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TIMING ABILITIES OF CROATIAN MUTUAL FUNDS: A THRESHOLD REGRESSION APPROACH

MOGUĆNOSTI TEMPIRANJA TRŽIŠTA HRVATSKIH INVESTICIJSKIH FONDOVA: PRISTUP *THRESHOLD* REGRESIJE

ABSTRACT: Market-timing abilities of mutual funds are an issue which has been extensively researched on different markets all over the world. Henriksson-Merton model is a usual way to empirically test for presence of those abilities. However, researchers assume that all of the funds are characterized with the same threshold value in the Henriksson-Merton model framework. This paper goes beyond the simple assumption of the zero value of the threshold in the mentioned model. Main question in the research is whether each fund has its own threshold value. The paper tests for individual threshold effects for a sample of 27 mutual funds in Croatia for the period June 1st 2012 to May 27th 2014. The results indicate that each fund has its own threshold value in the model, but only 7 funds exhibit market-timing strategies.

KEY WORDS: Market-timing strategy, mutual funds, threshold regression, Croatian capital market, Henriksson-Merton model.

SAŽETAK: Mogućnosti tempiranja tržišta investicijskih fondova je pitanje koje se već dugi niz desetljeća istražuje na različitim tržištima. Henriksson-Merton model je uobičajena metodologija koja se koristi za provođenje testa tempiranja tržišta. Međutim, istraživači pretpostavljaju da sve fondove označava jednaka vrijednost *threshold* varijable u okviru Henriksson-Merton modela. Ovaj rad nadilazi jednostavnu pretpostavku da je vrijednost spomenute varijable jednaka nuli za sve fondove. Kao glavno istraživačko pitanje postavlja se, postoji li zasebna vrijednost *threshold*-a za svaki fond. Testira se prisustvo *threshold* učinaka na uzorku od 27 investicijskih fondova u Hrvatskoj za razdoblje od 1. 6. 2012. do 27. 5. 2014. godine. Rezultati analize upućuju da svaki fond ima vlastitu *threshold* vrijednost, ali samo njih 7 ostvaruje strategije tržišnoga tempiranja.

KLJUČNE RIJEČI: strategija tempiranja tržišta, investicijski fondovi, *threshold* regresija, hrvatsko tržište kapitala, Henriksson-Merton model.

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1. INTRODUCTION

When making investment decisions, investment funds employ different strategies in order to beat the market. Ever since they have been formed, both academics and investors in practice have been interested in evaluating their performance. This is reasonable, because investor wants to employ his scarce resources in the best possible way, and in that way he wants to find a best fund to invest in. Over the past couple of decades, a lot of different models, methods and techniques have been developed in order to evaluate some performance of the mutual funds. One of the most famous models is the Henriksson-Merton /14/ model (HM henceforward). This model assumes that the fund's excess return depends on the stock market excess return in a nonlinear way. The change of the relationship depends upon the threshold value of the stock market excess return. Henriksson and Merton /14/ assumed that this value is equal to zero. Thus, if this value is greater than zero, a standard CAPM relationship exists between the two aforementioned returns. When this value falls below zero, the beta in the model reduces its value. This means that a fund is a market timer; it will be more aggressive when the market is rising (bullish markets), and defensive when the market is falling (bearish market). In that way, funds gain greater risk premiums in bullish markets and suffer smaller losses in bearish markets compared to the market as a whole.

There has been a lot of research over the past couple of decades regarding these issues. Authors have been investigating funds both on developed markets as well as on emerging ones. All of the works implicitly assume that the relationship between the excess returns of each fund and the market should be as Henriksson and Merton /14/ describe. More precisely, market timers should react when the threshold value is greater or smaller than zero. By observing the performance of funds, it can be seen that they do not exhibit the same results and portfolios. Thus, it is reasonable to assume that each fund has its own threshold value of excess market return in the HM model. Only one paper /6/ has examined this possibility up until now. It was focused on the US mutual funds. Since there exists a deficiency of mutual fund analysis in Croatia, this paper hopes to contribute the existing literature. Moreover, this is a first type of this study in Croatia and South and Eastern Europe by testing for threshold effects in the HM model. Other purpose of the paper includes trying to identify adequate methodology to test these issues. The paper is structured as follows. Second section describes previous research regarding fund performance evaluation. The methodology is given in the third section. Fourth section describes the data and the results of the empirical investigation and the final, fifth section concludes the paper.

