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Explanatory Power of Pre-Issue Financial Strength for Long-Term Market Performance: Evidence from Initial Equity Offerings on an Emerging Market

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Abstract: This study tests possible sources of long-term risk-adjusted returns on initial public offerings (IPO) in Poland under the calendar-time portfolio (CTP) approach. The moment of going public still remains a puzzle in many areas. Poland's status as an emerging market has been indisputable for many years, though improvements in capital market infrastructure have led to its recent reclassification as a developed country. It is an important European equity market. Thus, research on IPO pricing explanation for Poland is important for both investors and academics. In this study, we estimate risk premiums and run regressions on four asset pricing models, including the latest innovation, which is the Fama-French 5-factor model. We also check the robustness. The research documents the existence of the long-run underperformance for Polish IPOs independently of the specification of the calendar-time portfolio approach as alphas range from −9.6% to −13.2% annually. We show that the underperformance is mainly driven by IPOs in a position of weak pre-issue financial health. More profitable IPOs experience less negative long-term returns and the underperformance is even absent in some specifications.

Keywords: initial public offering; equity issue; calendar-time portfolio approach; asset pricing model; risk premium; profitability

JEL Classification: G14; G32; O16

1. Introduction

This research focuses on possible sources of long-term returns of initial public offerings of equities (IPO). More precisely, we explore the relationship between pre-issue financial health and subsequent long-term equity returns in Poland, which was an example of an emerging market during the research period. Our paper contributes to the existing research in several ways. First, we offer some new international evidence on the long-term returns observed after going public in an emerging market. This paper investigates the long-term performance of initial public offerings listed in Poland with the calendar-time portfolio approach, including the Capital Asset Pricing Model (Sharpe 1964; Lintner 1969); the Fama French 3-factor model (Fama and French 1993); the Carhart four 4-factor model (Carhart 1997); and the latest innovations in capital asset pricing models, such as the Fama-French 5-factor model (Fama and French 2015, 2016). Second, we check the link between pre-issue accounting performance and long-term market abnormal returns. We test the divergence of opinion as a theory explaining the IPO long-term underperformance. Providing empirical conclusions in these areas is important for both investors and academics. Our study also provides additional insights into market efficiency for an emerging market, especially in the area connected with IPO anomalies and

asset pricing models. Third, we investigate the robustness of both the long-run underperformance of initial public offerings and the relation between pre-issue financial health and long-term returns for equity issuers.

Exploring the long-term predictive power of indicators of divergence of opinion, we apply accounting performance measures connected with earnings, as well as cash flow. We check whether uncertainty about the real value of IPO firms experiencing good pre-issue financial health is less pronounced. If this is the case, the long-term performance of such firms should be better. At the same time, the long-term underperformance for less profitable IPOs would be stronger. However, if a better profitability is a result of earnings management, the long-term consequences may not be so obvious.

The methodology for measuring long-term market performance after important company events has been much debated in the literature. This question is probably going to remain an unresolved practical and theoretical issue (Kothari and Warner 2007). Beginning with the milestone of the event study by Ritter (1991), an extensively used measure of long-term IPO performance is a buy-and-hold abnormal return (BHAR). Other early studies on the long-term performance of US IPOs reveal negative abnormal returns (Ibbotson 1975; Loughran and Ritter 1995; Rajan and Servaes 1997). The first studies on IPOs in Poland were also based on the buy-and-hold approach (Aussenegg 2000; Jelic and Briston 2003; Lyn and Zychowicz 2003; Jewartowski and Lizińska 2012). However, the literature points to the many misspecifications of the buy-and-hold approach, such as violations in cross-sectional independence, re-balancing, and skewness bias (Barber and Lyon 1997; Lyon et al. 1999; Jegadeesh and Karceski 2009).

Fama (1998) advocates the application of the calendar-time portfolio approach (CTP), arguing that it alleviates most of the systematic errors that may arise in measuring long-term wealth effects of events. Mitchell and Stafford (2000) and Lyon et al. (1999) also advocate this methodology as robust to the most critical statistical problems in empirical corporate finance. This approach is quite well-known in studies on the long-term effects of US equity issues (Loughran and Ritter 1995; Brav and Gompers 1997; Brav et al. 2000), though there is an indisputably smaller body of evidence for less developed markets. This research applies this method for long-term IPO abnormal performance estimation. Empirically, we use the calendar-time portfolio approach and four factor models. The sample is divided into quantiles, depending on the financial health before going public. The results document significant underperformance following initial public offerings in Poland. The intercepts are negative and robust to methodology specifications. We report that IPO underperformance was mainly driven by issues with a low pre-issue accounting performance. A higher level of divergence of opinion about the future prospects of companies approximated with a worse pre-issue accounting performance resulted in a more severe underperformance. The findings on the explanatory power of pre-issue financial health for IPO long-term performance are robust to different methodology specifications.

The paper is organized as follows. Section 2 discusses the previous literature. In Section 3, we describe the data and explain the methodology. Section 4.1 reports the post-issue long-term IPO performance according to the calendar time-portfolio approach. Sections 4.2–4.4 provide evidence for abnormal risk-adjusted returns in performance groups using alternative measures of financial health. Section 5 provides a discussion of the robustness checks of empirical results. The last section concludes the research and discusses future research.

2. Related Literature

This section starts by providing a brief review of studies on the abnormal long-term market performance of IPOs. This has been discussed most extensively for US stock exchanges. The evidence is less comprehensive for other markets. The research applies the event study tools proposed by, e.g., Fama et al. (1969) and their followers, for testing market efficiency. These procedures apply to events such as equity offerings, mergers, splits etc. This way of testing the long-term effects has evoked many discussions and resulted in many proposals. The fact is that proper estimators of long-term performance, as well as ways of testing its statistical significance, are still much debated in the literature. Two main approaches have appeared. First, the buy-and-hold abnormal return

(BHAR) applied by Ritter (1991). The second approach is advocated by Fama (1998) and is based on calendar-time portfolios (CTP) and asset pricing models.

