Equilibrium. Quarterly Journal of Economics and Economic Policy
Volume 17 Issue 4 December 2022
p-ISSN 1689-765X, e-ISSN 2353-3293
www.economic-policy.pl

ORIGINAL ARTICLE

Citation: Perez, K., & Szymczyk, Ł. (2022). Actual rate of the management fee in mutual funds of different styles. *Equilibrium. Quarterly Journal of Economics and Economic Policy, 17*(4), 969–1014. doi: 10.24136/eq.2022.033

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Article history: Received: 3.06.2022; Accepted: 4.11.2022; Published online: 30.12.2022

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Actual rate of the management fee in mutual funds of different styles

JEL Classification: *G12; G14; G23*

Keywords: *actual rate of the management fee; before-fee fund return; mutual fund operating model; mutual fund styles*

Abstract

Research background: Exponential growth of passive mutual funds after 2007–2008 global financial crisis put pressure on active fund managers to lower the management fees. The real costs of active fund management are, however, very often higher than the values of management fees reported publicly. Thus it is not easy to decide on the quality of the fund management and estimate the level of management charges optimal for the future fund performance.
Purpose of the article: In this study, we propose to utilize an actual rate of the management fee (ARMF) disclosed in the management company financial statements as a measure of the real value of the management costs and investigate its determinants in mutual funds of different styles.
Methods: Using a dataset of 21,618 monthly observations for 500 mutual funds from a market of diversified structure and high management fees charged we test the operating model of a mutual fund performance, and derive the formula of a before-fee return with the ARMF as its component. The fund performance is measured by a raw before-fee return and two types of risk-adjusted alphas based on the multifactor model of Carhart (1997) and the fund attributes. Later, using panel data we explain ARMF by mutual fund performance and attributes. We also compare the results to the ones obtained for the total operational cost (TOC) — a value similar to ARMF that is disclosed in mutual fund financial reports.
Findings & value added: We find that the proposed ARMF is related more to the size and not to the performance, age or a cash flow of mutual funds. We observe it among all studied fund styles.

The largest deviations of the average ARMF are seen in the management companies that belong to the banks' capital groups. The proposed measure of the management fee included in the operating model of a mutual fund performance can be used for any local mutual fund worldwide, and compared with other fund markets of more or less diversified style structures.

Introduction

The increasing growth of the mutual fund industry and its international competition over the last few decades, has brought a lot of attention to the relation between a fund management cost and a fund performance. Academic evidence shows that higher management costs are typical for losing — not winning — funds that underperform even the low-cost index funds (Ferreira *et al*., 2013; Gil-Bazo & Ruiz-Verdu, 2009; Malkiel, 2013). This evidence comes from the most mature mutual fund industry in the United States, and is based on the analysis of the total expense ratio (TER) as a measure for the management costs. TER includes charges that are both directly and indirectly connected to a mutual fund management1. For US mature mutual fund market with a long-recorded history, a stable cost structure and a high competition level, it is a sufficient enough subject of study. However, this may not be enough for other mutual fund markets that are characterized with a higher volatility of volume of direct management costs throughout any given year. Moreover, the level of the competition in these markets is not so high as in the United States and the cost structure varies significantly among mutual funds managed by different companies. Therefore, in order to study the relation between mutual fund management costs and a fund performance in such markets another value and measure should be considered.

In this study, we propose the actual rate of the management fee (ARMF) and investigate its determinants in mutual funds of different styles. ARMF is the total income of a management company from providing a service of managing mutual funds that is disclosed in the semi-annual and annual financial statements of this management company. It conveys the quality of a mutual fund management for the reason that it includes only the actual spending that is connected to a fund management, and no other operating expenses of funds. This study presents how ARMF is included in the operating model of a mutual fund performance and seeks the mutual fund attributes that determine its value. ARMF is further compared to a similar value of mutual fund management costs in order to investigate their quality

[1] The direct costs are the portfolio management costs and the indirect ones are the administration, compliance costs, legal costs, accounting services, and payments to distributors.

that has not yet been challenged in the literature. The additional value of this study stems from the fact that the analysis of determinants of ARMF is conducted for funds of different styles; not only equity funds that dominate the mutual fund research, but also hybrid, fixed income, money market, and absolute return funds. These funds may be dominant in the structure of a fund market, therefore the level of average management fees charged by management companies may differ among the local markets worldwide.

There are three aims of this study: 1. to present the mutual fund operating model of a mutual fund performance that is controlled with the actual rate of the management fee; 2. to find the determinants of the ARMF in equity, hybrid, fixed income, money market, and absolute return funds; 3. to find which value of a management cost is better predicted by the fund attributes — the proposed ARMF or the total operational cost (TOC) that contains the former. The mutual fund operating model that initiates this study catches high volatility of the fund net asset value (NAV) and cash flows (CFs) changes because it allows calculating these values for each trading day. That leads to deriving a formula for a before-fee return. We calculate such returns using a dataset of 21,618 monthly observations for 500 mutual funds operating in the biggest European emerging fund market of Poland. Next, using panel data, we examine determinants of the level of proposed ARMF according to the mutual fund styles. Finally, we compare the results with the results for the TOC, which is a standardized book value from the financial statements of mutual funds. This value is similar to ARMF, but it does not fully reflect the actual cost of mutual fund management. We treat it as an alternative to ARMF and as an element of our robustness test. This allows us to conclude about the usefulness of the proposed measure.

This study makes the following contributions to the literature. First, the ARMF is tested as a reliable measure of a management fee for mutual funds operating in any market worldwide. In the theory and practice of mutual funds, we can find three management cost measures disclosed in the mutual fund documents: total expense ratio (TER), ongoing charge figure (OCF) and total operational cost (TOC). All three indicators are imperfect. TER contains some costs not directly related to the fund's investment activity and doesn't contain some costs that are directly connected to this activity; in particular, it excludes transaction costs or interest paid by a management company on loans or credits. Such interest payments are a tool to reduce taxes and shift profits via indirect dividends (Białek-Jaworska & Klapkiv, 2021). OCF reflect the same costs as TER, but it still has a short history. It is published periodically in the Key Investor Information Document (KIID) — a simplified prospectus of two pages that is mandatory in the European Union since 2013 and changes every time the parameters connected to a single fund change[2]. Finally, TOC incorporates a management cost and other limited and unlimited operating expenses of a mutual fund which are not directly connected to the cost of fund portfolio management. All three measures are reported in relation to the NAV on a yearly basis; therefore, it is difficult to use them for mutual funds with management costs that are volatile throughout a year. The ARMF, with a special control variable named an *actual rate of the additional costs* (ARAC) equal to the difference between TOC and ARMF, overcomes these imperfections. It informs us about the real quality of a mutual fund management reflected in the delivered fund performance. It takes into account a total income of a management company from a given fund that includes both a management fee, and a performance fee. It can be measured in a half-yearly basis and, due to the low dynamics of this process, it can be also used in a monthly basis.

