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FREE CASH FLOWS AND ANOMALOUS RETURNS – THE CASE OF POLAND

This study investigates the performance of the free cash flow portfolio in the period of 2001-2011 in Poland. Firstly, a portfolio of large firms with positive free cash flows, low free cash flow multiples, and low financial leverages was selected. Then it was compared to other firms listed on the Warsaw Stock Exchange. The results were observed in different time periods and exposed to different models. Both buy-and-hold (BHARs) and cumulative abnormal returns (CARs) were estimated. Mean and median buy-and-hold abnormal returns for the free cash flow portfolio were in most of the years much above the averages for other companies. This was also observed for the whole sample period. The difference between the free cash flow portfolio and other companies was significant in economic and statistical terms during market downturns. It may seem plausible that the free cash flow portfolio outperforms other companies, especially during bear markets. However, the free cash flow anomaly was not always robust to different models and statistical tests and dependable in all the years of the sample period. Negative medians for BHARs and the unfavorable comparison of mean CARs between the free and non-free cash flow portfolio were found. This makes the possibility of earning above-average risk adjusted returns on investing in the free-cash-flow portfolio questionable.

Keywords: market anomaly, free cash flows, Warsaw Stock Exchange
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1. INTRODUCTION

Market anomalies can be defined as some empirical findings that seem to be inconsistent with the predictions of accepted models of asset pricing. They have been very often treated as proof either of market inefficiency or imperfections in asset-pricing models. The popularity of the empirical research connected with efficient market hypothesis exploded after Fama's famous article (1970). Uncovering some puzzling results in the literature absorbed many researchers, both the devotees and staunch opponents of the efficient market hypothesis. Some of the anomalies appeared to be notorious enough to fascinate economists from all over the world, where some of them attracted scientists' attention to a smaller extent.

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The most prominent anomalies that have been identified so far include those connected with corporate actions such as equity public offerings (e.g. Ritter 1991, Loughran and Ritter 1995), earnings announcements (e.g. Foster et al. 1984) or securitization issues (Lockwood et al. 1996). A very large number of papers in the academic literature focused on seasonal regularities and related to the weekend (e.g. Cross, 1973), pre-holidays, the turn of the week, around the turn of the month, or around the turn of the year (e.g. Lakonishok and Smidt, 1988), to cite the best known examples. A vast number of prior research on the borderline between finance and accounting revealed many anomalies observed for securities selected on the basis of financial data. Research in this field examined to what extent stock returns were related to financial data. They referred to small-capitalization (Fama and French 1992), book-to-market ratios (Basu 1977), or accruals (Sloan 1996). An example of a less well-known anomaly are abnormal returns generated on the basis of the free cash flow strategy (Hackel et al. 1994). The free cash flow strategy has been tested for the US stock market (Hackel et al. 2000), the Finnish stock exchange (Jokipii and Vähämaa 2006) and Turkish securities (Arslan and Karan 2007).

Market anomalies are still triggering discussion in finance. They were sometimes seen to be more apparent than real (Schwert 2002). The supporters of behavioural finance attribute the anomalies either to investor irrationality (Shiller 1981) or the mistakes resulting from incomplete information (Brav and Heaton 2002). Fama advocates the efficient market hypothesis by saying that the anomalies were of a random nature and that underreaction occurred as often as overreaction (1998). He put the relevancy of the anomaly-detecting methods into question, especially in the long term.

The paper is a continuation of a broad and extensive discussion reported in prior literature on stock market anomalies, which have received a great deal of attention so far. The main contribution of the paper concentrates on examining the free cash flow anomaly in a market setting different from those previously documented. Market anomalies turned out sometimes to be not robust to methodology, sample or period choice. Besides, if it is assumed that anomalies are real, many of them could be exploited by the market and found absent. It is important if an anomaly uncovered within a specific sample will also be found in new independent samples (Schwert 2002). These were the main reasons to explore the performance of the investment strategy based on free cash flows for the Warsaw Stock Exchange in Poland. The period under review was 2001–2011.

The research aimed to answer three main questions: first, whether the long-term abnormal returns for a portfolio of Polish stocks based on the free

cash flow investment strategy could be observed; second, if the free cash flow anomaly did exist, whether it was constant, changing or it disappeared with time; finally, whether the anomalies increased in declining markets, as previous research reported.

The paper is organized as follows. The next section briefly presents existing literature and the results of prior studies on the free cash flow anomaly. Section 3 describes the dataset and selection criteria for securities listed on the Warsaw Stock Exchange. Section 4 describes the methodology. In section 5,estimates of abnormal returns are presented to evaluate the performance of the free cash flow investment strategy, with special consideration given to its profitability in crisis periods. It also contains a robustness check analysis. Section 6 states the conclusions[2].

2. PREVIOUS STUDIES REVIEW

At the end of the twentieth century, the efficient market hypothesis slowly started to be not so widely accepted as before. Financial economists emphasized market inefficiency, investor irrationality and the risk factors associated with security returns. The research in finance started to be dominated by studies challenging stock price determinants. This resulted in describing price regularities in new models in addition to the Capital Asset Pricing Model developed by Sharpe (1964) and Lintner (1965), such as the Fama-French three factor model (1992) or the Carhart four factor model (1997), to mention the most prominent. Mounting evidence reported also many departures from documented stock price patterns, such as the size effect as in Banz (1981) and Reinganum (1981), the weekend effect observed by French (1980), IPO returns described in the famous research of Ibbotson (1975), and many others. Recently, more and more arguments have been heard that traditional finance appears to play a limited role in understanding the key issues of finance, or at least it should be supported by behavioural finance findings (Subrahmanyam 2008, Gajdka 2013). No matter the theoretical background, the anomalies did arouse interest in the past and the discussion associated with them will stay vivid for many years.

