Multifactor models of momentum portfolios on the Warsaw Stock Exchange, 1999–2009

Wojciech Grabowski, Ph.D., Department of Banking and Finance, Faculty of Economic Sciences, University of Warsaw
Konrad Rotuski, M.Sc., Artal Investments

1. Introduction

The continuation of returns in momentum strategies is one of the important areas of investigation. One of the main research problems is the identification of a source or sources of these returns. Several hypotheses were advanced in the literature, related to the autocorrelation of returns, the cross-serial covariance of returns or the cross-sectional variation in unconditional and conditional mean returns [see e.g. [Jegadeesh and Titman, 2001; Lewellen, 2002; Chen and Hong, 2002; Du and Watkins, 2007; Dittmar et al., 2007]. Another line of research tries to investigate the characteristics of momentum portfolios in terms of factor returns models, e.g. the Fama and French model. Such approach can potentially shed light both on factor models and their practical applications, as well as explain momentum returns in terms of some other portfolio characteristics. Below, we follow this second line of investigation and contribute to the existing literature, first, by proposing new multifactor decompositions of momentum profits, and, second, by the examination of such profits in an emerging stock market, the Warsaw Stock Exchange (WSE) [see e.g. van der Hart et al., 2003 and 2005].

Specifically, we construct four new factors based on the relative value of stocks and on corporate liquidity measures and check if such factors better explain momentum profits on the WSE during the past decade than the standard factor models.

The rest of the paper is organized as follows: the next Section presents data, methods and models, Section 3 discusses the results and Section 4 concludes.

2. Data and methods

The data set used to compute portfolio returns was prepared using the following sources: the web pages parkiet.com, bossa.pl, money.pl, KDPW and the Notoria database.

All returns presented in the paper are monthly returns for the period from July 1999 to April 2009 for the total of 118 monthly observations. The MKT, the market return factor, is calculated as the difference between the return on the value-weighted portfolio of all non-financial stocks listed on the WSE in a given month and the monthly compounded risk-free return implied by the yield on the 52-week Treasury bills from the last auction in the preceding month.

The SMB and HML factor returns were computed according to the standard methodology of Fama and French (1996) taking into account all non-financial stocks with a positive book value listed at the end of June of a given year on the WSE. The WML momentum factor returns as well as the momentum decile factor returns, WML1 (the loser portfolio) to WML10 (the winner portfolio), were computed using the methodology of Jegadeesh and Titman (2001) taking into account all WSE stocks with the price above PLN0.50.

In addition to these factors we computed also the following four factors: SP, EP, CP and STI. The first two, SP and EP, reflect relative value characteristics of stocks. SP is computed based on the Sales to Price ratio and EP is calculated using the Earnings to Price ratio. The CP and STI factors reflect liquidity characteristics of firms. CP is calculated based on the Cash to Price ratio and STI is based on the Short-term Investments to Price ratio. All these factors were computed in the same way as the HML factor using the Fama and French (1996) methodology, but with the above ratios substituted in place of the Book to Market ratio to sort the stocks.

The SP and EP factors represent different relative value aspects of stocks. While HML is based on the relationship between the book value and the market price, SP is based on revenues and EP on earnings. Positive SP or EP mean, like HML, that there is a premium to undervalued stocks, but the basis for the value classification is different. The CP and STI factors, instead, represent the relationship between the most liquid corporate assets elements and the market price. Positive CP or STI factors mean that there is a premium to corporate liquidity. High CP or STI stocks have high values of the corresponding ratios.

Two models are estimated below.

In Model 1:

$$WML_t = \alpha + \beta_{FACT1} FACT1_t + \beta_{FACT2} FACT2_t + \beta_{FACT3} FACT3_t + \beta_{FACT4} FACT4_t + \varepsilon_t$$

the WML factor returns are regressed on a number of factors (one to four). First, the CAPM is estimated, with the only factor, FACT1 equal to MKT factor. Then a number of different three and four factor models are estimated, including the standard Fama and French three-factor model, where FACT1 is MKT, FACT2 is SMB and FACT3 is HML. In the remaining models the SMB, HML, SP, EP, CP and STI factors are combined in various ways with the MKT factor.

