



DOI 10.2478/sbe-2025-0040

SBE no. 20(2) 2025

PORTFOLIO SELECTION AND OPTIMIZATION IN ROMANIAN AND POLISH STOCK MARKETS

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Abstract:

This research aims to explore the selection and optimization of stocks from two Eastern European markets, Romania and Poland, starting from the maximum return criterion, downside risk, and Sortino ratio when building a portfolio. The Post-Modern Portfolio Theory (PMPT) serves as the main methodological framework to achieve our primary objective, 'Building portfolios of stocks on the two markets in Eastern Europe, Romania and Poland, starting from the maximum return criterion'. The research focused on stocks from the flagship indexes of the Bucharest Stock Exchange (BSE) and the Warsaw Stock Exchange (WSE), namely the BET Index and the WIG20 Index. The data was collected for 40 companies, 20 companies in each stock market, for the period June 2020 until June 2025, 5 'stock years', with daily close prices, government 10-year bonds as risk-free rates, and equity risk premiums for Romanian and Polish markets. Two portfolios were built, one from the BSE and another from the WSE. The results indicate, through PMPT and Sortino ratio as a performance indicator, that indeed the potential loss of a stock (downside risk) and the expected return play a crucial role in building portfolios, especially in volatile markets.

Key words: *Downside risk, Maximum return criterion, Post-Modern Portfolio Theory, Security Market Line, Sortino ratio.*

1. Introduction

The Modern Portfolio Theory, shortly MPT, as Markowitz conceived it, allows the investor to select and build an investment portfolio of assets by maximizing its expected return considering a certain level of risk. It starts by assuming that the investor has a risk aversion, and at a certain level of risk, there is a given level of expected return (CFI, 2025). Based on the investor's risk profile, as the "individual's willingness and ability to take risks"

(Young, 2024), a diversified portfolio is built to minimize risk by having those assets in the portfolio. The central idea in MPT is 'diversification', involving a portfolio of different types of assets, like stocks, government bonds, ETFs, etc. (Investopedia, 2025).

Being a theory developed in the early 1950s, it is criticized primarily for the way it evaluates the assets from the portfolio, on one hand, and the other hand, for how it views the investor. Instead of looking at the potential loss in value of the assets, MPT evaluates the variance and the levels of return. As Todoni (2015) points out, in the evolution of the finance field, namely in the behavioral finance field, the investor is more sensitive to losses than to gains.

As a result, the Post-Modern Portfolio Theory (PMPT) examines the potential loss of assets from the portfolio (Chen, 2022). The potential loss in value of the evaluated asset is made through the downside risk. The downside risk takes into account the changing market conditions and could result in losses on the assets. Developed in the early 90s, the PMPT was conceived as an alternative to the MPT, aiming to overcome its limitations, not only in how the risk and return are approached, but also in how the performance of the portfolios is measured. The Sharpe ratio, created by William Sharpe in the mid-1960s, is a measure of the total risk and is widely used in the MPT (Lioudis, 2024). The PMPT is using a variation of the Sharpe ratio, namely the Sortino ratio, a measure of risk, which differs from the Sharpe ratio by taking into account only the downside risk. In a volatile market, the downside risk indicates the amount of loss that it brings to the investor when an asset's price is falling (Kenton, 2025).

Recent macroeconomic events, like the COVID-19 pandemic, the Ukrainian war, the Israel war, and high inflation, influence the stock markets. In this study, we are analyzing two stock markets from the Eastern European Region, the Bucharest Stock Exchange (BSE) from Romania, and the Warsaw Stock Exchange (WSE) from Poland. Both stock markets, the Romanian and Polish ones, in recent years, faced several drops due to the events mentioned above. Considering the recent evolution in these two stock markets, we want to analyze, select, and optimize a portfolio of stocks using PMPT. As pointed out above, and more detailed in the Methodology section, PMPT focuses on the downside risk, being the go-to optimization methodology, we use to achieve the primary objective of our paper, namely *'Building portfolios of stocks on the two markets in Eastern Europe, Romania and Poland, starting from the maximum return criterion'*. The primary objective of our paper is splitted into two secondary objectives, (1) *'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Romanian stock exchange (Bucharest Stock Exchange - BSE)'*; (2) *'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Polish stock exchange (Warsaw Stock Exchange - WSE)'*.

Following the primary and secondary objectives, the paper is structured as follows: a Literature Review section with the current approaches towards portfolio selection, optimization, and investors' expectations. The Methodology and Data section describes the theoretical framework selected for our research, the data collected (period of analysis, sample, etc.). The paper continues with Results and Discussions, in which the results and interpretations of the research are shown. At the same time, the Conclusions

section ends the paper with the main findings, limitations, practical and theoretical implications for academics and practitioners, and also further research directions.

