Investment Opportunities in the WSE: Bull *Versus* Bear Markets

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Abstract This paper investigates how mispriced equity in emerging economies is. To do so, we test for abnormal excess returns using classic and modern asset pricing models. We document that size, investment, and momentum effects are not unequivocal enough to advertise them as trading opportunities. Abnormal returns of profitability and value anomalies are statistically and economically significant and they are persistent throughout different investment climates. Further, we report higher degree of mispricing at an aggregated level, and thus higher abnormal investment opportunities, in the period of bear market and stable macro-conditions (2000–2006) than during and after the recent global financial crisis (2007–2013). We advocate that in emerging stock markets, like the Warsaw Stock Exchange, investors' asset pricing skills outweigh the effect of international portfolio rebalancing in the process of asset pricing. Investors might benefit from acknowledging these findings in formulating their investment policies. For instance, they may consider switching towards less aggressive portfolio allocations during bear markets.

1 Introduction

The purpose of this paper is to establish which investment strategies prevail in the WSE regardless of bull and bear market, i.e. during the period 2000–2013. Hereto, we analyze the performance of portfolios formulated in accordance with five generic trading strategies i.e. portfolio formation rules designed to capture anomalous returns related to: size (small and big market capitalization), value (high and low book-to-market), momentum (past winners and past losers), profitability

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(robust and weak operating profitability), and investment (aggressive and conservative investment policy). Portfolio creation is rooted in the asset pricing theory and is performed in line with the conventional procedures of the asset pricing tools' empirical application.

Considering that our sample period encompasses both bullish (2000–2006) and bearish (2007–2013) market, we then divide it into two sub periods respectively. Intuitively, due to the changing investment climate and the rapid development of the Polish stock market (WSE 2014), we expect that in these two periods the level of mispricing, and thus investment opportunities in the WSE would be different.

2 Study Background

The process of capturing new anomalies has been closely observed by academics, but foremost by market practitioners. Reflecting on the phenomenon of anomalies, one may conclude that each has immanent self-destructing tendency—as the new anomaly is discovered, sophisticated investors, with help of academic research on asset pricing, learn how to identify its existence and benefit from trade on securities. Ultimately, potential profits are distributed among those investors, and equity becomes less mispriced. Importantly, the process of reaching equilibrium via arbitrage trading is conditional on how strong limits to arbitrage is, as described in Grossman and Stiglitz (1980). However, the general tendency is always towards more precise pricing.

Additionally, the investors' composition strongly affects asset pricing in emerging financial markets. On the one hand, investors from advanced stock markets tend to have higher asset pricing skills. On the other hand, they treat their investment in emerging equity as secondary priority. Behavior of foreign investors can distort pricing in emerging markets particularly in times of economic distress. In the event of global crisis, international investors tend to withdraw their funds from markets they consider riskier. Their behavior is the element of crisis contagion mechanism—the irrational fears leads to high the comovement of prices resulting from withdrawals (King and Wadhwani 1990). The effect will be particularly pronounced on the downside, creating price pressure in the result of asset fire sales. Alternatively, international shock transmission may have somewhat more rational justification. According to Longstaff (2010) global investors may be particularly limited in making their portfolio allocation decisions by the restricted access to funding. Thus, they will tend to withdraw their investments because of insufficient liquidity. In addition to higher perceived riskiness and lower liquidity, limited information is said to be another major difficulty in investing in emerging markets (Chuhan 1994), potentially strengthening motivation for withdrawals. Also, since the increased number of speculators generally contributes to market efficiency by improving pricing accuracy (Grossman 1995), the diminishing activity of international investors may likely cause the opposite effect. Therefore, it seems reasonable to expect higher pricing distortions (as evidenced by the enhanced abnormal

returns) during the times of global market turmoil in the emerging stock exchanges with large (yet volatile) representation of foreign investors.

3 Identification Strategy

3.1 Asset Pricing Models

We employ the Capital Asset Pricing Model of Sharpe (1964) and Lintner (1965) (thereafter CAPM)—a single-factor model that uses only the excess market return (Eq. 1):

$$R_i(t) - Rf(t) = \alpha_i + b_i MKT(t) \tag{1}$$

where $R_i(t)$ is the actual monthly return on a given portfolio i at time t, $Rf(t)$ is the return on the risk-free asset, α_i is the intercept and $MKT_i(t)$ is the market excess return and the corresponding factor sensitivity b_i. The market factor is the difference between a proxy for market return and the risk-free rate. The assumptions of the model are outlined in Sharpe (1964) and Lintner (1965), Fernandez (2015) explains how the assumptions are not met in practice.