In Model 2:

$$WML_t xR_t = \alpha + \beta_{FACT1} FACT1_t + \beta_{FACT2} FACT2_t + \beta_{FACT3} FACT3_t + \\ + \beta_{FACT4} FACT4_t + \varepsilon_t$$

where x = 1 to 10 indicates the decile portfolio, the same factor models as for the Model 1 are estimated for the ten decile momentum portfolio returns adjusted for the risk-free rate. The GRS statistics of Gibbons, Ross and Shanken [1989] is calculated in the standard way based on each set of ten regressions to compare the models. In all regressions Newey-West standard errors are computed.

The main objective of estimating both models is to find out if some factor models other than the standard CAPM and the Fama and French models provide better explanation of momentum profits. In addition, we are also interested in the characteristics of factor and momentum returns on the WSE over the past decade.

3. Results

The descriptive statistics for the factor returns (Table 1) demonstrate that there is a size premium on the WSE of about 2.3%, as seen from the average return on the SMB factor. The standard value premium (average return on the HML factor) appears to be much smaller, about 0.7%. Interestingly, the premium on the SP factor is larger, about 1.5% and the premium on the EP factor is negative, equal to about –1%. Since all these three factors, HML, SP and EP represent a form of value characteristics, it appears that various ways of relative value measurement produce different premiums. Further, both in terms of CP and STI factors, there is a corporate liquidity premium on the WSE of about 1.2–1.3%.

The average WML momentum factor return is 1.3%. The individual momentum deciles do not appear to have monotonically growing returns (Table 2), in fact the decile portfolios WML8 and WML9 exhibit larger mean return (1.6 and 1.9%, respectively) than the winners portfolio WML10 (1.47%). Still, these returns are much larger than the average WML1 loser decile return of 0.15%.

The Fama and French factor returns are not excessively correlated (Table 3). The WML factor correlations with other factors are also not very large, although its negative correlation of –0.26 with the MKT factor should be noted. The value factors, HML, SP and EP exhibit, in part, surprising correlations. While HML and SP are quite highly correlated, SP and EP are not. HML and EP are negatively correlated with the market while SP is practically uncorrelated with the MKT factor. The corporate liquidity factor, CP, is also practically uncorrelated with the market.

The results of the Model 1 estimations (Table 4) show that the factor models involving SP as a factor perform much better than the other models. The MKT-SP-EP model performs the best, which is also interesting since it

groups two relative value factors, SP and EP. These two factors exhibit little correlation over the period, which may indicate that investors perceive various relative value factors differently. It is worth noting that among the value factors the SP factor is the least susceptible to accounting effects. The Model 2 results in terms of the GRS statistics are as follows. The MKT-SP-EP-CP and the MKT-SP-EP are the best performing models and the MKT-SP-EP-STI model also performs well being also the second best in Model 1 regressions. The MKT-SP-CP model produces also one of the best GRS scores. This model is noteworthy since the factors are practically uncorrelated, and since it combines market, value and corporate liquidity characteristics.

Overall, these results suggest that there is a potential scope to further scrutiny of different multifactor models of returns other than the standard ones. In particular, the SP factor deserves wider testing on other data sets. The corporate liquidity factors should also be examined more extensively.

It appears also that different factor models of the type tested in this paper may contribute to the explanation of the WML factor. The importance of the SP factor in both models estimated above indicates, perhaps not surprisingly, that the relative value element may be in part driving the momentum returns. Earlier, little success in the WML decomposition resulted in including the momentum factor, in addition to the Fama and French factors, in the standard four-factor model.

4. Conclusion

We have computed selected portfolio factor returns for the stocks listed on the WSE over the 1999–2009 period. There is a size premium on the WSE, while the size and sign of the value premium depends on the value factor used. Investors also seem to put a premium on corporate liquidity. Top momentum deciles as well as the momentum factor exhibit on average positive returns.