2. Literature review

Emerging capital markets are relatively scarce in the literature, according to Hadhri and Ftiti (2019), in terms of returns concerning the additional profit that investors can obtain. Unlike developed markets, frontier and emerging markets are characterized by higher risks, smaller in size, more fragmented, and less liquid, but where there is also a higher potential for profitability (Cussen, 2025). In terms of connection to global markets, of the three categories listed, frontier markets are the weakest connected to the global economy, relying more on regional and local links. According to Cussen (2025), frontier markets can outperform emerging markets in certain conditions, depending on economic conditions, but taking into account the relationship between risk and profitability, namely, in the case of frontier markets, risks and returns are higher.

In our study, we analyze two capital markets in Eastern Europe, one of which is a frontier market in an advanced stage of promotion to emerging market status. In 2020, a significant promotion of the Romanian capital market took place, FTSE Russell advances the Romanian capital market to the status of 'Secondary Emerging Market' (LSEG, 2020), and in June 2025, Morgan Stanley Capital International's (MSCI) classifies the Romanian capital market to the status of 'Advanced Frontier Market' (ASF, 2025). This intermediate classification makes the transition from a frontier market to an emerging one. The other market analyzed is the capital market in Poland, classified as an emerging market and aspiring to be a developed market. In 2017, FTSE Russell advanced the Polish capital market to developed market status (LSEG, 2017), while MSCI maintains it as an emerging market. Capital markets have, in recent years, attracted the attention of both researchers and investors alike. Studies such as Todoni (2015), Ferreira (2018), Hadhri and Ftiti (2019), Moagăr-Poladian et. al. (2019), Spulbăr et. al. (2020), Boțoc and Anton (2020), Pirgaip et. al. (2021) and Brătian (2024) show interest on the one hand in emerging and frontier markets in Eastern Europe, and on the other hand the investment opportunities that these markets offer viewed through the lens of Modern Portfolio Theory, but especially Post-Modern Portfolio Theory, which emphasizes a characteristic of emerging and frontier markets, volatility, especially downside-risk.

Downside risk is a statistical measure that shows downward deviations from the mean, unlike the standard deviation, which measures total risk. The semi-variance is a widely accepted method as a measure for downside risk (CFI, 2025).

In the case of MPT, the Capital Asset Pricing Model (CAPM) developed by Sharpe (1964) is used to calculate the expected return. The model uses beta as a measure of total risk. The PMPT model uses downside beta as a measure of downside risk. Estrada (2007), as cited in Venkataraman (2023), proposes downside beta as a measure of negative deviations that reflects negative movements of financial assets relative to the market. To differentiate the two approaches, the D-CAPM model was proposed, which uses D-Beta instead of beta as presented by Venkataraman (2023). Several authors have used negative beta in their works, such as Artavanis et al. (2010), Beach (2011), Chen et. al.

(2019), Hoque and Low (2020), Bayram and Aktaş (2025). Beach (2011), cited in Venkataraman (2023), found that in emerging markets, over 40% of the total risk can be explained by downside risk, while in developed markets, up to 70% of the total risk. During the period 2007-2020, BSE recorded some of the most significant declines, as shown in Figure 1.

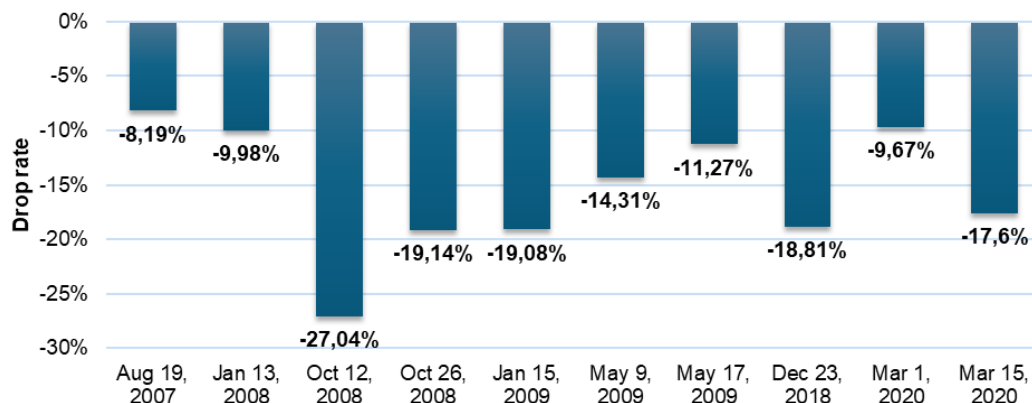


Figure 1. BSE drops during the period 2007-2020

Source: Ziarul Financiar (2020), citet in Statista

As a result of the changes in the approach to risk, our approach is to select and optimize stock portfolios on the two capital markets, BSE and WSE in Romania and Poland, respectively, starting from the 'maximum return' criterion, and applying the PMPT framework as described in the methodology.