2. PREVIOUS RESEARCH

By observing the previous literature on market timing abilities of investment funds, it can be concluded that there exists a lot of research on this issue. Studies both on developed and developing market observe funds performance. However, the literature usually tests the model in its original form, with the assumption that the threshold value of the market excess return is equal to zero. This means that researchers implicitly assume that all of the analyzed funds should react in the same way when the market is transitioning into bullish or bearish one. When observing the characteristics of funds, this assumption becomes false.

Moreover, most of the studies analyze monthly data, but Bollen and Buse /3/ showed that using the daily data provides more forceful tests. Here, a brief overview of foreign and Croatian research is given.

Some of the early studies include the Treynor and Mazuy /28/ paper in which they assume a quadratic relationship exists between the market and fund's return. They examined 57 open-end mutual funds for the period from 1953 to 1962 and did not find evidence of timing strategies. After the HM /13/ model was developed, Henriksson /13/ investigated 116 mutual funds for the period from 1968 to 1980. He also did not find any evidence on market timing. The same year Chang and Lewellen /5/ investigated 67 mutual funds in USA for the period 1971-1979. They found little evidence of market timing abilities. Their results suggest that funds reverse their timing compared to the theoretical model.

Usual methodology for testing the market timing issue is to estimate the two original models with the implicit assumption that the threshold parameter of excess market return is equal to zero. In that way, they estimate regression modes with dummy variables. Some papers include other variables in the model, such as the size of the fund, its' age and similar characteristics (see Low /17/). There exist fewer studies which use non-parametric methods in order to evaluate market timing skills (see Cuthbertson et al. /7/ or Jiang /16/).In the newer studies we include the one of Friesen and Sapp /8/. They analyzed funds from the CRSP Survivor-Bias Free US Mutual Fund Database for the period 1991-2004. They conclude that the underperformance of the funds is a result of a poor timing strategy, in which funds reduce their annual returns by 1,56% each year. Malaysian funds were examined by Low /17/. In this paper, a five year period sample (from January 2000 to December 2004) is observed. Results indicate that funds with high exposure to broad market movements have timing abilities but poor selectivity performance. Moreover, the bigger the fund gets, the poorer the selectivity performance becomes. Prather et al. /22/ investigated Australian funds (for the period from June 1993 to May 1998). They were unable to conclude whether there exists timing ability using one part of the tests, and the other part of the study suggested that there are not any differences between the performances of funds managed by teams or managed by individuals. Greek mutual funds have been analyzed by Philipas and Tsionas /21/. For the period January 1996 to December 1999 they concluded what majority of the previous works has already observed: fund managers fail to have market timing abilities. However, a great number of funds have the ability to pick under valuated assets. Cuthbertson et al. /7/ tested UK funs (for the period January 1988 to December 2002) for market timing abilities. Only 1% of funds realized positive market timing ability, whilst 19% of the funds exhibit negative timing strategy. Indian mutual funds were investigated in Miglani /19/ for the period 1999-2004. The results are not surprising that only 2% of the funds are timing the market in the right direction. This is in accordance with other mentioned studies. Tripathy /29/ also investigated the Indian funds for an earlier period 1992-2003 and the conclusions were the same. There are many more works on this topic, both for developed markets and emerging ones as well. Only the research of Chou et al. /6/ applied testing of the threshold value for US mutual funds for daily data from January 1st 2000 to January 31st 2003. They detected timing ability for only 4 out of 17 analyzed funds. However, each fund had its own threshold value of excess market return.

If we examine the Croatian literature dealing with Croatian funds, there are two groups of papers. First group deals mostly with descriptive statistics of mutual funds (see

Valdevit et al. /30/). The second group analyses the performance of the fund industry. Here we include the paper of Sajter /23/ in which he calculates Jensen alphas for 5 equity funds for the period before and after the financial crisis in 2008. He concluded that funds exhibit underperformance compared to the market return.

Balen et al. /2/ investigated Croatian, Slovenian and Bosnian and Herzegovinian funds for the period 1999-2005. They applied a Treynor-Mazuy /28/ model in order to detect market timing abilities, but only found that 1 out of 14 Croatian fund is characterized with timing abilities. Finally, paper of Škrinjarić /24/ is the only one left which estimated both the Treynor-Mazuy and Henriksson-Merton model for a sample of 10 funds for the period December 2002 – November 2011. She had similar conclusions as the previous mentioned paper of Balen et al. /2/ that the Croatian funds lack of market timing abilities.