The free cash flow anomaly has been previously documented for the US, Finnish and Turkish capital markets. Hackel et al. (2000) used daily returns in the US capital markets during the period 1979–1996 and observed returns cumulated over a calendar year. The authors found that large-capitalization

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firms that were consistent long-term operating and free cash flow generators and had low free cash flow multiples, combined with a low financial leverage, provided higher returns relative to the market index. The mean of the free cash flow portfolio return was 21.9 percent annually, compared with the CRSP value-weighted index, which was 16.4 percent. Market-adjusted returns averaged 5.5 percent. The portfolio outperformed the market also in the years of market downturns.

The free cash flow investment strategy was also examined for publicly traded Finnish stocks during the period 1992–2002 (Jokipii and Vähämaa, 2006). Due to the limitations of the Helsinki Stock Exchange, they simplified the selection criteria and assumed neither a positive four-year average of operating and free cash flow nor any growth in free cash flows. The only criterion referring to cash flows was that the last year's free cash flows should be positive. The other criteria were adopted from Hackel et al. (2000). Jokipii and Vähämaa observed that the free cash flow portfolio yielded 12-month buy-and-hold returns (the mean and the median of 23.3 and 22.5 percent, respectively) superior to those of the HEX Portfolio Index (11.5 percent and 12.0 percent for the mean and the median, respectively). The mean market-adjusted return for the free cash flow portfolio was 11.8 percent annually and 0.8 percent on a monthly basis.

Jokipii and Vähämaa documented that the investment strategy based on free cash flows was profitable, especially during bear markets. The mean monthly market-adjusted return for the free cash flow portfolio was 2.3 percent. The portfolio also outperformed the market by about 4.1 percent during market downturns (defined as months in which the HEX Portfolio Index fell by more than 5%).

The studies of Arslan and Karan (2007) re-examined the free cash flow anomaly for the Istanbul Stock Exchange, a Eurasian emerging market, for the period of 1999–2005. They used monthly stock data and applied the buy-and-hold approach. The paper presented no irrefutable evidence for the superiority of the free cash flow portfolio returns over the market index. However, the authors found that during market downturns the mean (median) return for the free cash flow portfolio was around 0.1 percent (0.0 percent), while the return on the ISE 100 index was -10.7 percent (-9.4 percent). The mean values were reported to be statistically significant based on a conventional t-test. The mean monthly market-adjusted return during market declines was significantly different from zero and totaled 10.8 percent with a median of -0.0 percent.

The free cash flow anomaly was also discussed by Chughtai et al. (2011) for Pakistan. There were also studies connected with cash flows in a broad

context such as that of Rayburn (1986), Bernard and Stober (1989), Livnat and Santicchia (2006), Livnat and López-Espinosa (2008) and Foerster et al. (2014). The importance of free cash flows was also challenged in rather narrow topics connected with seasoned equity offerings by McLaughlin et al. (1996).

To sum up, the literature review on the anomaly mostly showed that a portfolio of firms selected on the basis of a free cash flow level appeared to be quite attractive. Higher excess returns seemed to be especially noticeable during market turbulence.

3. DATA AND SAMPLE SELECTION

The research was conducted for companies listed on the Warsaw Stock Exchange (WSE) which is the main stock market in Poland. The key source of information was Ceduła and Notoria Serwis. The first step was to prepare the authors' own database of daily close prices for all companies, as there was no other comprehensive database to exploit. Although this was a very time-consuming process, it was also essential since the existing sources do not have the satisfactory quality and data. The database prepared for the existing research also includes delisted firms as the necessary adjustments (dividends, splits and preemptive rights).

Because of the anomaly documented by Ritter (1991) for the newly listed firms, securities for which close prices from the previous full year cannot be obtained were eliminated. Companies that were delisted during a given investment year were also excluded. The initial sample consisted of 470 non-financial firms for which all of the necessary market and financial statement data could be retrieved. Investment portfolios identified on the basis of financial statements and market information were built. The selection criteria were adopted from Hackel et al. (2000) and Hackel and Livnat (1995):

$$Free\ Cash\ Flow > PLN\ 0 \tag{1}$$

$$5 < \frac{Market\ Value}{Free\ Cash\ Flow} < 30 \tag{2}$$

$$\frac{Total\ Debt}{Free\ Cash\ Flow} < 10 \tag{3}$$

$$Market\,Value > PLN\,70\ million. \tag{4}$$

Firstly, the criterion that ensured that a company was a positive free cash flow generator in the most recent year was imposed. Free cash flow was defined as the cash generated by operations that can be distributed back to shareholders without affecting the current level of a firm's growth. Free cash flow was estimated as the net cash flow from operations minus capital expenditure. The second criterion of a free cash flow multiple between 5 and 30 was imposed. This was estimated as the ratio of market value divided by free cash flow. The third criterion was applied to select firms with a favorable debt capacity. The leverage was expressed as the ratio of total debt divided by free cash flow. The last criterion allowed to focus only on larger companies as measured with market capitalization. The upper bound was chosen arbitrarily and the research focused on firms with a market value of equity equal to more than PLN 70 million, which was about the 40th percentile for the WSE.

