QUANTITATIVE METHODS IN ECONOMICS
Vol. XI, No. 1, 2010, pp. 128-138

ORTHOGONALIZED FACTORS IN MARKET-TIMING MODELS OF POLISH EQUITY FUNDS[22]

Joanna Olbryś
Department of Informatics, Bialystok University of Technology
e-mail: j.olbrys@pb.edu.pl

Abstract: The main goal of this paper is to examine the influence of factor orthogonalization in modified versions of classic market-timing models with the Fama and French spread variables *SMB* and *HML*, which have been introduced in [Olbryś 2010]. We construct the orthogonal market factors using the Busse procedure [Busse 1999]. The market-timing and selectivity abilities of 15 equity open-end mutual funds have been evaluated for the period January 2003 – December 2009 based on the panel data estimation using the SUR method. We compare the regression results of the models with common and orthogonal market factors and investigate their statistical properties.

Keywords: mutual fund, multifactor market-timing model, orthogonalized factor, SUR method

THREE-FACTOR MARKET-TIMING MODELS WITH FAMA AND FRENCH SPREAD VARIABLES

E. Fama was the first to propose a formalized theoretical methodology for the decomposition of total return into the components of timing and selectivity [Fama 1972]. Treynor and Mazuy develop a procedure for detecting timing ability that is based on a regression analysis of the managed portfolio's realized returns, which includes a quadratic term [Treynor & Mazuy 1966]. Henriksson and Merton propose a theoretical structure that allows for the formal distinction of managers' forecasting skills into timing and selectivity [Henriksson & Merton 1981]. By assuming that the market timer's forecasts take two possible predictions: either

[22] Financial support in 2009 – 2011 from the Polish Committee for Scientific Research within the grant No. N N113 173237 is gratefully acknowledged

stocks will outperform bonds or bonds will outperform stocks, Merton derives an equilibrium theory that shows that the return patterns resulting from a market-timing strategy are similar to the return pattern of an option strategy (of the put-protective type) [Merton 1981]. Based on this model, Henriksson and Merton develop statistical procedures to investigate market-timing abilities of portfolios' managers. Fama and French find that two variables, the market value (MV) and the ratio of book value to market value (BV / MV) capture much of the cross – section of average stock returns [Fama & French 1993]. They form portfolios meant to mimic the underlying risk factors in returns related to size and book-to-market equity. These mimicking portfolios (*SMB* and *HML*) have been introduced as explanatory variables into regressions of Polish equity mutual funds' portfolios excess returns in [Olbryś 2010]. The size (*SMB*) and book-to-market (*HML*) mimicking portfolios on the Polish market have been constructed using the Fama and French procedure. The market-timing and selectivity abilities of the funds' managers have been evaluated for the period January 2003 – December 2009, based on the modified three-factor market-timing models, using Newey-West robust HAC estimators or the SUR method, respectively.

In [Olbryś 2010] the modified three-factor Treynor - Mazuy model with Fama and French spread variables (T-M-FF model) has been expressed as:

$$r_{P,t} = \alpha_P + \beta_P \cdot r_{M,t} + \delta_{1P} \cdot r_{SMB,t} + \delta_{2P} \cdot r_{HML,t} + \gamma_P \cdot (r_{M,t})^2 + \varepsilon_{P,t} \tag{1}$$

where:

$r_{P,t} = R_{P,t} - R_{F,t}$ is the excess return of the portfolio P in the period t,

$r_{M,t} = R_{M,t} - R_{F,t}$ is the excess return of the portfolio M in the period t,

$R_{P,t}$ is the one-period return of the portfolio P,

$R_{M,t}$ is the one-period return of the market portfolio M,

$R_{F,t}$ is the one-period return of riskless securities,

Jensen's α_P measures selectivity skills of the portfolio's P manager [Jensen 1968],

β_P is the systematic risk measure of the portfolio P,

γ_P measures market-timing skills of the portfolio's P manager [Henriksson & Merton 1981],

$\varepsilon_{P,t}$ is a residual term, with the following standard CAPM conditions: $E(\varepsilon_{P,t}) = 0$, $E(\varepsilon_{P,t} | \varepsilon_{P,t-1}) = 0$.