Thus, it can be concluded that there have been emerging a lot of studies of funds timing abilities on stock market in the foreign research. Croatian research is still rather scarce. Majority of the few studies employ the original Henriksson-Merton model with the assumption of a zero value of the threshold. If each fund has its own threshold value (different from zero) the results from the estimation with the zero value assumption can be misleading. Thus, this paper aims to shed some light into the market timing abilities of Croatian funds with the assumption that each fund has its own threshold value in the Henriksson-Merton model. In that way, if individual threshold effects are found, model used in this study can explain fund behavior better than previous models. Potential investors can then use the results to plan their investment schemes.

3. METHODOLOGY

Henriksson and Merton /14/ proposed the following model to empirically evaluate the fund's market timing:

$$R_{it} - R_{ft} = \alpha + \beta\left(R_{mt} - R_{ft}\right) + \delta D_t\left(R_{mt} - R_{ft}\right) + \varepsilon_t, \tag{1}$$

where R_{it} denotes the return on fund i, R_{ft} a risk free return rate, R_{mt} the market return rate (approximated usually by a stock market index). The parameter α is the parameter of selectivity ability, β can be interpreted as the CAPM beta and δ denotes the parameter measuring market timing ability (if positive and statistically significant, it implies the existence of a timing ability of a fund). ε_t is the error term and

$$D_t = \begin{cases} -1, & \text{if } R_{mt} - R_{ft} \le 0 \\ 0, & \text{if } R_{mt} - R_{ft} > 0 \end{cases}. \tag{2}$$

Of course, equation (1) can be expressed in the following way:

$$R_{it} - R_{ft} = \begin{cases} \alpha_1 + \beta_1\left(R_{mt} - R_{ft}\right) + \varepsilon_t, & \text{if } R_{mt} - R_{ft} \le 0 \\ \alpha_2 + \beta_2\left(R_{mt} - R_{ft}\right) + \varepsilon_t, & \text{if } R_{mt} - R_{ft} > 0 \end{cases}, \tag{3}$$

where $\beta_1 = \beta - \delta$, $\beta_2 = \beta$. The model given in (3) is in the form of a threshold regression model. The threshold level is $\gamma = 0$. The Henriksson-Merton model is basically a special case of a threshold regression model, where the threshold level is known. When the threshold value is $\gamma > 0$, the market is bullish, thus, the slope of the equation (1) is β, but when the market is bearish ($\gamma \leq 0$), the slope is equal to $\beta - \delta$. This indicates that if funds are market timers, they aim to be more aggressive when the markets are rising and defensive when the market is falling. However, it is a strict assumption that all of the funds have the same threshold $\gamma = 0$. In this study we aim to estimate for each observed fund its threshold (if it exists).

The threshold regression methodology is briefly explained by following Hansen /11, 12/. Let us assume we are observing the following model:

$$y_t = \begin{cases} \theta_1' x_t + \varepsilon_t, & \text{if } q_t \leq \gamma \\ \theta_2' x_t + \varepsilon_t, & \text{if } q_t > \gamma \end{cases}, \tag{4}$$

where q_t is the threshold variable. The model can be written in a single equation:

$$y_t = \theta' x_t + \delta' x_t(\gamma) + \varepsilon_t,\ t \in \{1, 2, ..., T\}, \tag{5}$$

where $\theta' = \theta_2'$, $\delta' = \theta_2' - \theta_1'$, $x_t(\gamma) = x_t d_t(\gamma)$, $d_t(\gamma)$ is a dummy variable $d_t(\gamma) = \{q_t \leq \gamma\}$ where $\{\cdot\}$ is the indicator function. To be more compact, a matrix notation of the model (5) can be observed:

$$\boldsymbol{Y} = \boldsymbol{X}\theta + \boldsymbol{X}_\gamma \delta + \boldsymbol{e} \tag{6}$$

where $\boldsymbol{Y}, \boldsymbol{e} \in \mathbb{R}^T$, X, $\boldsymbol{X}_\gamma \in M_{t,m}$. Parameters θ, δ and γ are estimated by the conditional LS method with the condition of γ to be restricted to a bounded set (in empirical research, the bounds for γ are usually defined by excluding 15 percent of lowest and 15 percent of highest values of the sample). Thus, the concentrated sum of squared error function is the following one:

$$S_T(\gamma) = S_T\left(\hat{\theta}(\gamma), \hat{\delta}(\gamma), (\gamma)\right) = Y'Y - Y'X_\gamma^*\left(X_\gamma^{*\prime} X_\gamma^*\right)^{-1} X_\gamma^{*\prime} Y. \tag{7}$$