The company must have fulfilled all the mentioned four selection criteria to be included in the free cash flow portfolio (FCF). The securities that did not conform to at least one filtering rule were included in the non-free cash flow portfolio (nFCF). The original screening criteria applied for the US stock market were slightly changed because of the relatively small number of companies in the Polish market. In consequence, neither any growth in net operating cash flow nor a positive four-year average of operating and free cash flow was assumed here. The criteria of Jokipii and Vähämaa (2006) as well as Arslan and Karan (2007) were followed, which resulted in requiring only the last year's free cash flow to be positive. The upper bound of the free cash flow multiple was also replicated.

December 31 of each year was selected as the classification date. For that day free cash flows, the free cash flow multiple, and the debt multiple were estimated on the basis of financial statements from the end of the year, and the market value for the last trading day of that year was taken. A period of a half of a year was given to investors to get information about the financial statement content. It was assumed that an investor buys securities in the portfolio during the first trading day of July in the next year after the classification date and holds the securities for a year. For example, the financial statement from the end of 2003 and the market value from the last trading day of 2003 were used as filtering criteria to build portfolios and observe the abnormal performance from the first trading day of July 2004 through to the last trading day of June 2005.

As a result of applying all these selection criteria, the number of companies in the free cash flow portfolio was on average 23, which was

about 10 percent of the total number of listings. The annual maximum was 50 firms and the minimum totaled 8 firms.

Table 1

Descriptive statistics

	MV			MV/FCF			D/FCF		
	FCF	nFCF	ALL	FCF	nFCF	ALL	FCF	nFCF	ALL
Panel A: Medians for investment years									
2001	342	42	48	12.69	-2.22	-	4.27	-2.21	-1.82
2002	310	31	35	14.52	0.43	0.54	2.33	1.95	1.97
2003	306	19	22	9.43	0.67	1.00	2.97	4.22	3.93
2004	819	35	43	9.59	2.22	3.01	2.42	3.17	3.12
2005	488	58	78	6.02	4.31	4.79	1.73	3.42	2.56
2006	518	86	115	7.66	2.48	3.15	2.33	1.92	1.96
2007	751	167	212	10.76	-3.34	-	2.24	-1.40	-1.12
2008	415	214	252	5.81	-4.15	-	1.10	-2.05	-1.82
2009	196	77	79	3.56	-1.89	-	2.37	-2.14	-2.01
2010	458	94	107	7.90	2.37	2.51	1.09	1.47	1.42
2011	399	102	141	7.61	1.83	2.91	2.94	1.17	1.30
Panel B: Averages for sample investment period 2001–2011									
Median	432	77	92	7.66	-0.39	0.41	2.26	-0.21	0.58
Mean	2,767	690	893	7.45	7.23	7.25	0.43	64.83	58.55

Notes: The table reports average values of the market value (PLN million), free cash flow multiple and debt multiple estimated for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF) and for the two samples together (ALL). Market value is expressed as the market capitalization for the last trading day of the previous year. The free cash flow multiple is estimated as the ratio of market value divided by estimated free cash flow from the last financial statements. The debt multiple is expressed as the ratio of total debt divided by free cash flow. Panel A shows medians for each year separately. Panel B presents mean and median values for 2001–2011.

Table 1 reports descriptive statistics for the entire sample regarding market value measured with capitalization (MV), a free cash flow multiple (MV/FCF) and a debt multiple (D/FCF), for the years between 2001 and 2011.The results are presented for the free cash flow (FCF) and non-free cash flow (nFCF) sample and for both samples together (ALL). The median market values of companies in the free cash flow sample were much higher than for the non-free cash flow sample. The same was true of the free cash flow multiple and debt multiple. The median value of the free cash flow multiple was negative for the non-free cash flow sample.

4. METHODOLOGY

Abnormal performance of the free cash flow investment strategy was observed for equity securities traded on Poland's Warsaw Stock Exchange. Abnormal returns were calculated for eleven annual investment periods from 02.07.2001–30.06.2002 to 01.07.2011–30.06.2012.

Daily abnormal returns were found by subtracting from each security's daily return the corresponding benchmark daily return.

The first benchmark was WIG, which is the main Polish index. The abnormal return on company i on day t ($AR_{i,t}^{WIG}$) according to the market comparison (WIG) was then as follows:

$$AR_{i,t}^{WIG} = R_{i,t}^{C} - R_{i,t}^{WIG},$$

where $R_{i,t}^{C}$ denotes the daily raw return on company i on day t and $R_{i,t}^{WIG}$ is the corresponding daily return on the WIG index.

Then, two alternative measures of abnormal performance were applied. The first was estimated by the application of the Capital Asset Pricing Model (CAPM), where the abnormal return formula ($AR_{i,t}^{CAPM}$) looks as below:

$$AR_{i,t}^{CAPM} = R_{i,t}^{C} - \left[R_{F,t} + \beta_i \left(R_{i,t}^{WIG} - R_{F,t} \right) \right],$$

where $R_{F,t}$ is the risk-free rate (1-month WIBOR rate for t day), β_i is calculated with the use of daily security returns ($R_{i,t}^{C}$) and daily WIG returns ($R_{i,t}^{WIG}$) for the estimation period of the calendar year prior to the start of the investment year.

