An analysis
of technical factor returns on the Warsaw Stock Exchange, 1999–2009

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1. Introduction

Technical and fundamental analysis are frequently contrasted with each other and the possible relationships between the investment results attainable with these methods are seldom investigated. The objective of this paper is an initial exploration of the returns of portfolios based on several widely followed technical indicators by means of the standard four-factor model, an extension of the Fama and French model with the momentum factor. We want to find out in this way if the technically formed portfolios exhibit any links with the fundamental firm size and value-growth factors as well as with the basic trend following factor.

The portfolios and factors are formed from the stocks listed on the Warsaw Stock Exchange (WSE), a major Central European emerging market. Selected multifactor models for this market were investigated in our earlier papers [Grabowski and Rotuski, 2008 and 2009; Skrzypczak, 2010].

2. Data and methods

Five technical indicators *FACT* used in the analysis below are the 14-day *RSI* indicator (*FACT = RSI*), the Stochastic indicator computed as the 3-day average of the 5-day *%K* line (*FACT = STS*), 20-day *ROC* (*FACT = ROC*), 20-day moving average (*FACT = SR*), and 20-day volume-adjusted moving average (*FACT = SRVOL*), where the sum of daily closing prices multiplied by volume

is divided by the total volume for that period. These specifications are frequently referred to in technical analysis, for reference see e.g. Pring [1991].

Technical factor returns *FACTF* for each of the above indicators *FACT* were constructed independently in the following way. At the end of June of each year all stocks in the WIG index (only stocks with the continued listing at the end of February, 2011 were used here), were sorted on the value of the technical indicator *FACT* at the close of that month. Next, the 30% of stocks with the lowest values of the indicator and 30% of stocks with the highest values of the indicator were put into two portfolios, Low and High. Then, for the next twelve months, the averages of monthly returns of the stocks in each of these two portfolios were computed. The final return on the factor portfolio *FACTF* for each month is the difference between Low and High portfolio returns.

The portfolios *FACT*1 and *FACT*5, where *FACT* is a technical indicator, were constructed in the similar way, the portfolio *FACT*1 with the 20% stocks with the lowest values of *FACT* and *FACT*5 with 20% of stocks with the highest values of *FACT*. *FACT*1 and *FACT*5 may be interpreted as the oversold and overbought portfolio, respectively.

The returns *FACTxR*, where x is 1 or 5 and *FACT* is one of the technical indicators above, are *FACTx* returns adjusted for the monthly risk-free rate implied by the 52-week Treasury bills yields from the last auction of the preceding month.

The *MKT* market factor return is the value-weighted return on a portfolio of all non-financial stocks listed on the WSE in a given month adjusted for the risk-free rate. The *HML*, *SMB* and *WML* factor returns are computed using the standard methodologies of Fama and French (1996) and Jegadeesh and Titman (2001) and including all non-financial stocks listed on the *WSE*, reduced additionally in case of *WML* by all stocks with the price below PLN 0.50.

We examine monthly returns for the period July 1999–April 2009.

We estimate two cases of the standard four-factor model:

$$FACTF_t = \alpha + \beta_{MKT}MKT_t + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{WML}WML_t + \varepsilon_t \quad \text{(Model A)}$$

$$FACTxR_t = \alpha + \beta_{MKT}MKT_t + \beta_{SMB}SMB_t + \beta_{HML}HML_t + \beta_{WML}WML_t + \varepsilon_t \text{ (Model B)}$$
$$x = 1,5$$

The dependent variables are the returns on the technical factors *FACTF* in Model A, and the risk-free rate adjusted returns on the oversold and overbought portfolios *FACT*1*R* and *FACT*5*R* in Model B.

The data set used in the computations is based on the raw data taken from the web pages of parkiet.com, bossa.pl, KDPW, money.pl and from the Notoria database.

3. Results and discussion

Table 1.

Descriptive statistics for the monthly fundamental and technical factor portfolio returns for the stocks listed on the Warsaw Stock Exchange in the period July 1999–April 2009, 118 observations

Variable	Mean	Std. Dev.	Min	Max
MKT	−.0010216	.0733501	−.196344	.212919
SMB	.0227861	.0709031	−.1224605	.2912505
HML	.006719	.0624452	−.2489188	.1440725
WML	.0131528	.0716653	−.2920572	.2569392
SRVOLF	−.000531	.0445252	−.1145585	.1326634
RSIF	.0003843	.045264	−.1204761	.1207934
ROCF	.0000247	.0459112	−.1165944	.1461914
SRF	.003544	.0486377	−.1048061	.1780477
STSF	.0025277	.0392947	−.0810535	.155071

Table 2.