The consistency threshold value $\hat{\gamma}$ is defined as

$$\hat{\gamma} = \arg\min_\gamma S_T(\gamma). \tag{8}$$

In order to test the hypothesis $H_0: \gamma = \gamma_0$, an LR test is conducted, where the test statistic is calculated as given in Hansen /12, pp. 582/:

$$LR_T(\gamma) = T \frac{S_T(\gamma) - S_T(\hat{\gamma})}{S_T(\hat{\gamma})}, \tag{9}$$

and the p-value is constructed based on bootstrap replications. Test value given in (9) is based upon the assumption of homoskedasticity of error terms. However, if there exists heteroskedasticity of the error terms, the test statistic in (9) is corrected by the estimated value $\hat{\eta}$ of the nuisance parameter

$$\eta = \frac{E\left((\delta' x_i)^2(\varepsilon_i^2 / \sigma^2) \,|\, q_i = \gamma_0\right)}{E\left((\delta' x_i)^2 \,|\, q_i = \gamma_0\right)}. \tag{10}$$

Thus, (9) becomes

$$LR_T^*\left(\gamma\right) = \frac{LR_T\left(\gamma\right)}{\hat{\eta}}. \tag{11}$$

More details on the threshold regression, testing for the threshold value and other aforementioned issues can be seen in Tong /26, 27/, Hansen /10, 11, 12/, Andrews and Ploberger /1/ and Chan /4/.

4. EMPIRICAL RESULTS

Data on daily NAV (net asset value) for the period from June 1st 2012 to May 27th 2014 on 27 Croatian mutual funds was collected from the Hrportfolio /15/. Open-end funds which invest into stocks the majority of their resources are being analyzed because previous research assumes that these funds should exhibit the most pronoun timing strategies. Furthermore, data on index CROBEX[1] was collected from the Zagreb Stock Exchange /31/ for the approximation of the stock market return. Finally, in order to calculate excess returns, data on the Treasury bill interest rate was collected from the Ministry of Finance /20/ (91 day bill). The analysis was performed in Stata 13. Daily returns were calculated by using the following formula:

$$R_{it} = \ln\left(\frac{P_{it}}{P_{it-1}}\right), \tag{12}$$

where P_{it} denotes daily net asset value for the i-th fund and daily value of the index CROBEX. The excess returns were calculated by subtracting the Treasury bill interest rate from the original return series. Daily frequencies were used because Bollen and Busse /3/ showed that daily tests are more forceful compared to other frequencies.

Mutual fund industry in Croatia had a good start around year 2000. Net asset value had growth rates around 200% in 2000 and 2001 (HANFA /9/). After the initial boom, in the years which followed, the average growth rate of the assets was around 50% up until

[1] Croatian stock market index was used as a proxy for the stock market return although the majority of funds invest on other markets as well. Since data on detailed geography structure of investments fund portfolios was not available when this study was conducted, composite stock market index was not been able to be calculated.

2008. The financial crisis had a great impact on the financial market in Croatia, and as well on the mutual fund industry. Net asset value has dropped by more than 110% in 2008 compared to the previous year. In the years which followed, the recovery is mild, and the asset value is estimated around 13,5 billion HRK, which is less compared to the value before the crisis (16 billion in 2006 and 30 billion in 2007). Capital market in Croatia is in a similar situation (for details see Škrinjarić and Besek /25/): its' liquidity is low with low level of development. The mutual fund industry is also underdeveloped compared to other countries (some of them were analyzed in the literature overview).

Table 1. Descriptive statistics of analyzed funds, for the period June 1st 2012 to May 27th 2014