3. Methodology and Data

Starting from the primary objective of this article, '*Building portfolios of stocks on the two markets in Eastern Europe, Romania and Poland, starting from the maximum return criterion*', the work first follows the selection of those stocks on each of the two stock exchanges studied, using the maximum return criterion, then analyzed based on the expected return, through CAPM (Capital Asset Pricing Model) and their graphic representation using SML (Security Market Line) to evaluate them, if the stocks are under or overvalued. For CAPM, we will formally use the following equation (Kenton, 2024):

$$CAPM \text{ or } ER_i = R_f + \beta_i(ER_m - R_f)$$

Where:

ER_i = the expected return on the stock i

R_f = risk-free rate

β_i = the beta volatility coefficient of the stock i

ER_m = equity risk premium

After selecting the stocks that will be part of the two portfolios, we will move on to the two secondary objectives, 'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Romanian stock exchange (Bucharest Stock Exchange - BSE)'; (2) 'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Polish stock exchange (Warsaw Stock Exchange - WSE)', using PMPT, which unlike the classical MPT approach, uses downside risk. As a result, the methodological framework of PMPT uses the D-CAPM (Downside-Capital Asset Pricing Model), as formally described by Venkataraman (2023) and Brătian (2024). To graphically describe those portfolios that obtain the best risk-return ratio, the CML (Capital Market Line) is used. In the case of PMPT, considering that we will not use the total risk related to the profitability obtained, but the downside risk, we will adapt the CML, as D-CML (Brătian, 2024). Moreover, if in the case of MPT and CML the Sharpe ratio is used as a performance indicator, in the case of PMPT, we will use the Sortino ratio, as follows (CFI, 2025):

$$\text{Sortino ratio} = \frac{\text{Expected return} - \text{Risk-free rate}}{\text{Standard deviation of the downside risk}}$$

Regarding the data in this study, the returns are calculated as daily returns for each stock from the sample analyzed, both from Romania and Poland. During the period June 2020 until June 2025, 5 years, and considering the 'stock year' as having 252 days. As a result, 1.260 daily prices/stocks are analyzed, followed by the calculation of daily returns and average annual returns. In terms of the risk-free rate, for both Romania and Poland, we have used the 10-year Government Bond yield, in June 2025, being 7,60% for Romania, and 5,623% for Poland. For both stock exchanges, the Warsaw Stock Exchange (WSE) and the Bucharest Stock Exchange (BSE), the top 5 stocks have been selected, considering the 'maximum return' criterion. These stocks will be part of the portfolio construction by applying the PMPT.

The two representative indices, the BET Index on the BSE and the WIG20 Index on the WSE, each contain 20 companies that track the performance of companies listed on the two stock exchanges. The companies analyzed are from several sectors of activity (classified according to the GICS ranking – The Global Industry Classification Standard, MSCI, 2025), such as *Communication Services* (3), *Consumer Discretionary* (3), *Consumer Staples* (2), *Energy* (3), *Financials* (10), *Health Care* (2), *Industrials* (1), *Materials* (3), and *Utilities* (5). Out of the total of 40 companies, 15 from Romania and 17 from Poland remained in the sample, the rest being listed after 2018, thus not falling within the analyzed period. Applying PMPT, and taking into account its distinguishing element from MPT, namely return-downside-risk, instead of return-risk, the chosen period is justified by events such as COVID-19, the war in Ukraine, the war in Israel, plus economic turbulence in the two countries Romania and Poland, which could have been factors for declines in financial markets, as a result of which this is reflected in the performance of the portfolios obtained through our study.

4. Results and Discussions

To achieve the paper's main objective, 1.260 days were analyzed over five years (June 2020 to June 2025). Initially, the two stock market indexes, BET and WIG20, each comprised 20 companies; however, some companies listed after June 2020 reduced the sample size to 15 for BET and 17 for WIG20, respectively.

Then, in both the cases of BET and WIG20, the maximum return criterion was applied, and 5 companies from the Romanian stock exchange and 5 companies from Poland were analyzed. Applying SML (Security Market Line), we obtained the results in Tables 1 and 2, in Figures 2 and 3, presented below.

Table 1. BSE selected stocks evaluation

Indicator/ Stocks	Risk -free rate	Antibiotice SA	Compania Nationala de Transport al Energiei Electrice Transelectric a SA	Med Life SA	Market	Societatea Nationala Nuclearelectri ca SA	Teraplast SA
Volatility coefficient (Beta)	0,00	0,41	0,80	0,97	1,00	1,02	1,27
Expected return (CAPM, %)	7,60	10,61	13,43	14,62	14,86	14,99	16,85
Average annual return (%)		27,94	20,00	31,64		19,71	19,82
Stock evaluation		Undervalued	Undervalued	Undervalued		Undervalued	Undervalued

Source: Author's calculation

As we can see in Table 1 above, for all 5 companies, the expected return (CAPM) is lower compared to the average annual return (CAPM < Average annual return).

As a result, after evaluating the 5 shares, based on the expected return vs. the average annual return, it turns out that they are all undervalued, meaning that they can be considered in the construction of the investment portfolio on the Romanian capital market. 3 out of 5 companies have a beta volatility coefficient < 1 (Market), while two have Beta > 1. If we look at the three analyzed indicators, Beta, CAPM, and Average Annual Return, it is observed that at the lowest risk (0.41), the company Antibiotice SA recorded an average annual return of approx. 27,94%, compared to CAPM 10,61%, a difference of +17,33%.

