0.454			0.001	0.916	0.361		
Beta	-0.014	-1.152	0.252			-0.011	-1.801	0.074*		
N	102					147				
Model 1 with Idiosyncratic Risk				8.45%	2.67%				7.50%	3.53%
α	-0.013	-1.581	0.117			0.002	0.514	0.608		
Size	0.000	0.692	0.490			0.000	1.358	0.177		
Book to Market	0.020	6.993	0.000***			0.005	2.319	0.022**		
Op Profitability	0.007	1.232	0.220			0.003	1.299	0.196		
Investments	-0.002	-0.276	0.783			0.001	0.732	0.465		
Idiosyncratic Volatility	-0.041	-0.946	0.346			-0.119	-3.675	0.000***		
N	102					147				
Model 1 with All Characteristics				15.09%	6.78%				13.91%	8.25%
α	-0.009	-1.158	0.249			0.002	1.360	0.176		
Size	0.001	0.999	0.320			0.001	0.229	0.819		
BM	0.019	7.087	0.000***			0.006	0.327	0.744		
Op Profitability	0.004	0.642	0.522			0.003	0.870	0.386		
Investments	-0.004	-0.650	0.517			0.002	0.983	0.328		
Liquidity	0.003	1.133	0.260			0.004	0.367	0.714		
Momentum	-0.008	-0.480	0.632			0.047	0.327	0.744		
Beta	-0.018	-1.418	0.159			-0.009	-0.637	0.526		
Idiosyncratic Volatility	-0.039	-0.867	0.387			-0.121	-0.268	0.789		
N	102					147				

5.2 Cross-Sectional Regressions (Hou, Xue and Zhang Characteristics)

Table 3 reports average slopes, R^2, adjusted R^2 as well as t-statistics, p-values and sample sizes for 119 monthly cross-sectional regressions for Romania and 132 cross-sectional regressions for Norway. The monthly log returns were regressed on the lagged models' characteristics. The computation of the statistics was performed identically as in section 5.1.

Just like in the previous section, the Romanian market seems to have one statistically significant characteristic that explains the stock returns, and in this case it seems to be ROE. Unlike the previous models though, the other characteristics do not have any explanatory power. Moreover, the statistical significance of the constant is erased as well, suggesting that ROE is the missing variable from the previous models. The goodness of fit test however is diminished overall, across all the models, in comparison to the previous ones.

In the Norwegian case, ROE is quite distinctive in its statistical significance. Along side it, liquidity , momentum, size and idiosyncratic volatility prove to be statistically significant in the individual models as well as in the All Hue Characteristics model. Investments and beta are the only characteristics that remain non-significant. The goodness of fit measures are overall diminished relative to the previous models, suggesting that although ROE improves the statistical significance of other characteristics, book-to-market ratio and operating profitability alongside other characteristics explain a larger percentage of variation in the stock returns than ROE alonside other characteristics do.

The consistency of the slopes is maintained throughout the models, just like in the previous analysis and with few exceptions there seems to be a positive relation between the stock returns and the stock characteristics. The null hypothesis is once again disproved for both Romania and Norway. The two issues from the previous section seem to be correctly addressed here, whereby ROE proves to be the missing characteristic from the models, diminishing not only the statistical significance of the constant, but also improving the statistical significance of the other characteristics.

Table 3: Cross-sectional Regressions - Hou, Xue and Zhang Characteristics

Description: This table summarizes cross-sectional regressions when monthly log returns are regressed on firm characteristics. T-stats are based on the time-series variability of the slopes. The goodness of fit measurements R^2 and adjusted R^2 are averaged. Only Hou, Xue and Zhang characteristics with the additional explanatory characteristics are summarized in this table. For model 2, the slopes have been derived by regressing the monthly log returns on the one-month lag firm characteristics from Hou, Xue and Zhang (2012) model, namely size, ROE and investments. This process is repeated with the addition of the other explanatory firm characteristics, such as liquidity, momentum, beta and idiosyncratic volatility. In the end, all the Hou, Xue and Zhang characteristics + the additional characteristics have been utilized for the derivation of the slopes. Superscripts ***, ** and * refer to the statistical significance at the 1%, 5% and 10% levels, respectively.