$r_{SMB,t} = R_{SMB,t} - R_{F,t}$ is the excess return of the portfolio *SMB*,

$r_{HML,t} = R_{HML,t} - R_{F,t}$ is the excess return of the portfolio *HML*,

δ_{1P} is a sensitive measure of the portfolio P returns due to the changes in the *SMB* factor returns,

δ_{2P} is a sensitive measure of the portfolio P returns due to the changes in the *HML* factor returns.

In a way analogous to (2), Olbryś expressed the modified three-factor Henriksson - Merton model with Fama and French spread variables (H-M-FF model) as:

$$r_{P,t} = \alpha_P + \beta_P \cdot r_{M,t} + \delta_{1P} \cdot r_{SMB,t} + \delta_{2P} \cdot r_{HML,t} + \gamma_P \cdot y_{M,t} + \varepsilon_{P,t} \tag{2}$$

where:

$r_{P,t}$, $r_{M,t}$, $r_{SMB,t}$, $r_{HML,t}$, α_P, β_P, γ_P, δ_{1P}, δ_{2P}, $\varepsilon_{P,t}$ are as in the equation (1),

$y_{M,t} = \max\{0, R_{F,t} - R_{M,t}\} = \max\{0, -r_{M,t}\}$.

ORTHOGONALIZED FACTORS IN MARKET-TIMING MODELS

We orthogonalize the *SMB* and *HML* indices to maintain consistency with the theoretical and practical development that there is a correlation between the market factor *M* and mimicking portfolios *SMB* or *HML* ([Busse 1999], [Fama & French 1993]).

We take the orthogonal *SMB* factor (call it *SMBO*) to be the intercept plus the *SMB* factor regression residuals on the simple excess returns of the main index of Warsaw Stock Exchange companies, given as:

$$r_{SMB,t} = \alpha_{SMB} + \beta_{SMB} \cdot r_{M,t} + \varepsilon_t \tag{3}$$

The sum of the intercept and the residuals in (3):

$$r_{SMBO,t} = \alpha_{SMB} + \varepsilon_t \tag{4}$$

is uncorrelated with the explanatory market variable in (3).

Similarly, we take the orthogonal *HML* factor (call it *HMLO*) to be the intercept plus the *HML* factor regression residuals on the simple excess returns of the main index of Warsaw Stock Exchange companies and the orthogonal *SMBO* factor, which is expressed as:

$$r_{HML,t} = \alpha_{HML} + \beta_{HML} \cdot r_{M,t} + \gamma_{HML} \cdot r_{SMBO,t} + e_t \tag{5}$$

The sum of the intercept and the residuals in (5):

$$r_{HMLO,t} = \alpha_{HML} + e_t \tag{6}$$

is uncorrelated with the explanatory variables in (5).

Then the three-factor T-M-FF model (1), with the orthogonalized *SMBO* and *HMLO* factors can be expressed as:

$$r_{P,t} = \alpha_P + \beta_P \cdot r_{M,t} + \delta_{1P} \cdot r_{SMBO,t} + \delta_{2P} \cdot r_{HMLO,t} + \gamma_P \cdot (r_{M,t})^2 + \varepsilon_{P,t} \tag{7}$$

where the notations are as in the equation (1) but the explanatory variables $r_{SMBO,t}$ and $r_{HMLO,t}$ are given by the equations (4) or (6), respectively.