On the opposite spectrum, Teraplast SA, with the highest risk (1.27), we observe an average annual return of 19,82%, compared to CAPM 16,85%, a difference of only approx. +3%.

Also, as we could see from the graphic representation of the SML, in Figure 2, those companies on the Romanian BSE that are above the SML are considered undervalued.

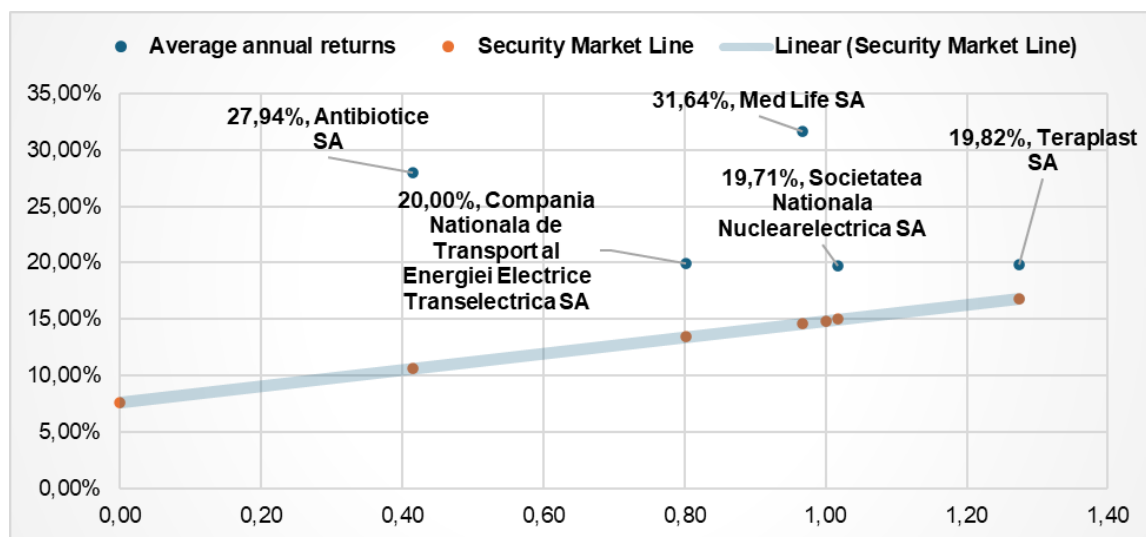


Figure 2. BSE Security Market Line and Average Annual Returns

Source: Author's calculation

In the case of WSE, in Table 2, we find a similar situation regarding the five stocks analyzed, all of which are undervalued, as a result of the analysis of expected rates of return (CAPM) and average annual returns. Moreover, only one company in Poland presents a lower beta volatility coefficient compared to the market (Beta < 1). As a result, the stocks analyzed on the WSE present a higher degree of risk, 4 out of 5 companies having a Beta > 1.

If we look at the three analyzed indicators, Beta, CAPM, and Average Annual Return, it is observed that at the lowest risk (0,77), the company Kruk SA recorded an average annual return of approx. 32%, compared to CAPM 9,82%, a difference of +22,32%. In contrast, Alior Bank SA and mBank SA, both with a risk of approx. 1,33, had a similar expected return (12,9%) but recorded a different average annual return in the analyzed period, of +16,92% for mBank SA and +27,37% for Alior Bank SA.

Also, as we could see from the graphical representation of the SML, in Figure 3, those companies on the Polish WSE that are above the SML are considered undervalued.

Table 2. WSE selected stocks evaluation

Indicator/ Stocks	Risk -free rate	Kruk SA	Market	CCC SA	Bank Polska Kasa Opieki SA	mBank SA	Alior Bank SA
Volatility coefficient (Beta)	0,00	0,77	1,00	1,16	1,30	1,33	1,33
Expected return (CAPM, %)	5,62	9,82	11,08	11,97	12,70	12,88	12,90
Average annual return (%)		32,14		31,99	25,40	29,80	40,27
Stock evaluation		Undervalued		Undervalued	Undervalued	Undervalued	Undervalued

