IS CAPM AN EFFICIENT MODEL? ADVANCED VERSUS EMERGING MARKETS

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Abstract: *CAPM is one of the financial models most widely used by the investors all over the world for analyzing the correlation between risk and return, being considered a milestone in financial literature. However, in recently years it has been criticized for the unrealistic assumptions it is based on and for the fact that the expected returns it forecasts are wrong. The aim of this paper is to test statistically CAPM for a set of shares listed on New York Stock Exchange, Nasdaq, Warsaw Stock Exchange and Bucharest Stock Exchange (developed markets vs. emerging markets) and to compare the expected returns resulted from CAPM with the actually returns. Thereby, we intend to verify whether the model is verified for Central and Eastern Europe capital market, mostly dominated by Poland, and whether the Polish and Romanian stock market index may faithfully be represented as market portfolios. Moreover, we intend to make a comparison between the results for Poland and Romania. After carrying out the analysis, the results confirm that the CAPM is statistically verified for all three capital markets, but it fails to correctly forecast the expected returns. This means that the investors can take wrong investments, bringing large loses to them.*

Keywords: CAPM; risk; portfolio return; capital market

Introduction and literature review

For a modern investor the investment decision is based on a detailed study of financial instruments, trying in this way to find the perfect combination between the risk and return in order to build an optimal and efficient portfolio. The major part of the investors think about using as a risk measure the variance or standard deviation of the portfolio return, but this measure is not by far the single one.

If the return-variance analysis of Harry Max Markowitz represented a cornerstone of the financial analysis, bringing him the Nobel Prize for Economics in 1990, the CAPM (Capital Asset Pricing Model) represented an essential step for the analysis of the primary financial instruments, being developed by William Sharpe (1964), Nobel Prize winner in the same year, highlighting the link between

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the risk of a financial instrument and the investor expected return. CAPM is used in practice both by professional investors and people working in the field of corporate finance.

The CAPM has a series of hypotheses, as follows (Hiller *et al.*, 2012, p. 140):

1. All the investors have a Markowitz behavior, considering only the variance and mean return of the portfolios.
2. There are no transaction costs or other spending for buying and selling financial assets (frictionless markets).
3. All the investors have homogenous beliefs, namely they estimate identical distributions for the future returns. There is a perfect competition between the investors and they will not try to beat the market by an active administration of the portfolios.
4. The stock markets are in equilibrium. The financial assets are correctly evaluated.
5. The time horizon of the investments is identical for all investors.

Over the time a series of tests have been employed in order to test the CAPM, and the results both confirmed and rejected its validity. Thus, Jensen *et al.* (1972) proved the CAPM validity on the US stock market for the period between 1931 and 1965. He reported a linear relationship between the risk premium of the portfolios and beta and, for large (small) values of beta, alpha tends to become negative (positive). By developing the work of Black *et al.* (1973) reviled: (i) the existence of a larger value of alpha than the return of risk-free assets; (ii) the fact that there is a linear relationship between the mean returns and beta and (iii) the fact that the linear relationship persists when the time series is very long. Zhang and Wihlborg (2004) have analyzed the monthly prices of 753 companies from 6 European emerging countries: Cyprus, Czech Republic, Greece, Hungary, Russia and Turkey between 1995 and 2002 and identified a positive correlation between beta and returns computed by using CAPM.

In the financial literature CAPM was extensively criticized because of its caveats. Ibbotson and Sinquefiled (1976) revised the initial CAPM formula by excluding the beta and arguing that the returns are better explained by the size of the company and the market to book ratio. Fernandez (2015) considers CAPM an „absurd" model because it is built on unrealistic hypothesis and its predictions are not connected to the real world. Moreover, he separated the expected return and required return by the investors, arguing that CAPM is only about the expected return. Other authors - Basu (1977), Banz (1981), Reinganum (1981), Litzenberger and Ramaswamy (1979), Keim (1983), Fama and French (1992) – suggest that:

- The expected return is not determined only by the beta and the market risk premium, but also by other characteristics of the companies, as: size, market to book ratio, dividend return etc., that is CAPM needs additional factors in order to explain the assets' return.
- The historical prices have nothing in common with the computation of the expected value of beta and historical market risk premium.