Second, our approach highlights the role of the management fee for the supply side of the mutual fund market. In practice, the level of a management fee is set by a management company due to a competition in sales and performance, or a risk level of similar style funds and a management company's own income. It is often motivated by the expectations of the management company shareholders. By introducing and investigating the actual rate of management fees, this study deepens the discussion on the meaning behind this fee for the supply side of this market.

Third, the gap within the characteristics of mutual funds that represent different investment styles is reduced. Individual and panel data on management fees; before-fee returns and mutual fund attributes, such as historical returns, age, size or cash flows of equity, hybrid, fixed-income, money market, and absolute return mutual funds; are taken into account. This allows for concluding about a comparison of the management fee determinants among these styles; this also assists in comparing the approach of a single management company, as a fund family, to the costs of managed fund styles.

Another reason for this study is that there is a shortage of research focusing on different mutual fund styles from markets which differ significantly and economically from the United States one[3]. Performance and

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[2] Collecting such data would be a very time-consuming task, which may be a reason as to why there is no data provider of information on OCFs from individual KIIDs.

[3] Chen *et al.* (2021b) recall the literature showing that there are statistically and economically significant differences (e.g. Ferreira *et al*., 2013, 2019), including the cultural ones (Keswani *et al*., 2020) in the conduct of mutual fund around the world and that the US fund industry has different features than in other countries.

attributes of actively managed equity funds operating within the U.S. market have been both vastly and thoroughly studied (from the early works of Sharpe (1966) and Jensen (1968, 1969), through the studies of Carhart (1997) or Berk and Green (2004); to more recent research of Brown and Wu (2016) or Huang *et al*. (2020) among others). This should come as no surprise, given that the U.S. mutual fund market has the longest (close to 100 years) history and currently accounts for roughly 45% of the total NAV of this market worldwide — half of which being equity funds[4]. The next 55% is divided among different funds from Europe (35%), Asia-Pacific (14%), and the rest of the world (6%). Not only does this 55% have a much younger and different history, but it also has a much more diversified fund styles structure. This raises a question about the determinants of management fees in markets with a lower level of maturity and a higher level of diversification in its fund styles structure than in the U.S. market. The literature on fund styles other than equity funds is sparse and our study covers this gap regarding the emerging countries in Europe.

The article is structured as follows. In section 2, we review the literature. In section 3, we present the data set. In section 4, we propose an operating model for a mutual fund performance; as well as derive the formula for the before-fee return with the ARMF as its component. In section 5, we relate the ARMF to the performance and other mutual fund attributes, as well as compare the results to the ones obtained for TOC. In section 6, we conclude.

Literature review

Mutual funds are sponsored by management companies that charge their clients a management fee as a promise of a positive expected return net of this fee. However, this promise is generally not met. Mutual funds either deliver zero net expected returns (Barras *et al*., 2010), as the equilibrium model of Berk and Green (2004) describes, or they persistently underperform (Carhart, 1997; French, 2008; Gruber, 1996) — at least at the gross level (Ferreira *et al*., 2013). Worse funds charge higher management fees and follow the strategy of fee-setting, in the presence of investors, with different degrees of sensitivity to performance (Gil-Bazo & Ruiz-Verdu, 2009). This is especially documented for actively managed U.S. equity funds — that of which are widely recognized in the literature. This is

[4] Birdthistle and Morley (2018) say even that “mutual funds are the way Americans invest today”.

where, in the majority cases, the fund performance is the focus of concern, and the management fee is among the variables that explain its value (Dumitrescu & Gil-Bazo, 2018; Fama & French, 2010; Sharpe, 1966).

This study focuses the attention towards the management fee. Undoubtedly, this fee is crucial for the net profit of both mutual fund investors and management companies. For investors, it is the biggest portion of expenses that they must cover in order to demand an expected performance. However, investors either examine the issue insufficiently and slowly (Anufriev *et al.*, 2019; Ferreira *et al.*, 2013; Gil-Bazo & Ruiz-Verdu, 2009; Schwarz & Sun, 2022), or they do not examine it at all (Birdthistle & Morley, 2018). The management fee is the largest number seen in a management company's income statement, which is used after the end of a fiscal year in order to calculate and distribute dividends to their shareholders[5]. The management fee has the advantage of being less severe than the performance fee in regards to solving the moral hazard problem that is generated by the principle-agent problem (Brown & Davies, 2017; Das *et al.*, 2010; Demski & Feltham, 1978; Stoughton, 1993). However, management company shareholders are in a better position than fund investors, due to the fund manager's behavior potentially aligning with the profit maximization of the company — rather than of the fund investors (Reynolds *et al.*, 2006). This might be a reason as to why the level of a management fee does not reward a realized fund performance (Cooper *et al.*, 2021; Gil-Bazo & Ruiz-Verdu, 2009; Parida & Tang, 2018); though the recent literature also considers the opposite scenario (He *et al.*, 2018; Sheng *et al.*, 2022; Vidal *et al.*, 2015). This study works towards solving this problem since, unlike the demand side of the mutual fund market, its supply side is always very attentive. The management fee measure used in this article reflects the actual value of the direct management cost that is considered in practice, in order to calculate the value of fund managers' bonuses and management company shareholders' dividends. Therefore, it justifies reconsideration of known relationships between fund costs and their determinants — including a fund performance.