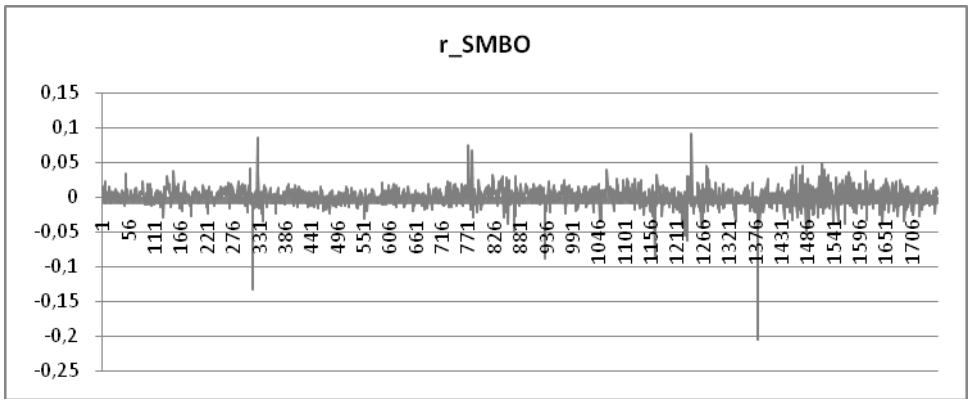
Similarly, the three-factor H-M-FF model (2) with the orthogonalized *SMBO* and *HMLO* factors can be given as:

$$r_{P,t} = \alpha_P + \beta_P \cdot r_{M,t} + \delta_{1P} \cdot r_{SMBO,t} + \delta_{2P} \cdot r_{HMLO,t} + \gamma_P \cdot y_{M,t} + \varepsilon_{P,t} \quad (8)$$

where the notations are as in the equation (2) but the explanatory variables $r_{SMBO,t}$ and $r_{HMLO,t}$ are given by the equations (4) or (6).

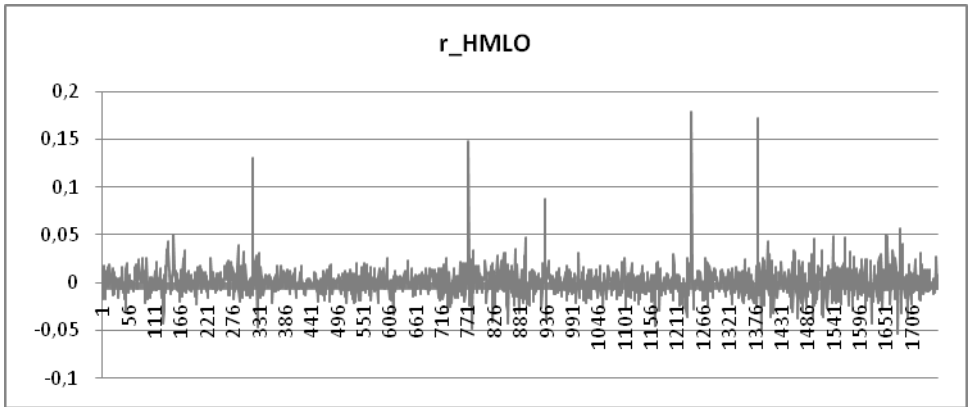
Fig. 1 and Fig. 2 present the exogenous variables $r_{SMBO,t}$ (4) and $r_{HMLO,t}$ (6) in the form of charts, respectively. We have detected (based on Dickey – Fuller test) that the analysed series are stationary.

Figure 1. The exogenous variable $r_{SMBO,t}$ from Jan 2003 to Dec 2009



Source: author's calculations

Figure 2. The exogenous variable $r_{HMLO,t}$ from Jan 2003 to Dec 2009



Source: author's calculations

ESTIMATION METHOD AND EMPIRICAL RESULTS

The SUR (seemingly unrelated regression) method was described by Zellner [Zellner 1962]. SUR is a way of estimating panel data models that are long (large T) but not wide (small N). The assumptions underlying the SUR model are the following [Marshall & Young 2003]:

1) All disturbances have a zero mean;
2) In a given cross-sectional unit, the disturbance variance is constant over time, but each cross-sectional unit can have a different variance;
3) Two disturbances in different cross-sectional units but corresponding to the same time period are correlated (contemporaneous correlation);
4) Disturbances in different time periods, whether they are in the same cross-sectional unit or not, are uncorrelated (autocorrelation does not exist).