Nevertheless, the CAPM model is still widely used by investors in order to compute the expected returns of various assets. In later years a series of other

models were used as an alternative to the CAPM, respectively the Arbitrage Pricing Theory or the Multi-factorial Model.

1. Research objectives, methodology and data

The current research objective is to empirically test the CAPM model and to conclude if the predicted results are confirmed by the real behavior of the markets. Thus, in our study we will focus on USA (New York Stock Exchange and Nasdaq), Poland (Warsaw Stock Exchange) and Romania (Bucharest Stock Exchange). We compare these three markets by analyzing the performance of 10 shares traded on the markets of Warsaw and New York and 7 shares from different industries traded on Bucharest market, with various capitalizations and the highest liquidity. The selected companies are: Apple, Berkshire Hathaway, Ebay, McDonald's, Nike, JP Morgan, Exxon, Scholatic Corporation, SBA Communications and Boeing (US); Asseco, Cyfrowy Polsat, KGHM, Bank Pekao, Globe Trade Centre, Apator, Pelion, ATM, Famur and Rovese (Poland); SIF3, Banca Transilvania, Antibiotice S.A., SSIF Broker Cluj S.A., Alro Slatina and Transgaz (Romania).

The choice of these companies is motivated by the following:

- The S&P 500 index is preferred by the literature as a proxy of market portfolio. Poland has one of the most competitive markets in the CEE, with a high liquidity and can be analyzed with CAPM. The Romanian Stock Exchange is under-developed and the composite indexes (BET-C in the past and BET Plus in the present) are composed by a small number of shares and CAPM can generate questionable results, but we are interested by a comparison with the Polish market.

- Given the financial performance of the US and Poland, the risk free rate for the US can be considered as Treasury bills, government bonds with various maturities or Treasury notes; for Poland - government bonds with various maturities. For Romania the choice of the risk-free asset is problematic and we will use the return of government bonds with 5 years maturity. An alternative is the use of treasury bills interest rates or the National Bank of Romania deposit facility rate as the Romanian market is bank oriented.

Our paper analyzed a period of 5 years (2009-2013), excluding 2008, the year when the global financial crisis started and the majority of the markets were falling. The data is collected from the Yahoo Finance, Google Finance, Bloomberg and Investing.com websites and consist in daily closing adjusted prices of the mentioned stock. The adjustment is computed by the Yahoo Finance (only for US market) and includes the distribution of dividends, the M&A's and the related events. We computed by ourselves the stock returns and other statistical indicators and made a qualitative and quantitative analysis of the results. The risk-free asset return is computed, in our case, as the geometrical average of the monthly return of the T-Notes (US) and the geometric average of the government bills return (Poland and Romania) for the period 2009-2013.We then tested CAPM, estimating the following regression:

$$E(R_i) - r_f = \alpha_i + \beta_i[E(R_m) - r_i)] + e_i \quad (1)$$

where:

$E(R_i)$ – expected return af the asset i;

$E(R_m)$ – expected return af the market portfolio;

β – market (systematic) risk, computed as a ratio between the covariance of the asset i return and market portfolio return and the variance of the market portfolio return;

r_f – risk-free asset return;

α_i – excess expected return of asset i, that is not related to its risk. If CAPM is validated should then αi should equal zero for all the assets;

e_i – standard error for asset i.

Finally we will compute the expected returns of the considered shares by applying the CAPM - $E(R_i) = r_f + \beta[E(R_m) - r_f]$, and will compare with the returns for 2014.

2. Results and discussion

Appendix 1 exhibits the correlation coefficients between the returns of the analyzed shares. As the evidence shows all the shares are highly and positively correlated and thus are not suitable for diversification. The largest correlation coefficients between the market portfolio (S&P 500) and the considered shares are 0.73 (Boeing), 0.74 (Berkshire Hathaway) and 0.81 (Exxon). Only the second one is part of the index. At a first view we may appreciate that CAPM will fit for these 3 shares.