Overall, apart from the fund performance, the agency considerations and competition are important determinants of fund fees (Cremers *et al.*, 2016; Khorana *et al.*, 2009; Wahal & Wang, 2011). Brown and Pomerantz (2017) add legal matters to this list and Roussanov *et al.* (2021) pay attention to the marketing and distribution expenses. Evans and Fahlenbrach (2012)

[5] In the case of foreign shareholders, who quite often are the owners of management companies in mutual fund emerging markets, a withholding tax matters. A rise in this tax on dividends may not contradict payouts, but may motivate the shareholders to provide debt instead of equity (Białek-Jaworska, 2021).

underline monitoring the managers and operational fees of funds by institutional investors. Iannotta and Navone (2012) analyze the factors impacting the cross-section of equity mutual fund fee dispersion. Haslem (2015) extends previous research and analyzes mutual fund fee dispersion, explained by observable heterogeneity, in decisions concerning fund and investor attributes. Cooper *et al.* (2021) finds that fee dispersion in the mutual fund industry is economically meaningful, robust, persistent and pervasive. Adams *et al*. (2012) claim that the industry competition limits a mutual fund's ability to charge excessive fees relative to shareholder services. They find that excessively high fees are prevalent in index funds with multiple share classes and weak governance structures. It is true in both mature and emerging markets (e.g. Babalos *et al*., 2009; Wongsurawat, 2011). Higher fees and turnover ratios are typical for more risky active funds (Livingston *et al*., 2019). Though, the growing competition from low-fee passive funds does not reduce high fees of actively managed funds (Carneiro *et al*., 2021; Sun, 2021).

The literature covering other than equity fund styles, in or outside the U.S. market, is sparse. By studying equity, hybrid, fixed-income, money market and absolute return funds this paper tries to cover this gap and report that mutual fund styles matter. The early studies of the U.S. bond mutual funds by Blake *et al.* (1993) and Elton *et al.* (1995) report funds' net-of-fee underperformance that persists. This result is confirmed by Chen *et al.* (2010), and Chen *et al*. (2021a), who find it is caused by the fund poor market timing ability or by the fund misclassification. Cici and Gibson (2012) or Moneta (2015) and Goldstein *et al*. (2017) study U.S. bond fund managers' selectivity skills. Their findings are mixed. The evidence that bond fund managers are able to select outperforming bonds is found by Moneta (2015) and Goldstein *et al.* (2017), but not by Cici and Gibson (2012). Clare *et al*. (2019) show that investors of the US bond funds cannot rely on past performance to predict funds' future performance. In contrast to this, Otero-González *et al*. (2022) find performance persistence and rating persistence in the European bond mutual funds with high Morningstar Star ratings. Such funds attract more flows than funds with low ratings, but they take higher risk, both in terms of volatility and value-at-risk.

Comer *et al*. (2009a, 2009b) look for abnormal returns of the U.S. hybrid funds. They do not find them because of too big exposure of these funds to the bond market. Herrmann and Scholz (2013) do, but abnormal returns are positive partially and they persist in a short term. However, on average the U.S. hybrid funds do not beat their benchmarks. Ayadi *et al.* (2016) report that the net-of-fees performance of the Canadian hybrid funds is negative, but positively related with the asset allocation to Canadian equity and with the fund family's orientation more on equity than bond funds. Ayadi *et al*. (2022) continue studying the Canadian hybrid funds and their stock and bond timing performances. They report that on average the individual funds are much more successful in timing the stock markets than the corporate bond markets.

This study is also related to the literature concerning the relevance of fund fees for operations of mutual funds with different styles in international markets. Khorana *et al*. (2009) examine management fees, total expense ratios and total shareholder costs, including load charges of a large dataset of mutual funds of different investment objectives offered for sale in 18 countries. They find that management fees vary substantially across funds and from country to country. Higher fees are a characteristic for funds distributed in more countries and funds that are domiciled in certain offshore locations. Lower fees are typical for larger funds and fund complexes, as well as funds operating in countries with a stronger investor protection (Khorana *et al*., 2009). Miguel *et al.* (2017) investigate the effects of equity mutual fund size on fund fees from 30 countries. They show that the level of fees varies substantially for funds with different size not only across countries, but also within countries. Vidal *et al.* (2015) report that the fees of domestic and international equity mutual funds may be predictable. Vidal-García *et al.* (2018) who use the data sample of equity funds from 35 countries, add that the relationship between mutual fund expenses and risk-adjusted performance across countries is negative, which means that higher fund expenses are associated with poorer performance. Finally, Cumming *et al.* (2015) note that European mutual fund expenses, including the management fee or subscription fee, may be decreased when different types of services, such as custodians, transfer agents or administrators, are outsourced. However, the positive effect of service outsourcing is more associated with the subscription fee than with the management fee. Additionally, it occurs only for the institutional investors, and not for retail investors. It is a pity, especially since the retail investors are dominant clients of mutual funds in emerging markets. An important example of such markets is China, where individual investors are attracted to mutual funds because on average Chinese mutual funds beat the market. They do it when they are older, smaller and charge higher fees (Kiymaz, 2015), and because they invest in growth stocks (Chi *et al*., 2022; Liu *et al*., 2019; Sha & Gao, 2019; Wagner & Margaritis, 2017).

The literature on mutual funds is very well developed in the subject of the fund performance, its persistence and the fund attributes that explain it. The main focus is paid to the demand side of the fund market — investors, who lack information and attention towards funds in order to earn positive returns from this investment. Numerous studies show that such returns are rare, especially in net-of-fee terms. Sparse studies pay attention to the real value of the direct management cost that matters especially for the supply side of the fund market — the management companies who expect a yearly bonus and their shareholders, who require dividends. This study fills this gap and examines the actual rate of the management fee that is a part of the operating model of a mutual fund performance. The model is tested on a mutual fund emerging market, characterized with a different fund style structure than the most advanced mutual fund market of the USA. In general, the more diversified the structure of mutual fund styles the more differences in the value of the management fees charged by management companies. The proposed actual rate of the management fee allows to calculate this value for any local market worldwide and conclude from comparisons of these differences that can be informative for both — the demand and the supply — sides of a mutual fund market.