The second alternative measure based on the approach of comparison to the size portfolio and was based on the market value benchmark (MVB). The abnormal daily security performance ($AR_{i,t}^{qMV}$) was calculated as:

$$AR_{i,t}^{qMV} = R_{i,t}^{C} - R_{i,t}^{qMV}$$

where $R_{i,t}^{qMV}$ is the market-value weighted average daily return for the portfolio of similar companies. Each company was assigned to one of the quartile portfolios according to its market value of equity at the end of the year prior to the start of the investment period.

In the next step, abnormal returns were cumulated. Cumulating abnormal returns for security *i* across the investment year yielded an annual

cumulative return for firm i (CAR_i). Barber and Lyon (1997) argued that cumulating was not designed properly to detect long-term abnormal performance, so in the next step buy-and-hold returns were calculated. Through compounding abnormal returns on each security, the annual buy-and-hold return for security i ($BHAR_i$) was estimated. To minimize the potentially detrimental effect of extreme outliers, the literature was followed and the sample was Winsorized with the use of the interquartile range (IQR). Outliers were defined as the observations that fell below $Q1-1.5IQR$ or above $Q3+1.5IQR$ (Q), where $Q1$ and $Q3$ were the first and the third quartile, respectively. The bottom and upper limits were calculated for the whole sample, without distinguishing returns between the free cash flow portfolio and other companies.

In order to test whether the estimated average abnormal returns were statistically significant, the conventional *t*-tests and non-parametric Wilcoxon signed rank test were both applied for the buy-and-hold and cumulative approach. The normality of the distribution was checked with the Shapiro-Wilk test. The parametric *t*-test was applied to test the difference in means. The Mann-Whitney U-test was applied to test the null hypothesis that the free cash flow portfolio and non-free cash flow portfolio have equal distributions.

5. EMPIRICAL RESULTS

In this section, the results of the analysis of the performance of the free cash flow portfolio for the Warsaw Stock Exchange in Poland is presented. Securities were classified into the free-cash-flow portfolio and the non-free cash flow portfolio using the most recent financial statements and market data for eleven annual investment periods from 02.07.2001–30.06.2002 to 01.07.2011–30.06.2012.

The portfolio performance for the whole sample period is presented in section 5.1. Section 5.2 reports the abnormal performance for the crisis periods. In section 5.3 the results of robustness checking for the whole period and during market turbulence are presented.

5.1. Performance of the free cash flow portfolio during the sample period

A summary representation of the relative performance, both for the free-cash-flow portfolio and for the non-free cash flow portfolio, is given in Table 2. It demonstrates the buy-and-hold (Panel A) and cumulative (Panel

B) abnormal returns. Table 3 presents the buy-and-hold returns for each year separately.

Table 2

Abnormal returns for sample period

	WIG				CAPM				MVB			
	FCF		**nFCF**		**FCF**		**nFCF**		**FCF**		**nFCF**	
Panel A: BHARs												
Mean (%)	2.92		0.45		5.48		4.36		6.22		-10.10	
Median (%)	-3.93		-10.84		-3.49		-8.31		-3.00		-13.29	
Std. dev.	0.47		0.52		0.51		0.56		0.46		0.53	
Skewness	0.88		0.78		0.88		0.80		0.66		0.19	
Kurtosis	0.35		0.06		0.21		-0.09		0.24		0.15	
% of positive	46		41		46		43		48		38	
Shapiro-Wilk p-value	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***
Parametricp-value	0.3175		0.6901		0.0845	*	0.0004	***	0.0295	**	0.0000	***
Non-param. p-value	0.4023		0.0000	***	0.9039		0.0817	*	0.5692		0.0000	***
FCF/nFCFparam.p-valueue	0.4297				0.7414				0.0000	***		
FCF/nFCF U-test p-value	0.1916				0.3606				0.0000	***		
N	257		2,132		257		2,132		257		2,132	
Panel B: CARs												
Mean (%)	0.85		2.98		2.40		6.36		6.13		-1.04	
Median (%)	1.22		-0.95		1.41		1.40		2.61		-1.83	
Std. dev.	0.46		0.54		0.51		0.59		0.44		0.50	
Skewness	0.22		0.24		0.23		0.23		0.17		0.07	
Kurtosis	0.47		0.16		0.46		0.11		0.54		0.17	
% of positive	51		49		52		51		53		48	
Shapiro-Wilk p-value	0.0191	**	0.0000	***	0.0116	**	0.0000	***	0.0074	***	0.0000	***
Parametricp-value	0.7661		0.0108	**	0.4485		0.0000	***	0.0265	**	0.3412	
Non-param. p-value	0.9212		0.2440		0.6526		0.0004	***	0.0757	*	0.1911	
FCF/nFCFparam.p-value	0.4913				0.2472				0.0158	**		
FCF/nFCF U-test p-value	0.6699				0.4699				0.0306	**		
N	257		2,132		257		2,132		257		2,132	

Notes: ***, ** and * represent 1%, 5%, and 10% significance levels, respectively. The table reports the annual buy-and-hold (BHAR, Panel A) and cumulative (CAR, Panel B) abnormal returns for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF). Abnormal returns were calculated as WIG-adjusted returns (WIG), according to the CAPM approach (CAPM) and in comparison to the market value-based benchmark. The parametric test was the conventional t-test and the non-parametric test was the Wilcoxon signed-rank test. The difference between both portfolios (FCF/nFCF) is examined using the parametric *t*-test and non-parametric U test.