Similar to the US case, the shares listed on the Polish market are positively correlated (Appendix 2) and cannot be considered for diversification for a portfolio that includes all of them. The largest correlation coefficients between the WIG30 return and the other shares are 0.8 (Bank Pekao), 0.71 (KGHM) and 0.56 (Asseco) and all three are part of the market index.

The Romanian shares are positively correlated and, again, cannot be considered o veritable source of portfolio diversification (Appendix 3). The largest correlation indexes between the BET-C index return and share return are 0.78 (Petrom), 0.64 (SIF3) and 0.65 (Transgaz), while the smallest correlation is 0.16 (Banca Transilvania). We may anticipate that the latter share will have the smallest systematic risk (beta).

We estimated CAPM by using the market model for all the 10 shares listed on the US market, the 10 shares listed on Polish market and, respectively, the 7 shares listed on the Romanian market. First we check the statistical significance of the estimated coefficients (alpha and beta), respectively if these are significantly different from zero.

For alpha, null hypothesis is H0: $\alpha=0$, and alternative hypothesis is H1: $\alpha\neq0$.

Table 1. Alpha estimates for New York Stock Exchange

Dependent var.	**Industry**	**Alpha**			
		coef. (alpha)	**std. dev.**	**t-stat**	**prob**
Apple	IT&C	0.000994	0.000415	2.3951*	0.0168

Dependent var.	Industry	Alpha			
Berkshire	Finance	-5.32E-05	0.000289	-0.1844	0.8537
Ebay	Internet, Online sales	0.000404	0.000457	0.8832	0.3773
McDonald's	Food	0.000184	0.000234	0.7864	0.4317
Nike	Clothing, accessories	0.41852	0.000367	1.1882	0.2350
JP Morgan	Banking, financial services	-0.000409	0.000507	-0.8071	0.4197
Exxon	Oil	-0.000189	0.000208	-0.9086	0.3637
Scholastic	Media	8.18E-05	0.000529	0.8773	0.8773
SBA	IT&C	0.000762	0.000374	2.040*	0.0416
Boeing	Aerospatial / Aeronautics	0.000389	0.000351	1.1089	0.2677

Source: Authors' calculations

For a significance level of 5%, the alpha coefficients are statistically different from zero for all the tested dependent variables (the value of t-statistic is not higher than 2 and we cannot reject the null hypothesis), except for Apple and SBA, that are not significantly different from zero (probability of 1.68 for Apple and 4.16% for SBA). Therefore we will accept the null hypothesis, $\alpha=0$, and can conclude that alpha coefficients are not significantly different from zero for the other 8 variables (Table 1).

For beta the null hypothesis is H_0: $\beta=0$ and alternative hypothesis is H_1: $\beta\neq0$.

Table 2. Beta estimates for New York Stock Exchange

Dependent var.	Industry	Beta			
		coef. (beta)	std. dev.	t-stat	prob
Apple	IT&C	0.8837	0.0338	26.08	0.0000
Berkshire	Finance	0.9427	0.0232	40.03	0.0000
Ebay	Internet, Online sales	1.1861	0.0372	31.80	0.0000
McDonald's	Food	0.5103	0.0190	26.77	0.0000
Nike	Clothing, accessories	0.8992	0.0299	30.05	0.0000
JP Morgan	Banking, financial services	1.7894	0.0413	43.27	0.0000
Exxon	Oil	0.8433	0.0170	49.60	0.0000
Scholastic	Media	1.2118	0.0431	28.05	0.0000
SBA	IT&C	0.9740	0.0304	31.95	0.0000
Boeing	Aerospatial / Aeronautics	1.0887	0.0286	38.04	0.0000

Source: Authors' calculations

Table 2 shows that all the coefficients are statistically different from zero and we reject the null hypothesis. Moreover, the probability that beta equals zero is very close to zero for all the shares. Our results show that the riskiest shares are Ebay, Scholastic, JP Morgan and Boeing, with a beta larger than 1 (risk is larger than the market portfolio). As alpha coefficient (excess return) is not statistically different from zero for 8 shares of 10, The CAPM is valid for the US stock market.