	Romania			(2007 -2016)		Norway			(2006 - 2016)	
	Slope	t-stat	p-value	R^2	Adj. R^2	Slope	t-stat	p-value	R^2	Adj. R^2
Model 2				3.70%	-0.27%				4.57%	1.89%
α	-0.006	-0.997	0.321			-0.009	-3.685	0.000***		
Size	0.000	0.356	0.722			0.000	0.936	0.351		
ROE	0.024	3.127	0.002***			0.011	4.860	0.000***		
Investments	0.003	0.556	0.579			0.002	1.160	0.248		
N	102					147				
Model 2 with Liquidity				5.06%	0.11%				5.75%	2.40%
α	-0.006	-1.011	0.314			-0.009	-3.857	0.000***		
Size	0.000	0.284	0.777			0.000	0.720	0.473		
ROE	0.024	3.149	0.002***			0.012	4.905	0.000***		
Investments	0.003	0.511	0.610			0.002	1.626	0.106		
Liquidity	0.001	0.426	0.671			0.003	2.054	0.042**		
N	102					147				
Model 2 with Momentum				6.28%	1.40%				7.39%	4.10%
α	-0.006	-0.933	0.353			-0.008	-3.595	0.000***		
Size	0.000	0.141	0.888			0.000	1.266	0.208		
ROE	0.024	2.980	0.004***			0.011	4.784	0.000***		
Investments	0.004	0.781	0.436			0.002	1.310	0.193		
Momentum	-0.004	-0.254	0.800			0.051	2.999	0.003***		
N	102					147				

(table 3 continued)

	Romania			(2007 -2016)		Norway			(2006 - 2016)	
	Slope	t-stat	p-value	R^2	Adj. R^2	Slope	t-stat	p-value	R^2	Adj. R^2
Model 2 with Beta				6.92%	2.07%				7.44%	4.16%
α	-0.004	-0.827	0.410			-0.008	-3.054	0.003***		
Size	0.000	0.906	0.367			0.001	3.845	0.000***		
ROE	0.021	2.554	0.012**			0.012	5.060	0.000***		
Investments	-0.001	-0.126	0.900			0.001	0.920	0.359		
Beta	-0.010	-0.845	0.400			-0.010	-1.611	0.110		
N	102					147				
Model 2 with Idiosyncratic Volatility				6.56%	1.69%				6.09%	2.76%
α	-0.003	-0.318	0.751			0.001	0.343	0.732		
Size	0.000	0.277	0.782			0.000	0.737	0.462		
ROE	0.022	2.856	0.005***			0.010	4.213	0.000***		
Investments	0.003	0.590	0.557			0.001	0.785	0.434		
Idiosyncratic Volatility	-0.023	-0.517	0.606			-0.101	-3.164	0.002***		
N	102					147				
Model 2 with All Hue Characteristics				13.41%	5.96%				12.52%	7.45%
α	0.000	0.007	0.994			0.002	0.513	0.609		
Size	0.000	0.716	0.476			0.001	2.911	0.004***		
ROE	0.017	2.142	0.034**			0.010	4.627	0.000***		
Investments	0.000	0.080	0.936			0.002	1.077	0.283		
Liquidity	0.001	0.213	0.832			0.004	2.371	0.019**		
Momentum	-0.014	-0.832	0.407			0.043	2.808	0.006***		
Beta	-0.014	-1.143	0.255			-0.007	-1.267	0.207		
Idiosyncratic Volatility	-0.023	-0.498	0.619			-0.101	-3.153	0.002***		
N	102					147				

5.3 Cross-Sectional Regressions (All Characteristics)

Table 4 reports average slopes, R^2, adjusted R^2 as well as t-statistics, p-values and sample sizes for 119 monthly cross-sectional regressions for Romania and 132 cross-sectional regressions for Norway. The monthly log returns were regressed on all the lagged models' characteristics. The computation of the statistics was performed identically as in section 5.1.

In the Romanian case, when the stock returns are regressed on all the characteristics, book to market ratio remains highly significant. The majority of the slopes are positive, indicating a positive relation with the stock returns, with the exception of investments, momentum, beta and idiosyncratic volatility. The goodness of fit measure is improved as well, both in terms of R^2 and adjusted R^2.

In the Norwegian case, apart from investments and beta, all the characteristics are statistically significant at 1% and at 5% level, implying a non-zero risk premium. The intercept is diminished as well in terms of statistical significance, suggesting that book to market equity ratio, operating profitability and ROE have high explanatory power. Except operating profitability, beta and idiosyncratic volatility, all the other characteristics have a positive relation with the stock returns. The goodness of fit measure is large as well, both in terms of R^2 and adjusted R^2.