Source: authors' own calculations

Table 3

Buy-and-hold abnormal returns for particular years

		WIG				CAPM				MVB			
		FCF		**nFCF**		**FCF**		**nFCF**		**FCF**		**nFCF**	
200	Mean (%)	14.16		-21.00		6.46		-27.89		40.09		-3.06	
	Median (%)	17.91		-21.74		11.53		-28.17		45.31		-5.45	
	Param.p-value	0.3232		0.0000	***	0.6492		0.0000	***	0.0240	**	0.3362	
	Non-par.p-value	0.3594		0.0000	***	0.4961		0.0000	***	0.0195	**	0.1566	
200	Mean (%)	18.84		-6.48		21.28		-2.96		16.89		-12.53	
	Median (%)	4.55		-11.98		7.64		-8.85		2.68		-14.34	
	Param.p-value	0.4818		0.1416		0.4304		0.5071		0.5309		0.0056	***
	Non-par.p-value	0.5469		0.0390	**	0.5469		0.1568		0.6406		0.0026	***
200	Mean (%)	52.08		52.45		74.28		71.70		55.13		-27.73	
	Median (%)	47.51		54.64		81.67		83.15		57.65		-41.89	
	Param.p-value	0.0202	**	0.0000	***	0.0016	***	0.0000	***	0.0077	***	0.0001	***
	Non-par.p-value	0.0319	**	0.0000	***	0.0079	***	0.0000	***	0.0312	**	0.0000	***
200	Mean (%)	-22.91		-6.54		-19.88		-0.85		-19.84		-7.39	
	Median (%)	-28.11		-19.50		-25.00		-14.65		-24.78		-17.53	
	Param.p-value	0.0003	***	0.1351		0.0014	***	0.8479		0.0058	***	0.0851	*
	Non-par.p-value	0.0010	***	0.0087	***	0.0020	***	0.0978	*	0.0062	***	0.0069	***
200	Mean (%)	20.04		20.13		31.08		29.65		19.70		-19.45	
	Median (%)	-3.92		13.72		10.35		17.95		6.49		-24.21	
	Param.p-value	0.1428		0.0002	***	0.0216	**	0.0000	***	0.1490		0.0017	***
	Non-par.p-value	0.3479		0.0017	***	0.0707	*	0.0000	***	0.2659		0.0012	***
200	Mean (%)	38.92		45.18		64.16		69.24		29.50		-7.73	
	Median (%)	28.44		55.80		69.15		83.78		25.42		-15.10	
	Param.p-value	0.0083	***	0.0000	***	0.0001	***	0.0000	***	0.0535	*	0.2551	
	Non-par.p-value	0.0194	**	0.0000	***	0.0005	***	0.0000	***	0.0434	**	0.1536	
200	Mean (%)	-4.98		-16.09		-22.73		-30.31		-0.49		-8.14	
	Median (%)	-18.52		-18.56		-31.09		-32.46		-4.57		-11.65	
	Param.p-value	0.3651		0.0000	***	0.0004	***	0.0000	***	0.9231		0.0001	***
	Non-par.p-value	0.3992		0.0000	***	0.0006	***	0.0000	***	0.4919		0.0000	***
200	Mean (%)	15.86		5.67		8.91		6.61		3.47		-25.11	
	Median (%)	13.48		0.14		9.08		3.15		0.21		-24.19	
	Param.p-value	0.0247	**	0.0214	**	0.2618		0.0161	**	0.6020		0.0000	***
	Non-par.p-value	0.0233	**	0.2369		0.3146		0.1246		0.5202		0.0000	***
200	Mean (%)	-9.20		-1.66		0.02		7.16		-3.33		-4.69	
	Median (%)	-4.57		-9.73		-1.90		-0.83		-5.73		-10.52	
	Param.p-value	0.2033		0.5537		0.9980		0.0144	**	0.5867		0.1033	
	Non-par.p-value	0.2522		0.0564	*	0.9799		0.1646		0.5619		0.0128	**
201	Mean (%)	-13.88		-18.65		-3.04		-9.72		-2.36		-4.92	
	Median (%)	-20.13		-27.42		-9.04		-17.90		-10.37		-13.57	
	Param.p-value	0.0260	**	0.0000	***	0.6118		0.0002	***	0.6891		0.0477	**
	Non-par.p-value	0.0016	***	0.0000	***	0.1272		0.0000	***	0.1531		0.0002	***
201	Mean (%)	-7.36		-12.55		-15.79		-20.89		-1.89		-3.17	
	Median (%)	-8.59		-17.16		-15.86		-25.68		-5.43		-7.01	
	Param.p-value	0.1066		0.0000	***	0.0014	***	0.0000	***	0.6749		0.1041	
	Non-par.p-value	0.0678	*	0.0000	***	0.0012	***	0.0000	***	0.5017		0.0074	***

Notes: ***, ** and * represent 1%, 5%, and 10% significance levels, respectively. The table reports the buy-and-hold returns for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF) for each of the investment years. Abnormal returns were calculated as WIG-adjusted returns (WIG), according to the CAPM approach (CAPM) and in comparison to the market value-based benchmark. The parametric test was the conventional *t*-test and the non-parametric test was the Wilcoxon signed-rank test.