Fund	$\bar{R}$	*Max*	*Min*	σ	α_3	α_4	*Corr*
CT	-0,0115	0,0092	-0,0329	0,0070	-0,5204	2,9921	0,7955
EAE	-0,0117	0,0444	-0,0426	0,0073	0,2500	9,9050	0,6938
FE	-0,0120	0,0984	-0,1762	0,0120	-4,9200	94,578	0,2353
HIG	-0,0115	0,0099	-0,0386	0,0081	-0,4506	3,0204	0,6050
HPBD	-0,0116	0,0078	-0,0390	0,0069	-0,7284	3,3059	0,7173
IAT	-0,0120	0,0204	-0,0434	0,0089	-0,1857	3,3560	0,4063
IBRIC	-0,0121	0,0149	-0,0469	0,0098	-0,0714	3,2296	0,4912
IJIE	-0,0116	0,0243	-0,0496	0,0097	-0,1885	3,8448	0,4764
KDE	-0,0116	0,0159	-0,0541	0,0105	-0,3737	3,2945	0,4521
KDPI	-0,0115	0,0162	-0,0391	0,0089	-0,2708	3,2011	0,5368
KDV	-0,0111	0,0266	-0,0389	0,0082	-0,3108	4,8579	0,5902
NF	-0,0117	0,0084	-0,0360	0,0079	-0,3015	2,7512	0,5424
NGD	-0,0116	0,0112	-0,0416	0,0083	-0,3896	3,0332	0,5346
NNE	-0,0119	0,0172	-0,0510	0,0092	-0,5190	4,5543	0,4588
NUSA	-0,0113	0,0282	-0,0679	0,0133	-0,5221	4,2551	0,3754
OTPI	-0,0117	0,0103	-0,0466	0,0076	-0,5330	4,0188	0,9829
OTPM	-0,0113	0,0025	-0,0386	0,0070	-0,7821	3,2606	0,6932
PBZE	-0,0116	0,0057	-0,0385	0,0068	-0,7413	3,2667	0,7845
PBZI	-0,0119	0,0212	-0,0702	0,0100	-0,4862	5,3271	0,4874
PBC	-0,0115	0,0084	-0,0369	0,0078	-0,4638	3,2247	0,5663
PGO	-0,0114	0,0109	-0,0416	0,0085	-0,3848	3,0712	0,5142
RAA	-0,0115	0,0072	-0,0421	0,0078	-0,8713	3,7784	0,5947
RNE	-0,0114	0,0127	-0,0396	0,0090	-0,4528	3,2911	0,5335
RW	-0,0116	0,0185	-0,0372	0,0073	-0,6041	3,5665	0,6947
VBC	-0,0117	0,0157	-0,0455	0,0084	-0,3041	3,8206	0,9361
ZBA	-0,0115	0,0791	-0,0330	0,0080	2,4943	34,990	0,5358
ZBB	-0,0118	0,0187	-0,0491	0,0096	-0,1531	3,3458	0,4864
CROBEX	-0,0118	0,0114	-0,0468	0,0078	-0,5339	3,9860	-

Source: author's calculation

Note: $\bar{R}$ denotes the mean excess return on *i*-th fund, *Max* the maximum excess return, *Min* the minimum excess return, σ standard deviation, α_3 coefficient of skewness, α_4 kurtosis and *Corr* stands for the coefficient of correlation with market excess return.

Descriptive statistics for each fund is given in the table 1. It can be seen that average excess return is actually a loss for every fund. Although, there was a chance to gain positive returns (up to 9,8%), funds also realized substantial losses at some points in the observed period. This is not unusual since the net asset value of all funds in Croatia has been declining in the last couple of years. The coefficient of skewness indicates that the majority of the funds had fallen in 2014 by 2,12% compared to the previous year (HANFA /9/). Distributions are negatively asymmetric (meaning that the losses which occurred were bigger compared to the positive returns achieved in the observed period). Finally, by looking at the coefficient of correlation between each funds excess return and the stock market excess return, it can be seen that most of the returns have similar co movements as the market return. This indicates in which intensity the analyzed funds invest on the Croatian capital market.

In the last row of table 1, we can observe descriptive statistics for the stock market excess return (CROBEX). 21 funds had a smaller loss compared to the market one, which can be a preliminary indicator that funds try to implement investment strategies in order to beat the market. Since the average stock market excess return is actually a loss and the coefficient of skewness indicates a negative asymmetry of data, it can be expected that the estimated threshold parameter will be a negative value.

Afterwards, a Likelihood ratio test was performed for each analyzed fund, in order to test the existence of a threshold value γ for the equation (5). The results are given in table 1. As it can be seen, out of 27 funds, only 4 resulted in not rejecting the hypothesis of no threshold. There exists evidence of nonlinearity in the relationship between the excess fund and excess market return. Thus, a threshold regression is going to be estimated for funds with respect to the results from table 2.