Neither the magnitude nor the sign of the characteristics change throughout the tested models, only the statistical significance of the variables and the goodness of fit measures of the models. Comparatively, Romania seems to be largely described by book to market ratio whereas Norway, as aforementioned, follows the path of a mature stock market, being described by the majority of the traditional characteristics and not only by one single outlier. However, the explanatory power seems to reside in the book-to-market equity ratio, ROE and operating profitability, size, momentum and idiosyncratic volatility.

Table 4: Cross-sectional Regressions - All Characteristics

Description: This table summarizes cross-sectional regressions when monthly log returns are regressed on firm characteristics. T-tests are based on the time-series variability of the slopes. The goodness of fit measurements R² and adjusted R² are averaged. All characteristics are tested and summarized in this table. Superscripts ***, ** and * refer to statistical significance at the 1%, 5% and 10% levels, respectively.

	Romania			(2007 -2016)		Norway			(2006 - 2016)	
	Slope	t-stat	p-value	R^2	Adj. R^2	Slope	t-stat	p-value	R^2	Adj. R^2
All Characteristics				16.97%	7.84%				15.72%	9.52%
α	-0.008	-1.071	0.29			0.002	0.741	0.46		
Size	0.001	1.013	0.31			0.001	4.073	0.00^{***}		
BM	0.020	7.003	0.00^{***}			0.005	2.609	0.01^{***}		
ROE	0.014	0.637	0.53			0.018	4.381	0.00^{***}		
Operating Profitability	0.005	0.256	0.80			-0.010	-2.458	0.02^{**}		
Investments	-0.003	-0.510	0.61			0.002	1.040	0.30		
Liquidity	0.002	1.098	0.27			0.003	2.021	0.05^{**}		
Momentum	-0.011	-0.622	0.54			0.042	2.719	0.01^{***}		
Beta	-0.020	-1.593	0.11			-0.008	-1.343	0.18		
Idiosyncratic Volatility	-0.045	-1.014	0.31			-0.106	-3.263	0.00^{***}		
N	102					147				

5.4 One Year Rolling Slope Estimates

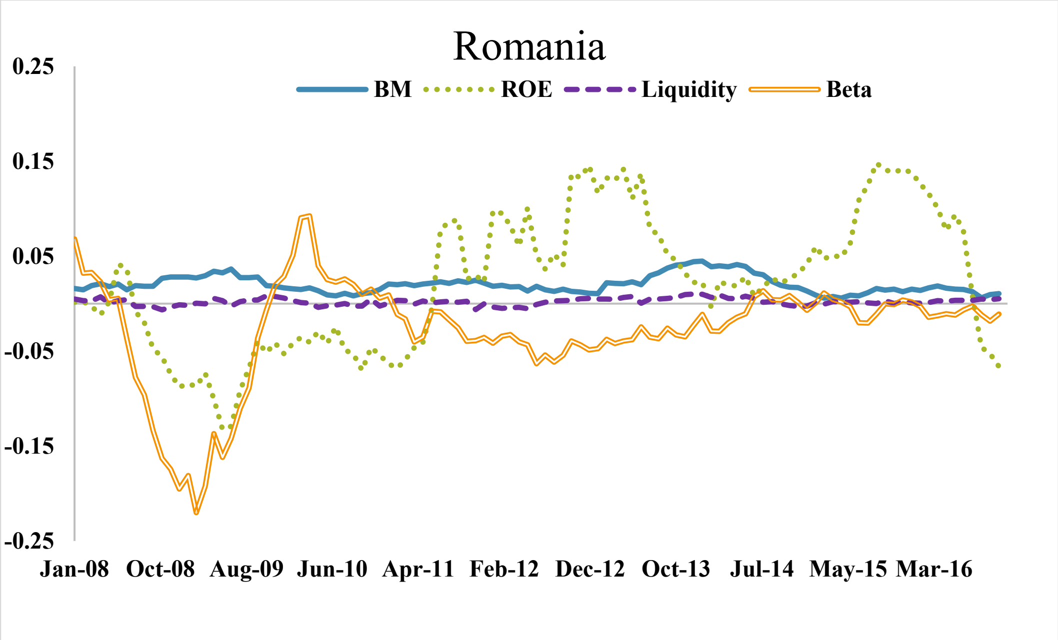

Figure 1: One-year rolling slope estimates, Romania, 2008-2016

Description: The figure plots one-year rolling averages of cross-sectional slope estimates from Model All Characteristics. The variables are defined in section 3.1

Figure 1 plots one-year rolling averages of the estimates from Model All Characteristics, the best fitted model, and includes the characteristics that are statistically significant throughout the models tested. There is large variation in both the magnitudes and the signs change through time especially for ROE and beta. Book to market equity ratio and liquidity characteristics do not change neither in magnitude nor in their sign. The implication from Figure 1 would be that past estimates have a tendency to overestimate the cross-sectional variation in the true expected returns going forward, especially in the ROE and beta case. (Lewellen 2015) However, the time horizon is quite limited so further investigation would be required.