In the basic SUR model, the errors are assumed to be homoskedastic and linearly independent within each equation. Each equation is correlated with the others in the same time period. This assumption is called contemporaneous correlation, and it is this property that sets SUR apart from other models [Adkins 2009]. Given that it is very likely that equity funds' portfolios from the same market are contemporaneously correlated, the SUR model seems to be appropriate for this case. If contemporaneous correlation does not exist, the LSR method applied separately to each equation (fund's portfolio) is quite efficient.

We use daily data following evidence that daily data provide better inferences than monthly data regarding timing ability [Bollen & Busse 2001]. This evidence has been examined in the case of Polish equity mutual funds in [Olbryś 2008b]. We examine the performance of 15 selected equity open-end mutual funds. We study daily simple excess returns from Jan 2003 to Dec 2009. Daily returns on the main index of Warsaw Stock Exchange companies are used as the returns on the market portfolio. The average daily returns on 52-week Treasury bills are used as the riskless asset returns. Daily return rates on spread factors *SMB* and *HML* are used as the values of the additional exogenous variables in the T-M-FF (1) and H-M-FF (2) models. In the data panel the number of funds is equal to N=15 and the number of time periods is T=1760.

Tables 1 and 2 provide details on the estimated T-M-FF (1) and H-M-FF (2) market-timing models, respectively. The SUR method has been used to consider the contemporaneous correlation effects. In all of the tables: * denotes coefficients that are significantly different from zero at the ten percent level; ** denote coefficients that are significantly different from zero at the five percent level and *** denote coefficients that are significantly different from zero at the one percent level.

Table 1. Three-factor T-M-FF model (1) (Jan 2, 2003 - Dec 31, 2009)

	Equity funds	$\hat{\alpha}_P$	$\hat{\beta}_P$	$\hat{\delta}_{1P}$	$\hat{\delta}_{2P}$	$\hat{\gamma}_P$	R^2
1	Arka BZ WBK Akcji FIO	0.0006***	0.730***	0.070***	0.046***	-2.03***	0.623
2	Aviva Investors FIO Polskich Akcji	0.0005***	0.751***	-0.002	0.021*	-1.92***	0.691
3	BPH FIO Akcji	0.0001	0.716***	0.011	0.031***	-0.96***	0.716
4	DWS Polska FIO Top 25 Małych Spółek	0.0002	0.445***	0.216***	0.070***	-1.54***	0.297
5	DWS Polska FIO Akcji	0.0002	0.630***	0.033	0.017	-1.30**	0.373
6	DWS Polska FIO Akcji Plus	0.0002	0.555***	0.092***	0.025	-1.27**	0.355
7	ING FIO Akcji	0.0001	0.746***	0.009	0.027**	-0.92**	0.695
8	Legg Mason Akcji FIO	0.0003*	0.698***	0.017	0.035***	-1.05***	0.700
9	Millennium FIO Akcji	0.0000	0.683***	0.033***	0.050***	-1.07***	0.673
10	Pioneer Akcji Polskich FIO	0.0000	0.814***	-0.001	0.035***	-1.52***	0.698
11	PKO/CREDIT SUISSE Akcji FIO	0.0003	0.559***	0.029*	0.028*	-2.20***	0.422
12	PZU FIO Akcji KRAKOWIAK	0.0001	0.702***	-0.003	0.035***	-1.39***	0.689
13	SEB 3 – Akcji FIO	0.0004	0.522***	0.085***	0.017	-1.64***	0.315
14	Skarbiec – Akcja FIO	0.0003	0.457***	0.068***	0.013	-0.52	0.279
15	UniKorona Akcja FIO	0.0004	0.519***	0.091***	0.019	-1.06*	0.309

Source: author's calculations (using *Gretl 1.8.5*)

Table 2. Three-factor H-M-FF model (2) (Jan 2, 2003 - Dec 31, 2009)