As an alternative to the CAPM, we also employ the Fama and French three-factor model of (1993) (thereafter FF3F) is a multi-factor model that uses three distinct risk factors (Eq. 2):

$$R_i(t) - Rf(t) = \alpha_i + b_i MKT(t) + s_i SMB(t) + h_i HML(t) \tag{2}$$

where the original CAPM regression is enhanced with two additional factors: size factor $SMB(t)$ (small minus big market cap), meant to mimic the risk factor in returns related to size, and $HML(t)$ (high minus low book-to-market) used to represent the risk factor in returns related to book-to-market equity (B/M) and the corresponding factor sensitivities, denoted s_i and h_i. The model is empirically-motivated and thus lacks formal background.

3.2 LHS Portfolios

Despite founding our inference on time-series regressions, we still acknowledge the cross-sectional character of our research. To address this aspect, stocks are first sorted into left-hand side (hereafter 'LHS') portfolios.

In our study, we employ five different sorting categories, resembling the generic strategies we consider, which also meet the case of the empirical evidence provided by Edelen et al. (2016). Table 1 briefly describes the LHS portfolios used in the study and summarizes relevant formation rules.

Table 1 LHS portfolios description

Portfolio	Description
Small	LHS Small-stock portfolio; value-weighted return on all stocks in the bottom 30% of stocks sorted on market capitalization.
Big	LHS Big-stock portfolio; value-weighted return on all stocks in the top 30% of stocks sorted on market capitalization.
High	LHS High-book-to-market stock portfolio; value-weighted return on all stocks in the bottom 30% of stocks sorted on book-to-market ratio.
Low	LHS Low-book-to-market stock portfolio; value-weighted return on all stocks in the top 30% of stocks sorted on book-to-market ratio.
Winner	LHS Winner-stock portfolio; equally-weighted return on all stocks in the top 30% of stocks sorted on prior returns.
Loser	LHS Loser-stock portfolio; equally-weighted return on all stocks in the bottom 30% of stocks sorted on prior returns.
Robust	LHS Robust-profitability stock portfolio; value-weighted return on all stocks in the top 30% of stocks sorted on operating profitability (*OP*).
Weak	LHS Weak-profitability stock portfolio; value-weighted return on all stocks in the bottom 30% of stocks sorted on operating profitability (*OP*).
Aggressive	LHS Aggressive-investment stock portfolio; value-weighted return on all stocks in the top 30% of stocks sorted on operating profitability (*Inv*).
Conservative	LHS Conservative-investment stock portfolio; value-weighted return on all stocks in the bottom 30% of stocks sorted on operating profitability (*Inv*).

3.3 Testing for Model's Robustness

The straightforward way to verify model's robustness is to test the statistical significance of its intercept α. This can be done for every portfolio separately (using basic statistical inference) or jointly for all intercepts using the GRS test (Gibbons et al. 1989).

We present the findings regarding models' performance and we conclude on investment opportunities yield by each model, accounting for all limitations that apply. Last but not least, we conclude on investment opportunities in different market climates (bull vs. bear market) by examining regression parameters, intercepts in particular, for two periods separately: 2000–2006 and 2007–2013. Hereto, we present results only at an aggregated level.

4 Findings

4.1 Excess Returns for the Set of Univariate LHS Portfolios

Table 2 presents summary statistics for 10 univariate portfolios formed separately on size, B/M, momentum, profitability, and investment. We report average

Table 2 Summary statistics for the LHS portfolio excess returns

	Small	Big	High	Low	Winner	Loser	Robust	Weak	Conservative	Aggressive
Mean	0.20	−0.65	−0.60	−1.49	1.41	0.91	0.53	−1.65	−1.18	−0.83
Std dev	9.45	7.68	8.32	10.19	8.27	8.63	6.81	11.79	10.13	10.33
t-Mean	0.28	−1.09	−0.93	−1.90	2.21	1.36	1.02	−1.81	−1.51	−1.04
N_max	123	117	119	116	119	120	112	118	124	115
N_min	28	24	28	22	21	22	18	24	27	21

portfolio's return, standard deviation, and t-statistic of its return, minimum and maximum count of stocks in each portfolio.

Inspection of Table 2 provides some interesting conclusions. First, LHS portfolios produce a wide range of average monthly excess returns, from −1.65% per month for Weak profitability firms up to 1.41% per month for Winner stocks. All LHS portfolio returns are accompanied by notably high variation in their values (average Std dev on all 10 univariate portfolios of 9.16%). Our study provides another proof of De Santis (1997) observation that emerging stock markets are characterized by persistently higher volatility than advanced markets are. Second, in each sort the LHS portfolios have returns that work in line with the pre-assumed anomaly, i.e. Small stocks outperform Big stocks, High B/M stocks outperform Low B/M stocks, etc. The only exception are portfolios in the investment sort—they perform counterintuitively since in our sample Aggressive-investment firms outperform Conservative-investment ones. This is against the conventional view on investment anomaly, according to which firms characterized by conservative investment (usually associated with value stocks) outperform firms aggressively investing (usually associated with growth stocks).