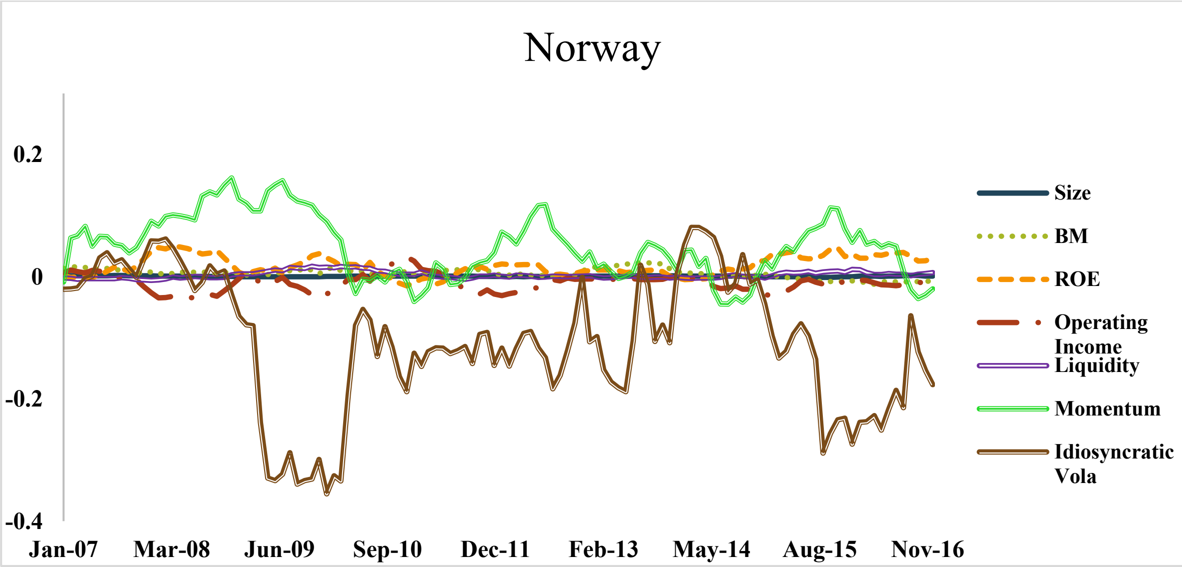

Figure 2: One-year rolling slope estimates, Norway, 2007-2016

Description: The figure plots one-year rolling averages of cross-sectional slope estimates from Model All Characteristics. The variables are defined in section 3.1

Figure 2 plots one-year rolling averages of the estimates from Model All Characteristics, the best fitted model, and includes the characteristics that are statistically significant across the models tested. Even though Norway is described by more characteristics than Romania, there is a clear distinction between the maximum and minimum of slopes between the countries. While in Romania the minimum reached -0.25, the minimum in Norway is much larger touching the -0.4 point. Another key distinction is in the period of the dips themselves. Romania seems to have been largely hit by the financial crisis in the wake of it whilst Norway received the shocks later, in the second half of 2009. Overall however, there is no change neither in the magnitude nor in the sign of the size, book to market, ROE and liquidity characteristics. Apart from idiosyncratic volatility and momentum however, the past estimates tend not to overestimate the cross-sectional variation in the true expected returns going forward. (Lewellen 2015) Yet again, further investigation is required due to the small time horizon.

5.5 Predictive ability of the estimates of expected stock returns

Table 5 summarizes the distribution and in-sample predictive ability of expected returns derived from the cross-sectional regressions above. The estimates of the expected returns are calculated by using the firm's characteristics from *t-1* and the prior *t-12* to *t-1* rolling average of the intercepts and slopes from the models above. Afterwards the actual stock returns from *t* are regressed on the estimates constructed as aforementioned. The goal is to reveal how good these estimates would predict the subsequent realized returns. The null hypothesis is that the slopes are indistinctive from 0, proving no predictive ability. The alternative hypothesis refers to the fact that the values of the slopes are higher than 0. One should take note of the fact that these regressions are made in-sample and not out-of-sample and thus the existence of bias is not entirely eliminated.