Some academics argue that the buy-and-hold approach is appropriate for measuring an investor's wealth changes as it resembles the real investment situation. In practice, it is an average long-term return earned on a strategy of investing in all IPO firms on the event date, and selling the portfolio at the end of a specified holding period compared with the gains from implementing a comparable strategy for a benchmark (Mitchell and Stafford 2000). Some studies have shown that a buy-and-hold return suffers from several biases. Jegadeesh and Jegadeesh and Karceski (2009) argue that the event-time approach connected with the estimation of buy-and-hold returns assumes the cross-sectional independence of returns. Event samples are not random and IPO returns are correlated. Barber and Lyon (1997) use simulations to show new listing, re-balancing, and skewness biases in the BHAR approach and discuss the reference portfolio choice. The buy-and-hold approach was also criticized for magnifying the long-run underperformance (Brav et al. 2000).

Fama (1998) recommends the use of the calendar-time portfolio approach and points out that monthly returns better address the bad model problem, the cross-correlation problem, and the skewness bias. We follow the proposal of Fama (1998) and investigate the long-term performance of initial public offerings in Poland with calendar-time portfolios. The idea of this approach is as follows. First, portfolios consisting of IPO firms are formed for each calendar month in a sample period. These portfolios consist of all IPO companies that went public within a specified period of time. For each calendar month, calendar portfolios are rebalanced as new IPO companies enter and some firms drop out. Then, a mean monthly portfolio abnormal return is estimated by regressing excess returns using models such as CAPM or multifactor models. The intercept proxies for the abnormal monthly return.

Calendar-time portfolios have mainly been implemented for IPOs listed in the United States. The first research with empirical testing of long-term abnormal IPO market performance was published by Loughran and Ritter (1995). With a sample of both initial and seasoned US equity offerings, they reported negative intercepts. Negative returns were also found by Brav et al. (2000) for the equal weights and for the smallest tercile. However, alphas for value weighted and large portfolios were statistically insignificant. Brav and Gompers (1997) found significant and negative intercepts for non-venture backed initial equity offerings. The results for venture backed IPOs were not significant. They also drew the conclusion that the long-term underperformance of IPOs was driven by non-venture backed IPOs in the smallest decile of firms. Mitchell and Stafford (2000) also reported a significant negative abnormal performance for US IPO portfolios. The calendar-time portfolio approach was also applied to non-US markets in countries such as Canada (Kooli et al. 2006), Spain (Alvarez and González 2001), and China (Shen et al. 2015).

The performance of initial public offerings listed in Poland has been discussed using the buy-and-hold approach. The first studies mainly focused on the privatization issues (Aussenegg 2000; Jelic and Briston 2003; Lyn and Zychowicz 2003). More recently, long-term underperformance was found with the buy-and-hold approach, according to different benchmarks (Jewartowski and Lizińska 2012; Lizińska and Czapiewski 2016; Brycz et al. 2017).

There are several theories explaining why initial public offerings underperform in the long-run. One of them is the divergence of opinion hypothesis and the optimistic investor theory. Under the divergence of opinion hypothesis (Miller 1977), the higher the level of divergence of opinion, the worse the subsequent long-term returns. Some optimistic investors may perceive the situation around equity offerings to be much better than others and offer higher prices. The level of information asymmetry is relatively high around the time of going public as usually little is known about market newcomers. The higher the asymmetry of an IPO and the higher the uncertainty, the worse the level of the long-term performance (Levis 1993; Brav and Gompers 1997). One cannot measure the level of divergence of opinion directly. The proxies can be based on both accounting and market data. There have been several measures of the divergence of opinion proposed in previous empirical research. Diether et al. (2002) used analyst forecast dispersion and Gao et al. (2006) applied early-market return

volatility. We proxy for the divergence of opinion with accounting measures of financial health. We use ratios based on financial statements as such reports seem to be a very important source of information about market newcomers.

Relating the market performance of Polish IPOs to around-the-issue accounting performance is not a new idea. Lyn and Zychowicz (2003) found no significant relationship between profitability and short-term IPO underpricing. Lizińska and Czapiewski (2014) observed that short-term IPO returns in Poland were much higher for more profitable firms. However, the relationship between around-the-IPO profitability was not so evident for long-term abnormal performance measured with BHARs as it was not robust to alternative methods. Brycz et al. (2017) found that short-term IPO success is strongly determined by pre-IPO profitability, with no significant results for the long-term buy-and-hold returns. We propose to test the relationship for Polish IPOs using the improved estimation method of long-term performance.

3. Empirical Modelling

The research sample consists of non-financial initial public offerings (IPOs) listed on the Warsaw Stock Exchange (WSE), which is the main equity market in Poland. The research only includes issues with a new common stock issuance, and those without a prior trading history on alternative markets. The data sources include Notoria Serwis, the official site of the WSE and InfoStrefa.com. The database also covers delisted firms. We use equity close prices with the necessary adjustments (such as dividends, splits, and pre-emptive rights) to calculate returns. The sample period ranges from January 2002 to December 2014. However, the timespan of market data for returns and other financial items for asset pricing models is longer because it also covers the succeeding years as it was necessary to observe the long-term performance of equity offerings.

There are two main groups of methods for assessing the long-term performance of post-event firms. The risk adjusted performance can be analysed using benchmarks together with the buy-and-hold approach, or the calendar-time portfolio approach (Fama 1998; Eckbo et al. 2000; Mitchell and Stafford 2000). Fama (1998) proposes using the rolling calendar-month portfolio approach to reduce some of the drawbacks of buy-and-hold returns. We apply the calendar-time portfolio approach to measure abnormal return with the application of four asset pricing models. The monthly abnormal returns are intercepts in regressions.

The idea for the empirical research encompasses three steps. First, we test the long-term abnormal performance of initial public offerings with the calendar-time portfolio approach. Hence, we estimate risk premiums for asset pricing models and construct calendar IPO portfolios to regress the monthly excess return for each of these portfolios on factor models. Second, we assess the long-term performance of quantiles of IPOs according to the around-the-issue accounting performance. Here, we start by selecting a measure and we repeat the procedure of the calendar-time portfolio approach in performance quantiles. Third, we check the robustness of empirical results.