Table 3. Alpha estimates for Warsaw Stock Exchange

Dependent var.	Industry	Alpha			
		coef. (alpha)	std. dev.	t-stat	prob
Asseco	IT&C	-0.000261	0.000442	-0.5900	0.5553
Cyfrowy Polsat	Communications	0.000124	0.000515	0.24064	0.8099
KGHM	Mining	0.000660	0.000537	1.22921	0.2192
Bank Pekao	Banking	-0.000179	0.000400	-0.4475	0.6545
Globe Trade Centre	Real Estate	-0.000913	0.000612	-1.4928	0.1357
Apator	IT&C	0.000929	0.000514	1.80888	0.0707
Pelion	Helth	0.000892	0.000625	1.42754	0.1537
ATM	Media	0.000797	0.000673	1.18466	0.2364
Famur	Mining	0.001022	0.000632	1.61721	0.1061
Rovese	Construction	-0.001892	0.001038	-1.82172	0.0687

Source: Authors' calculations

In the case of Poland we can't reject the null hypothesis and can conclude that the alpha coefficients are not statistically different from zero.

Table 4. Beta estimates for Warsaw Stock Exchange

Dependent var.	Industry	Beta			
		coef. (beta)	std. dev.	t-stat	prob
Asseco	IT&C	0.7675	0.03171	24.2032	0.0000
Cyfrowy Polsat	Communications	0.4984	0.03693	13.4935	0.0000
KGHM	Mining	1.4070	0.03853	36.5166	0.0000
Bank Pekao	Banking	1.3615	0.02869	47.4476	0.0000
Globe Trade Centre	Real Estate	1.0524	0.04388	23.9839	0.0000
Apator	IT&C	0.3910	0.03683	10.6159	0.0000
Pelion	Helth	0.5000	0.04481	11.1758	0.0000
ATM	Media	0.4630	0.04821	9.5990	0.0000
Famur	Mining	0.5291	0.04534	11.6710	0.0000
Rovese	Construction	1.0460	0.07447	14.0450	0.0000

Source: Authors' calculations

For the Polish market, beta is statistically significant for all the shares and we reject the null hypothesis. The shares with a largest risk than the market portfolio are KGHM, Bank Pekao, Globe Trade Centre and Rovese. As in the case of US, CAPM is valid as the alpha coefficients are not statistically different from zero.

Table 5. Alpha estimates for Bucharest Stock Exchange

Dependent var.	Industry	Alpha			
		coef. (alpha)	std. dev.	t-stat	prob
Alro Slatina	Manufacturing	-0.000271	0.000647	-0.4189	0.6753
Antibiotice	Farmaceutical	-2.69E-05	0.000525	-0.051	0.9592
Broker Cluj	Financial intermediation	-0.000238	0.000716	-0.3326	0.7395
Banca Transilvania	Banking	0.001253	0.001335	0.9391	0.3478

Petrom	Oil	0.000283	0.000367	0.7714	0.4406
SIF3	Finance	0.000165	0.000623	0.2649	0.7911
Transgaz	Natural Gas	3.00E-05	0.000371	0.0809	0.9355

Source: Authors' calculations

For a significance level of 5% all the alpha coefficients for Romanian shares are statistically different from zero. Moreover the t-statistic is much lower than the benchmark and it's clear that the null hypothesis can't be rejected.

Table 6. Beta estimates for Bucharest Stock Exchange

Dependent var.	**Industry**	**Beta**			
		coef. (beta)	**std. dev.**	**t-stat**	**prob**
Alro Slatina	Manufacturing	0.917768	0.043190	21.249	0.0000
Antibiotice	Farmaceutical	0.826362	0.035006	23.606	0.0000
Broker Cluj	Financial intermediation	1.258436	0.047790	26.332	0.0000
Banca Transilvania	Banking	0.515928	0.089061	5.7929	0.0000
Petrom	Oil	1.105000	0.024502	45.098	0.0000
SIF3	Finance	1.255676	0.041552	30.219	0.0000
Transgaz	Natural Gas	0.767217	0.024741	31.010	0.0000

Source: Authors' calculations

As Table 6 exhibits, all the beta coefficients are statistically significant and we reject the null hypothesis. Moreover the probability that beta equals zero is very close to zero for all the shares considered. From all the shares from the Romanian market sample, the riskiest are Broker Cluj, Petrom and SIF3 with a beta (systematic risk) larger than 1, thus larger than the portfolio risk.