Research method

Research sample description

In order to conduct our study, we collect the information on the actual value of a management fee from the monthly financial statements of management companies concerning the funds they managed. We do so manually for a representative sample of mutual funds registered in the biggest European fund emerging markets of Poland. This market has a highly diversified structure of mutual fund styles[6] with the management fees that are the double of what fund participants pay in other European countries — across all fund styles (European Commission, 2018). The average asset-weighted ongoing charge for European funds was in 2016 only 1.00%; whereas, at the same time in Poland, its main component — a declared management fee — was 1.95%. The reasons for this difference, together with other features of a market of similar characteristics, have still not been recognized neither in the local, nor international literature (see Białkowski & Otten, 2011; Fraś, 2018; Swinkels & Rzezniczak, 2009; Urbański *et al.*, 2016 for Poland and e.g. Ferreira *et al.*, 2013 for international evidence).

[6] The structure of Polish fund market is much more diversified than what is seen in the U.S. or EU. In 2004–2018 taking into account NAV the equity funds counted for 17,9%, hybrid funds for (19%), and bond and money market funds accounted for 16,7% and 12,4% respectively.

We use the data available on Morningstar Direct local database, combined with the unique information from the financial statements of Polish mutual funds and their management companies (called Investment Fund Companies, IFC) collected manually from their websites, in order to obtain the data on the attributes of Polish open-end investment funds that were active for at least one year from January 2012 to June 2016; and had more than Polish zloty (PLN) 1 Mio assets under management in a given month. Such a time horizon was determined by the availability of data and the successive reduction of the management fee of all mutual funds registered in Poland imposed by the legislator, on which the debate began in 2017. Eventually, the mandatory reduction of this fee started in 2019. At that time, the maximum management fee charged by any Polish mutual fund could be up to 3.5%. In each subsequent year, it had to be reduced by 0.5%, so that since 2022 it may be the maximum of 2%.

We collect information about *size* represented by NAV; *age in months* (AGEM); ARMF, which is disclosed in semi-annual and annual financial statements of a management company for all funds as well as TOC presented in the semi-annual and annual financial statements of funds for each fund; and *quotation* (QT, that means price) of funds, which is the net asset value per share (NAV p.s.). The analysis is carried out for 4 main peer groups (styles) due to the asset class: equity, hybrid, fixed income, and money market open-end investment funds that are further divided into domestic and foreign funds. We also analyze three groups of alternative funds: capital protection, absolute return, and commodity funds. Additionally, “domestic equity” and “domestic hybrid” funds, for which we apply the Carhart’s (1997) model, are divided into more groups (see Table 3 for details).

Our sample is free of survivorship bias. We also consider the changes in the fund’s investment policy and exclude observations from periods of which no financial statements were published. Finally, this leads us to a dataset of 21,618 monthly observations for 500 open-end investment funds from 33 management companies divided into 11 peer groups (subsamples). More details are displayed in Table 1. To improve the fit of the model, in the key analysis carried out based on formulas 10 and 11, we exclude outliers. We considered many methods to exclude outliers — including multivariate procedures. Ultimately, we decided on a simple interval of tripled standard deviation from the mean in both directions. In addition, measurements for which the explained variable is 0 are excluded as outliers. The level of outliers is shown in Tables 7 and 8 and it does not exceed 5%.

To build risk factors from Carhart's (1997) model, we use data on the capitalization and book-to-market ratios derived in semiannual statistics from both the Warsaw Stock Exchange (WSE)[7] and the local OTC market called NewConnect (NC)[8] for 2011H2 to 2015H2. Returns from stock companies were calculated according to the daily changes, available on the official WSE archive[9], during the period from the end of December 2010, to end of June 2016 (the first year is related to the construction of the momentum factor). Table 2 contains summary statistics about this stock data. Warsaw Interbank Bid Rate (WIBID) 1M[10] was adopted as a risk-free rate r_t^F and the Warsaw Stock Exchange Index (WIG) was used to calculate returns from market portfolio r_t^{WIG}.

Definitions of variables and research procedure

We consider any fixed time period t, which in our case is a calendar month. Let $u(t)$ mean any fixed valuation day of month t and $L(t)$, $\Xi(t)$ mean the number of valuation and calendar days in the month t, respectively. In general considerations, we omit the argument t and simply write u, L or Ξ. Furthermore, i denotes a unique designation for the investment fund.

From daily *quotations* (prices) of investment funds $QT_{i,u}$, we can calculate monthly[11] or daily returns marked as $r_{i,t}$ and $r_{i,u}$, respectively. The first step of the analysis is to calculate the before-fee return. For this purpose, we propose a simple operating model of an investment fund change of NAV, which is defined by two equations:

$$NAV_u = (1 + r_u)NAV_{u-1} + NF_u \tag{1}$$

$$NAV_u = NAV_{u-1} + RM_u + NF_u \tag{2}$$

where NAV_u denotes NAV, NF_u means *net flows*[12] and RM_u is *result of management*[13], all on a given day u. From the comparison of the above

[7] https://www.WSE.pl/statystyki_polroczne (28.03.2021)

[8] http://www.newconnect.pl/index.php?page=statystyki_polroczne (28.03.2021)

[9] http://infostrefa.com/infostrefa/pl/index/ (12.04.2021)

[10] WIBID 1M is the reference interest rate of one-month deposits on the Polish interbank market.

[11] We calculate returns at the end of a given month.

[12] Net flows mean any flow associated with a change in the number of shares, such as gross sales, redemptions, and conversions.

[13] Result of management is any flow associated with a change in the value of share (price); so that mean the result from the investment portfolio, as well as unlimited and limited costs (include charged management fee).

formulas, we get $RM_u = r_u NAV_{u-1}$ and one of the components of this result of management is *charged management fee*:

$$CMF_u = \xi_u \frac{RMF_u}{365} NAV_{u-1} \quad (3)$$

where RMF_u denotes a rate of management fee and ξ_u means the *weight of the valuation day*; i.e. the number of calendar days since the last valuation day (note that $\sum_u \xi_u = \Xi$).