First of all, the mean of the estimates is negative both in the Romanian case and in the Norwegian case. This is largely due to the fact that both distributions are negatively skewed, indicating the fact the cross-sectional estimates of expected returns would forecast a greater percentage of returns negatively. The estimates have been derived using a time horizon that includes the years of the financial crisis and thus a negatively skewed distribution of the estimates of the expected returns is not surprising. The dispersion of the distributions is higher overall for the Romanian market, although the estimates from the Hou, Xue and Zhang (2012) model provide a higher dispersion for Norway.

In the Romanian case, there seems to be a large decrease in the cross-sectional volatility of the expected returns when book-to-market is eliminated from the models and ROE is added. This is also supported by the standard deviation derived from the estimates of the All Characteristics model, implying, as mentioned in the previous sections, that book-to-market ratio and in a smaller measure ROE are the characteristics that best describe and predict the stock returns going forward.

Table 5: Expected Stock Returns Regressions

Description: This table summarizes the point estimates (mean, standard deviation, 10th and 90th percentiles) and predictive ability (slope, t-stat, p-value and R2) of monthly expected stock returns derived from a firm's characteristics and one-year rolling averages of the cross-sectional slopes. All point estimates equal time-series averages of monthly cross-sectional parameters. T-stats are based on the time-series variability of the slopes. The slopes and R^2 are averaged. Superscripts ***, ** and * refer to statistical significance at the 0.5%, 2.5% and 5% levels, respectively.

	Romania (2007 - 2016)								Norway (2006 - 2016)							
	Distribution				Predictive Ability				Distribution				Predictive Ability			
Model	Mean	Std	p10	p90	Slope	t-stat	p-value	R^2	Mean	Std	p10	p90	Slope	t-stat	p-value	R^2
FF	-0.87%	2.15%	-3.26%	1.54%	0.99	7.18	0.00***	2.31%	-0.69%	1.45%	-2.10%	0.84%	0.42	2.55	0.01**	2.39%
FF 1L	-0.88%	2.18%	-3.32%	1.53%	1.07	8.01	0.00***	2.35%	-0.68%	1.54%	-2.21%	0.91%	0.40	2.76	0.00***	2.35%
FF 1M	-0.88%	2.29%	-3.34%	1.62%	0.95	6.88	0.00***	2.76%	-0.64%	1.86%	-2.61%	1.14%	0.42	3.19	0.00***	2.72%
FF 1B	-0.85%	2.26%	-3.68%	1.84%	0.92	6.29	0.00***	3.48%	-0.67%	1.65%	-2.53%	1.07%	0.46	2.88	0.00***	3.73%
FF 1V	-0.86%	2.20%	-3.41%	1.57%	1.07	7.53	0.00***	2.70%	-0.70%	1.60%	-2.53%	1.14%	0.48	3.41	0.00***	2.38%
FF All	-0.93%	2.50%	-0.04%	0.02%	1.05	7.41	0.00***	4.30%	-0.70%	2.10%	-3.22%	1.52%	0.48	3.67	0.00***	3.67%
HXZ	-1.02%	1.42%	-1.90%	-0.21%	1.22	4.78	0.00***	1.25%	-0.71%	1.59%	-1.97%	0.56%	0.37	1.88	0.03*	2.29%
HXZ 2L	-1.02%	1.47%	-2.01%	-0.09%	1.39	5.18	0.00***	1.50%	-0.71%	1.69%	-2.08%	0.69%	0.43	2.73	0.00***	2.34%
HXZ 2M	-1.07%	1.70%	-2.16%	0.01%	0.98	4.68	0.00***	1.71%	-0.66%	1.99%	-2.49%	0.94%	0.23	1.20	0.12	2.64%
HXZ 2B	-0.99%	1.67%	-2.76%	0.65%	0.77	2.96	0.00***	3.09%	-0.71%	1.80%	-2.47%	0.81%	0.44	2.76	0.00***	3.27%
HXZ 2V	-1.01%	1.55%	-2.13%	0.01%	1.32	4.31	0.00***	2.02%	-0.72%	1.71%	-2.36%	0.92%	0.37	2.42	0.01**	2.27%
HXZ All	-1.08%	2.07%	-3.26%	1.00%	1.14	5.43	0.00***	3.94%	-0.72%	2.25%	-3.13%	1.40%	0.36	2.83	0.01**	3.52%
All	-0.98%	2.84%	-4.18%	2.07%	0.96	7.78	0.00***	4.10%	-0.75%	2.90%	-3.39%	1.63%	0.34	3.40	0.00***	2.87%

In the Norwegian case, the standard deviations do not differ as much as in the Romanian case, suggesting that more characteristics play an important role in explaining cross-sectional variation of the expected returns. However, ROE seems to add more explanatory power in terms of the cross-sectional variation. This is also supported by the results derived from the slopes of the All Characteristics model, whereby the explanatory power of the cross-sectional variation in the expected returns is largely improved.