Table 2. Likelihood ratio test results for each fund

Fund	*LR* test	*p*-value	Fund	*LR* test	*p*-value
CT	21,281	$0,005^{***}$	NUSA	3,337	0,822
EAE	27,536	$0,000^{***}$	OTPI	8,173	0,113
FE	23,437	$0,000^{***}$	OTPM	38,224	$0,000^{***}$
HIG	17,386	$0,001^{***}$	PBZE	32,249	$0,000^{***}$
HPBD	11,740	$0,026^{**}$	PBZI	9,152	0,107
IAT	38,723	$0,000^{***}$	PBC	27,514	$0,000^{***}$
IBRIC	21,472	$0,000^{***}$	PGO	16,063	$0,002^{***}$
IJIE	16,087	$0,002^{***}$	RAA	18,030	$0,003^{***}$
KDE	7,459	0,225	RNE	40,229	$0,000^{***}$
KDPI	17,674	$0,001^{***}$	RW	9,398	$0,096^{*}$
KDV	16,803	$0,002^{***}$	VBC	10,366	$0,048^{**}$
NF	22,544	$0,000^{***}$	ZBA	31,786	$0,000^{***}$
NGD	19,721	$0,001^{***}$	ZBB	10,880	$0,048^{**}$
NNE	13,484	$0,012^{**}$			

Source: author's calculation

Note: the abbreviations for each fund are explained in the Appendix. *LR* test stands for the LR test statistic for the test $H_0 : \gamma = \gamma_0$. *p*-value stands for the bootstrapped *p*-value computed with 2000 replications. ***, ** and * stand for the statistical significance on 1%, 5% and 10% level respectfully.

The results from the estimation of the threshold model for each fund are given in table 3. First of all, the estimated threshold value for each fund is below the Henriksson-Merton value of zero. This indicates that funds react to the changes on the market when the excess market return becomes a loss. Some funds react when the excess market return is –2,2%, which can bring big losses to the portfolio. Half of the funds stay longer in the state of $q_t \leq \hat{\gamma}$ and the other half in the state when $q_t > \hat{\gamma}$. Thus, there are not any visible strategies of the funds on the Croatian capital market. The results in this paper differ from previous literature which was reviewed in section 2 due to the different methodology. The methodology used in this study enabled us to find an individual threshold value for each fund. Previous methodology assumed equal value of zero for each fund which could be misleading in the model and could result with wrong conclusions on market timing abilities.

If we observe the estimated coefficients for each equation, we can give couple of conclusions. Only two estimated alphas were found to be non significant, but almost all of them have a negative sign, which indicates a lack of selectivity ability. Moreover, by observing the estimated betas, 11 funds exhibit such behavior that betas become insignificant in one of the equations; the funds do not follow the market trends. The reason can be found in the explanation that in those periods they focus on other markets. Furthermore, only 7 funds exhibit market timing behavior. Their betas are bigger when $q_t > \hat{\gamma}$ holds, compared to betas when $q_t \leq \hat{\gamma}$ holds. This means that these funds increase their systematic risk in order to receive a bigger risk premium when the market is bullish. On the other hand, when they anticipate the bearish market, they reduce the risk. All other funds worsen their strategies when the market is falling. Although market timing is present in 7 funds, all of the estimated betas for all of the funds are found to be less than unit value. Interpreting this in the context of the CAPM model, funds exhibit defensive behavior. This is a surprising finding, given the fact that the analyzed funds invest their resources mostly in stocks which are found to be more risky compared to other types of securities.

Finally, some conclusions can be made. The *LR* test indicated existence of a nonlinear relationship between the funds and market return for majority of the funds. This is a first indicator of a market timing strategy on the Zagreb Stock Exchange. In order to analyze the quality of the timing strategy, parameters of model (4) needed to be estimated. Based on the results from the previous literature, the results in this analysis are not very surprising that funds lack of market timing skills. This is in accordance with the previous findings. In that way, small investors should not fear of the funds' strategies as superior ones. Although, small investors could invest their resources into funds with the goal of achieving dividends over a longer run. Funds are advised to reconsider their trading strategies in a way to achieve better results when the market is changing from bullish to bearish and vice versa.