To calculate before-fee return r_t^* , we use an alternative scenario of flows where we assume $RM_u^* = RM_u + CMF_u$, and from here, we get:

$$r_t^* \approx \prod_{u=1}^{L} \left(1 + r_u + \xi_u \frac{ARMF_t}{365}\right) - 1 = \prod_{u=1}^{L} \left(\frac{QT_u}{QT_{u-1}} + \xi_u \frac{ARMF_t}{365}\right) - 1 \quad (4)$$

where we take the $ARMF_t$ disclosed in the semi-annual and annual financial statements for the semester — containing given month t as the rate of management fee (RMF_t). In our opinion, ARMF is the best of the real commonly available values that describe the costs of management. We also believe that the use of daily values for fast-changing valuation processes, as well as semi-annual values for low-changing cost processes in one formula, is the optimal way to analyze fund performance; and, at the same time, is the only possible description of the process using all available data. This is an equation for any open-end investment fund i from our sample: if $u \to (i,u)$, then $t \to (i,t)$.

To estimate before-fee risk-adjusted performance, we apply two independent approaches. The first one is a four-factor model of Carhart (1997). We use it for two peer groups (styles): equity and hybrid funds. Only investment funds that are active for at least three years over the examined period are taken into account. Analyzing hybrid funds apart from the equity ones is meaningful, as they are dominant in the structure of the analyzed mutual fund market.

The model is given by:

$$r_{i,t}^{\#} = \alpha_i^{Carh} + \beta_i^M r_t^M + \beta_i^S SMB_t + \beta_i^H HML_t + \beta_i^W WML_t + \varepsilon_{i,t}\ , \quad (5)$$

where $r_{i,t}^{\#} = r_{i,t}^* - r_t^F$ denotes excess before-fee return and $r_t^M = r_t^{WIG} - r_t^F$ denotes excess market portfolio return — which are calculated with the use of the market portfolio return r_t^{WIG} and the risk-free rate r_t^F. Using quotations of listed companies (WSE and NC), we calculate differential weighted returns from portfolios that represent risk factors related to the size, value of companies, and momentum effect. First, we divide the companies into *small* (S) and *big* (B) — using the median of market capitalization from the reference market (WSE only). These portfolios are divided into *high* (SH and BH, top 30%), *middle* (SM and BM, middle 40%) and *low* (SL and BL, bottom 30%) portfolios due to book-to-market ratio. SMB_t (*small minus big*) is the difference between the arithmetic mean of weighted returns from small and big portfolios, while HML_t (*high minus low*) is a similar difference build on high and low portfolios (in this case, we do not use return from middle portfolios). To calculate momentum WML_t , first, we calculate the returns for the previous 11 months to define the ranking of *winners* (W, top 30%) and *losers* (L, bottom 30%) and we then take the difference. All portfolios are capitalization-weighted and are rebalanced in every half year. Table 2 presents statistics for the excess risk factors used in equation (5).

As a result of the regressions, we receive the estimation of before-fee risk-adjusted performance α_i^{Carh} — known as Carhart's alpha. Some of the funds from the underlying sample are rejected due to the insufficient number of observations during the period considered (restriction min. 36 observation). All mutual funds, as well as asset-weighted fund portfolios, are examined.

In the second approach, we describe the excess before-fee return by the characteristics of investment funds; which, regardless of a fund manager, can influence the returns. One of them is a relative cash flow:

$$CF_{i,t} = NF_{i,t}/NAV_{i,t-1}. \tag{6}$$

Its value is dependent only on the decision of the fund's participants; it can be assumed that it is often associated with the emotions tied to the current situation on the capital market. In order to calculate cash flows, the recursive equation (1) of the operating model of the fund is used.

Let us assume a uniform daily distribution of net flows for a given month, i.e. $NF_u = NF_t/L$ for each $u \in t$. This is a necessary assumption, due to the lack of data on fund flows[14]. Now, from a general solution for equation (1) we obtain:

$$\frac{NF_t}{L} = \frac{NAV_t - NAV_{t-i}\prod_{u=1}^{L}(1+r_u)}{\left[\sum_{u=1}^{L-1}\prod_{j=u+1}^{L}(1+r_u)\right]+1}, \tag{7}$$

[14] One can also consider daily flows as a function of changing the price with the appropriate delay. This, however, requires several additional analyzes and goes beyond the scope of this article.

It is easy to see that $\prod_{u=1}^{L}(1+r_u) = (1+r_t)$ and $1+r_u = QT_u/QT_{u-1}$, so we can write the cash flows formula as:

$$CF_{i,t} = \frac{L}{QT_L \sum_{u=1}^{L_t} QT_k^{-1}} \frac{NAV_{i,t} - NAV_{i,t-i}(1+r_{i,t})}{NAV_{i,t-i}}. \quad (8)$$

In the limit of very small valuation changes ($r_{i,u} \approx 0$), we receive an equation commonly used in literature after:

$$CF_{i,t}^{\lim} = \frac{NAV_{i,t} - NAV_{i,t-i}(1+r_{i,t})}{NAV_{i,t-i}} \quad (9)$$

where $CF_{i,t}^{\lim} = \lim_{r_{i,u} \to 0,\ u \in t} CF_{i,t}$. Therefore, equation (7) is a generalization of equation (8) by considering the volatility of fund quotes within a month. The generalization of equation (8) allows us to assess the dynamics of fluctuations in cash flows in relation to the examined period and the changes in a fund valuation in this period. The value of the introduced correction varies from 0,634 to 1,180, and its arithmetic mean is 0.998. However, in 90.8% of cases, the coefficient is within the range of 0.975 to 1.025.

The next independent factors are a fund size and age. A fund size is calculated as a logarithm of NAV. It is included in this way because the smaller fund may be more agile in implementing investment decisions and the pace of loss of ability is inversely proportional to NAV. On the other hand, the increase of the age of investment fund should have a positive impact on its performance when the effects of a long-term investment strategy are manifested. In addition, the first phase of the fund's operation is the process of building the investment portfolio; this is a logical reason for using the logarithmic pace of change. The influence of fund characteristics on before-fee risk-adjusted performance is described by:

$$r_{i,t}^{*} = \alpha_i^{char} + \beta^C CF_{i,t} + \beta^N \ln NAV_{i,t-i} + \beta^A \ln AGEM_{i,t-i} + \varepsilon_{i,t}\ , \quad (10)$$

where $AGEM_{i,t}$ is the age of the given investment fund, counted in months, and $\varepsilon_{i,t}$ is a completely random error.