Regarding the predictive ability of the slopes, the Romanian market has higher values for slopes across the models than the Norwegian market. The p-values reject the null hypothesis that the slopes are indistinctive from zero at 0.5% level. This is true for Norway as well, except for the FF model (reject the null hypothesis at 2.5% level though), the HXZ model (reject the null hypothesis at 5% level), the HXZ 2M model, and the HXZ 2V and the HXZ All model (reject the null hypothesis at 2.5% level).

These results imply the fact that the expected-return estimates have strong predictive power, especially for the Romanian case, whereby the book-to-market ratio characteristic coupled with ROE seem to carry all the explanatory power. In the Norwegian case, book-to-market ratio and ROE have high explanatory power as well, but values of the slopes and the t-stats as well do not differ as much as in the Romanian case, once again pinpointing to the fact that the majority of the characteristics have a high predictive ability.

VI. Conclusion

This thesis evaluates the stock characteristics of two main asset-pricing models both in the Norwegian and Romanian stock markets with the addition of liquidity, momentum, beta and idiosyncratic volatility in order to:

- identify what factors best desribe the markets;
- suggest the relevant models best suited for the markets in question (developed vs developing);
- infer the possible roots of the differences (if any) between a developed stock market and a developing one on the basis of the analysis aforementioned.

Before outlining the main findings, it is worth mentioning two key constraints. The first one refers to the limited time horizon of the analysis. The second one takes into account the downward bias in terms of t-statistics due to the fact that serial correlation was not modified accordingly.

Liquidity is not an important characteristic when evaluating incipient markets such as Romania, rather the book-to-market equity ratio, coupled with ROE. Future research on incipient markets should thus accommodate the existing asset pricing models accordingly. The case is quite different when it comes to Norway, whereby the majority of the stock characteristics are better suited for describing and predicting the stock returns. In terms of the suitability of the models, a model with book-to-market equity ratio and ROE is the most relevant in the Romanian case whilst the all characteristics model is the most appropriate in the Norwegian case. In both cases however, investments can be omitted without much information loss while other stock characteristics can be added accordingly.

In conclusion, the results would suggest the fact that future research should accommodate the existing models with a book-to-market ratio and ROE characteristic in terms of incipient markets. Regarding the possible roots of the differences between the markets in terms of the relevant stock characteristics, further investigation would be required that would accommodate a longer time horizon and a higher number of stocks in the sample.

References

Banz, W. Rolf. 1981. “The Relationship Between Return and Market Value of Common Stocks.” *Journal of Financial Economics* 3-18.

Basu, S. 1977. “Investment Performance of Common Stocks in Relation to Their Price-Earnings Ratios: A Test of the Efficient Market Hypothesis.” *The Journal of Finance* 663-682.

Bekaert, Geert, J. Robert Hodrick, and Xiaoyan Zhang. 2009. “International Stock Return Comovements.” *The Journal of Finance* 2591-2626.

Bessembinder, Hendrik, J. Michael Cooper, and Feng Zhang. 2016. “Characteristic-Based Expected Returns and Corporate Events.”

Black, Fischer. 1972. “Capital Market Equilibrium with Restricted Borrowing.” *The Journal of Business* 444-455.

Bodie, Zvi, Alex Kane, and J. Alan Marcus. 2014. *Investments.* New York: McGraw-Hill Education.

Bontaş, Alexandra, and Ioan Odăgescu. 2011. “Testing APT Model upon a BVB Stocks' Portfolio.” *Informatica Economică* 96-109.

Breeden, T. Douglas. 1979. “An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities.” *Journal of Financial Economics* 265-296.

Brown, J. Stephen, and I. Mark Weinstein. 1983. “A New Approach to Testing Asset Pricing Models: The Bilinear Paradigm.” *The Journal of Finance* 711-743.