Table 3. Threshold regression estimate for each fund

Fund	$\hat{\gamma}$	Joint R^2	No_1	$\hat{\alpha}_1$	$\hat{\beta}_1$	No_2	$\hat{\alpha}_2$	$\hat{\beta}_2$
CT	-0,01608	0,7027	121	0,007 (4,9615)	0,5723 (9,1339)	373	-0,0043 (-11,7283)	0,5271 (14,0527)
EAE	-0,01626	0,6621	119	0,0066 (3,9839)	0,6189 (8,5457)	375	-0,0044 (-10,5231)	0,5106 (11,9933)
FE	-0,01205	0,5009	219	-0,0032 (-2,6409)	0,7156 (11,5006)	275	-0,0056 (-9,7277)	0,3479 (4,5752)
HIG	-0,02200	0,3846	51	-0,0182 (-3,4742)	0,1889 (0,9846)	443	-0,0047 (-7,8993)	0,5466 (10,6989)
HPB	-0,00539	0,5489	401	-0,0017 -3,4843)	0,7798 (22,6614)	93	-0,0064 (-9,6068)	0,3405 (1,6975)
IAT	-0,01556	0,2078	136	-0,0116 (-4,0687)	0,3124 (2,418)	358	-0,0085 (-10,3122)	0,1277 (1,4542)
IBRIC	-0,00887	0,2647	303	-0,0038 (-2,7758)	0,6670 (8,4184)	191	-0,0077 (-7,9861)	-0,1856 (-1,1389)
IJIE	-0,02200	0,2249	51	-0,0233 (-3,0855)	0,0148 (0,0535)	443	-0,0053 (-6,1181)	0,4899 (6,6358)
KDPI	-0,01001	0,3125	269	-0,0033 (-2,4404)	0,6854 (8,9414)	225	-0,0066 (-7,8825)	0,1085 (0,8445)
KDV	-0,01414	0,3784	170	-0,0048 (-2,5399)	0,6189 (6,7577)	324	-0,0056 (-8,134)	0,2903 (3,6128)
NF	-0,01556	0,3382	136	-0,0125 (-5,4206)	0,2891 (2,7689)	358	-0,0066 (-9,9446)	0,2934 (4,1341)
NGD	-0,02200	0,3235	51	-0,0297 (-5,3361)	-0,2595 (-1,2699)	443	-0,0054 (-8,5397)	0,4830 (8,8808)
NNE	-0,01407	0,2295	171	-0,0100 (-4,2358)	0,3738 (3,2886)	323	-0,0067 (-7,6963)	0,3133 (3,1199)
OTP	-0,00491	0,5196	413	-0,0015 (-2,7759)	0,7723 (19,4952)	81	-0,0066 (-12,8899)	0,3852 (2,8912)
PBZE	-0,01647	0,6453	118	-0,0056 (-3,3749)	0,6512 (9,0234)	376	-0,0049 (-12,1036)	0,4709 (11,201)
PBC	-0,01009	0,3609	269	-0,0031 (-2,6592)	0,6820 (10,4651)	225	-0,0075 (-10,4817)	0,0039 (0,0359)
PGO	-0,02200	0,2958	51	-0,0214 (-3,6391)	0,0613 (0,2845)	443	-0,0057 (-8,5557)	0,4293 (7,4867)
RAA	-0,02200	0,3938	51	-0,0232 (-4,6139)	0,0182 (0,1029)	443	-0,0054 (-10,3129)	0,4694 (8,9266)
RNE	-0,01009	0,5289	269	-0,0010 (-1,0929)	0,8223 (15,781)	225	-0,0067 (-11,6748)	0,1179 (1,3497)
VBC	-0,00374	0,8804	435	-0,0005 (-1,5007)	0,9724 (47,1322)	59	0,0015 (3,9018)	0,9550 (8,6548)
ZBA	-0,01598	0,3409	123	-0,0098 (-3,8167)	0,4249 (3,7603)	371	-0,0071 (-10,5823)	0,2209 (3,2074)
ZBB	-0,02132	0,2527	60	-0,0207 (-3,9949)	0,0635 (0,3292)	434	-0,0053 (-7,1961)	0,5198 (7,4885)

Source: author's calculation.

Note: $\hat{\gamma}$ denotes the estimated threshold value, No_1 and No_2 denote number of observations which belong to the state $q_t \leq \hat{\gamma}$ and $q_t > \hat{\gamma}$, respectfully. Columns $\hat{\alpha}_1$, $\hat{\beta}_1$, $\hat{\alpha}_2$, $\hat{\beta}_2$ refer to estimated values of each parameter and t-values are given in parenthesis.