Now we concentrate on finding a relation between the level of fee in the analyzed funds (FEE) and their before-fee performance (PER). The former is measured by ARMF or by TOC; and the latter is measured by Carhart alpha α_i^{Carh} for equity based funds and by before-fee return $r_{i,t}^{*}$ for all types of funds. To investigate this relationship, we modify the approach proposed by Gil-Bazo and Ruiz-Verdú (2009). We assume that the level of a management fee is a dependent variable, whereas the before-fee fund performance is an independent variable:

$$FEE_{i,t} = \delta_i + \delta^P PER_{i,t} + \delta_F \delta^R ARAC_{i,t} + \varepsilon_{i,t} \,, \qquad (11)$$

where $FEE_{i,t}$ is the measure of fee ($ARMF_{i,t}$ or $TOC_{i,t}$), $PER_{i,t}$ is measure of performance (α_i^{Carh} or $r_{i,t}^*$), $ARAC_{i,t}$ stands for an *actual rate of the additional cost* and is the difference between TOC and ARMF, and $\delta_F = 1$ if fund fee measure is ARMF and $\delta_F = 0$ in other cases (i.e. if the fee measure is TOC). The optimal model is chosen according to the procedure described above.

Finally, we examine the relationship (10) in a broader context. Similar to Otten and Bams (2002) or Babalos *et al.* (2009), we use a wide range of fund characteristics within the method:

$$\begin{aligned} FEE_{i,t} = \delta_i^* + \delta^E PER_{i,t} + \delta^C CF_{i,t} + \delta^N \ln NAV_{i,t-i} + \\ + \ \delta^A \ln AGEM_{i,t-1} + \delta_F \delta^R ARAC_{i,t} + \delta^T OAUM_{i,t} + \varepsilon_{i,t} \end{aligned} \qquad (12)$$

where $OAUM_{i,t}$ is a total "open" asset under management[15] of IFC managing the fund i in a given month t given in PLN bn, which we can also call the size of IFC. Additionally, in this case, we carry out the procedure for assessing the validity of using variables and introducing the individual fixed effect. The results of the Hausman test and eliminated characteristics (according to the order) are shown in Table 8.

Additionally, we examine the fixed effects, which are estimated according to the equation:

$$\begin{aligned} \hat{\delta}_i^* = \overline{ARMF_\iota} - (const + \hat{\delta}^E \overline{PER}_{i,t} + \hat{\delta}^C \overline{CF_\iota} + \hat{\delta}^N \overline{\ln NAV_\iota} + \\ + \hat{\delta}^A \overline{\ln AGEM_\iota} + +\delta_F \hat{\delta}^R \overline{ARAC_\iota} + \hat{\delta}^T \overline{OAUM_\iota}) \end{aligned} \qquad (13)$$

where we use parameters estimated by regression (Table 9) and average variables of a given unit with respect to time. The results of the analysis are shown in Table 10.

The choice of fixed effects (FE) instead of random effects (RE) was not obvious. As Wooldridge (2010) points out, when individual effects are treated as random, it means that they are included in the model to avoid a mistake of omitted variables. On the other hand, treating individual effects as fixed means assigning certain non-random characteristics to each

[15] "Open", because we only take into account the assets of open-end investment funds.

unit — they affect the dependent variable, but due to their nature (they could be non-quantifiable or difficult to measure), they are not directly included in the model. Such variables include the skills of the portfolio manager, but also the characteristics of the investment fund company — an organization that manages an investment fund as such, according to its best practices implemented as the internal procedures and policies. Eventually, we chose the fixed effects instead of random effects, because during our study it turned out that higher-level variables were most often not very important and were eliminated from the model. In our choice we follow Bell *et al*. (2019) who indicate such situation as one of the reasons why it is worth choosing fixed effects model.

To compare the results between groups, we carry out normalization by subtracting the mean value and dividing by the standard deviation. The normalized deviation from the average ARMF in the group, due to the given IFC, is outlined in Figure 13.

Results

Table 3 and Table 4 present the values of before-fee risk-adjusted returns for analyzed equity and hybrid mutual funds calculated by a regular Carhart's model (1997) presented in equation 5. The average Carhart's alpha for equity funds is positive and equal +0.47% and +0.31% for asset-weighted portfolio. We observe values three times higher for funds of small and medium-sized companies than for universal equity funds (groups of sector and others domestic equity funds are unrepresentative). The portfolio of domestic hybrid funds shows an alpha value that's identical to the equity funds portfolio; however, in the case of the average, we get +0.25% — which is almost twice the lower value than for domestic equity funds. The indicators for equity universal, balanced, and stable growth groups of fund show that when the equity share in the fund portfolio falls, then the impact from both the stock market (measured by β^M), as well as the quality of the fit of the model also falls — this seems to be intuitive. Coefficients of determination (R^2) for equity portfolios (especially universal) are very high as similarly seen in Otten and Bams (2002). The average values of coefficients of determination from a given style (or group) are significantly higher than in the cross-market study of frontier markets conducted by Blackburn and Cakici (2020). This allows us to hypothesize that the impact of local factors is very important and should be considered as widely as possible when designing risk factors (see detailed results in Tables 3 and 4).

Tables 5 and 6 present the results for the second measure of before-fee risk-adjusted return calculated according to the equation 9. We use the ordinary least squares method (OLS) and then based on the Wald and Breusch-Pagan test we adjudge on the validity of the introduction of individual effects: fixed (FE) or random (RE). A statistically better variant is indicated using the Hausman test. However, because we have data for the entire population we strongly prefer the FE model — that of which will show us the individual effects of all given units. We are, therefore, opposed to the RE model, where an individual effect is introduced to increase the efficiency of the estimator and to correct the error of omitted variables. Consequently, due to very low coefficients of determination, which probably resulted from the high heterogeneity in styles, we abandon α_i^{char} as a measure of performance by taking the before-fee return $r_{i,t}^{*}$ as an alternative to α_i^{Carh}. Later in this study, we use the funds' characteristics from α_i^{char} directly in the analysis of the management fees. This approach allows us to explore the performance-fee relationship in all analyzed styles — not just for the equity and hybrid funds. We believe that the application of a specific strategy from the four-factor model (SMB or WML) is an investment objective for some groups of funds and should then be included in the management price.