The relationship between average return and market beta was first described in the Sharp-Lintner Capital Asset Pricing Model (CAPM) (Sharpe 1964; Lintner 1969). Fama and French (1993) shed new light on the explanation of the cross-section of average returns in their 3-factor model with size and price ratios (3FF, hereafter). Carhart (1997) proposed a 4-factor model (4C, hereafter) capturing the momentum factor as this anomaly was proposed by Jegadeesh and Titman (1993). Fama and French (2015) and Fama and French (2016) proposed a 5-factor model (5FF, hereafter) that captured the size, value, profitability, and investment patterns in average stock returns. Factor models have a very broad application in research in the area of finance and capital markets and are not the only constraint to measuring effects of equity offerings. Their use in studies of US capital markets has a long history. Recently, they have started becoming popular in studies for emerging markets (Ewen 2018; Fu 2018; Ali et al. 2018).

First, risk premiums for portfolios are estimated according to each of the asset pricing models. The portfolios include all stocks listed on the main market of the Warsaw Stock Exchange, also

including delisted companies. The method of portfolio formation for the risk-premium estimation according to the Fama-French 3-factor model, the Carhart 4-factor model, and the Fama-French 5-factor model is illustrated in Figures 1–3.

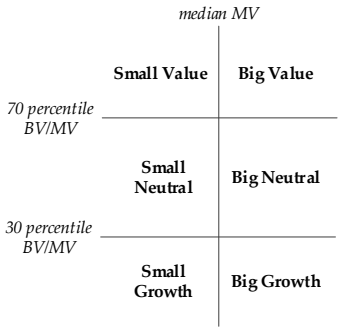

Figure 1. Construction of portfolios for the Fama-French 3-factor model.

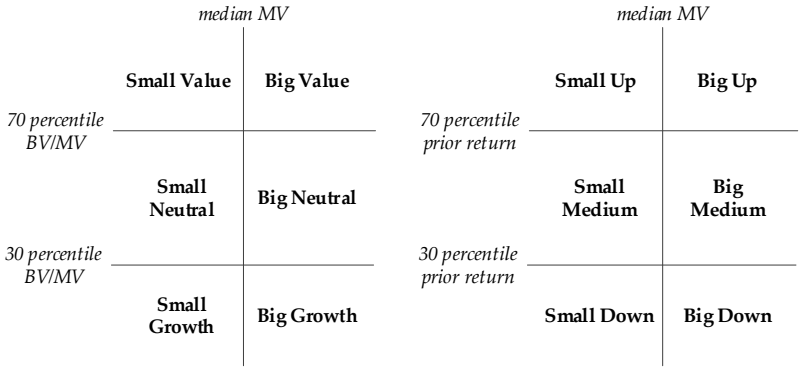

Figure 2. Construction of portfolios for the Carhart 4-factor model.

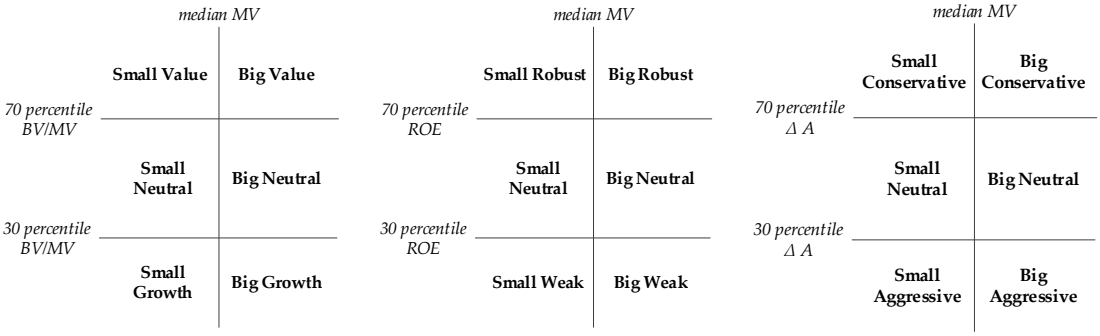

Figure 3. Construction of portfolios for the Fama-French 5-factor model.

Risk premiums for the Fama-French 3-factor model are estimated according to formulas:

$$SMB_t = \frac{Small\ Value_t + Small\ Neutral_t + Small\ Growth_t}{3} - \frac{Big\ Value_t + Big\ Neutral_t + Big\ Growth_t}{3} \quad (1)$$

$$HML_t = \frac{Small\ Value_t + Big\ Value_t}{2} - \frac{Small\ Growth_t + Big\ Growth_t}{2}, \quad (2)$$

Risk premiums for the Carhart 4-factor model are estimated as:

$$SMB_t = \frac{SMB_t^{BM/MV} + SMB_t^{PR}}{2}, \tag{3}$$

$$SMB_t^{BM/MV} = \left(\frac{\frac{Small\ Value_t + Small\ Neutral_t + Small\ Growth_t}{3} - }{\frac{Big\ Value_t + Big\ Neutral_t + Big\ Growth_t}{3}} \right), \tag{4}$$

$$SMB_t^{PR} = \left(\frac{\frac{Small\ Value_t + Small\ Medium_t + Small\ Growth_t}{3} - }{\frac{Big\ Value_t + Big\ Medium_t + Big\ Growth_t}{3}} \right), \tag{5}$$

$$HML_t = \frac{Small\ Value_t + Big\ Value_t}{2} - \frac{Small\ Growth_t + Big\ Growth_t}{2}, \tag{6}$$

$$WML_t = \frac{Small\ Up_t + Big\ Up_t}{2} - \frac{Small\ Down_t + Big\ Down_t}{2}, \tag{7}$$

Risk premiums for the Fama-French 5-factor model are as follows:

$$SMB_t = \frac{SMB_t^{BM/MV} + SMB_t^{ROE} + SMB_t^{\Delta A}}{3}, \tag{8}$$

$$SMB_t^{BM/MV} = \left(\frac{\frac{Small\ Value_t + Small\ Neutral_t + Small\ Growth_t}{3} - }{\frac{Big\ Value_t + Big\ Neutral_t + Big\ Growth_t}{3}} \right), \tag{9}$$

$$SMB_t^{ROE} = \left(\frac{\frac{Small\ Robust_t + Small\ Neutral_t + Small\ Weak_t}{3} - }{\frac{Big\ Robust_t + Big\ Neutral_t + Big\ Weak_t}{3}} \right), \tag{10}$$

$$SMB_t^{\Delta A} = \left(\frac{\frac{Small\ Conservative_t + Small\ Neutral_t + Small\ Aggressive_t}{3} - }{\frac{Big\ Conservative_t + Big\ Neutral_t + Big\ Aggressive_t}{3}} \right), \tag{11}$$

$$HML_t = \frac{Small\ Value_t + Big\ Value_t}{2} - \frac{Small\ Growth_t + Big\ Growth_t}{2}, \tag{12}$$

$$RMW_t = \frac{Small\ Robust_t + Big\ Robust_t}{2} - \frac{Small\ Weak_t + Big\ Weak_t}{2}, \tag{13}$$

$$CMA_t = \frac{Small\ Conservative_t + Big\ Conservative_t}{2} - \frac{Small\ Aggressive_t + Big\ Aggressive_t}{2}, \tag{14}$$