Source: Author's calculation

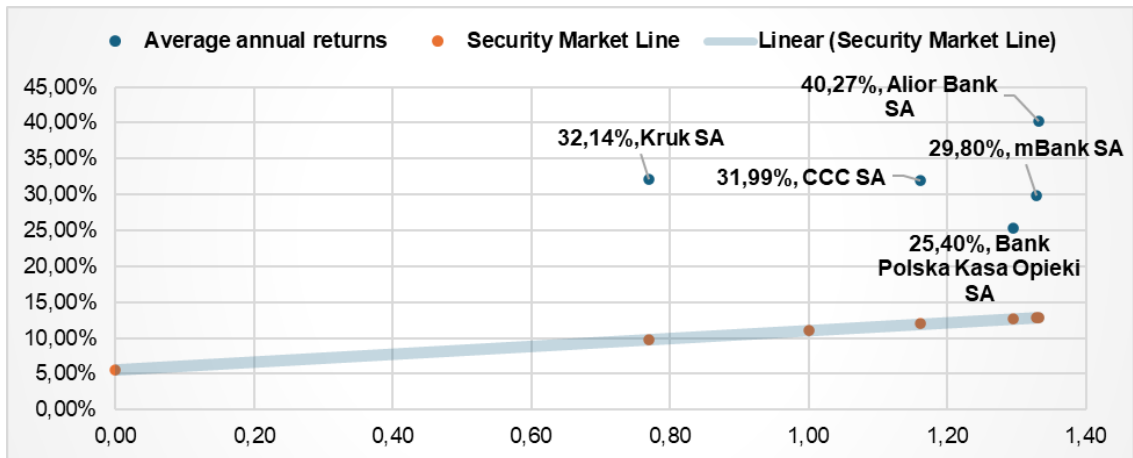


Figure 3. WSE Security Market Line and Average Annual Returns

Source: Author's calculation

Comparing the results regarding the analysis and selection of stocks on the two capital markets in Romania and Poland, we observe firstly that the stocks of both stock exchanges, according to the maximum return criterion, are undervalued, and secondly, a particularity, namely the fact that although Poland is an emerging capital market, with a lower level of uncertainty and risk unlike the capital market in Romania which is a frontier one, less liquid and connected to the global economy. However, the Polish capital market shows a larger difference between the expected return and the average annual return recorded, which indicates higher risk and uncertainty.

Regarding the secondary objectives (1) 'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Romanian stock exchange (Bucharest Stock Exchange - BSE)' and (2) 'Analysis of the downside-risk and return of portfolios built based on the maximum return criterion on the Polish stock exchange (Warsaw Stock Exchange - WSE)' the results are shown in Tables 3, 4 and 5, but also in Figures 4 and 5.

Within the BSE, applying the PMPT and D-CAPM methodologies, we can observe the following:

- the minimum variant portfolio offers a portfolio return of 15,92% at a portfolio risk of 13,78%. The Sortino ratio (0,604) shows us the return obtained by an investor per unit of downside risk that he assumes;
- the efficient portfolio offers the investor a portfolio return of 17% at a downside risk of 14,43%. Compared to the minimum variant portfolio, the Sortino ratio is higher (0,651), offering a higher return per unit of downside risk assumed;
- the market portfolio, which, from the Sortino ratio point of view, is the most performing ($0,751 > 0,651 > 0,604$);

Table 3. BSE PMPT – Maximum return criterion

Indicators/ Portfolio Type						MVP ¹	EP ²					MP ³
Portfolio Risk (%)	23,85	20,75	17,98	15,73	14,25	13,78	14,43	16,06	21,24	27,75	0,00	10,57
Portfolio Return (%)	11,00	12,00	13,00	14,00	15,00	15,92	17,00	18,00	20,00	22,00		15,92
Capital Market Line (%)	26,37	23,93	21,75	19,98	18,81	18,44	18,96	20,24	24,32	29,44	7,60	15,92
Sortino ratio	0,143	0,212	0,300	0,407	0,519	0,604	0,651	0,648	0,584	0,519		0,787

Source: Author's calculation

¹ Minimum Variance Portfolio

² Efficient Portfolio

³ Market Portfolio

In the graphical representation of the CML and the Efficient Frontier, we observe that efficient portfolios, which balance the downside risk-return ratio as measured by the Sortino ratio, are characterized by a return greater than 15,92%, a downside risk greater than 13,78%, and a Sortino ratio greater than 0,6.

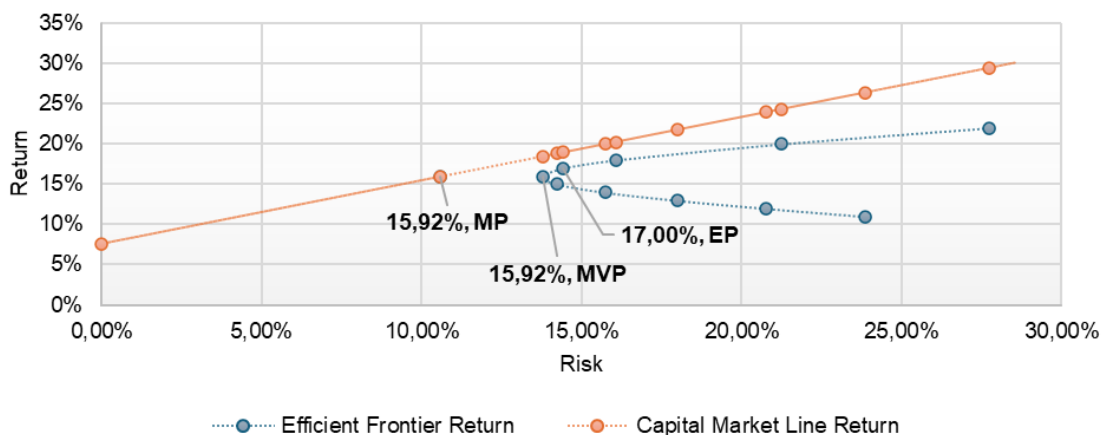


Figure 4. BSE PMPT – Maximum return criterion

Source: Author's calculation

Regarding WSE, applying the PMPT and D-CAPM methodologies, we can observe the following:

- the minimum variant portfolio offers a portfolio return of 11,23% at a portfolio risk of 23,04%. The Sortino ratio (0,243) shows us the return obtained by an investor per unit of downside risk that he assumes;
- the efficient portfolio offers the investor a portfolio return of 12% at a downside risk of 24,33%. Compared to the minimum variant portfolio, the Sortino ratio is higher (0,262), offering a higher return per unit of downside risk assumed;

- the market portfolio, which, from the Sortino ratio point of view, is the most performing ($0,338 > 0,262 > 0,243$);

Table 4. WSE PMPT – Maximum return criterion

Indicators/ Portfolio Type						MVP ¹	EP ²					MP ³
Portfolio Risk (%)	48,75	40,09	32,32	26,22	23,16	23,04	24,33	29,21	44,65	62,92	0,00	16,59
Portfolio Return (%)	7,00	8,00	9,00	10,00	11,00	11,23	12,00	13,00	15,00	17,00		11,23
Capital Market Line (%)	22,10	19,17	16,55	14,48	13,45	13,41	13,85	15,50	20,72	26,89	5,62	11,23
Sortino ratio	0,028	0,059	0,104	0,167	0,232	0,243	0,262	0,253	0,210	0,181		0,338

Source: Author's calculation

¹ Minimum Variance Portfolio

² Efficient Portfolio

³ Market Portfolio

In the graphical representation of the CML and the Efficient Frontier, we observe that efficient portfolios, which balance the downside risk-return ratio as measured by the Sortino ratio, are characterized by a return greater than 11,23%, a downside risk greater than 23,04%, and a Sortino ratio greater than 0,24.

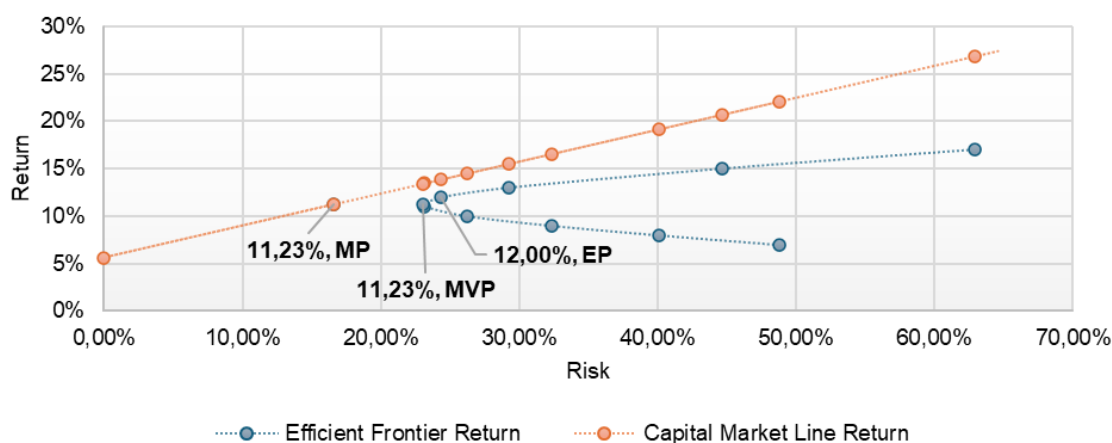


Figure 5. WSE PMPT – Maximum return criterion

Source: Author's calculation

Comparatively, Table 5 presents the results of the three types of portfolios created using the PMPT methodology on the two stock exchanges, BSE and WSE, in Romania and Poland. Starting from the maximum return criterion, then using as a performance indicator the Sortino ratio, suitable for those types of financial instruments (shares), with high volatility, as we find on frontier and emerging markets, we observe:

- in the case of the portfolio with the minimum variant, a higher Sortino ratio in the case of the BSE ($0,604 > 0,243$), by approx. 2,4 times;
- in the case of the efficient portfolio on the BSE, it has a Sortino ratio of 0,651, compared to 0,262 on the WSE, keeping the same difference as in the case of the portfolio with the minimum variant;
- a smaller difference, of approx. 2,33 times, we find it in the case of the market portfolio, where the Sortino ratio is higher ($0,787 > 0,338$) compared to the WSE.

Table 5. Portfolios performance indicator

Criterion	Portfolio/Stock Exchange	Bucharest Stock Exchange	Warsaw Stock Exchange	Performance indicator
Maximum return	MVP – Minimum Variance Portfolio	0,604	0,243	Sortino ratio PMPT
	EP – Efficient Portfolio	0,651	0,262	
	MP – Market Portfolio	0,787	0,338	

Source: Author's calculation

Based on the results obtained, we can conclude that using the PMPT methodology and applying the maximum return criterion, the portfolios within the Romanian BSE have a superior performance compared to the Polish WSE, if we compare them using the Sortino ratio. This means that these portfolios on the BSE offer a higher return relative to the downside risk assumed by the investor compared to those on the WSE.