	Equity funds	$\hat{\alpha}_P$	$\hat{\beta}_P$	$\hat{\delta}_{1P}$	$\hat{\delta}_{2P}$	$\hat{\gamma}_P$	R^2
1	Arka BZ WBK Akcji FIO	0.0010***	0.650***	0.071***	0.046***	-0.17***	0.623
2	Aviva Investors FIO Polskich Akcji	0.0010***	0.672***	-0.002	0.021*	-0.17***	0.690
3	BPH FIO Akcji	0.0004*	0.673***	0.011	0.031***	-0.09***	0.716
4	DWS Polska FIO Top 25 Małych Spółek	0.0005	0.387***	0.217***	0.071***	-0.12**	0.297
5	DWS Polska FIO Akcji	0.0005	0.579***	0.034	0.017	-0.11*	0.373
6	DWS Polska FIO Akcji Plus	0.0005	0.501***	0.092***	0.025	-0.11**	0.355
7	ING FIO Akcji	0.0004	0.702***	0.008	0.026**	-0.09***	0.695
8	Legg Mason Akcji FIO	0.0006**	0.651***	0.016	0.035***	-0.10***	0.700
9	Millennium FIO Akcji	0.0004*	0.631***	0.032***	0.049***	-0.11***	0.674
10	Pioneer Akcji Polskich FIO	0.0005*	0.746***	-0.001	0.034***	-0.14***	0.698
11	PKO/CREDIT SUISSE Akcji FIO	0.0008**	0.467***	0.029*	0.028*	-0.19***	0.422

12	PZU FIO Akcji KRAKOWIAK	0.0005**	0.640***	-0.003	0.035***	-0.13***	0.689
13	SEB 3 – Akcji FIO	0.0007*	0.462***	0.085***	0.017	-0.13**	0.314
14	Skarbiec – Akcja FIO	0.0005	0.429***	0.067***	0.012	-0.06	0.279
15	UniKorona Akcja FIO	0.0007*	0.475***	0.091***	0.019	-0.09*	0.309

Source: author's calculations (using *Gretl 1.8.5*)

Tables 1-2 include the estimation results of the three-factor T-M-FF (1) and H-M-FF (2) models. Results of the T-M-FF tests (Table 1) show that the estimates of Jensen's measure of performance ($\hat{\alpha}_P$) are positive, but not significant in the case of twelve funds. We can observe that in the case of H-M-FF models (Table 2) ten out of fifteen funds present a significant positive estimate of selectivity. According to Jensen's interpretation of the $\hat{\alpha}_P$ value, this measure could be positive for two reasons: (1) the extra returns actually earned on the portfolio due to the manager's ability, and (2) the positive bias in the estimate of $\hat{\alpha}_P$ resulting from the negative bias in the $\hat{\beta}_P$ estimate [Jensen 1968, pp. 396]. The systematic risk levels ($\hat{\beta}_P$) are significantly positive (Tables 1-2). Unfortunately, the empirical results show no statistical evidence that Polish equity funds' managers have outguessed the market. Almost all of the funds (except Skarbiec – Akcja FIO in Tables 1-2) present significantly negative estimates of market-timing skills ($\hat{\gamma}_P < 0$). We find evidence of negative market-timing. Significant negative estimates of market-timing indicate that, contrary to what would be expected of rational investors, the managers increase the exposition of their portfolios to the market in down markets and act inversely in up markets [Romacho & Cortez 2006]. There is a statistically significant negative relationship between selectivity ($\hat{\alpha}_P$) and timing ($\hat{\gamma}_P$). As for the sensitive measure of the fund's portfolio P returns due to the changes in the *SMB* factor returns, only eight out of fifteen funds (in Tables 1-2) exhibit positive and statistically significant coefficients $\hat{\delta}_{1P}$. The spread variable *HML* is positive and statistically significant in the case of ten out of fifteen funds (coefficients $\hat{\delta}_{2P}$ in Tables 1-2).

Tables 3-4 include the estimation results of the three-factor T-M-FF (7) and H-M-FF (8) models with the orthogonalized *SMBO* (4) and *HMLO* (6) factors as the explanatory variables.