After examining the statistical significance of the regression coefficients we test to what extent the independent variable (market portfolio return) explains the dependent variable movement by the R^2 statistic. We mention that the shares' returns are adjusted with $r_f*[E(R_i)-r_f)]$ and market returns are adjusted with $r_f*[E(R_m)-r_f)]$.

R^2 expresses how much of the variation of a share return is explained by the variation of the market portfolio return. Thus, in the case of Exxon (Appendix 4) 66,22% from the return variance is explained by the variance of the market portfolio return (S&P500). The standard error of the regression is considered in the market model as the specific risk of the particular share (the risk that can be diversified). For Exxon, this risk is 7,3% (the largest from the analyzed shares) and can be eliminated by diversification. The F-test checks if all the regression coefficients (except the constant) are significantly different from zero and in our analysis we reject the null hypothesis that beta equals zero.

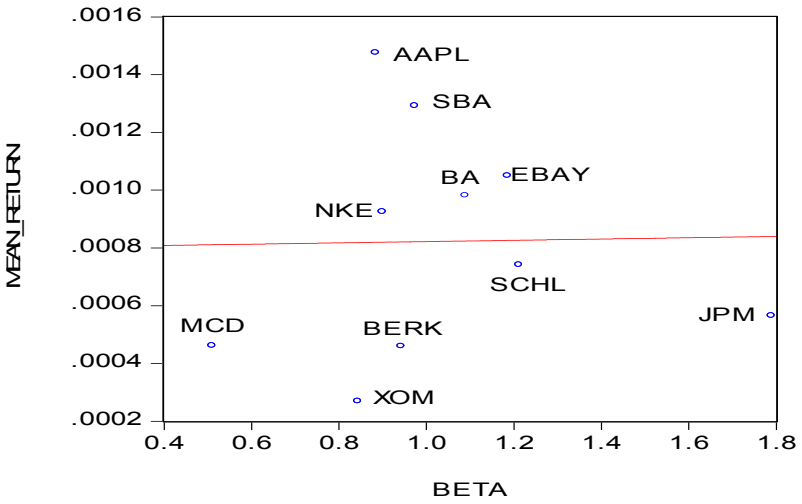
For the Warszaw market, KGHM and Bank Pekao have the largest R^2 (Appendix 5), that is 51,63% of the return variance for KGHM (64,31% for Bank Pekao) is explained by the variance of the WIG30 index return. The largest non-systematic risks are of Rovese and ATM.

On Romanian market, Petrom has the largest R^2 (Appendix 6), that is 61,78% of the variance of share return is explained by the variance of the market

portfolio. The smallest value is for Banca Transilvania (only 2,59%); this is also the asset with the lowest risk comparing to the risk of the BET-C index (beta is 0.52). Moreover, Banca Transilvania has the largest specific risk (4.73%) that can be diversified.

By employing the CAPM estimated betas and the average returns of the analyzed shares, we built the Security Market Line (SML). If the assets are correctly valued, then they will be on the SML. Otherwise, if the shares are above the line, they are undervalued and a long position is recommended („buy"); if they are under the line (overvalued) a short position is recommended („sell").