Source: authors' own calculations

Mean and median buy-and-hold abnormal returns for the free-cash-flow portfolio were in most of the years much above the averages for other companies (nFCF). The mean annual buy-and-hold adjusted returns for the free cash flow portfolio in the whole sample period were positive and above the averages for the other companies. The mean buy-and-hold abnormal return for the free cash flow portfolio equaled 2.92 in the case of WIG-adjusting (0.45 for nFCF), 5.48 for the CAPM (4.36 for nFCF) and 6.22 for size matching (-10.10 for nFCF). The median values of BHARs for the free cash flow portfolio were negative but the values were still much higher than the averages for the non-FCF portfolio. Table 2 reveals the lack of satisfactory statistical significance for the buy-and-hold approach. This was most severe for WIG-adjusted averages, where neither parametric nor non-parametric tests gave satisfactory results. The Mann-Whitney test allowed to reject the null hypotheses of equal distribution of both investment subsamples only for size-matched benchmarks.

Hence the findings have given some support to the existence of the free cash flow anomaly on the Polish market. The anomaly's existence seemed to be plausible if one looked at the mean and median buy-and hold abnormal returns and median cumulative abnormal returns. However, the negative value of median BHARs and the unfavourable comparison of mean CARs for the free and non-free cash flow portfolio puts the anomaly relevance in the whole sample period into question.

The average returns for particular years according to market-adjusting, CAPM application and size-matching (WIG, CAPM and MVB, respectively) were not equal, but all of the free methods of abnormal return calculation led to similar conclusions about the anomaly's existence in particular years. There was no irrefutable evidence found that the free cash flow anomaly existed in each year of the 2001–2011 investment period.

With these findings it can be concluded that the free cash flow anomaly was not robust and dependable in all the years of the sample period. Here, the market could be viewed as efficient by not allowing investors to incessantly earn above-average risk adjusted returns. It was also questionable if the free cash flow strategy was robust enough to create real, indisputable profitable investment opportunities in the whole sample period.

5.2. Abnormal returns in times of market declines

The results of the crisis year analysis are reported in Table 4. These years were defined as the years when the median annual daily returns for the WIG index were below zero and included the investment years 2001, 2007, 2008. These were also the years with very high volatility of the WIG return.

Table 4

Buy-and-hold abnormal returns during crisis years

	WIG				CAPM				MVB			
	FCF		**nFCF**		**FCF**		**nFCF**		**FCF**		**nFCF**	
Mean (%)	5.36		-9.39		-7.01		-15.58		6.75		-12.98%	
Median (%)	4.70		-13.26		-3.49		-20.59		-0.47		-13.37%	
Std. dev.	0.33		0.36		0.38		0.40		0.34		0.41	
Skewness	0.16		0.69		0.35		0.77		0.50		0.03	
Kurtosis	-0.89		1.28		-0.75		1.22		-0.09		0.89	
% of positive	54		35		46		30		49		36	
Shapiro-Wilk p-value	0.1840		0.0000	***	0.0173	**	0.0000	***	0.1491		0.0000	***
Parametricp-value	0.2061		0.0000	***	0.1475		0.0000	***	0.1203		0.0000	***
Non-parametricp-value	0.2902		0.0000	***	0.1365		0.0000	***	0.3293		0.0000	***
FCF/nFCFparam.p-value	0.0015	***			0.0950	*			0.0001	***		
FCF/nFCF U-test p-value	0.0012	***			0.0920	*			0.0002	***		
N	63		539		63		539		63		539	

Notes: ***, ** and * represent 1%, 5%, and 10% significance levels, respectively. The table reports the annual buy-and-hold returns for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF). Bear market periods were defined as the years with the lowest median market return. Abnormal returns were calculated as WIG-adjusted returns (WIG), according to the CAPM approach (CAPM) and in comparison to the market value-based benchmark. The parametric test was the conventional *t*-test and the non-parametric test was the Wilcoxon signed-rank test. The difference between both portfolios (FCF/nFCF) is examined using the parametric *t*-test and non-parametric U test.

Source: authors' own calculations

The evidence showed that the free cash flow portfolio outperformed other companies by almost 15 percentage points (almost 9 percent) in terms of the mean (median) annual market-adjusted buy-and-hold return calculated for

2001–2011. The difference in means (medians) for both subsamples equaled almost 14 (13) percentage points in the case of size-matching and totaled almost 9 (17) percentage points for the CAPM application. The Mann-Whitney test results suggested the rejection of the null hypothesis of equal distribution for the free cash flow portfolio and the non-free cash flow portfolio at conventional levels of significance. The differences between both portfolios were of high statistical and economic significance. The returns produced by free cash flow generators were much higher in comparison to the opposing portfolio. Although the average buy-and-hold returns according to CAPM were higher for the free cash flow portfolio, they were also reported to be negative during market turbulence. This made the superiority of the free cash flow portfolio during market turbulence to be not robust to the model choice. The existence of the free cash flow anomaly in crisis years seemed to be partly documented.

5.3. Robustness check

Here, the robustness analysis of the findings reported in the previous section is performed. The impact of individual selection criteria on the performance of the free cash flow portfolio was examined. The results are presented in Table 5 (for the whole period) and Table 6 (for crisis years). The procedure of portfolio selection was repeated according to limited filtering criteria. First, the portfolio of companies with positive free cash flows was constructed with the results in Panel A of both tables. Then, in addition to the positive cash flows, another criterion was imposed. The free cash flow multiples for cash flow generators were assumed to be between 5 and 30 (Panels B). Panels C repeated the results for all of the criteria adopted in the basic research.