Correlations for the monthly basic factor portfolio returns for the stocks listed on the Warsaw Stock Exchange in the period July 1999–April 2009, 118 observations

	MKT	*SMB*	*HML*	*WML*
MKT	1.0000			
SMB	0.2298	1.0000		
HML	−0.2170	−0.1094	1.0000	
WML	−0.2638	−0.0279	0.1409	1.0000

Table 3.

Correlations for the monthly technical factor portfolio returns for the stocks listed on the Warsaw Stock Exchange in the period July 1999–April 2009, 118 observations

	SRVOLF	*RSIF*	*ROCF*	*SRF*	*STSF*
SRVOLF	1.0000				
RSIF	0.8444	1.0000			
ROCF	0.7862	0.7301	1.0000		
SRF	0.9363	0.8447	0.8114	1.0000	
STSF	0.5843	0.6082	0.5819	0.5923	1.0000

Table 1 reports the basic descriptive statistics for the factor variables. As already presented elsewhere [Grabowski and Rotuski, 2008 and 2009], a size-able capitalization premium and momentum premium are present on the

WSE in the sample period. There is also a smaller value premium. The mean monthly market return is close to zero. The technical factors exhibit no significant premium and they are less volatile than the market return. Tables 2 and 3 display correlations between independent and dependent variables, respectively. The correlations between technical factors are high. This indicates that the technical factors investigated here may have resulted in similar investment signals over the sample period. In contrast, the correlations between independent variables are low.

Table 4.

The results of the estimation of the four-factor model for the technical factor portfolios on the Warsaw Stock Exchange

	RSIF	*ROCF*	*STSF*	*SRF*	*SRVOLF*
β_{MKT}	.2294883*** (0.000)	.1104958* (0.054)	.1717812*** (0.000)	.1830701*** (0.003)	.1543271*** (0.005)
β_{SMB}	.0186358 (0.848)	.0649645 (0.464)	.1032959 (0.213)	.0490902 (0.631)	.0400748 (0.677)
β_{HML}	−.088956 (0.240)	−.1349205 (0.125)	−.0293083 (0.676)	−.1689746* (0.063)	−.1433116* (0.088)
β_{WML}	−.106105* (0.065)	−.2539299*** (0.000)	−.1032185* (0.075)	−.181636*** (0.000)	−.1690016*** (0.000)
α	.0021873 (0.518)	.0029037 (0.260)	.001904 (0.564)	.0061368* (0.054)	.0018993 (0.508)
F statistic	9.14 (0.0000)	13.46 (0.0000)	7.45 (0.0000)	16.96 (0.0000)	17.08 (0.0000)

The results of the estimation of the four-factor Model A, where the dependent variables are *FACTF*, the monthly returns on technical factor portfolios for *FACT* = *RSI*, *ROC*, *STS*, *SR* and *SRVOL*. The tables present the regression coefficients and intercepts as well as F statistics for the individual equations, together with p-values below. All standard errors are estimated using the Newey-West correction for heteroskedasticity and autocorrelation. The data are from the period July 1999–April 2009, 118 monthly observations. The coefficient significance at 1%, 5% and 10% level is denoted by ***, ** and * respectively. For further details see the main text.

The estimation results of Model A are presented in Table 4. All technical factors display relatively small positive association with the market return, i.e. low but positive market betas, and negative relationship with the momentum factor. This indicates that the technical factor portfolios lead to strategies relatively independent of the overall market. The negative *WML* coefficient indicates that buying oversold stocks and selling overbought stocks is a contrarian strategy. This result is even more interesting as the portfolio composition is fixed once a year while the effect seems to persist for the whole year. *SRF* and *SRVOLF* exhibit in addition a negative relationship with the *HML* factor. This might suggest that oversold stocks are not necessarily fundamentally undervalued.

