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Problems Related to the Capital Assets Pricing Model on the Warsaw Stock Exchange: Applications of the 5-Factor Fama and French Model

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This paper represents an attempt at empirically assessing the applicability of the Fama and French five-factor model in explaining the cross-sectional variation of stock return for the Polish market. Consistent with Fama and French results, this research shows that value, profitability and investment risk factors play an important role in assessing the expected return of an asset. Many researchers have since sought to identify alternative asset pricing models that could serve as the benchmark empirical asset-pricing model. It is hoped that the analysis conducted in this paper tests whether the revised five-factor model that incorporates the profitability and investment factors can address some of the issues of the three-factor model and could be incorporated in explaining the cross-section of stock returns for Poland.

Keywords: Fama-French factors, asset pricing, Warsaw Stock Exchange.

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Problemy związane z modelem wyceny aktywów kapitałowych na Giełdzie Papierów Wartościowych w Warszawie: Wykorzystanie 5-czynnikowego modelu Famy i Frencha

Artykuł stanowi próbę empirycznej oceny możliwości zastosowania pięcioczynnikowego modelu Famy i Frencha w wyjaśnieniu przekrojowej zmienności stopy zwrotu z akcji na polskim rynku kapitałowym. Zgodnie z wynikami Famy i French, badanie to pokazuje, że kapitalizacja rynkowa przedsiębiorstwa, jego rentowność i towarzyszące czynniki ryzyka inwestycyjnego odgrywają ważną rolę w ocenie oczekiwanej stopy zwrotu z aktywów. Wielu badaczy poszukiwało od tego czasu alternatywnych modeli wyceny aktywów, które mogłyby służyć jako wzorcowy empiryczny model wyceny. Analiza przeprowadzona w tym artykule ma na celu sprawdzenie czy zrewidowany model pięcioczynnikowy, który obejmuje czynniki rentowności i inwestycji, jest w stanie złagodzić niektóre problemy modelu trójczynnikowego i może zostać włączony do wyjaśnienia przekroju stóp zwrotu z akcji notowanych na polskim rynku kapitałowym.

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Słowa kluczowe: pięcioczynnikowy model Famy-Frencha, wycena aktywów kapitałowych, Giełda Papierów Wartościowych w Warszawie.

JEL: G10, G12

1. Introduction

For many years, both in theory and in economic practice, attempts have been made to identify factors affecting the level of realized risk premium. Their explanation would undoubtedly help to determine the cost of capital with high precision, which is crucial from the potential investor's point of view. For a very long time, the single-factor CAPM (Capital Assets Pricing Model) was considered to address these factors relatively well. However, with the development of capital markets, many empirical studies have arisen that have confirmed and denied its empirical correctness.

Nevertheless, according to the author, the CAPM model signaled the birth of asset valuation models that try to measure the relationship between risk and expected return. However, attempts to explain all cross-sectional differences in the rate of return through the prism of one factor (beta factor) have serious limitations. Such limitations have been highlighted by Lakonishok, Shleifer and Vishny, who indicated that profitability models based on such figures as the profit/price ratio, cash flow/price ratio or sales growth are not explained by the CAPM model (Lakonishok et al., 1994). In the mid-eighties of the twentieth century, DeBondt and Thaler showed that the reversal of the trend of long-term rates of return was not explained by the CAPM model (DeBondt & Thaler, 1985).

In light of the various anomalies that are not used in the unifactorial model, many scientists have sought to create a model that would more comprehensively explain the crosscutting determinants of the rates of return on equity investments. Of the various models proposed, none seems to have gained such recognition as the three-factor model of Fama and French (Fama & French, 1993). This model adds two additional factors to the standard CAPM model, namely the size and value factors. The size factor is represented through the difference in the rate of return on shares between companies characterized by high and low capitalization, while the value factor is expressed by the ratio of the book value of the company to its market value. The effect of grandeur was actually first signaled by Banz in 1981. He found that low-cap companies have a higher average rate of return than the CAPM predicts (Banz, 1981). Many researchers also identified the value effect previously. These include Basu (Basu, 1983), Rosenberg, Reid and Lanstein (Rosenberg et al., 1985). They stated unequivocally that the rate of return on shares of companies with a high ratio of market price to book value is higher compared to companies where the level of this ratio is lower.