Tables 6 and 7 contain the results for regressing the rate of a management fee (ARMF and alternative TOC) with the performance and fund attributes. Because the OLS model does not appear to be optimal in any case, in Table 7, we present the results of the estimation of FE model and only of the value of the Hausman test — based on which we assess the robustness of using the model with individual effects. Low values of the test statistics in some cases may suggest an error in the functional form of the model (e.g. lack of exogeneity of explanatory variables).

In nearly all cases, we obtain a weak positive correlation between the level of fees and the performance — pertaining to what can be seen in Figure 1. However; for foreign equity, foreign fixed income, and absolute return; the results are not statistically significant. This effect is so negligible, that even with a high monthly before-fee returns (e.g. 2–3%), its impact on the level of management fee is not noticeable — of the order of several basis points. This constant, however, oscillate around the average rates of the management fee for particular groups (compare Tables 1 and 7). As we go further, this is a prerequisite for extending the study on management fees and their relation to other fund characteristics.

As for the relation between the rate of management fee and the fund characteristics including performance the results, again, show that there is no significant correlation between the level of management fees and the fund performance. CF appears steadily often among the rejected explanatory variables due to lack of statistical significance. We observe the strongest relationship of management fees with the size and the age of the funds. It also turns out that the bigger the fund the higher the management fee; while in the case of age, older funds turned out to be cheaper. In addition, we obtained a very interesting result regarding the size of the investment fund companies (IFCs): on average larger IFCs charge lower fees. We combine this effect with the dilution of fixed costs related to both the operation of the funds and the IFCs themselves. The influence of explanatory variables on the result by style can be seen in Figures 3-12. We notice that in most cases, the fixed rate — again — turned out to be close to the average value in a given fund style.

Figure 13 presents the normalized deviation from the average ARMF in a given fund style, due to the given IFC. We can see that the largest deviations of the average ARMF in IFC, weighted by funds' assets, are characteristic to so-called ”banking IFCs;” that is, those that belong to banks' capital groups. It is an important result that proves that the shareholder structure of the IFCs matters for the level of fees the management companies establish for providing a service of the fund management.

Discussion

In this study, we propose the actual rate of a management fee (ARMF) that catches volatility of real management costs and investigate its determinants in mutual funds of different styles that operate in the emerging mutual fund market. We do so by including ARMF in a mutual fund operating model presenting the fund before-fee performance. To the best of our knowledge, this model is the first detailed delivery of a fund performance that takes into account different fund operations, like calculating cash flows or fees. Importantly, the proposed formulas are derived in a fundamental way from the mathematical description of fund processes. They can therefore be adapted to a situation where there are certain restrictions and limitations in access to data or modifications to the fund's operation process.

We use various measures of a fund before-fee performance in order to investigate the relation between the ARMF and fund attributes. The use of the first measure is justified with the findings of Zaremba *et al.* (2019), who prove that the four-factor model of Carhart (1997) is the most suitable method for asset pricing in local markets. The use of the second measure is justified by the concept that risk level is a measure of the fund's potential and is reflected in the management fee. Therefore, it should not be eliminated from the performance measure when testing fees. The use of the third measure is justified by the fact that the fund parameters, used as control variables, may be relevant for performance assessment. We report that the first measure can only be used for solutions with a predominant share of equities, i.e. equity and hybrid funds. The second hypothesis about the legitimacy of using control variables at the stage of determining the performance measure is not justified by the results (it is, instead, about the level of significance). We find that the best fit for modeling management fees in all considered styles of mutual funds is the last model that tests the relation between a fund management fee and a fund attributes, including fund performance.

Our investigation brings few findings. Firstly, there is no significant correlation between the level of the management fee and the mutual fund performance. This is true in all types of fund styles for both measures of this fee: the actual rate of the management fee (ARMF) disclosed in the financial statements of the management companies as well as the total operational costs (TOC) presented in the fund financial statements. Our observation is in contradiction to the model of the rational mutual fund market described by Berk and Green (2004) discussed in the numerous studies on the mature fund industry of USA. These studies indicate that mutual fund performance is related to the management costs. Gil-Bazo and Ruiz-Verdu (2009) find that this relation is negative and results from the strategic fee setting by mutual funds in the presence of investors with different degrees of sensitivity to performance: low-performing funds charge higher fees to the relatively less sophisticated, less performance sensitive investors. Parida and Tang (2018) and Song (2020) claim that such investors are the main reason why funds strategically increase management fees in highly competitive markets. Sheng *et al.* (2022) disagree and explain that high management fees of US active funds are not determined by the naïve behavior of investors, but by difficult and costly valuation of growth companies that are in the portfolios of these funds. The fund managers are compensated for their hard work and they deliver by producing more fund alpha. This is not the case in our study because of at least two reasons lying both on the demand and on the supply sides of this market. We consider an example of a mutual fund industry that is less developed, less competitive and dominated by less educated non-professional investors than in the USA. As Fraś (2018) reports, those investors have low tradition and small awareness of investing money in mutual funds. We think this is one of the main reasons why the actual rate of the management fee is not related to the fund performance — the unsophisticated investors simply do not pay attention to this relation. Knowing that, management companies care more on marketing funds that brings a capital inflow, a fund asset value increase and eventually an increase in the profit from management fees that satisfies themselves and the management company shareholders.

Our second finding is that the ARMF is not related to the flows of mutual funds. Again, it holds for all considered fund styles. This result is in line with Barber *et al*. (2005) who show that flow of money into mutual funds is not correlated with the operating expenses. We also complement recent study by Miguel (2021), who finds that in most countries in the world mutual fund flows have limited impact on fund performance persistence.