Brown, Philip, and Terry Walter. 2013. “The CAPM: Theoretical Validity, Empirical Intractability and Practical Applications.” *ABACUS* 44-50.

Buckberg, Elaine. 1995. “Emerging Stock Markets and International Asset Pricing.” *The World Bank Economic Review* 51-74.

Campbell, Y. John, and Tuomo Vuolteenaho. 2004. “Bad Beta, Good Beta.” *The American Economic Review* 1249-1275.

Carhart, M. Mark. 1997. “On Persistence in Mutual Fund Performance.” *The Journal of Finance* 57-82.

Chan, K. C. Louis, Yasushi Hamao, and Josef Lakonishok. 1991. "Fundamentals and Stock Returns in Japan." *The Journal of Finance* 1739-1764.

Chen, Jianguo, Andrea Bennett, and Ting Zheng. 2006. "Sector Effects in Developed vs. Emerging Markets." *Financial Analysts Journal* 40-51.

Chen, Long, Robert Marx-Novy, and Lu Zhang. 2011. "An Alternative Three-Factor Model." *SSRN.* http://ssrn.com/abstract=1418117.

Chen, Nai-Fu. 1983. "Some Empirical Tests of the Theory of Arbitrage Pricing." *The Journal of Finance* 1393-1414.

Chen, Nai-Fu, Richard Roll, and A. Stephen Ross. 1986. "Economic Forces and the Stock Market." *The Journal of Business* 383-403.

Copeland, Thomas E., J. Fred Weston, and Kuldeep Shastri. 2013. *Financial Theory and Coporate Policy: Pearson New International Edition.* Pearson.

De Bondt, M. F. Werner, and Richard Thaler. 1985. "Does the Stock Market Overreact?" *The Journal of Finance* 793-805.

Dimson, Elroy. 1979. "Risk Measurement When Shares Are Subject to Infrequent Trading." *Journal of Financial Economics* 197-226.

Dimson, Elroy, and Massoud Mussavian. 1999. "Three centuries of asset pricing." *Journal of Banking & Finance* 1745-1769.

Fama, F. Eugene, and D. James MacBeth. 1973. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy* 607-636.

Fama, F. Eugene, and R. Kenneth French. 2014. "A five-factor asset pricing model." *Journal of Financial Economics* 1-22.

Fama, F. Eugene, and R. Kenneth French. 1993. "Common risk factors in the returns on stocks and bonds." *Journal of Financial Economics* 3-56.

Fama, F. Eugene, and R. Kenneth French. 2015. *International Tests of a Five-Factor Asset Pricing Model.* 25 December. doi:http://dx.doi.org/10.2139/ssrn.2622782.

Fama, F. Eugene, and R. Kenneth French. 1996. "Multifactor Explanations of Asset Pricing Anomalies." *The Journal of Finance* 55-84.

Fama, F. Eugene, and R. Kenneth French. 1992. "The Cross-Section of Expected Stock Returns." *The Journal of Finance* 427-465.

Fama, F. Eugene, and R. Kenneth French. 1998. "Value versus Growth: The International Evidence." *The Journal of Finance* 1975-1999.

Friend, Irwin, and Marshall Blume. 1970. "Measurement of Portfolio Performance Under Uncertainty." *The American Economic Review* 561-575.

Gibbons, R. Michael. 1982. "Multivariate Tests of Financial Models: A New Approach." *Journal of Financial Economics* 3-27.

Gibbons, R. Michael, A. Stephen Ross, and Jay Shanken. 1989. "A Test of the Efficiency of a Given Portfolio." *Econometrica* 1121-1152.

Griffin, M. John. 2002. "Are the Fama and French Factors Global or Country Specific?" *The Review of Financial Studies* 783-803.

Harvey, R. Campbell. 1995. "Predictable Risk and Returns in Emerging Markets." *The Review of Financial Studies* 773-816.

Haugen, A. Robert, and L. Nardin Baker. 1996. "Commonality in the determinants of expected stock returns." *Journal of Financial Economics* 401-439.

Hou, Kewei, Andrew G. Karolyi, and Bong-Chan Kho. 2011. "What Factors Drive Global Stock Returns?" *The Review of Financial Studies* 2527-2574.

Hou, Kewei, Chen Xue, and Lu Zhang. 2016. *A Comparison of New Factor Models.* 1 November. doi:http://dx.doi.org/10.2139/ssrn.2520929.