5. Conclusions

We analyzed a sample of 32 companies—15 from the Romanian stock exchange (Bucharest Stock Exchange) and 17 from the Polish stock exchange (Warsaw Stock Exchange)—over June 2020 to June 2025. This spans 5 stock exchange years, totaling 1,260 daily observations. We conclude that our primary objective—'Building portfolios of stocks on the two markets in Eastern Europe, Romania and Poland, starting from the maximum return criterion'—shows that companies selected for the portfolio are undervalued in both markets when applying the maximum return criterion. Portfolio selections come from sectors such as Consumer Discretionary (1), Financials (4), Health Care (2), Materials (1), and Utilities (2). Moreover, BSE stocks exhibit a larger discrepancy between the expected return (CAPM) and the average annual return compared to those on the WSE. This indicates greater undervaluation for Romanian stocks than Polish ones, which is expected since the Romanian market is a frontier market while the Polish one is emerging.

By applying the Post-Modern Portfolio Theory methodology, we achieved two secondary objectives related to our primary goal. Both portfolios, built using D-CAPM and the Sortino ratio to measure performance, show that the return obtained by investors per unit of downside risk is higher for BSE stocks than for WSE stocks in all portfolio types analyzed. In the Minimum Variance Portfolio, the BSE Sortino ratio is 0,604, higher than the WSE's 0,243. For the Efficient Portfolio, the BSE ratio is 0,651 versus 0,262 for WSE.

In the Market Portfolio, the BSE ratio is 0,787, outpacing WSE's 0,338. Although the Sortino ratio is less than 1, we conclude that risk-averse investors find BSE stocks more attractive in terms of return compared to risk, based on the maximum return criterion.

Overall, our work contributes to asset management, stock analysis using the maximum return criterion, and portfolio selection and optimization. We present empirical results by analyzing the BSE and WSE capital markets' flag indices from June 2020 to June 2025. Our approach is based on portfolio theory, specifically PMPT, with a focus on downside risk rather than total risk. We address the potential losses from negative financial asset movements in these volatile markets. Thus, our findings offer investors, portfolio managers, and theorists a decision-making perspective based on results.

Our research also presents some inherent limitations, which will be addressed in future research. Applying the maximum return criterion, using flag indices from the two analyzed markets, means that the results obtained cannot be generalized to other frontier and emerging markets. Instead, the methodology can be applied, taking into account other additional criteria, such as those related to sustainable investments, or extended to others. Moreover, the analysis over a longer period, on a larger sample of companies, but also on more markets, both frontier and emerging, may lead to different results. With the publication of ESG scores for as many companies and over a longer period of time in frontier and emerging markets, it offers the possibility that future research will help to study sustainable investments in these markets as well, not just in developed ones.

Data Availability

The data for the daily closing prices of the analyzed stocks, the daily closing prices of the BET and WIG 20 indexes, and the risk-free rates were retrieved from LSEG Workspace, available at: <https://workspace.refinitiv.com/web>.

6. References

- Artavanis, N., Diacogiannis, G., & Mylonakis, J. (2010). *The D-CAPM: the case of Great Britain and France*. International Journal of Economics and Finance, 2(3), 25-38. <https://doi.org/10.5539/ijef.v2n3p25>
- ASF (2025). *Morgan Stanley Capital International (MSCI) recognizes Romania's capital market as an "Advanced Frontier Market"*. Retrieved from <https://www.asfromania.ro/en/a/3295/morgan-stanley-capital-international-%28msci%29-recunoaste-piata-de-capital-din-romania-ca-piata-de-frontiera-avansata%22>.
- Bayram, E., & Aktaş, R. (2025). *Portfolio Construction with Postmodern Portfolio Theory Framework*. Ekonomi Politika ve Finans Araştırmaları Dergisi, 10(1), 27-43. <https://doi.org/10.30784/epfad.1576857>
- Beach, S. L. (2011). *Semivariance decomposition of country-level returns*. International Review of Economics & Finance, 20(4), 607-623. <https://doi.org/10.1016/j.iref.2011.01.004>
- Brătian, V. (2024). *Portfolio optimization under the Mean-Semivariance Behavioral Hypothesis. Empirical evidence of the dependence between optimal portfolio structure and ESG Risk Scores*. Management of Sustainable Development, 16(2). <https://doi.org/10.54989/msd-2024-0011>