Starting with January 2002, each calendar month, we construct a portfolio of firms that went public in the past 36 months. Portfolios based on 24-month periods are also included for a robustness check. The portfolios are rebalanced each month as some IPO companies exit and enter. Next, we regress the monthly excess returns, on the monthly factors of the CAPM, 3FF, 4C, and 5FF models. We start with the CAPM model, where the monthly returns, adjusted by the risk-free rate, are regressed as follows:

$$R_t^P - R_t^F = \alpha + \beta\left(R_t^M - R_t^F\right) + \varepsilon_t^P, \tag{15}$$

where the calendar time portfolio return is given as R_t^P, the risk-free rate R_t^F is calculated with WIBOR, the monthly market return R_t^M is approximated using the main Polish stock index (Warsaw Stock Index, WIG), market risk premium is expressed as $\left(R_t^M - R_t^F\right)$, α is an average monthly abnormal return on a portfolio of IPO firms, β is the OLS regression parameter specific to the portfolio, and ε_t^P is the error term.

The regressions on the Fama-French 3-factor model proceed as follows:

$$R_t^P - R_t^F = \alpha + \beta_M\left(R_t^M - R_t^F\right) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \varepsilon_t^P, \tag{16}$$

where SMB_t is the difference in returns between the portfolios of small and big firms, and HML_t is the average return on the two value portfolios minus the average return on the two growth portfolios.

The regression on the Carhart model proceeds as follows:

$$R_t^P - R_t^F = \alpha + \beta_{RM}\left(R_t^M - R_t^F\right) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{WML}WML_t, \quad (17)$$

where WML_t is the average return on the two high prior return portfolios minus the average return on the two low prior return portfolios.

The regression on the Fama-French 5-factor model is:

$$R_t^P - R_t^F = \left(\alpha + \beta_{RM}\left(R_t^M - R_t^F\right) + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{RMW}RMW_t + \beta_{CMA}CMA_t\right), \quad (18)$$

where RMW_t is the average return on the two robust operating profitability portfolios minus the average return on the two weak operating profitability portfolios, and CMA_t is the average return on the two conservative investment portfolios minus the average return on the two aggressive investment portfolios.

Next, we run quantile regressions based on the pre-issue accounting performance of IPOs. Three measures of financial results are applied: net income, operating income, and operating cash flow. In the basic research design, they are all scaled by sales. IPO firms are divided according to the accounting performance into two groups, below (L) and above the median (H). Finally, we again estimate regressions according to the CAPM, FF3, C4, and FF5 models to assess the long-term abnormal market performance of initial public offerings in performance groups.

We check the robustness of empirical results and we employ additional measures of accounting performance. We expand proxies by adding another scaling factor, namely the size of a company according to its pre-issue assets. Taken together, it gives us six measures of pre-issue accounting performance: net profitability of sales (net income to sales, ROS), net profitability of assets (net income to assets, ROA), operating profitability of sales (operating income to sales, OROS), operating profitability of assets (operating income to assets, OROA), operating cash flow to sales (OCFS), and operating cash flow to assets (OCFA). Factor regressions are run independently in all of the previously described specifications. Summing up, we repeat factor-regressions 48 times under the calendar-time portfolio approach (four asset pricing models, two portfolio periods, and six performance measurements). Alphas are tested in quantiles under 96 specifications in the basic approach and in the robustness check.

4. Empirical Results

4.1. Long-Term IPO Performance According to the Calendar-Time Portfolio Approach for All Issuers

We investigate long-term abnormal IPO market performance with the calendar-time portfolio approach and estimate alpha in factor regressions. The results are detailed in Table 1. We use the CAPM model, the Fama-French 3-factor model, the Carhart 4-factor model, and the Fama-French 5-factor model (CAPM, 3FF, 4C, and 5FF, respectively). The dependent variables in regressions are the IPO portfolio returns in excess of the risk-free rate. The portfolios are formed from all initial public offerings that have gone public within the previous 36 or 24 months (Panel A and Panel B, respectively of Table 1).

Table 1 reports strong evidence of underperformance following the initial public offering in Poland for all specifications of methodology. The intercept is the lowest in regressions for the CAPM and equals −9.6% annually for portfolios built both on 36- and 24-month samples. For multifactor models, similar results were obtained. The alphas from the 3FF, 4C, and 5FF regressions were also negative and statistically significant. If we look at 36-month portfolios in Panel A, the post-issue underperformance of IPOs measured with the annualized intercepts from the 3FF, 4C, and 5FF regressions is equal to −12.0%, −9.6%, and −13.2% annually, respectively. It is also negative and economically important for 24-month portfolios as it respectively equals −9.6%, −12%, and −9.6% annually, as reported in Panel

B. The research documents the existence of long-run underperformance for Polish IPOs independently of the specification of the calendar-time portfolio approach.

Table 1. Results of calendar-time portfolio regressions for IPO firms.