The results in Table 5 and Table 6 demonstrated the rejection of the null hypothesis of the distribution normality. In consequence, the means seemed to be not so informative as medians. Imposing the first criterion of positive free cash flows allowed the free cash flow portfolio to beat the buy-and-hold abnormal return estimated for other companies with all three adjusting methods. This was observed as well for the whole period as for the crisis years. The additional selection criteria appeared to improve the better performance of the free cash flow strategy especially during market downturns. The robustness check confirmed the final conclusions drawn for the basic assumptions.

Table 5

Robustness check for buy-and-hold free-cash-flow portfolio returns – sample period

	WIG				CAPM				BMV			
	FCF		**nFCF**		**FCF**		**nFCF**		**FCF**		**nFCF**	
Panel A: FCF>0												
Mean (%)	5.39		0.45		9.78		4.36		-5.83		-10.10	
Median (%)	-6.46		-10.84		-4.77		-8.31		-9.94		-13.29	
% of positive	45		41		47		43		41		38	
Shapiro-Wilk p-value	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***
Parametricp-value	0.0004	***	0.6901		0.0000	***	0.0004	***	0.0002	***	0.0000	***
Non-parametricp-value	0.7194		0.0000	***	0.0867	*	0.0817	*	0.0000	***	0.0000	***
N	1,233		2,132		1,233		2,132		1,233		2,132	
Panel B: FCF> 0 & 5<MV/FCF< 30												
Mean (%)	2.64		0.45		6.33		4.36		-4.99		-10.10	
Median (%)	-6.58		-10.84		-4.46		-8.31		-9.61		-13.29	
% of positive	45		41		46		43		41		38	
Shapiro-Wilk p-value	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***
Parametricp-value	0.1921		0.6901		0.0042	***	0.0004	***	0.0205	**	0.0000	***
Non-parametricp-value	0.1582		0.0000	***	0.9386		0.0817	*	0.0006	***	0.0000	***
N	603		2,132		603		2,132		603		2,132	
Panel C: FCF> 0 & 5<MV/FCF< 30 & TD/FCF< 10 & MV> 70 million (basic criteria)												
Mean (%)	2.92		0.45		5.48		4.36		6.22		-10.10	
Median (%)	-3.93		-10.84		-3.49		-8.31		-3.00		-13.29	
% of positive	46		41		46		43		48		38	
Shapiro-Wilk p-value	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***	0.0000	***
Parametricp-value	0.3175		0.6901		0.0845	*	0.0004	***	0.0295	**	0.0000	***
Non-parametricp-value	0.4023		0.0000	***	0.9039		0.0817	*	0.5692		0.0000	***
N	257		2,132		257		2,132		257		2,132	

Notes: ***, ** and * represent 1%, 5%, and 10% significance levels, respectively. The table reports the annual buy-and-hold returns for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF). Abnormal returns were calculated as WIG-adjusted returns (WIG), according to the CAPM approach (CAPM) and in comparison to the market value-based benchmark. The criteria involved free cash flows (FCF>0), free cash flow multiple (market value divided by free cash flow, MV/FCF), debt capacity (total debt divided by free cash flow, TD/FCF), company size (measured with market capitalization, MV). The parametric test was the conventional *t*-test and the non-parametric test was the Wilcoxon signed-rank test.

Source: authors' own calculations

Table 6

Robustness check for buy-and-hold free-cash-flow portfolio returns – crisis years

	WIG				CAPM				BMV			
	FCF		**nFCF**		**FCF**		**nFCF**		**FCF**		**nFCF**	
Panel A: FCF>0												
Mean (%)	-2.60		-9.39		-11.61		-15.58		-4.83		-12.98	
Median (%)	-2.83		-13.26		-16.05		-20.59		-7.73		-13.37	
% of positive	45		35		36		30		41		36	
Shapiro-Wilk p-value	0.002	***	0.000	***	0.0001	***	0.0000	***	0.0006	***	0.0000	***
Parametricp-value	0.282		0.000	***	0.0000	***	0.0000	***	0.0714	*	0.0000	***
Non-parametricp-value	0.074	*	0.000	***	0.0000	***	0.0000	***	0.0412	**	0.0000	***
N	244		539		244		539		244		539	
Panel B: FCF> 0 & 5<MV/FCF< 30												
Mean (%)	0.22		-9.39		-9.57		-15.58		-3.33		-12.98	
Median (%)	-0.83		-13.26		-13.03		-20.59		-7.14		-13.37	
% of positive	48		35		40		30		43		36	
Shapiro-Wilk p-value	0.077	*	0.000	***	0.0055	***	0.0000	***	0.0841	*	0.0000	***
Parametricp-value	0.951		0.000	***	0.0193	**	0.0000	***	0.4002		0.0000	***
Non-parametricp-value	0.693		0.000	***	0.0081	***	0.0000	***	0.2967		0.0000	***
N	119		539		119		539		119		539	
Panel C: FCF> 0 & 5<MV/FCF< 30 & TD/FCF< 10 & MV> 70 million (basic criteria)												
Mean (%)	5.36		-9.39		-7.01		-15.58		6.75		-12.98	
Median (%)	4.70		-13.26		-3.49		-20.59		-0.47		-13.37	
% of positive	54		35		46		30		49		36	
Shapiro-Wilk p-value	0.184		0.000	***	0.0173	**	0.0000	***	0.1491		0.0000	***
Parametricp-value	0.206		0.000	***	0.1475		0.0000	***	0.1203		0.0000	***
Non-parametricp-value	0.290		0.000	***	0.1365		0.0000	***	0.3293		0.0000	***
N	63		539		63		539		63		539	