Table 3. Three-factor T-M-FF model (7) with the orthogonalized *SMBO* and *HMLO* factors (Jan 2, 2003 - Dec 31, 2009)

	Equity funds	$\hat{\alpha}_P$	$\hat{\beta}_P$	$\hat{\delta}_{1P}$	$\hat{\delta}_{2P}$	$\hat{\gamma}_P$	R^2
1	Arka BZ WBK Akcji FIO	0.0006***	0.712***	0.049***	0.046***	-2.03***	0.623
2	Aviva Investors FIO Polskich Akcji	0.0005***	0.748***	-0.011	0.021*	-1.92***	0.691
3	BPH FIO Akcji	0.0001	0.709***	-0.003	0.031***	-0.96***	0.716
4	DWS Polska FIO Top 25 Małych Spółek	0.0002	0.399***	0.184***	0.070***	-1.54***	0.297
5	DWS Polska FIO Akcji	0.0002	0.622***	0.026	0.017	-1.30**	0.373
6	DWS Polska FIO Akcji Plus	0.0002	0.535***	0.081***	0.025	-1.27**	0.355
7	ING FIO Akcji	0.0001	0.741***	-0.003	0.027**	-0.92**	0.695
8	Legg Mason Akcji FIO	0.0003*	0.690***	0.0009	0.035***	-1.05***	0.700
9	Millennium FIO Akcji	0.0000	0.671***	0.010	0.050***	-1.07***	0.673
10	Pioneer Akcji Polskich FIO	0.0000	0.809***	-0.016	0.035***	-1.52***	0.698
11	PKO/CREDIT SUISSE Akcji FIO	0.0003	0.550***	0.017	0.028*	-2.20***	0.422
12	PZU FIO Akcji KRAKOWIAK	0.0001	0.698***	-0.018*	0.035***	-1.39***	0.689
13	SEB 3 – Akcji FIO	0.0004	0.505***	0.077***	0.017	-1.64***	0.315
14	Skarbiec – Akcja FIO	0.0003	0.444***	0.062***	0.013	-0.52	0.279
15	UniKorona Akcja FIO	0.0004	0.500***	0.082***	0.019	-1.06*	0.309

Source: author's calculations (using *Gretl 1.8.5*)

Table 4. Three-factor H-M-FF model (8) with the orthogonalized *SMBO* and *HMLO* factors (Jan 2, 2003 - Dec 31, 2009)

	Equity funds	$\hat{\alpha}_P$	$\hat{\beta}_P$	$\hat{\delta}_{1P}$	$\hat{\delta}_{2P}$	$\hat{\gamma}_P$	R^2
1	Arka BZ WBK Akcji FIO	0.0010***	0.631***	0.050***	0.046***	-0.17***	0.623
2	Aviva Investors FIO Polskich Akcji	0.0010***	0.669***	-0.011	0.021*	-0.17***	0.690
3	BPH FIO Akcji	0.0004*	0.667***	-0.003	0.031***	-0.09***	0.716
4	DWS Polska FIO Top 25 Małych Spółek	0.0005	0.340***	0.185***	0.071***	-0.12**	0.297
5	DWS Polska FIO Akcji	0.0005	0.571***	0.026	0.017	-0.11*	0.373
6	DWS Polska FIO Akcji Plus	0.0005	0.482***	0.081***	0.025	-0.11**	0.355
7	ING FIO Akcji	0.0004	0.697***	-0.003	0.026**	-0.09***	0.695
8	Legg Mason Akcji FIO	0.0006**	0.643***	0.0006	0.035***	-0.10***	0.700
9	Millennium FIO Akcji	0.0004*	0.618***	0.098	0.049***	-0.11***	0.674
10	Pioneer Akcji Polskich FIO	0.0005*	0.742***	-0.017	0.034***	-0.14***	0.698