Figure 1. SML for USA market

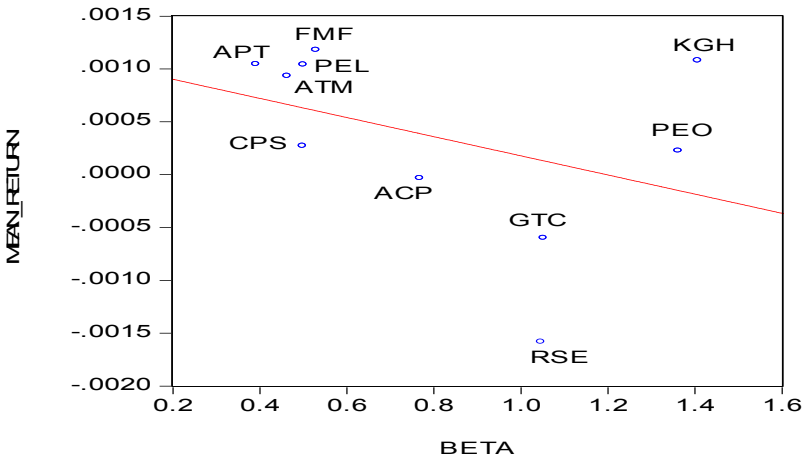


Source: Authors' calculations

From Figure 1 results that Apple, SBA, Nike, Ebay and Boieng are undervalued and the investor should open a long position. Let's presume that we built a portfolio with these five shares at the end of 2013. Considering CAPM, the expected return will be: $E(R_{AAPL})$=16.19%, $E(R_{SBA})$=17.74%, $E(R_{EBAY})$=21.22%, $E(R_{NIKE})$=16.43% si $E(R_{BA})$=19.55%[1]. If we presume that the shares have an equal weight in the portfolio, the expected return of the portfolio will be $E(R_{port})$=0.2*16.19%+0.2*17.74%+0.2*21.22%+0.2*16.43%+0.2*19.55%=18.23 %. For 2014, the annual returns of the shares considered were 24.54% for Apple, 4.63% for Ebay, 23.52% for Nike, 13.49% for SBA and -0.87% for Boeing. Thus the portfolio return at the end of the year 2014 was 13.06%, smaller than the one predicted by CAPM.

[1] The expected return of the market portfolio is 18.10%, computed as the geometrical mean of the daily returns for 5 years and the risk-free asset has a return of 1.35%, calculated as a geometrical mean of the T-Notes return over 5 years.

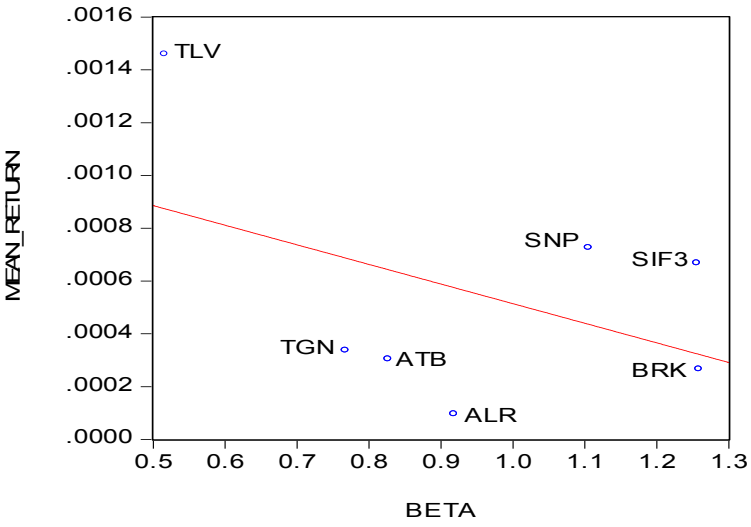
Figure 2. SML for Polish market



Source: Authors' calculations

Figure 2 exhibits the SML for the Polish market. Considering CAPM the Apator, Famur, Pelion, ATM, KGHM and Bank Pekao shares are undervalued and need to be bought (long position). By estimating CAPM, on a portfolio of 20% APT (small risk and an average return close to the one of other shares) and 16% of each other shares will result $E(R_{port})=5.43\%$ (risk free asset has a return of 4.82% and 5.63% for WIG30). At the end of 2014, the annual return of the portfolio with similar weights was -7.79%, much smaller than the one predicted by CAPM.