	CAPM	3FF	4C	5FF
Panel A: 36-month portoflio				
α	−0.008 **	−0.010 ***	−0.008 **	−0.011 ***
	(−2.503)	(−3.308)	(−2.570)	(−3.977)
RMP	0.864 ***	0.823 ***	0.811 ***	0.763 ***
	(16.648)	(17.112)	(16.457)	(16.795)
SBM		0.491 ***	0.511 ***	0.649 ***
		(5.312)	(5.367)	(7.005)
HML		0.326 ***	0.264 **	0.496 ***
		(2.724)	(2.176)	(4.136)
WML			−0.100 *	
			(−1.689)	
RMW				0.067
				(0.711)
CMA				−0.575 ***
				(−4.785)
p-value for F	0.000	0.000	0.000	0.000
adj. R^2	0.699	0.759	0.761	0.800
Panel B: 24-month portfolio				
α	−0.008 **	−0.010 ***	−0.008 **	−0.010 ***
	(−2.372)	(−2.958)	(−2.339)	(−3.050)
RMP	0.867 ***	0.834 ***	0.826 ***	0.786 ***
	(15.680)	(15.347)	(14.723)	(15.063)
SBM		0.365 ***	0.376 ***	0.528 ***
		(3.856)	(3.855)	(5.381)
HML		0.175	0.125	0.239 **
		(1.498)	(1.080)	(2.131)
WML			−0.070	
			(−1.038)	
RMW				0.007
				(0.072)
CMA				−0.543 ***
				(−4.233)
p-value for F	0.000	0.000	0.000	0.000
adj. R^2	0.651	0.683	0.682	0.721

Note: The t-statistic is in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

4.2. Net Profitability and Long-Term IPO Performance

Having established the robustness of the findings about the long-term IPO underperformance with the calendar-time portfolio approach, we next explore the relationship between pre-issue financial health and the long-term performance of initial public offerings in Poland. We proxy for the financial health with a set of measures. First, we use net return on sales (ROS), defined as net income to sales. IPOs are partitioned using the median value of net profitability of sales before going public as a breakeven point. The first quantile encompasses low-profitable IPOs (L), and the second quantile includes high-profitable issues (H). In the next step, we follow the methodology applied in the previous section and re-estimate factor regressions on profitability quantiles. We again use the CAPM model, the Fama-French 3-factor model, the Carhart 4-factor model, and the Fama-French 5-factor model (CAPM, 3FF, 4C, and 5FF, respectively). The dependent variables in regressions are the IPO portfolio returns in excess of the risk-free rate and portfolios are formed from all IPOs that have gone public within the previous 36 months. The results are detailed in Table 2.

Table 2. Results of calendar-time portfolio regressions in quantiles based on net profitability of sales of IPO firms.

	CAPM (L)	CAPM (H)	3FF (L)	3FF (H)	4C (L)	4C (H)	5FF (L)	5FF (H)
α	−0.012 ***	−0.005	−0.014 ***	−0.006 *	−0.011 ***	−0.006 *	−0.015 ***	−0.008 ***
	(−2.793)	(−1.593)	(−3.675)	(−1.961)	(−2.643)	(−1.856)	(−3.906)	(−2.748)
RMP	0.922 ***	0.809 ***	0.867 ***	0.782 ***	0.841 ***	0.786 ***	0.804 ***	0.729 ***
	(13.458)	(16.163)	(13.831)	(15.643)	(13.192)	(15.224)	(13.067)	(15.178)
SBM			0.682 ***	0.291 ***	0.703 ***	0.311 ***	0.821 ***	0.468 ***
			(5.662)	(3.031)	(5.704)	(3.122)	(6.548)	(4.780)
HML			0.429 ***	0.209 *	0.320 **	0.196	0.553 ***	0.421 ***
			(2.747)	(1.677)	(2.037)	(1.541)	(3.400)	(3.318)
WML					−0.187 **	−0.009		
					(−2.439)	(−0.148)		
RMW							−0.043	0.186 *
							(−0.332)	(1.856)
CMA							−0.616 ***	−0.503 ***
							(−3.787)	(−3.961)
p-value for F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
adj. R^2	0.602	0.686	0.689	0.707	0.697	0.706	0.722	0.749
α(H)–α(L)		0.086 **		0.099 **		0.058		0.081 **

Note: The difference α(H)–α(L) is annualized. The t-statistic is in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Alphas are statistically and economically significant for all low-profitability IPO quantiles. We find that the levels of monthly abnormal returns vary across models, but they are negative in all specifications. The intercepts are less negative for the high-profitability quantiles, where they are significant in most of the cases. Annual returns for the low-profitability quantile range from −13.4% up to −18.0%, whereas for the high-profitability IPOs, they range from −6.1% to −9.9% annually. IPO firms with lower pre-issue net profitability of sales experience stronger long-term market underperformance. The difference in annual returns between quantiles is quite substantial, no matter the regression specification. The average equals almost nine percentage points annually. The differences between more and less profitable portfolios are economically significant and they are statistically significant in most of the specifications.

We show that less-profitable firms drive the IPO long-term underperformance. For less-profitable firms, the effect of negative returns is much more severe and significant under all specifications. The evidence on negative alphas for IPOs with a lower level of divergence of opinion proxied with high profitability is generally mixed as the negative returns are either much less negative or they are not statistically significant.

4.3. Operating Profitability and Long-Term IPO Performance

Net income is an important item of a company's financial statement for its stakeholders. It gives an overall idea of the firm's financial health. It also helps to assess the prospects for the future. Reported earnings seem to be especially important for potential investors in IPO companies as relatively little is known about companies that are going public. A change to a company's status from a private to public one attracts a lot of attention from market participants. This is one of the arguments for suspecting that the moment of going public is especially susceptible to earnings management practices (Teoh et al. 1998). It is not easy to manipulate each income level. This was a motivation for testing whether operating earnings explain the long-term IPO performance in the same way as in the case of net profitability.

In this section, we continue the investigation of the relationship between pre-issue financial profitability and the long-term performance of IPOs listed on the WSE in Poland. We change the measure of profitability into the operating return on sales, which is defined as operating income to sales (OROS). As proceeded in the adjacent anteceding section, IPOs are partitioned into new quantiles. In this research step, we use the median value of operating profitability of sales before going public as a breakeven point. The first quantile encompasses low-profitable IPOs (L), and the second

quantile includes high-profitable issues (H), both in terms of operating profitability of sales. We repeat the calendar-time portfolio estimation based on the CAPM model, the Fama-French 3-factor model, the Carhart 4-factor model, and the Fama-French 5-factor model (CAPM, 3FF, 4C, and 5FF, respectively) and we re-estimate factor regressions on two quantiles. The dependent variables in regressions are the IPO portfolio returns in excess of the risk-free rate and portfolios are formed from all IPOs that have gone public within the previous 36 months. The results are detailed in Table 3.