11	PKO/CREDIT SUISSE Akcji FIO	0.0008**	0.458***	0.017	0.028*	-0.19***	0.422
12	PZU FIO Akcji KRAKOWIAK	0.0005**	0.636***	-0.019*	0.035***	-0.13***	0.689
13	SEB 3 – Akcji FIO	0.0007*	0.445***	0.078***	0.017	-0.13**	0.314
14	Skarbiec – Akcja FIO	0.0005	0.416***	0.062***	0.012	-0.06	0.279
15	UniKorona Akcja FIO	0.0007*	0.457***	0.082***	0.019	-0.09*	0.309

Source: author's calculations (using *Gretl 1.8.5*)

It can be observed that our initial conclusions concerning $\hat{\alpha}_P$ and $\hat{\gamma}_P$ remain unaltered. The levels of the systematic risk $\hat{\beta}_P$ in Tables 3-4 down somewhat relative to the values in Tables 1-2, respectively. However, the two sets of regressions produce the same R-squared values. As for the sensitive measure of the fund's portfolio P returns due to the changes in the *SMBO* factor returns, only seven out of fifteen funds (in Tables 3-4) exhibit positive and statistically significant coefficients $\hat{\delta}_{1P}$. The evidence is that the values of $\hat{\delta}_{1P}$ coefficients in Tables 3-4 significantly differ from these in Tables 1-2. On the other hand, in the case of all models and all funds, we have received the same estimator values of $\hat{\delta}_{2P}$ coefficients in Tables 1, 3 and Tables 2, 4, respectively.

The three-factor T-M-FF (7) and H-M-FF (8) models with the orthogonalized *SMBO* (4) and *HMLO* (6) factors as the explanatory variables have also been estimated using logarithmic excess returns. A logarithmic excess return is given by the equation:

$$\textit{logarithmic rate}=\ln(1+\textit{simple rate})$$

Table 5 reports the estimation results of T-M-FF (7) market-timing models using logarithmic excess returns. It can be observed that in the case of all funds, we have received almost the same estimator values as when using simple excess returns (see Table 3). The R-squared values in Table 5 up somewhat relative to the values in Table 3. We have received similar regression effects of H-M-FF (8) market-timing models using logarithmic excess returns but due to the space restriction, we do not report full results.

Table 5. Three-factor T-M-FF model (7) with the orthogonalized *SMBO* and *HMLO* factors (logarithmic excess returns from Jan 2, 2003 to Dec 31, 2009)

	Equity funds	$\hat{\alpha}_P$	$\hat{\beta}_P$	$\hat{\delta}_{1P}$	$\hat{\delta}_{2P}$	$\hat{\gamma}_P$	R^2
1	Arka BZ WBK Akcji FIO	0.0006***	0.713***	0.049***	0.049***	-2.06***	0.626
2	Aviva Investors FIO Polskich Akcji	0.0005***	0.749***	-0.011	0.023**	-1.96***	0.693
3	BPH FIO Akcji	0.0001	0.710***	-0.002	0.031***	-0.95***	0.718
4	DWS Polska FIO Top 25 Małych Spółek	0.0002	0.400***	0.182***	0.077***	-1.45***	0.299
5	DWS Polska FIO Akcji	0.0002	0.623***	0.025	0.018	-1.34**	0.374
6	DWS Polska FIO Akcji Plus	0.0002	0.537***	0.080***	0.027	-1.22**	0.356
7	ING FIO Akcji	0.0001	0.741***	-0.002	0.028**	-0.89**	0.697
8	Legg Mason Akcji FIO	0.0003	0.690***	0.0009	0.036***	-1.02***	0.702
9	Millennium FIO Akcji	0.0000	0.671***	0.011	0.051***	-1.05***	0.675
10	Pioneer Akcji Polskich FIO	0.0000	0.810***	-0.015	0.035***	-1.61***	0.701
11	PKO/CREDIT SUISSE Akcji FIO	0.0003	0.552***	0.017	0.029*	-2.23***	0.424
12	PZU FIO Akcji KRAKOWIAK	0.0001	0.699***	-0.018	0.036***	-1.38***	0.690
13	SEB 3 – Akcji FIO	0.0003	0.506***	0.075***	0.019	-1.64***	0.316
14	Skarbiec – Akcja FIO	0.0003	0.444***	0.060***	0.014	-0.43	0.279
15	UniKorona Akcja FIO	0.0004	0.501***	0.080***	0.021	-1.01*	0.310