Figure 3. SML for Romanian market



Source: Authors' calculations

Considering the theory, the shares TLV, SNP and SIF3 are undervalued and TGN, ATB, BRK and ALR are overvalued (Figure 3). In this case, we build a

portfolio from the first three shares with various weights: TLV – 50%, as it has a higher average return and a smaller risk comparing with the other shares and SNP and SIF3 – each 25%. The CAPM expected return will be $E(R_{TLV})$=7.00%, $E(R_{SNP})$=6.9% and $E(R_{SIF3})$=6,88%[2]. The expected portfolio return will be: 0.5*7.00%+0.25*6.9%+0.25*6.88%=6.95%. At the end of the year, the annual return of the portfolio was: 0.5*18.51%+0.25*(-11.82%)+0.25*(-78.51%)= -13.33%, much lower than the one predicted by CAPM.

Conclusions

Following the empirical study, the CAPM is statistically validated both for the US and Polish and Romanian markets, but the expected return that it predicts was close to the effective return only for the shares traded on the New York Stock Exchange and Nasdaq. This result may be explained by the fact that the S&P index can proxy more closely the market portfolio as it has more share in its composition than WIN30 of BET-C. Thus, the CAPM manages to predict more precisely the expected returns on the developed markets, but it fails on the emerging markets. The consequences are that the investors may take wrong decisions and record loses on their portfolios.

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[2] The expected return of the market portfolio is 6.92%, computed as the geometrical mean of the daily returns for 5 years and the risk-free asset has a return of 7.08%, calculated as a geometrical mean of the government bonds return over 5 years.

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Appendices

Appendix 1. Correlation coefficients of the stock returns and S&P500 return on US market

	RSP	REBAY	RBOEING	RBERK	RAPPLE	RJPM	REXXON	RMCD	RSBA	RNIKE	RSCH
RSP	1.00	0.67	0.73	0.75	0.59	0.77	0.81	0.60	0.67	0.65	0.62
REBAY	0.67	1.00	0.46	0.49	0.41	0.47	0.51	0.38	0.45	0.44	0.44
RBOEING	0.73	0.46	1.00	0.58	0.41	0.51	0.60	0.47	0.48	0.50	0.46
RBERK	0.75	0.49	0.58	1.00	0.40	0.63	0.60	0.42	0.52	0.49	0.49
RAPPLE	0.59	0.41	0.41	0.40	1.00	0.42	0.39	0.36	0.42	0.40	0.33
RJPM	0.77	0.47	0.51	0.63	0.42	1.00	0.57	0.41	0.54	0.47	0.48
REXXON	0.81	0.51	0.60	0.60	0.39	0.57	1.00	0.52	0.49	0.49	0.48
RMCD	0.60	0.38	0.47	0.42	0.36	0.41	0.52	1.00	0.38	0.50	0.35
RSBA	0.67	0.45	0.48	0.52	0.42	0.54	0.49	0.38	1.00	0.48	0.41
RNIKE	0.65	0.44	0.50	0.49	0.40	0.47	0.49	0.50	0.48	1.00	0.41
RSCH	0.62	0.44	0.46	0.49	0.33	0.48	0.48	0.35	0.41	0.41	1.00

Source: Authors' calculations

Appendix 2. Correlation coefficients of the stock returns and WIG30 return on Polish market