5. CONCLUSION

Mutual funds and their trading strategies has been an object of investigation since their beginnings on financial markets. In Croatia, such funds have been emerging before the crisis. Although their number has reduced in the years following the crisis, there still exist investment possibilities on the market. In order to determine the quality of their strategies, a market timing strategy model has been empirically tested for a sample of 27 mutual funds in Croatia. Since previous studies dealt only with timing strategies with the threshold value of zero in Croatia, this paper wanted to extend the existing research by observing the possibility that each fund has its own threshold value of the excess market return they react to. It is not realistic to assume that each fund with its own strategies and different information forms the same market timing strategy on the capital market. First results indicated that there exists a nonlinear relationship between the excess returns.

By estimating the relationship between the individual funds return and market return, results indicated that there is a lack of timing abilities for the majority of the analyzed funds. Only 7 funds exhibit timing behavior. This means that when the market is bullish, the funds become more aggressive in order to earn bigger risk premiums. On the other side, when the market is bearish, funds become more defensive in order to achieve smaller losses compared to the market. Although, there exists evidence on the timing strategy behavior, all of the analyzed funds are characterized with betas smaller than the unit value. In terms of the CAPM model, beta measures the systematic risk of an analyzed security or fund, or in other words, the sensitivity of individual fund's returns to changes in the market return. Since all of the estimated betas are less than the unit value, the funds do not exhibit aggressive behavior. This is a surprising fact due to the nature of these funds. They mostly invest into stocks.

There were some shortfalls of this study. Only the original model was observed with only the excess market return included as an explanatory variable. Some previous studies included other variables to extend the model (see, for example /8/). Moreover, only the Croatian index CROBEX was used as a proxy of the market index. In the last couple of years the integration between stock markets around Croatia has been in place. Thus, a weighted index of different country indices could be constructed and included in future study. More work has to be done in the future research.

Finally, a conclusion can be made that the Croatian mutual funds should reconsider their investment strategies, because the sample of observed funds did not beat the market by timing their strategies in the observed period. It seems that they lack of forecasting abilities. Since this is one of the first studies on timing abilities of mutual funds on the Croatian and similar markets, and a first one on estimating thresholds for each fund, we hope to contribute to the existing literature.

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APPENDIX

Table A1. Abbreviations and explanation of each fund

CT – Capital Two	NUSA – Neta US Algorithm
EAE –Erste Adriatic Equity	OTPI – OTP indeksni
FE – Fima Equity	OTPM – OTP Meridian 20
HIG –HI Growth	PBZE – PBZ Equity
HPBD – HPB Dionicki	PBZI – PBZ I-stock
IAT – Ilirika Azijski tigar	PBC – Platinum Blue Chip
IBRIC – Ilirika BRIC	PGO –Platinum Global Opportunity
IJIE – Ilirika JIE	RAA – Raiffeisen Absolute Agressive
KDE – KD Energija	RNE – Raiffeisen New Europe
KDPI – KD Prvi izbor	RW – Raiffeisen World
KDV – KD Victoria	VBC – VB Crobex
NF – Neta Frontier	ZBA – ZB Aktiv
NGD –Neta Global Developed	ZBB – ZB BRIC+
NNE – Neta New Europe	

Table A2. 95% confidence interval estimation of γ

Fund	Interval	
	Lower	Upper
Capital Two	-0,01667	-0,01595
Erste Adriatic Equity	-0,01682	-0,00468
Fima Equity	-0,02396	-0,00487
HPB Dionicki	-0,02394	0,00584
Ilirika Azijski tigar	-0,02020	-0,00449
Ilirika BRIC	-0,01587	-0,00947
Ilirika JIE	-0,01430	-0,00114
KD Energija	-0,03343	0,00584
KD Prvi izbor	-0,02220	0,00201
KD Victoria	-0,01694	-0,00049
Neta Frontier	-0,01578	-0,01537
Neta Global Developed	-0,02220	-0,01940
Neta New Europe	-0,03134	0,00584
OTP Meridian 20	-0,00492	-0,00491
PBZ Equity	-0,01682	-0,00488
Platinum Blue Chip	-0,01430	-0,00114
Platinum Global Opportunity	-0,02220	0,00201
Raiffeisen Absolute Agressive	-0,02209	-0,01940
Raiffeisen New Europe	-0,01694	-0,00447
VB Crobex	-0,02548	-0,00149
ZB Aktiv	-0,01647	-0,01578
ZB BRIC+	-0,02132	-0,02132

Source: author's calculation