- CFI (2025). *Downside Risk*. Retrieved from <https://corporatefinanceinstitute.com/resources/career-map/sell-side/capital-markets/downside-risk/>.
- CFI (2025). *Modern Portfolio Theory (MPT)*. Retrieved from <https://corporatefinanceinstitute.com/resources/career-map/sell-side/capital-markets/modern-portfolio-theory-mpt/>.
- Chen, D. H., Chen, C. D., & Chen, J. (2009). *Downside risk measures and equity returns in the NYSE*. *Applied Economics*, 41(8), 1055-1070. <https://doi.org/10.1080/00036840601019075>
- Chen, J. (2022). *Post-Modern Portfolio Theory (PMPT): What it is, How it Works*. Retrieved from <https://www.investopedia.com/terms/p/pmpt.asp>.
- Cussen, M.P. (2025). *The Difference Between Emerging And Frontier Markets*. Retrieved from <https://www.investopedia.com/articles/investing/092013/difference-between-emerging-and-frontier-markets.asp>.
- Estrada, J. (2007). *Mean-semivariance behavior: Downside risk and capital asset pricing*. *International Review of Economics & Finance*, 16(2), 169-185. <https://doi.org/10.1016/j.iref.2005.03.003>
- Ferreira, P. (2018). *Long-range dependencies of Eastern European stock markets: A dynamic detrended analysis*. *Physica A: Statistical Mechanics and its Applications*, 505, 454-470. <https://doi.org/10.1016/j.physa.2018.03.088>
- Hadhri, S., & Fiti, Z. (2019). *Asset allocation and investment opportunities in emerging stock markets: Evidence from return asymmetry-based analysis*. *Journal of International Money and Finance*, 93, 187-200. <https://doi.org/10.1016/j.jimonfin.2019.01.002>
- Hoque, M. E., & Low, S. W. (2020). *Industry risk factors and stock returns of Malaysian oil and gas industry: A new look with mean semi-variance asset pricing framework*. *Mathematics*, 8(10), 1732. <https://doi.org/10.3390/math8101732>
- Investopedia (2025). *Modern Portfolio Theory: What MPT Is and How Investors Use It*. Retrieved from <https://www.investopedia.com/terms/m/modernportfoliotheory.asp>.
- Kenton, W. (2024). *Capital Asset Pricing Model (CAPM): Definition, Formula, and Assumptions*. Retrieved from <https://www.investopedia.com/terms/c/capm.asp>.
- Kenton, W. (2025). *Sortino Ratio: Definition, Formula, Calculation, and Example*. Retrieved from <https://www.investopedia.com/terms/s/sortinoratio.asp>.
- Lioudis, N. (2024). *Understanding the Sharpe Ratio*. Retrieved from https://www.investopedia.com/articles/07/sharpe_ratio.asp.
- LSEG (2017). *FTSE Country Classification*. Retrieved from https://www.lseg.com/content/dam/ftse-russell/en_us/documents/country-classification/ftse-interim-country-classification-review-2017.pdf.
- LSEG (2020). *Reclassification of Romania to Secondary Emerging Market Status*. Retrieved from https://www.lseg.com/content/dam/ftse-russell/en_us/documents/country-classification/ftse-faq-document-romania.pdf.
- Moagăr-Poladian, S., Clichici, D., & Stanciu, C. V. (2019). *The comovement of exchange rates and stock markets in Central and Eastern Europe*. *Sustainability*, 11(14), 3985. <https://doi.org/10.3390/su11143985>
- MSCI (2025). *The Global Industry Classification Standard (GICS®)*. Retrieved from <https://www.msci.com/indexes/index-resources/gics>.
- Pirgaip, B., Ertuğrul, H. M., & Ulussever, T. (2021). *Is portfolio diversification possible in integrated markets? Evidence from South Eastern Europe*. *Research in International Business and Finance*, 56, 101384. <https://doi.org/10.1016/j.ribaf.2021.101384>
- Sharpe, W. F. (1964). *Capital asset prices: A theory of market equilibrium under conditions of risk*. *The journal of finance*, 19(3), 425-442. <https://doi.org/10.1111/j.1540-6261.1964.tb02865.x>

- Spulbăr, C., Trivedi, J., & Birau, R. (2020). *Investigating abnormal volatility transmission patterns between emerging and developed stock markets: A case study*. Journal of Business Economics and Management (JBEM), 21(6), 1561-1592. <https://doi.org/10.3846/jbem.2020.13507>
- Statista (2025). *Ten worst drops for the Bucharest Stock Market from 2007 to 2020*. Retrieved from <https://www.statista.com/statistics/1104449/bvb-worst-drops-romania/>.
- Todoni, M. D. (2015). *A post-modern portfolio management approach on CEE markets*. Procedia Economics and Finance, 32, 1362-1376. [https://doi.org/10.1016/S2212-5671\(15\)01513-0](https://doi.org/10.1016/S2212-5671(15)01513-0)
- Venkataraman, S. V. (2023). *A remark on mean-semivariance behaviour: Downside risk and capital asset pricing*. International Journal of Finance & Economics, 28(3), 2683-2695. <https://doi.org/10.1002/ijfe.2557>
- Young, G. (2024). *Risk Profile: Definition, Importance for Individuals and Companies*. Retrieved from <https://www.investopedia.com/terms/r/risk-profile.asp>.
- Ziarul Financiar (2020). *Cele mai abrupte scăderi săptămânale ale BET din 2007 încoace*. Retrived from <https://storage0.dms.mpinteractiv.ro/media/1/1481/22467/18989780/1/4-tabel-bet.jpg>.