Further, we tested a number of multifactor models of momentum portfolios. It appears that the SP factor based on the Sales/Price relative valuation of stocks has some power in explaining the momentum returns. Further testing of this and other factors introduced above, EP, CP and STI seems desirable.

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Annex

Table 1.

Descriptive statistics for the monthly 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
SP	.0151498	.0792618	–.3786263	.4082528
EP	–.0099796	.0823887	–.4401614	.1296429
CP	.0119522	.0865226	–.4976726	.3512076
STI	.0129567	.0694978	–.1675527	.3663036

Table 2.

Descriptive statistics for the ten decile WML portfolio monthly 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
WML1	.0015705	.1067786	–.224678	.3856507
WML2	.0076659	.0896105	–.2284202	.3106256
WML3	.007031	.0794163	–.2310697	.2661652
WML4	.0081113	.0749695	–.2344987	.2494894
WML5	.0107038	.074785	–.2327152	.2200908
WML6	.01349	.0786356	–.2373734	.2238512
WML7	.013393	.0794026	–.2262818	.3096755
WML8	.0162177	.0773592	–.2151433	.2076215
WML9	.0191317	.080276	–.1817488	.2303742
WML10	.0147233	.0919453	–.1862161	.3321063

Table 3.

Correlations for the monthly 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	SP	EP	CP	STI
MKT	1.0000							
SMB	0.2298	1.0000						
HML	–0.2170	–0.1094	1.0000					
WML	–0.2638	–0.0279	0.1409	1.0000				
SP	–0.0111	0.1465	0.6263	0.1760	1.0000			
EP	–0.3759	–0.5910	0.1408	–0.0196	–0.0541	1.0000		
CP	0.0040	–0.0806	0.4092	0.1223	0.4794	0.0561	1.0000	
STI	0.1351	0.2793	0.4380	0.0027	0.5531	–0.2965	0.6639	1.0000

Table 4.

Characteristics of the WML and the momentum decile models for the stocks listed on the Warsaw Stock Exchange in the period July 1999–April 2009, 118 monthly observations

Factor model (Factors 1–4)	WML model (Model 1) alpha different from 0 at 10%	WML model (Model 1) F statistics p-value	Decile model (Model 2) GRS statistics	Decile model (Model 2) GRS statistics p-value
MKT	yes	0.050	1.657	0.100
MKT, SMB, HML	yes	0.107	1.395	0.192
MKT, SMB, SP	no	0.034	1.369	0.204
MKT, SMB, EP	yes	0.161	1.467	0.162
MKT, SMB, CP	no	0.074	1.470	0.160
MKT, SMB, STI	yes	0.166	1.466	0.162
MKT, SP, EP	no	0.011	1.197	0.300
MKT, SP, CP	no	0.038	1.264	0.260
MKT, SP, STI	yes	0.024	1.305	0.236
MKT, EP, CP	no	0.048	1.348	0.214
MKT, EP, STI	yes	0.094	1.383	0.197
MKT, HML, EP	no	0.066	1.362	0.207
MKT, HML, CP	yes	0.089	1.446	0.170
MKT, HML, STI	yes	0.122	1.444	0.171
MKT, SMB, SP, EP	yes	0.023	1.406	0.187
MKT, SMB, EP, STI	no	0.047	1.533	0.137
MKT, SP, EP, CP	no	0.022	1.193	0.303
MKT, SP, EP, STI	no	0.019	1.248	0.269
MKT, HML, EP, STI	yes	0.117	1.372	0.203
MKT, HML, EP, CP	no	0.094	1.304	0.237

The first column lists independent variables of a factor model, the second column provides information on the WML regression (Model 1) alpha (different from zero at 10% significance = yes, otherwise = no), the third column provides p-value of the F statistics for the WML regression, the fourth and the fifth column provide the GRS statistics and its p-value for the ten decile regressions of the risk-free rate adjusted WML decile returns (Model 2).