Notes: ***, ** and * represent 1%, 5%, and 10% significance levels, respectively. The table reports the annual buy-and-hold returns for the free cash flow portfolio (FCF) in comparison to other companies quoted on the Warsaw Stock Exchange (nFCF). Abnormal returns were calculated as WIG-adjusted returns (WIG), according to the CAPM approach (CAPM) and in comparison to the market value-based benchmark. The criteria involved free cash flows (FCF>0), free cash flow multiple (market value divided by free cash flow, MV/FCF), debt capacity (total debt divided by free cash flow, TD/FCF), company size (measured with market capitalization, MV). The parametric test was the conventional *t*-test and the non-parametric test was the Wilcoxon signed-rank test.

Source: authors' own calculations

CONCLUSIONS

Over the years, a vast number of researchers has been shifting through mountains of data either to uncover anomalies or to prove their delusion (or even non-existence). The discussion connected with anomalies revolved around overlapping issues such as efficient market hypothesis, market rationality, complete knowledge of the economy structure, stock price determination models or behavioural underpinnings of investor decisions. A large body of academic literature has uncovered many anomalies existing in stock markets worldwide. In the present research, one of the most recently identified has been examined, mainly the free cash flow anomaly. This was analyzed within the context of the Warsaw Stock Exchange (WSE) in Poland during the period of 2001–2011. The free cash flow strategy has been previously documented by Hackel et al. (1994 and 2000), Hackel and Livnat (1995) for the US, Jokipii and Vähämaa (2006) for Finland, and Arslan and Karan (2007) for Turkey. It was also discussed for Pakistan (Chughtai et al. 2011).

The sample period of 2001–2011 was not a very long time to observe a market anomaly. Previous research on the free cash flow anomaly covered 18 years for the US market, but was also 11 years for the Finnish stock exchange and only 7 years for the emerging Turkish stock exchange. On the one hand, our sample size was limited by the history of the Warsaw Stock Exchange and its maturing since the economic and political changes. On the other, it was limited by data accessibility and the time-consuming preparation of our own database of market data with all the necessary adjustments.

Taken together, the results mostly gave support to the fact that the average returns for the free cash flow portfolio were higher in comparison to those reported for other firms. On the face of it, the findings were partly consistent with the previous evidence on the free cash flow anomaly. It seemed that the Polish stock market appreciated a portfolio of large firms with positive free cash flows, low free cash flow multiples, and low financial leverage, which was more apparent in times of market declines. Although it seemed to be true, that free cash flow portfolio generated higher returns, one cannot say that investing in the free cash flow portfolio was undoubtedly profitable as the median annual returns appeared to be negative. What is more, the differences between subsamples were mostly not significant for the whole sample period. The differences were of high economic and statistical significance only during market downturns. The conclusions were

mostly consistent for the application of market and size-adjusting methods and the CAPM approach. The results for the Warsaw Stock Exchange were only partly in accordance with the results reported by Hackel et al. for the US (2000) and by Jokipii and Vähämaa (2006) for Finland.

Next, no evidence was found that the anomaly has changed over time following one tendency nor that it existed in all the years of the sample period. Last but not least, the observation of free-cash-flow portfolio performance during market downturns provided more evident proof that the free cash flow portfolio outperformed the market in the bear years. The findings about the better performance of the free cash flow strategy during market turbulence in the stock market were consistent with the findings by Hackel et al. (2000) for the US, Jokipii and Vähämaa (2006) for Finland and Arslan and Karan for Turkey (2007). However, the free-cash-flow anomaly seemed to be not robust enough to be exploited during market downturns, especially when one looked at the negative average returns for the FCF portfolio in the context of CAPM.

The evidence of higher returns for the free cash flow portfolio on the WSE did not appear to be very strong. Even if we recognized the partial existence of the free cash flow anomaly, one may ask whether it is reasonable to fashion a trading strategy based on free cash flows. To make the issue more general, was it reasonable to try to make a profit on any of the uncovered anomalies? There has been an ongoing debate on the explanations of market anomalies as such, and the free cash flow anomaly is no exception. The attempts to explain the anomalies often connected them with market inefficiency resulting from irrational investor behaviour. The higher anomalous returns could also be explained by appealing to estimation mistakes and assumptions and the tendency of researchers to produce unusual findings by challenging existing theories. One may argue, in line with Fama (1998), that the anomalies were some random results and that the true value will win out in the end. Besides, even if there is an agreement that the anomalies were not apparent, the anomalies should be expected to disappear as more and more investors will exploit them until it is no longer profitable. Hudson et al. (2002) and Marquering et al. (2006) argued that stock market anomalies change over time: they sometimes tend to weaken substantially, disappear, reappear after some time, or even reverse themselves.

In this context, the free cash flow anomaly did not appear to offer to investors a dependable way to earn positive abnormal returns. It should be left for the future to re-evaluate the free cash flow anomaly and other

anomalies in the Polish stock market after several years and with new estimation methods. The results presented in the paper must be interpreted with due caution and care since the sample was not large, and the sample period was not long enough to provide indisputable results. The puzzling issue of market anomalies certainly merits further investigation. It is especially inspiring and challenging in times when behavioural finance is becoming a more and more prominent branch of finance.

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