Source: author's calculations (using *Gretl 1.8.5*)

Table 5 reports the estimation results of T-M-FF (7) market-timing models using logarithmic excess returns. It can be observed that in the case of all funds, we have received almost the same estimator values as when using simple excess returns (see Table 3). The R-squared values in Table 5 up somewhat relative to the values in Table 3. We have received similar regression effects of H-M-FF (8) market-timing models using logarithmic excess returns but due to the space restriction, we do not report full results.

CONCLUSION

In this paper we have examined the usefulness of the orthogonalized *SMBO* and *HMLO* factors as explanatory variables in market-timing models for the investment managers' performance evaluation. We have confirmed that the quality increase of the models is rather small. To summarize, basing on the empirical analysis it can be concluded that there is no clear reason to prefer the three-factor T-M-FF (7) and H-M-FF (8) models over those given by the equations (1) and (2). This evidence is consistent with the literature, for example [Fama & French 1993, pp. 31].

REFERENCES

Adkins L.C. (2009) Using Gretl for Principles of Econometrics, Third edition, Version 1.31, July 20.

Bollen N. P. B., Busse J.A. (2001) On the timing ability of mutual fund managers, The Journal of Finance, 56 (3), pp. 1075-1094.

Busse J.A. (1999) Volatility timing in mutual funds: evidence from daily returns, The Review of Financial Studies, Vol. 12, No. 5, pp. 1009-1041.

Cambell J.Y., Lo A.W., MacKinlay A.O. (1997) The Econometric of Financial Markets, Princeton University Press, New Jersey.

Fama E.F. (1972) Components of investment performance, The Journal of Finance, 27, pp. 551-567.

Fama E.F., French K.R. (1993) Common risk factors in the returns on stocks and bonds, Journal of Financial Economics, 33, pp. 3-56.

Henriksson R., Merton R. (1981) On market timing and investment performance. II. Statistical procedures for evaluating forecasting skills, Journal of Business, 54, pp. 513-533.

Henriksson R. (1984) Market timing and mutual fund performance: an empirical investigation, Journal of Business, 57, pp. 73-96.

Jensen M. (1968) The performance of mutual funds in the period 1945-1964, Journal of Finance, 23, pp. 389-416.

Kufel T. (2009) Ekonometria. Rozwiązywanie problemów z wykorzystaniem programu Gretl, PWN, Warszawa.

Maddala G.S. (2008) Ekonometria, PWN, Warszawa.

Marshall B.R., Young M. (2003) Liquidity and stock returns in pure order-driven markets: evidence from the Australian stock market, International Review of Financial Analysis, 12, 173-188.

Merton R. (1981) On market timing and investment performance. I. An equilibrium theory of value for market forecasts, Journal of Business, 54, 363-406.

Olbryś J. (2010) Three-factor market-timing models with Fama and French spread variables, Badania Operacyjne i Decyzje, 2/2010, in progress.

Olbryś J. (2008a) Parametric tests for timing and selectivity in Polish mutual fund performance, Optimum. Studia Ekonomiczne, Wydawnictwo Uniwersytetu w Białymstoku, 3(39), pp. 107-118.

Olbryś J. (2008b) Ocena umiejętności stosowania strategii market-timing przez zarządzających portfelami funduszy inwestycyjnych a częstotliwość danych, Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania 10, Uniwersytet Szczeciński, pp. 96-105.

Romacho J. C., Cortez M. C. (2006) Timing and selectivity in Portuguese mutual fund performance, Research in International Business and Finance, 20, 348-368.

Treynor J., Mazuy K. (1966) Can mutual funds outguess the market?, Harvard Business Review, 44, pp. 131-136.

Zellner A. (1962) An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias, Journal of American Statistical Association, 57, pp. 348-368.