Table 3. Results of calendar-time portfolio regressions in quantiles based on operating profitability of sales of IPO firms.

	CAPM (L)	CAPM (H)	3FF (L)	3FF (H)	4C (L)	4C (H)	5FF (L)	5FF (H)
α	−0.012 ***	−0.006 *	−0.014 ***	−0.007 **	−0.011 ***	−0.006 *	−0.014 ***	−0.009 ***
	(−2.790)	(−1.668)	(−3.676)	(−2.091)	(−2.811)	(−1.700)	(−3.923)	(−2.791)
RMP	0.924 ***	0.804 ***	0.871 ***	0.774 ***	0.854 ***	0.769 ***	0.810 ***	0.720 ***
	(14.154)	(15.377)	(14.581)	(14.992)	(13.938)	(14.453)	(13.846)	(14.424)
SBM			0.648 ***	0.346 ***	0.668 ***	0.366 ***	0.783 ***	0.516 ***
			(5.644)	(3.481)	(5.640)	(3.561)	(6.571)	(5.079)
HML			0.413 ***	0.235 *	0.324 **	0.199	0.536 ***	0.436 ***
			(2.776)	(1.826)	(2.152)	(1.517)	(3.471)	(3.309)
WML					−0.144 *	−0.056		
					(−1.951)	(−0.878)		
RMW							−0.040	0.162
							(−0.330)	(1.551)
CMA							−0.603 ***	−0.515 ***
							(−3.901)	(−3.901)
p-value for F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
adj. R^2	0.626	0.664	0.708	0.694	0.711	0.694	0.740	0.735
α(H)–α(L)		0.073 **		0.084 **		0.065 *		0.068 *

Note: The difference α(H)–α(L) is annualized. The t-statistic is in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

Alphas are statistically significant for all of the low- and high-profitability quantiles. The level of monthly abnormal returns varies across models, but it is negative in all specifications for the low- and high-profitability quantiles. Annual returns for the low-profitability quantile are quite substantial and range from −13.7% up to −17.2%. IPO firms with a higher level of divergence of opinion proxied with a lower pre-issue operating profitability of sales experienced strong underperformance measured with alpha. Alphas for the high-profitability IPOs seem to be less negative as they range from −6.7% to −10.5% annually. The conclusions about substantial differences in intercepts between the low- and high-profitability portfolios remain unchanged, no matter the regression specification. They are also statistically significant. The most pronounced difference is reported for the Fama-French 3-factor model, where the difference between the profitability quantiles equals 8.4 percentage points annually. The empirical results for operating profitability mostly confirm the conclusions based on net profitability.

4.4. Cash-Flow Efficiency and Long-Term IPO Performance

Market participants usually react strongly to any kind of information connected with earnings. Income is the item from financial statements that attracts a lot of stakeholders' attention. Hence, insiders sometimes try to increase earnings and manage it. Teoh et al. (1998) suggest that IPO companies can boost their earnings with accrual adjustments. Investor over-optimism around going public might be at least partly induced by equity issuers. If this is the case for the IPO firms in our sample, then two previous measures of profitability may give a misleading picture of the financial health of a company. It is much more difficult to manipulate cash flow. Hence, we continue the investigation of the relationship between pre-issue financial health and the long-term performance of Polish IPOs with cash flow ratios defined as operating cash flow to sales (OCFS). IPOs are again partitioned into two quantiles with the median value. So, the first quantile includes IPOs with a low cash flow efficiency (L), and the second encompasses issuers in better financial health (H). We repeat the calendar-time portfolio estimation based on the CAPM model, the Fama-French 3-factor model, the Carhart 4-factor

model, and the Fama-French 5-factor model (CAPM, 3FF, 4C, and 5FF, respectively) and re-estimate factor regressions. The dependent variables in regressions are the IPO portfolio returns in excess of the risk-free rate and portfolios are formed from all IPOs that have gone public within the previous 36 months. The results are detailed in Table 4.

Table 4. Results of calendar-time portfolio regressions in quantiles based on the operating cash flow to sales of IPO firms.

	CAPM (L)	CAPM (H)	3FF (L)	3FF (H)	4C (L)	4C (H)	5FF (L)	5FF (H)
α	−0.011 ***	−0.006 *	−0.013 ***	−0.007 **	−0.012 ***	−0.005	−0.014 ***	−0.009 ***
	(−2.641)	(−1.741)	(−3.222)	(−2.436)	(−2.700)	(−1.597)	(−3.795)	(−2.898)
RMP	0.915 ***	0.817 ***	0.874 ***	0.775 ***	0.869 ***	0.756 ***	0.795 ***	0.738 ***
	(13.746)	(15.983)	(13.751)	(15.972)	(13.170)	(15.420)	(13.178)	(15.233)
SBM			0.565 ***	0.417 ***	0.567 ***	0.454 ***	0.754 ***	0.550 ***
			(4.623)	(4.478)	(4.447)	(4.792)	(6.132)	(5.567)
HML			0.305 *	0.347 ***	0.246	0.279 **	0.526 ***	0.469 ***
			(1.925)	(2.869)	(1.515)	(2.309)	(3.300)	(3.664)
WML					−0.077	−0.128 **		
					(−0.969)	(−2.165)		
RMW							0.056	0.106
							(0.448)	(1.044)
CMA							−0.777 ***	−0.344 ***
							(−4.872)	(−2.682)
p-value for F	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
adj. R^2	0.612	0.681	0.670	0.732	0.665	0.742	0.724	0.752
α(H)–α(L)		0.067 *		0.065 *		0.080 *		0.066 *

Note: The difference α(H)–α(L) is annualized. The t-statistic is in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

The differences for portfolios based on cash flow according to different specifications are a little bit less economically pronounced compared to results based on profitability, but they are still statistically significant. The regression results for the IPO grouping based on pre-issue cash flow efficiency may be interpreted as being only partly consistent with the over-optimism explanation and the divergence of opinion hypothesis.