Hou, Kewei, Chen Xue, and Lu Zhang. 2012. "Digesting Anomalies: An Investment Approach." *Fisher College of Business Working Paper Series* 1-40.

Hou, Kewei, Chen Xue, and Lu Zhang. 2012. "Digesting Anomalies: An Investment Approach." *Fisher College of Business: Working Paper Series* 1-45.

Kahneman, Daniel, and Amos Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 263-292.

Kan, Raymond, Cesare Robotti, and A. Jay Shanken. 2012. "Pricing Model Performance and the Two-Pass Cross-Sectional Regression Methodology." *Journal of Finance, Forthcoming.* doi:http://dx.doi.org/10.2139/ssrn.1361823.

Keim, B. Donald. 1985. “Dividend Yields and Stock Returns: Implications of Abnormal January Returns.” *Journal of Financial Economics* 473-489.

Keim, B. Donald. 1983. “Size-related Anomalies and Stock Return Seasonality: Further Empirical Evidence.” *Journal of Financial Economics* 13-32.

Kim, Dongcheol. 2006. “On the Information Uncertainty Risk and the January Effect.” *The Journal of Business* 2127-2162.

Kim, Soon-Ho, Dongcheol Kim, and Hyun-Soo Shin. 2012. “Evaluating asset pricing models in the Korean stock market.” *Pacific-Basin Finance Journal* 198-227.

Koedijk, G. Kees, and A. Mathijs van Dijk. 2004. “Global Risk Factors and the Cost of Capital.” *Financial Analysts Journal* 32-38.

Lewellen, Jonathan. 2015. “The Cross-section of Expected Stock Returns.” *Critical Finance Review* 1-44.

Lintner, John. 1965. “The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets.” *The Review of Economics and Statistics* 13-37.

Litzenberger, H. Robert, and Krishna Ramaswamy. 1979. “The Effect of Personal Taxes and Dividends on Capital Asset Prices: Theory and Empirical Evidence.” *Journal of Financial Economics* 163-195.

Mankiw, Gregory N., and D. Matthew Shapiro. 1986. “Risk and Return: Consumption Beta Versus Market Beta.” *The Review of Economics and Statistics* 452-459.

Markowitz, Max Harry. 1999. “The Early History of Portfolio Theory:1600-1960.” *Financial Analysts Journal* 5-16.

Mateev, Miroslav, and Atanas Videv. 2008. “Multifactor Asset Pricing Model and Stock Market in Transition: New Empirical Tests.” *Eastern Economic Journal* 223-237.

Merton, C. Robert. 1973. “An Intertemporal Capital Asset Pricing Model.” *Econometrica* 867-887.

Petersen, A. Mitchell. 2009. “Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches.” *The Review of Financial Studies* 435-480.

Pieleanu, Dan Florin. 2012. “The APT Model and its Applicability in Romania's Case.” *Revista Română de Statistică* 103-112.

Reinganum, R. Marc. 1981a. “Misspecification of Capital Asset Pricing Empirical Anomalies Based on Earnings' Yields and Market Values.” *Journal of Financial Economics* 19-46.

Reinganum, R. Marc. 1981b. “The Arbitrage Pricing Theory: Some Empirical Results.” *The Journal of Finance* 313-321.

Roll, Richard. 1977. “A Critique of The Asset Pricing Theory's Tests Part I: On Past and Potential Testability of the Theory.” *Journal of Financial Economics* 129-176.

Roll, Richard. 1981. “A Possible Explanation of the Small Firm Effect.” *The Journal of Finance* 879-888.

Roll, Richard, and A. Stephen Ross. 1980. “An Empirical Investigation of the Arbitrage Pricing Theory.” *The Journal of Finance* 1073-1103.

Ross, A. Stephen. 1977. “Return, Risk and Arbitrage.” *Research Gate.* Accessed November 20, 2016. https://www.researchgate.net/publication/5071500.

Shanken, Jay. 1982. “The Arbitrage Pricing Theory: Is it Testable?” *The Journal of Finance* 1129-1140.

Sharpe F., William. 1964. “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk.” *The Journal of Finance* 425-442.

Stambaugh, F. Robert. 1982. “On the Exclusion of Assets from Tests of the Two-Parameter Model.” *Journal of Financial Economics* 237-268.

Statman, Meir. 2005. “Normal Investors, Then and Now.” *Financial Analysts Journal* 31-37.

Tobin, J. 1958. “Liquidity Preference as Behavior Towards Risk.” *The Review of Economic Studies* 65-86.