Despite the undoubtedly great success of the three-factor model, it was still questioned. In 1997, Carhart added a fourth factor related to dynamics to explain the short-term effect of momentum (Carhart, 1997). The momentum effect is defined by Jagadeesh and Titman as one in which the rate of return in the last three or twelve months has been high – usually exceeding that which is continuing on an ongoing basis (Jagadeesh & Titman, 1993). Fama and French, on the other hand, were reluctant to support the results of this research because they concluded that there was no macroeconomic argument for the momentum bonus (Cochrane, 2008). Nevertheless, in 2015, these authors decided to include two additional factors in their original three-factor model, which are related to profitability and the level of made investments (Fama & French, 2015).

The problem addressed in this paper is whether the five-factor Fama and French model can explain portfolio returns better than the CAPM. The investigation focuses on whether the empirical findings on the United States (US) stock market for the five-factor model can also be confirmed on the Polish stock market.

There is little research on how the Fama and French (2015) model holds up on the Polish stock market and whether the five-factor model explains portfolio returns. This research is aimed at validating if the empirical findings of the model on the

US stock market can be also be applied on the Polish market during the period of COVID-19.

The purpose of this article is to assess the possibility of using the Fama and French five-factor model on the Polish market, with such risk factors as: market factor, size, book-to-market ratio, operating profitability of equity and increase in the company's assets.

The paper limits its research to only include companies that have continuity of quotations of shares on the Warsaw Stock Exchange in the time horizon 2010–2020. Limited access to the information about the share value in the time range when a particular entity was out of the stock market was the reason for including only the companies with the continuity of quotations.

2. Research Review

Due to the anomalies on the capital market, the five-factor model of Fama and French has become the subject of research on foreign capital markets but also on the Polish capital market. Empirical research, which enjoyed great recognition in the academic environment, undoubtedly includes works authored by:

- E. Nichol and M. Dowling (Nichol & Dowling, 2014) – a study conducted on FTSE 350 (Financial Times Stock Exchange), between 2 January 2002 and 31 December 2013. The individual components of the model were verified using the Fama-MacBeth test. The conclusions from the conducted research indicated that not all factors passed positively all performed statistical tests, and the proposed five-factor model seems to be a marginal improvement over the widely used three-factor model.
- M. Chiah, D. Chai and A. Zhong (Chiah et al., 2015) – research was conducted on companies from the ASX index (Australian Stock Exchange), in the period from January 1982 to December 2013. The model was subjected to the GRS test. The authors found that the five-factor model could explain more market anomalies than the three-factor model. However, it was emphasized that it still could not explain the volatility of time series in the rate of return on individual portfolios. According to those authors, the results of empirical research coincide with the thesis of Fama and French, who indicated in one of their articles that the five-factor model provides an acceptable but incomplete description of the average rates of return from given investment portfolios (Fama & French, 2015).
- F.J. Fabozzi, D. Hung and J. Wang (Fabozzi et al., 2016) – the authors of this article hypothesized that the HXZ (Hou et al., 2015) model surpasses the five-factor model. A portfolio of 15 well-known capital market anomalies described by Novy-Marx and Velikov (Novy-Marx & Velikov, 2016) was selected as risky assets. The conclusions of this article indicate the superiority of the HXZ model over the five-factor model of Fama and French.
- L. Amézola and M. Dolz (Amézola & Dolz, 2017) – the research carried out by these authors, in turn, seems to be the most comprehensive when it comes to the European capital market. In the first place, Europe was divided into three geographical areas: north, center and south. Then, each area was sorted by the GDP level (gross domestic product). Those countries whose GDP exceeded 200 billion euros were selected. Due to the availability of data, the following countries are not included: Italy, Russia, the Netherlands, Switzerland, Turkey, Poland, Belgium, Austria, Norway, Ireland and Finland. The analyzed data covered the period from January 2001 to December 2016. The main conclusion of the study was that the risk factors calculated for Europe are very similar to the risk factors reported by Fama and French (Fama & French, 2015).
- L. Czapiewski (Czapiewski, 2016) – the author conducted research on the Polish regulated market WSE (Warsaw Stock Exchange) WIG in the period 2000–2014. The conclusions drawn on a sample of 630 companies confirmed the possibility of using multifactorial Fama and French models on the Polish capital market – both three-factor and five-factor models.
- S.K. Acaravci and Y. Karaomer (Acaravci & Karaomer, 2018) – the aim of this research was to test the performance of the Capital Assets Pricing Model and the Fama-French five-factor model in Borsa Istanbul during the period