4.2 Abnormal Returns in the WSE

The time-series regressions with two sets of risk factors on 10 LHS portfolios deliver a multitude of insights about stock performance and anomaly persistence in the stock market of Poland. We discuss them together with the general APM's performance (Table 3).

The performance of size anomaly of Banz (1981) disappoints. Although Small-stock portfolio clearly delivers higher alpha than the corresponding Big-stock portfolio (0.72% vs. −0.03%) in terms of CAPM, the results are not statistically significant, as evidenced by small t-stats (1.34 and −0.48). FF3F validates these conclusions. Controlling for size effect on the right hand side of the regression makes almost any indication of size anomaly disappear. The intercept estimates equal to merely 0.01% and 0.05%, and the corresponding t-stats are negligible (0.02 and 1.12). Regarding value anomaly, there is some evidence for risk-adjusted abnormal performance, however restricted to growth stocks and negative in sign. Low-stock portfolio yields a CAPM alpha of −0.73%, and a FF3F alpha of −0.85%. Both estimates are statistically significant (t-stats of −2.46 and −3.46 respectively). Our results imply increased reliance on shorting in any attempt to capture superior profits.[1] Interestingly, both momentum-portfolios deliver strong,

[1]Short sales are severely restricted on the Polish stock market. Only limited number of issues is allowed for shorting, as specific, generally very restrictive, criteria must be met. See *New rules of short selling on GPW in the light of European Union regulations* (GPW 2016), available at: https://www.gpw.pl/krotka_sprzedaz_i_pozyczki_papierow_en

Table 3 Intercept estimates for CAPM and FF3F regressions on 10 LHS portfolios individually, 2000–2013

	Small	Big	High	Low	Winner	Loser	Robust	Weak	Conservative	Aggressive
α_{CAPM}	0.72	−0.03	−0.20	−0.73	1.88	1.46	0.98	−0.82	−0.51	−0.17
t (α_{CAPM})	1.34	−0.48	−0.38	−2.46	4.16	3.62	3.08	−1.78	−1.13	−0.34
α_{FF3F}	0.01	0.05	−0.06	−0.85	1.26	0.98	1.12	−1.05	−0.47	−0.42
t (α_{FF3F})	0.02	1.12	−0.16	−3.46	3.20	2.84	3.61	−2.28	−1.02	−0.84

Table 4 Summary statistics for CAPM and FF3F regressions on 10 LHS portfolios at an aggregated level, 2000–2013

APM	GRS	GRS (p value)	Alαl	A s(α)	SR (α)	A(R^2)	A(adj. R^2)
CAPM	5.96	0.000	0.750	0.399	0.61	0.65	0.65
FF3F	5.14	0.000	0.626	0.358	0.58	0.74	0.73

positive risk-adjusted returns. In accordance with CAPM, Winner-portfolio yields an alpha of 1.88%, whereas Loser-portfolio produces an alpha of 1.46%. Both estimates are statistically significant, as confirmed by t-stats of 4.16 and 3.62, respectively. Noteworthy, winners offer the highest alpha across all portfolios. FF3F model further validates the anomalous performance of both portfolios. The corresponding FF3F's alphas are 1.26% for Winners and 0.98% for Losers. Again, both estimates are statistically significant (t-stats of 3.20 and 2.84). Although each of the two momentum-related portfolios yield significant alphas regardless of the pricing model used, the inference and implications are to some extent ambiguous because both portfolios share the same sign (compare Jegadeesh and Titman 1993). The profitability anomaly is by far more pronounced. Robust-stock portfolio delivers 0.98% CAPM alpha (t = 3.08), while Weak-stock portfolio yields negative −0.82 (t = −1.78). FF3F estimates support these results. Robust-profitability equities produce an alpha of 1.12% (t = 3.61), which is again remarkably higher than Weak-profitability stocks' alpha of −1.05% (t = −2.28). As it transpires, both models provide empirical evidence of the profitability anomaly. With respect to the investment sorts, the results are weak in terms of statistical significance (Table 4).

According to the major tests for the robustness of an asset pricing model, on a sample of the WSE stocks FF3F model performs slightly better than CAPM. The GRS statistic equals to 5.14 for the three-factor model and to 5.96 for the one-factor model. Average absolute alpha is higher for CAPM (0.750%) than for FF3F (0.626%). Our results confirm a stylized fact that in general a one-factor model produces larger anomalous returns. Therefore, we argue that despite being less popular in the investment practice in the CEE region (Zaremba and Konieczka 2015), FF3F better explains common variation in stock returns in the WSE, thus its intercept is a more reliable measure of the local investment opportunities.

4.3 Abnormal Returns in the WSE

Last but not least, we verify how abnormal returns change once we account for the different macroeconomic conditions and investment climate. Therefore, we divide our sample into two subperiods that reflect the bull (Table 5, Panel A) and the bear market (Table 5, Panel B).