5. Robustness Checks

We next check the robustness of empirical results. We expand the measures of financial health by relating accounting performance to an item reported in balance sheets, namely pre-issue assets. We maintain three groups of the reported accounting effect: net income, operating income, and cash flow. Taken together, it gives us three additional measures of pre-issue accounting performance: net profitability of assets (ROA), operating profitability of assets (OROA), and operating cash flow to assets (OCFA).

Initial public offerings are partitioned into quantiles using the median value of each of the mentioned additional performance measures in a similar way to Sections 4.2 and 4.3. Following this, we get IPOs with a weaker pre-issue performance (L) and those with a better performance (H). We repeat the calendar-time portfolio estimation based on the CAPM model, the Fama-French 3-factor model, the Carhart 4-factor model, and the Fama-French 5-factor model (CAPM, 3FF, 4C, and 5FF, respectively) and re-estimate factor regressions in quantiles for each of the additional measures. Additionally, factor regressions are run for IPOs that have gone public within the previous 36 or 24 months (Panel A and Panel B, respectively, of Table 5). The intercept is interpreted as the IPO portfolio monthly return. The results (only intercepts and statistical significance, for brevity) are detailed in Table 5. To make it more informative, both basic and additional measures are presented.

Table 5. Intercepts in calendar-time portfolio regressions for IPO quantiles (robustness check for different ratios as a base of quantile grouping).

	CAPM (L)	CAPM (H)	3FF (L)	3FF (H)	4C (L)	4C (H)	5FF (L)	5FF (H)
Panel A: 36-month portoflio								
α (ROS)	−0.012 ***	−0.005	−0.014 ***	−0.006 *	−0.011 ***	−0.006 *	−0.015 ***	−0.008 ***
	(−2.793)	(−1.593)	(−3.675)	(−1.961)	(−2.643)	(−1.856)	(−3.906)	(−2.748)
α(H)–α(L)		0.086 **		0.099 **		0.058		0.081 **
α (OROS)	−0.012 ***	−0.006 *	−0.014 ***	−0.007 **	−0.011 ***	−0.006 *	−0.014 ***	−0.009 ***
	(−2.790)	(−1.668)	(−3.676)	(−2.091)	(−2.811)	(−1.700)	(−3.923)	(−2.791)
α(H)–α(L)		0.073 **		0.084 **		0.065 *		0.068 *
α (OCFS)	−0.011 ***	−0.006 *	−0.013 ***	−0.007 **	−0.012 ***	−0.005	−0.014 ***	−0.009 ***
	(−2.641)	(−1.741)	(−3.222)	(−2.436)	(−2.700)	(−1.597)	(−3.795)	(−2.898)
α(H)–α(L)		0.067 *		0.065 *		0.080 *		0.066 *
α (ROA)	−0.014 ***	−0.003	−0.016 ***	−0.004	−0.012 ***	−0.005	−0.017 ***	−0.006 **
	(−3.099)	(−0.970)	(−4.094)	(−1.298)	(−2.880)	(−1.465)	(−4.384)	(−2.001)
α(H)–α(L)		0.126 ***		0.146 ***		0.084 **		0.129 ***
α (OROA)	−0.013 ***	−0.004	−0.015 ***	−0.005	−0.013 ***	−0.005	−0.016 ***	−0.008 **
	(−3.032)	(−1.275)	(−4.092)	(−1.624)	(−3.152)	(−1.343)	(−4.361)	(−2.389)
		0.104 **		0.118 ***		0.094 **		0.098 **
α (OCFA)	−0.011 ***	−0.006 *	−0.013 ***	−0.007 **	−0.012 ***	−0.005	−0.014 ***	−0.009 ***
	(−2.654)	(−1.782)	(−3.279)	(−2.448)	(−2.799)	(−1.569)	(−3.777)	(−2.927)
α(H)–α(L)		0.067 *		0.066 *		0.084 **		0.067*
Panel B: 24-month portfolio								
α (ROS)	−0.010 **	−0.006 *	−0.013 ***	−0.007 **	−0.011 **	−0.007 *	−0.012 ***	−0.008 **
	(−2.221)	(−1.818)	(−2.846)	(−2.102)	(−2.204)	(−1.887)	(−2.864)	(−2.237)
α(H)–α(L)		0.045		0.062		0.039		0.057
α (OROS)	−0.010 **	−0.007 *	−0.012 ***	−0.008 **	−0.011 **	−0.007 *	−0.012 ***	−0.009 **
	(−2.247)	(−1.972)	(−2.787)	(−2.244)	(−2.262)	(−1.669)	(−2.697)	(−2.348)
α(H)–α(L)		0.034		0.050		0.051		0.038
α (OCFS)	−0.009 **	−0.007 **	−0.011 **	−0.009 ***	−0.011 **	−0.006 *	−0.011 ***	−0.008 **
	(−2.182)	(−2.043)	(−2.490)	(−2.656)	(−2.345)	(−1.689)	(−2.753)	(−2.415)
α(H)–α(L)		0.024		0.016		0.055		0.033
α (ROA)	−0.014 ***	−0.003	−0.017 ***	−0.003	−0.013 ***	−0.004	−0.016 ***	−0.004
	(−3.015)	(−0.744)	(−3.853)	(−0.844)	(−2.787)	(−0.924)	(−3.743)	(−0.984)
α(H)–α(L)		0.132 ***		0.163 ***		0.111 ***		0.146 ***
α (OROA)	−0.015 ***	−0.001	−0.018 ***	−0.002	−0.015 ***	−0.001	−0.017 ***	−0.002
	(−3.285)	(−0.258)	(−4.040)	(−0.428)	(−3.102)	(−0.369)	(−3.916)	(−0.676)
α(H)–α(L)		0.173 ***		0.198 ***		0.162 ***		0.171 ***
α (OCFA)	−0.009 **	−0.008 **	−0.011 **	−0.010 ***	−0.010 **	−0.008 **	−0.011 ***	−0.010 ***
	(−2.046)	(−2.260)	(−2.457)	(−2.813)	(−2.175)	(−2.006)	(−2.777)	(−2.663)
α(H)–α(L)		0.007		0.005		0.029		0.016

Note: The difference α(H)–α(L) is annualized. The t-statistic is in parentheses. *, **, and *** indicate significance at the 10, 5, and 1 percent levels, respectively.