between July 2005 and June 2016. The result indicates that there is no pricing error as regard the result of GRS-F test of the Fama-French model excluding the CAPM. Further, the Fama-French model has the most explanatory power in variations regarding portfolio returns.

- S. Cox and J. Britten (Cox & Britten, 2019) – this study tested the effectiveness of the Fama and French five-factor model in explaining returns on the Johannesburg Securities Exchange. The results showed that the size-value and size-profitability three-factor model best describes time-series returns when comparing models. On the other hand, the five-factor model best explains the cross-section of returns and the results overall identify a significant inverse size premium and a negative relationship between beta and returns.
- A. Dutta (Dutta, 2019) – the purpose of the conducted analysis was to assess whether the five-factor model of Fama and French has sufficient power to identify the long-term abnormal performance of companies experiencing major corporate events. The analysis concludes that although the five-factor model is more powerful than the three-factor model, the extended model still lacks power. It was also noticed that the power of the five-factor model is substantially reduced as the event period advances.
- P. Dirkx and F.J. Peter (Dirkx & Peter, 2020) – the authors implemented the Fama-French five-factor model enhanced by the momentum factor for the German market using monthly data from 2002 to 2019. The result of the model compared with the three-factor model revealed that additional factors do not add significant explanatory power to the analysis.
- D. Hou and Z. Chen (Hou & Chen, 2021) – the researchers analyzed market changes of the US steel industry before and after the pandemic. Due to COVID-19, the robust minus week changed from significant to insignificant, small minus big and high minus low were significant and the change of the economic situation during the pandemic did not have a significant impact on the mentioned factors, while conservative minus aggressive was not significant.

While reviewing the literature concerning empirical research on the five-factor model of Fama and French for the Polish capital market, the author of this paper stated that the usefulness of this model should be re-verified in the light of recent, significant events on the WSE. The most important of them that could affect the credibility of the model include:

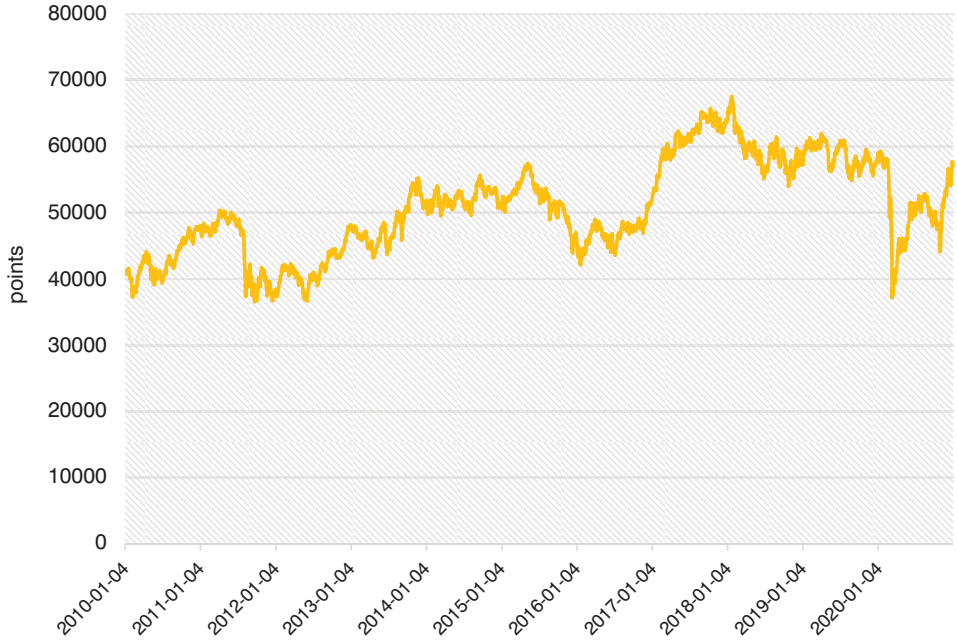
- Debut of the "Stock Exchange on the Stock Exchange" – in November 2010, the shares of the WSE (Polish: GPW S.A.) itself debuted on the Warsaw Stock Exchange. It was a very symbolic event and the offer itself was very popular. Over 300,000 subscriptions for shares were submitted.
- The downgrade of the Polish rating by the S&P agency – it took place on January 15, 2016 and was the result of many factors of both an economic and political nature. The most important of them include: the 2015 WIG ended with a decline of about 20% (this was unusual because the Polish GDP in 2015 grew by 4%), the presidential and parliamentary elections had a negative impact on large stock market sectors such as banks or energy companies.
- Suspension of GetBack shares – on 16 April 2018, the shares were suspended and the company turned out to be a fraudster that caused losses counted in billions of zlotys. According to the author of this work, this is the biggest scandal so far that has happened on the WSE.
- WSE promotion to developed markets – on 24 September 2018, FTSE Russell reclassified Poland from emerging markets to developed markets. Poland joined the group of 25 most developed global markets and the change itself meant that global equity indices, to some extent, changed the perception of the largest companies from the WSE.
- Entry of ETFs on the WSE – on 7 January 2019, for the first time in the history of the Warsaw Stock Exchange, ETFs (exchange-traded funds) that mimic the WIG 20 index entered trading.
- COVID-19 "debut" on the WSE – 12 March 2020 was the worst day on the WSE after 2000. The WIG index fell by approximately 12.6%, WIG 20 by 13.3%.
- Allegro debut – on 12 October 2020, Allegro shares were sold for about 10.6

billion zlotys. Allegro has become the largest company on the WSE in terms of capitalization – capitalization of nearly 72 billion zlotys.

3. Description of the Research Sample and Used Methods

The sources of information used to conduct the research were EMIS Market Intelligence Platform, Stooq, Notoria Serwis – financial statements databases, and the home page for Aswath Damodaran. The research was conducted between 1 January 2010 and 31 December 2020. From the first three databases, data about closing prices of companies and the WIG index performance in 2010–2020 as well as information on various types of operations affecting the quotations of shares were used. Financial information and information related to the risk-free rate level was obtained from the fourth and fifth databases. The stock data was obtained daily with a sample of 10 years. Below are the quotations of the WIG index from which it can be concluded that in the period under study, the index covered both bull and bear market periods.

Figure 1. WIG Index in 2010–2020



Note. This figure was prepared by the author based on: https://stooq.pl/q/d/?s=wig&c=0&d1=19991231&d2=20201231 (17.08.2021).

Table 1 presents all listed companies that maintained the continuity of quotations in the period 2010–2020 on the Warsaw Stock Exchange and their characteristics – average capitalization value per year.

Table 1. Characteristics of Companies Listed on the Warsaw Stock Exchange at the End of Individual Periods

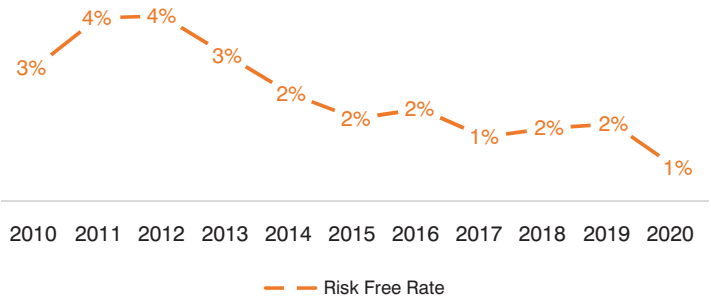
Year	Number of companies	Average total capitalization
2010	210	812,652,981
2011	227	935,869,587
2012	238	707,027,932
2013	246	875,536,315
2014	263	2,921,623,568
2015	266	830,464,859
2016	276	693,944,056
2017	307	879,315,287
2018	281	788,232,843
2019	278	745,405,293
2020	282	1,457,258,076

Note. This table was prepared by the author based on: https://stooq.pl/ (17.08.2021).