The results of Model A may be understood in more detail with the estimates of Model B. Important differences in the behavior of the oversold

Table 5.
The results of the estimation of the four-factor model for the oversold and overbought portfolios on the Warsaw Stock Exchange

	RSI1	RSI5	ROC1	ROC5	STS1	STS5	SR1	SR5	SRVOL1	SRVOL5
β_{MKT}	.9343715*** (0.000)	.7718456*** (0.000)	.975034*** (0.000)	.7918686*** (0.000)	.9665339*** (0.000)	.7042527*** (0.000)	.9638379*** (0.000)	.8009159*** (0.000)	.945115*** (0.000)	.7834428*** (0.000)
β_{SMB}	.4615542*** (0.000)	.4082118*** (0.000)	.5515948*** (0.000)	.4443542*** (0.000)	.4797488*** (0.000)	.4297464*** (0.000)	.5690464*** (0.000)	.5124864*** (0.000)	.6208787*** (0.000)	.4895438*** (0.000)
β_{HML}	.1930931* (0.095)	.2298068*** (0.001)	.0946379 (0.534)	.2985931*** (0.000)	.254525** (0.025)	.2737458*** (0.000)	.1752613 (0.205)	.295993*** (0.000)	.1539445 (0.315)	.3080094*** (0.000)
β_{WML}	−.221804*** (0.001)	.0617898 (0.421)	−.272253*** (0.004)	.0895003 (0.363)	−.1041882 (0.227)	−.0198776 (0.819)	−.198996*** (0.008)	.0695106 (0.374)	−.1773912** (0.025)	.0960709 (0.285)
α	−.0033806 (0.402)	−.0020419 (0.635)	.0014971 (0.778)	−.0030433 (0.556)	−.0026676 (0.509)	−.0034808 (0.462)	−.0021067 (0.637)	−.0054409 (0.243)	−.0062754 (0.154)	−.0047325 (0.330)
F statistic	81.00 (0.0000)	103.50 (0.0000)	65.64 (0.0000)	77.43 (0.0000)	77.21 (0.0000)	53.22 (0.0000)	73.17 (0.0000)	114.17 (0.0000)	57.71 (0.0000)	70.95 (0.0000)

The results of the estimation of the four-factor Model B, where the dependent variables are *FACT1R* and *FACT5R*, the risk-free rate adjusted monthly returns on FACT1(oversold) and FACT5(overbought) portfolios for *FACT = RSI, ROC, STS, SR* and *SRVOL*. The tables present the regression coefficients and intercepts as well as F statistics for the individual equations, together with p-values below. All standard errors are estimated using the Newey-West correction for heteroskedasticity and autocorrelation. The data are from the period July 1999–April 2009, 118 monthly observations. The coefficient significance at 1%, 5% and 10% level is denoted by ***, ** and * respectively. For further details see the main text.

(*FACT*1*R*) and overbought (*FACT*5*R*) portfolios are evident there (Table 5). In most cases the coefficients at the Fama and French factors are positive and significant. The oversold portfolios have market betas close to one and their values for the overbought portfolios are slightly lower. The coefficients at *SMB* factor are around 0.5 for most portfolios, usually somewhat higher for oversold ones. This shows that oversold portfolios are composed on average with more small capitalization stocks. The *HML* coefficients are again positive but higher for overbought portfolios and this might have been the reason for the negative coefficients in some results of Model A.

The coefficient at the momentum factor is statistically significant and negative only for the oversold portfolios, except the *STSFxR*, where it is insignificant for both oversold and overbought portfolios. This result indicates that it is the persistence of downward movement in oversold stocks that makes a contrarian strategy based on the technical factors risky.

For the purpose of the analysis here we have deliberately constructed the technical factors in a way similar to the Fama and French factors. Such method of the factor and portfolio formation, based on the value of an indicator at a single point of time in a year, might seem controversial not only for the technical factors but for the fundamental factors as well, given possible changes in their value throughout a year. The overlapping portfolio method of WML factor construction may further complicate the interpretation of the results from factor models. These standard methods were retained here to facilitate analysis in the standard factor environment. A change in the portfolio rebalancing frequency is an interesting topic for further research. Among other aspects, it may help investigate in a more detailed way the dynamical interplay between oversold and fundamentally undervalued stocks.

4. Conclusion

We have performed an initial investigation of the returns of the portfolios formed using five well-known technical indicators with the standard four-factor model. In forming the technical portfolios we used methods similar to the formation methodology of the well-known size and value factors. Two main results were obtained. First, the technical factor returns exhibit low market dependence and contrarian features. Second, the oversold portfolio returns seem to be in particular persistently negatively associated with momentum returns. We conjecture that the increased frequency of the rebalancing of both fundamental and technical factor portfolios would help investigate these relationships in more detail.

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