The underperformance of initial public offerings in Poland was mainly driven by IPOs with a high level of divergence of opinion proxied with low pre-issue accounting profitability. Alphas reported for IPOs with a lower performance range from −10.8% to −21.6% annually. The statistically significant long-term returns of IPOs with a low pre-issue accounting performance were negative in all of the specifications. A high level of divergence of opinion about the future prospects of companies approximated with a worse pre-issue performance resulted in a severe underperformance measured with alpha. The differences between quantiles based on profitability were economically important and statistically significant in most of the specifications. The underperformance of the high-profitable IPOs is not too strong and it is not statistically significant in some specifications. Such results may be interpreted as being only partly consistent with the over-optimism explanation and with the divergence of opinion hypothesis. In some specifications, the intercepts for high-performance IPOs were not statistically significant. The group of less profitable companies could consist of companies with a lower level of divergence of opinion because of really good financial health, as well as IPO companies that artificially managed earnings for the moment of going public. This could influence the mixed results of the robustness check.

The robustness check of the differences between quantiles based on cash flows reveals that the differences were statistically significant in half of specifications and were much lower than differences based on profitability. Cash flows are usually perceived as being not so easily managed as earnings.

If we take the cash flow ratios as a proxy for the divergence of opinion level, then the results are not so undisputable. The results of the robustness check are an argument for setting a question in further research: are cash flows less important than earnings in the process of assessment of the financial health of the IPO company by investors, even if earnings seem to be managed more easily? Finally, investors seem to be more worried.

6. Conclusions

This research has aimed to discuss the sources of long-term underperformance of initial public offerings of equities (IPO). We have explored the relationship between pre-issue financial health and subsequent long-term relative equity returns in Poland. This paper provides some international evidence on the long-term performance after going public for the Warsaw Stock Exchange. Poland was an example of an emerging market during the sample period, but its continuous improvements in capital market infrastructure and steady economic progress have led to its recent reclassification as a developed country by FTSE Russell. Poland is also an important European player in terms of capital market development. Providing empirical conclusions in the area of long-term underperformance explanation is important for both investors and academics.

This paper contributes to the existing research as it tests the long-term returns of IPOs with the calendar-time portfolio approach. Starting with January 2002, calendar month rolling portfolios of firms that had gone public in the previous 36 or 24 months were constructed with monthly rebalancing as some IPO companies exited and entered. Monthly excess returns were regressed on factor models. We started with the CAPM model that includes the market risk factor. Then, we tested with the Fama-French 3-factor model that expands on the CAPM by adding two more factors to the model: size risk and value risk factors. The Carhart 4-factor model is an expansion of the FF3 as it adds the momentum factor. Finally, the Fama-French 5-factor model that describes risk along with investment and profitability represents the latest innovation in asset pricing models. We reported evidence on strong underperformance following the initial public offering for different specifications of the calendar-time portfolio methodology. The level of abnormal returns is slightly different in the alternative specifications. It ranges from -9.6% to -13.2% annually. The change of the methods of alpha's calculation does not influence the general conclusion about the economically and statistically significant negative long-term returns after the first public equity offerings in Poland. The findings about the long-term IPO underperformance using the calendar-time portfolio approach seem to be similar to the conclusions of previous studies for Poland that have revealed significant long-term IPO underperformance with the buy-and-hold approach.

The research provides evidence of the explanatory power of pre-issue accounting performance for the long-term risk-adjusted market returns. The study has used several approaches to test the robustness of results. We have applied six different measures of the pre-issue IPO financial health, namely three dimensions of the reported accounting effect (net income, operating income, and operating cash flow) and two bases of performance: one from the income statement (sales) and the second from the balance sheet (assets). Each of the six measures allowed us to divide the sample into two quantiles. Regressions were run under four factor models for 24- and 36-month portfolios in quantiles. Taken together, we repeated the calendar-time portfolio procedure in 96 research specifications. By comparing alternative estimation approaches, we reported that weak pre-issue financial profitability resulted in experiencing strong underperformance in the long-run by IPO firms in Poland, no matter the regression specification. The difference in annual returns between quantiles based on profits was quite substantial. For more profitable companies, either less severe underperformance is observed or the underperformance is even absent as the intercepts are not significant under some settings. The differences between quantiles based on cash flows were much lower and statistically significant in half of the specifications.

Theoretical explanations of IPO underperformance include the divergence of opinion together with optimistic investor theory, as well as theories relating to investor sentiment, the fads phenomenon,

and market timing. Our results do not seem to support the window of opportunity hypothesis. If firms were to go public at the height of their accounting performance, thus seizing their window of opportunity, it would result in worse long-term returns for firms in good financial health. This was neither observed for quantiles based on profitability nor cash flow. Our results may be interpreted as being only partly consistent with the over-optimism explanation and divergence of opinion hypothesis (Miller 1977). Companies with a higher level of divergence of opinion proxied with lower pre-issue profitability suffered from weak market pricing in the long-term. It also seems to suggest that around-the-issue profitability influences the long-term perception of the IPO company. The results may also be, to some extent, in line with the psychological background (Kahneman and Tversky 1982) suggesting that investors may overweigh recent information and believe that a poor pre-issue performance will continue after going public. The results of the robustness check also lead us to suspect that some of the highly profitable IPO companies could manage earnings for the moment of going public as the results for highly profitable IPO firms are mixed.

Such results also provide opportunities for future research. A possible research direction may be to give additional insights into earnings manipulation around going public with the calendar-time approach. If earnings are artificially boosted around going public by accrual adjustments, a challenging direction of future research could be focused on combining the calendar-time portfolio approach together with accrual estimation. Such an approach should employ models to derive normal levels of accruals in order to observe discretionary accruals. Non-discretionary accruals may be estimated with methods such as the Jones model (Jones 1991); the Dechow, Sloan, and Sweeney model (Dechow et al. 1995); the Kothari, Leone, and Wasley model (Kothari et al. 2005); the Dechow-Dichev model in the version modified by McNichols (Dechow and Dichev 2002; McNichols 2002, 2000); and the Ball-Shivakumar model (Ball and Shivakumar 2006). Explaining the long-term IPO performance measured with the calendar-time portfolio approach combined with accruals estimation would expand the conclusions of this research and enrich the evidence on the implications of financial health together with earnings management around going public.

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