The companies' quotations have been adjusted for splits, pre-emptive rights, dividends paid, acquisition rights, subscription rights, denominations. Subsequently, based on such adjusted rates of return, individual time series of monthly logarithmic rates of return were determined.

The risk-free rate of return was determined on the basis of WIBOR 1Y (Warsaw interbank offered rate), which was then adjusted for the default risk premium based on the S&P rating determined for Poland and the CDS (credit default swap) hedge.

Figure 2. Level of Risk-Free Return in 2010 –2020



Note. This figure was prepared by the author based on: https://pages.stern.nyu.edu/~adamodar/ and https://stooq.pl/ (17.08.2021).

The research tested the possibility of using the Fama and French model on the Polish capital market. In this model, the surplus rates of return can be mathematically defined by the equation (Fama & French, 2014):

$$r_{and} = \alpha - 4_f + \beta_M(r_M - 4_f) + \beta_{SMB}SMB + \beta_{HML}HML + \varepsilon_{(1)}$$

where:
SMB – the difference between the average rate of return of low-cap companies and the average rate of return of high-cap companies,
HML – the difference between the average rates of return of companies with a high and low BV/MV ratio,
ε – intercept statistic,
$\beta_M, \beta_{SMB}, \beta_{HML}$ – the sensitivity of the portfolio to changes in certain factors.

It should be noted that Fama indicates that the proposed model is an empirical model – unlike the standard model, relies on historical data, treats any recurring rate of return formulas as data, and proposes parameters tailored to them that best describe the rates of return (Fama, 2014). In his empirical research, Vassalou confirms that the factors of SMB and HML depend on macroeconomic data (Vassalou, 2000).

Assuming the validity of the thesis that the rate of return depends on profits and the level of investments, Fama and French, based on the research of Novy-Marx (Novy-Marx, 2013), Aharoni, Grundy, Zheng (Aharoni et al., 2013), Titman, Wei and Xie (Titman et al., 2004), developed their model to a five-factor model:

$$r_{and} = \alpha - r_f + \beta_M(r_M - r_f) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{RMV}RMV + \beta_{CMA}CMA_{(2)}$$

where:
RMV – the difference between the average rates of return of companies with solid and poor profitability,
CMA – the difference between the average rates of return of companies with low and high investment outlays,
β_{RMW}, β_{CMA} – sensitivity of the portfolio to changes in specific factors.

The factors were selected in the following way:

- The first step was to identify factors, using theoretical background. No doubt, the most accurate model is the CAPM. This model suggests that the return on the market portfolio is the only factor that allows for calculating the expected return.
- The second step was statistical. This approach estimates factors exposure to the market and is motivated by the arbitrage pricing theory (Ross, 1976).
- The third approach was to create factors based on company characteristics.

In this study, the author calculated asset pricing factors based on the Fama-French five factor model. The performed analysis is based on the assumption that there must be a close relationship between companies' characteristics and their expected return.

In order to verify the usefulness of the Fama-French model for the generation of cross-sectional factor-effective portfolios, the hypothesis of zero value of all intercepts in the studied model was tested. GRS statistics were used to test this hypothesis (Gibbons et al., 1989):

$$GRS = \left(\frac{T}{N}\right)\left(\frac{T-N-L}{T-L-I}\right)\left[\frac{\partial^T \widehat{\Sigma}^{-1}\widehat{\alpha}}{1+\widehat{\mu}^T\widehat{V}^{-1}\widehat{\mu}}\right] \sim F(N, T-N-K)_{(2)}.$$

The zero value of intercept in the model under study means that the factors included in the model are sufficient to determine the rates of return by means of this model. The

advantage of the GRS test over other tests is that it examines the model as a whole and does not test its verifiability on a specific investment portfolio. This statistic can therefore be decisive when it comes to accepting or rejecting the model.