	RWIG30	RROV	RPEL	RPEK	RKGHM	RGTC	RFAM	RCYF	RATM	RASC	RAPT
RWIG30	1,00	0,37	0,30	0,80	0,72	0,56	0,31	0,36	0,26	0,57	0,29
RROV	0,37	1,00	0,13	0,27	0,26	0,22	0,14	0,14	0,09	0,21	0,16
RPEL	0,30	0,13	1,00	0,24	0,24	0,16	0,10	0,12	0,09	0,17	0,17
RPEK	0,80	0,27	0,24	1,00	0,47	0,39	0,23	0,24	0,21	0,41	0,19
RKGHM	0.72	0.26	0.24	0.47	1.00	0.34	0.24	0.20	0.16	0.31	0.22
RGTC	0.56	0.22	0.16	0.39	0.34	1.00	0.19	0.25	0.17	0.35	0.18
RFAM	0.31	0.14	0.10	0.23	0.24	0.19	1.00	0.14	0.13	0.17	0.18
RCYF	0.36	0.14	0.12	0.24	0.20	0.25	0.14	1.00	0.12	0.22	0.08
RATM	0.26	0.09	0.09	0.21	0.16	0.17	0.13	0.12	1.00	0.16	0.08
RASC	0.57	0.21	0.17	0.41	0.31	0.35	0.17	0.22	0.16	1.00	0.14
RAPT	0.29	0.16	0.17	0.19	0.22	0.18	0.18	0.08	0.08	0.14	1.00

Source: Authors' calculations

Appendix 3. Correlation coefficients of the stock returns and BET-C return on Romanian market

	RBETC	RALR	RATB	RBRK	RSIF3	RSNP	RTGN	RTLV
RBETC	1.00	0.51	0.55	0.60	0.65	0.79	0.66	0.16
RALR	0.51	1.00	0.25	0.31	0.38	0.30	0.31	0.16
RATB	0.55	0.25	1.00	0.38	0.46	0.39	0.38	0.17
RBRK	0.60	0.31	0.38	1.00	0.52	0.43	0.42	0.20
RSIF3	0.65	0.38	0.46	0.52	1.00	0.49	0.42	0.26
RSNP	0.79	0.30	0.39	0.43	0.49	1.00	0.46	0.22
RTGN	0.66	0.31	0.38	0.42	0.42	0.46	1.00	0.15
RTLV	0.16	0.16	0.17	0.20	0.26	0.22	0.15	1.00

Source: Authors' calculations

Appendix 4. Regression statistics for New York Stock Exchange shares

Shares	**R^2**	**Regression st. error**	**F-stat**	**Prob**
Apple	0.3515	0.0147	680.3753	0.0000
Berkshire	0.5607	0.0102	1602.433	0.0000
Ebay	0.4462	0.0161	1011.564	0.0000
McDonald's	0.3635	0.0082	716.8741	0.0000
Nike	0.4185	0.0129	903.641	0.0000
JP Morgan	0.5986	0.0179	1872.317	0.0000
Exxon	0.6622	0.0073	2460.694	0.0000
Scholastic	0.3854	0.0187	787.075	0.0000
SBA	0.4486	0.0132	1021.145	0.0000
Boeing	0.5356	0.0124	1447.420	0.0000

Source: Authors' calculations

Appendix 5. Regression statistics for Warsaw Stock Exchange shares

Shares	**R^2**	**Regression st. error**	**F-stat**	**Prob**
Asseco	0.3192	0.0156	585.7959	0.0000
Cyfrowy Polsat	0.1272	0.0182	182.0760	0.0000
KGHM	0.5163	0.0189	1333.467	0.0000
Bank Pekao	0.6431	0.0141	2250.953	0.0000
Globe Trade Centre	0.3153	0.0216	575.2298	0.0000
Apator	0.0827	0.0181	112.6981	0.0000
Pelion	0.0909	0.0220	124.9006	0.0000
ATM	0.0687	0.0237	92.1408	0.0000
Famur	0.0983	0.0223	136.2144	0.0000
Rovese	0.1363	0.0367	197.2646	0.0000

Source: Authors' calculations

Appendix 6. Regression statistics for Romanian Stock Exchange shares

Shares	**R^2**	**Regression st. error**	**F-stat**	**Prob**
Alro Slatina	0.2641	0.0022	451.5516	0.0000
Antibiotice	0.3069	0.0186	557.2561	0.0000
Broker Cluj	0.3553	0.0254	693.4129	0.0000
Banca Transilvania	0.0259	0.0473	33.55881	0.0000
Petrom	0.6178	0.0130	2033.877	0.0000
SIF3	0.4205	0.0220	913.1985	0.0000
Transgaz	0.4332	0.0131	961.6321	0.0000

Source: Authors' calculations