The evidence in Table 5 implies that the estimates of abnormal returns are materially different between the two subsamples. We report higher abnormal profits for the bull than for the bear period. Average absolute alphas for the 2000–2006

Table 5 Summary statistics for CAPM and FF3F regressions on 10 LHS portfolios at an aggregated level, separately for the bull (2000–2006) and the bear (2007–2013) market

APM	GRS	GRS (p value)	A|α|	A s(α)	SR (α)	A(R^2)	A(adj. R^2)
Panel A: 2000–2006							
CAPM	4.86	0.00	0.94	0.01	0.81	0.58	0.57
FF3F	3.56	0.00	0.76	0.01	0.73	0.71	0.70
Panel B: 2007–2013							
CAPM	2.38	0.02	0.65	0.00	0.57	0.74	0.73
FF3F	2.52	0.01	0.57	0.00	0.59	0.81	0.80

sample are 0.94% and 0.76% for CAPM and FF3F respectively. GRS test statistically supports these estimates. Mirroring the decline in average absolute alphas, Sharpe ratios decrease accordingly. Since the Sharpe ratio is itself primary component of the GRS test, it is bound to be higher for FF3F model. The goodness of fit, as measured by the average R^2 and average adjusted R^2, is noticeably higher for the later period.

5 Conclusions

By investigating particular trading strategies in a time-varying investment environment, we deliver sound empirical conclusions concerning two important aspects of asset pricing in the WSE.

First, we report that size anomaly is not statistically supported both under CAPM and FF3F model. Once SMB factor is included in model's specification, abnormal returns decline to virtually 0%. We document negative risk-adjusted performance of growth (Low book-to-market) stocks, however trading strategy based on value effect relies foremost on shorting. Momentum anomaly is ambiguous as both extreme strategies yield positive, statistically significant returns and, once employed in each asset pricing models, they produce positive and statistically significant alphas. Profitability-based portfolios are not the top-performers, but the anomaly itself is the most evident and statistically supported. Investment-related abnormal returns are not significant.

Second, we document that CAPM performs well in the emerging stock market of Poland. As expected, FF3F's performance is more robust, but there is only marginal improvement over CAPM in the full sample.

Further, our findings clearly indicate a stark decline in abnormal investment opportunities between the two subperiods: bull and bear market. For investor policy, this implies the need to shift towards less aggressive portfolio allocations.

A potentially interesting area for future research would be to exploit if, given the specific characteristics of post-transition economies and their financial markets, the results obtained for the WSE are representative to other emerging markets in the Central and Eastern Europe.

References

Banz RW (1981) The relationship between return and market value of common stocks. J Financ Econ 9(1):3–18

Chuhan P (1994) Are institutional investors an important source of portfolio investment in emerging markets? (vol 1243). World Bank, Washington DC

De Santis G (1997) Stock returns and volatility in emerging financial markets. J Int Money Financ 16(4):561–579

Edelen RM, Ince OS, Kadlec GB (2016) Institutional investors and stock return anomalies. J Financ Econ 119(3):472–488

Fama EF, French KR (1993) Common risk factors in the returns on stocks and bonds. J Financ Econ 33(1):3–56

Fernandez P (2015) CAPM: an absurd model. Bus Valuation Rev 34(1):4–23

Gibbons MR, Ross SA, Shanken J (1989) A test of the efficiency of a given portfolio. Econometrica 57:1121–1152

GPW (2016) New rules of short selling on GPW in the light of European Union regulations. https://www.gpw.pl/krotka_sprzedaz_i_pozyczki_papierow_en

Grossman SJ (1995) Dynamic asset allocation and the informational efficiency of markets. J Financ 50(3):773–787

Grossman SJ, Stiglitz JE (1980) On the impossibility of informationally efficient markets. Am Econ Rev 70(3):393–408

Jegadeesh N, Titman S (1993) Returns to buying winners and selling losers: implications for stock market efficiency. J Financ 48(1):65–91

King MA, Wadhwani S (1990) Transmission of volatility between stock markets. Rev Financ Stud 3(1):5–33

Lintner J (1965) The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. Rev Econ Stat:13–37

Longstaff FA (2010) The subprime credit crisis and contagion in financial markets. J Financ Econ 97(3):436–450

Sharpe WF (1964) Capital asset prices: a theory of market equilibrium under conditions of risk. J Financ 19(3):425–442

WSE (2014) WSE Factbook 2014. 2013 Data. Warsaw Stock Exchange, Warsaw. https://www.gpw.pl/Fact_book_2014

Zaremba A, Konieczka P (2015) Are value, size and momentum premiums in CEE emerging markets only illusionary? Czech J Econ Financ (Finance a uver) 65(1):84–104