4. Construction of Investment Portfolios

Each month, the surveyed companies were divided according to the value of capitalization:

- S (small) – small,
- M (media) – medium,
- B (big) – large.

Small companies included those that were less than or equal to a decile of 0.3 in terms of capitalization. Those whose capitalization level was equal to or greater than the decile of 0.7 were considered large. Entities with average capitalization were in the range of 0.3–0.7. An analogous division was applied to the other factors, with their individual values determined as follows:

- HML (high minus low) – assignment to the appropriate decile based on the size of the PT/BV ratio (price-to-book value). The stocks with the 30% higher PT/BV were categorized as growth stocks. Neutral stocks were those with PT/BV ranging from the 30th to 70th percentile. Those within the 70th and 100th percentiles were classified as value stocks.
- RMW (robust minus week) – the computation of the RMW factor is identical to HML except the benchmark – assignment to the relevant decile based on the level of operating profit margin. The higher the operating profit margin, the more robust the company is.
- CMA (conservative minus aggressive) – for the CMA factor, the second classification was not done based on PT/BV or operating margin but on the level of investment from the previous year (increase in total assets year-on-year). The lower the growth of assets, the more conservative the share price is.

First, 10 portfolios were formed (one per year) with companies listed on the Warsaw Stock Exchange (based on the condition of continuity of their shares quotations).

Each portfolio was built from the 1 January of the corresponding year. The first portfolio includes the companies that were part of the selected stock index in January 2010, the next portfolio includes the companies that were listed in the WIG index in January 2011 and so forth.

The market factor was computed by calculating the average return on the WIG value minus risk-free rate.

The final SMB factor was computed by averaging the returns of the SMB portfolios based on HML, RMW and CMA contributions to the size factor.

5. Analysis of the Results Obtained – Statistic Results and Correlation Among the Factors

Table 2 summarizes the statistics for each risk factor. Monthly mean logarithmic rates of return are 23% for SMB, 25% for HML, 39% for RMW, 52% for CMA, and 5% for the market factor. The summary of statistics suggests that the factor that has more weight on the Warsaw Stock Exchange is the investment factor, followed by the profitability factor and by the value and market factors.

Table 2. Characterization of the Risk Factor Premium

	SMB	HML	RMV	CMA	RM-RF
Average	0.23	0.25	0.39	0.52	0.05
Standard deviation	0.18	0.22	0.56	0.69	0.21
t-statistic	0.78	3.24	3.15	1.98	1.54

Note. This table was drawn up on the basis of the author's analysis.

Before starting a further analysis, it was determined that a given risk factor was significant at a 95% confidence level if the value of the statistic *t* was greater than 2.23.

In other words, if the value of the coefficient was at least 2.23 of the standard error from zero. The greater the magnitude of *t*, the greater the evidence against the null hypothesis. This means that there is greater evidence for a significant difference.

From the table above, we can conclude that the impact of risk factors is greater and more significant (in terms of statistic *t*) for small-business shares. This is a direct consequence of the size effect of the company. Smaller companies tend to perform better than large companies (as can be seen from the positive value of the SMB coefficient). In general, investors expect small companies to perform better than large ones, which are exposed to a stronger impact of macroeconomic factors. The same applies also to the CMA coefficient.

The results of the research show that the expected operating profitability for small businesses is at least 3.15 standard error from zero. This means that the average profitability premium of RMW is higher for large companies than for small ones. However, the evidence for this hypothesis is weak, as confirmed by the value of statistic *t*. In addition, the average return for companies with a conservative investment policy is higher than for profitable companies – the expected return on the portfolios with an average excess return of 52% for the CMA factor and 39% for RMV. Moreover, conservative investment policies (CMA) for both small and large companies present the results with standard deviations of at least 1.98, which makes the result statistically insignificant. In consequence, this allows for accepting the zero hypothesis, which assumes the irrelevance of individual variables due to the value of the test probability.

The evidence from the study suggests that the value of statistic *t* for HML is not statistically significant where the expected return on portfolios is in excess at 25% per year. The result is statistically significant given that the means for the HML factor are at least 3.24 times their standard deviation whatever the size of analyzed entities.

Overall, two factors (HML and RMV) of four have a positive contribution to the expected return, which means that value and robust companies achieve higher rates of returns than large developing entities with conservative investment policies. Moreover, the HML and RMV factors are statistically significant at the 95% level, with the t-statistic being 2.23.

To conclude, the performed statistical analysis for two factors (SMB and CMA) suggests that the results for the Polish market are not similar to those presented by Fama and French in their study on the US market, where all four factors have a positive contribution to the expected return (Fama & French, 2015). This fact may be due to lesser efficiency of the Polish market.

The correlation between the factors is shown in Table 3.

Table 3. Correlation Between Risk Factors

	SMB	**HML**	**RMV**	**CMA**	**RM-RF**
SMB	1.00	–0.93	0.73	0.83	–0.16
HML	–0.93	1.00	0.47	0.63	–0.12
RMV	0.73	0.47	1.00	0.96	0.10
CMA	0.83	0.63	0.96	1.00	0.18
RM-RF	–0.16	–0.12	0.10	0.18	1.00

Note. This table was drawn up on the basis of the author's analysis.

In the case of an investment portfolio based on companies from the WIG index, the highest correlations occur between RMV and CMA. This result is consistent with the common belief that companies with a high level of investment in tangible and intangible assets are able to achieve relatively high cost savings in the medium term, which allows increasing the operating margin.

The correlation of the size factor with the book value factor is significantly nega-

tive. This result may not come as a surprise as most investors would be willing to pay a higher market price for a larger company with an established market position.

Another interesting result can be obtained from the analysis of the correlation between the size and profitability factors. The size factor is positively correlated with profitability, which reinforces the thesis that small businesses are generally more profitable.

Finally, the correlation between profitability and value is not negative. This can certainly be a kind of surprise, given that in general, stocks that have a high book-to-market value reveal such a relationship due to the poor outlook for the future.

In order to verify hypothesis H_0: $\hat{\alpha} = 0$ about the irrelevance of the whole vector of intercepts of the five-factor model, the GRS test was carried out. Its statistic result is 4.996, where the critical value is 4.573 (with a significance level of 0.01). The results of the test thus provide grounds for rejecting the null hypothesis, according to which the value of the intercepts in all portfolios is equal to 0. The GRS test does not confirm the assumption that the five-factor model generates a cross-sectional factor of effective portfolios. This result is important because it covers the whole model and not its individual portfolios – different significance of individual variables obtained for different portfolios makes it difficult to decide in favor of accepting or rejecting the model. The result of the GRS test resolves this issue in favor of rejecting the five-factor model.

6. Conclusion

Both in theory and practice, attempts are made to define all the risk factors explaining the levels of the expected rate of return on investment. The aim of this work was to verify the possibility of using the five-factor model of Fama and French on the Warsaw Stock Exchange. With the help of the presented results of the statistics, its incomplete adjustment to the actual rates of return of companies listed on the Warsaw Stock Exchange market was demonstrated. Not all factors have a positive sign, from which we can conclude that small entities are rewarded with higher expected returns. The obtained results are significant just for the HML and RMW factors at the 95% confidence interval. This means that the contribution of any of them is different from zero in more than 95% of cases. According to the author, the results of the conducted research may give rise to a change in the construction of the CMA factor – with a standard deviation of at least 1.98. It may also turn out that other factors not yet identified by financial market theorists and practitioners are of great importance on the Warsaw Stock Exchange.

Due to the rather lengthy process of calculating individual factors of the Fama and French model for the Polish capital market compared to the US market, where it is possible to download ready-made input data starting from 1926, this model is rarely used in practice. Its partial alignment, as demonstrated in this article, may make retail and institutional investors use it more widely. An interesting solution seems to be the modification of its factors by increasing the reliability of its use and the publication of current SMB, HML, RMV, CMA levels on public websites.

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