We find that what matters more for the ARMF is the size of the mutual funds and the size of their families. This finding is in line with Song (2020), who demonstrates that mutual funds with positive past returns experience an increase in a fund size, which results in higher fund fees and consequently negative aggregate return performance of all funds. Chen *et al.* (2021b) prove the fund family size effects the fund flows' response to performance depending on the sophistication of investors in a country. While less sophisticated investors are persuaded by the great visibility and strategies of funds that are affiliated with large and established families, more sophisticated investors are not. In this study, we consider the mutual fund industry where majority of investors are not sophisticated and the biggest fund families are managed by the companies that have banks as both their primary distributors and their main shareholders. In the past, these banks used to gain as fund distributors from the high kickback value from a management fee, which made them uninterested in creating a truly competitive environment. The kickback fee is no longer permitted so more and more management companies introduce a performance fee that will satisfy them as shareholders with dividends. This fee is believed to be controversial (Servaes & Sigurdsson, 2022), but it is allowed in the case of mutual funds in more and more countries. Inclusion of this fee to the fund fee structure neither changes the importance of the ARMF nor change the content of the operating model of before-fee performance described in this study. In the proposed formulas, we use the daily volatility of participation unit quotations, which most often has a significant impact on the calculation of the performance fee. So overall, including the performance fee to the proposed model actually strengthens the results we obtain.

Conclusions

In this study, we propose the actual rate of the management fee (ARMF) as the element of the operating model of a mutual fund performance. The model is described by formulas which include different fund operations, e.g. calculating fund flows, before-fee returns or different fees charged. We further check whether the ARMF is determined by the mutual fund performance or other fund attributes. The additional value of the study stems from the fact that the analysis of determinants of ARMF is conducted not only for equity funds that dominate the mutual fund research, but also hybrid, fixed income, money market, and absolute return funds. Those funds come from an emerging mutual fund market with a diversified structure of fund styles. Worldwide, one of them may dominate a local mutual fund market and therefore influence the real value of the average management fees charged by the management companies operating there.

Our findings are contradictory to the existing literature on the advanced mutual fund market in the USA and show no significant relationship between ARMF and a fund performance, fund flows and its age. However, as in the world literature, we record evidence of the positive relationship between the amount of the fee charged and the size of the fund. Besides, the largest deviations of the average ARMF are seen in the management companies, that belong to the banks' capital groups. This apparently means that the will (and the profit) of the shareholders-banks influence the level of the real rate of the management fee (and the profit) of the management companies more than the will (and the profit) of investors. Our recommendation is that investors shall become more conscious and attentive about the management fees charged by the companies managing mutual funds of different size. This shall be the case of all styles of funds, especially the funds from big (bank) fund families that are well marketed.

There are two important limitations of our study. The first one is that the proposed operating model of the mutual fund performance is not complete, i.e. it may be expanded to other operations like calculating fees other than a management fee or performance fee charged by mutual funds. The model can actually consist of modules of operations that may be included or excluded from it, such that it meets the needs or requirements of theoreticians or practicians. More complex model could give more precise results. The second important limitation we are aware of is connected to the time and subject scopes of the study. Extending the time frame and a data sample may influence or modify the overall results, such that they may be more in line with the world literature. This, however, shall be the subject for further studies.

Future research should also look into utilizing proposed mutual fund operating model to explain both the real rate of the management fee and the performance fee, especially, since the latter has been introduced in more and more mutual funds in different markets around the world. Our operating model may be also used in studies on the competition among management companies from different local mutual fund markets and the meaning of their profits (and the profits of their shareholders) to the profits of mutual fund investors characterized with a different level of sophistication. The results of those studies may help to understand more the characteristics and differences among the demand and supply side of more and less advanced mutual fund markets around the world. This is beyond the current paper, but it deserves to become a topic for future research.

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Annex

Table 1. Sample summary statistics

	# funds	# observations	NAV**	mean before-fee return***	mean fee****	mean after-fee return*****
total	**500**	**21 618**	**115.9**	**+6.11%**	**2.56%**	**+3.42%**
domestic equity	88	4 225	17.6	+8.48%	3.62%	+4.62%
foreign equity	98	4 107	6.6	+6.93%	3.38%	+3.37%
domestic hybrid	75	3 454	17.0	+5.90%	2.90%	+2.87%
foreign hybrid	39	1 565	2.0	+4.98%	2.37%	+2.52%
domestic fixed income	77	3 328	32.6	+5.77%	1.32%	+4.38%
foreign fixed income	27	985	4.3	+5.59%	1.63%	+3.88%
domestic money market	49	2 150	30.1	+3.94%	0.91%	+3.00%
absolute return	22	788	2.8	+6.86%	2.94%	+3.76%
commodity*	10	378	0.69	-3.03%	3.21%	-6.09%
polish capital protection*	9	399	1.9	+3.33%	1.63%	+1.65%
foreign capital protection*	5	239	0.22	+4.74%	1.71%	+2.97%

Notes: The table contains the characteristics of the test sample and subsamples. The first three columns show the number of funds, the number of observations, and the NAV at the end of June 2016. In subsequent columns, there are annualized average monthly returns across the research panel (before-fee and after-fee) and the appropriate average actual rate of management fees.
*we resign from further study of these subgroups due to the small population size, **in PLN bn at the end of June 2016, ***annualized arithmetic mean across the panel (using all observations) of monthly before-fee returns, ****arithmetic mean across the panel (using all observations) of actual rates of management fee from financial statements, *****annualized arithmetic mean across the panel (using all observations) of monthly returns (after fee)

Table 2. Summary statistics for risk factors

factor	mean excess return	standard deviation	cross correlations			
			market	SMB	HML	WML
market	+0.19%	4.02%	+1.0000	-0.4638	+0.5370	-0.1941
SMB	-0.37%	3.45%	-0.4638	+1.0000	+0.0471	-0.3680
HML	+0.02%	3.59%	+0.5370	+0.0471	+1.0000	-0.6540
WML	+0.72%	6.70%	-0.1941	-0.3680	-0.6540	+1.0000

Notes: The table contains factors based on the monthly returns of listed companies (WSE and NewConnect) over the period from Jan 2012 to Jun 2016 and its correlations. As a risk-free rate, we assume WIBID 1M. The market factor is calculated based on WIG quotations. Pervasive risk factors SMB and HML are the difference between excess returns from respectively: portfolios of small vs big companies due to the size measured by median of capitalization (WSE only) and portfolios of high (top 30%) vs low (bottom 30%) book-to-market value. WML represents the momentum effect and is calculated based on the company ranking according to the rate of return for the last 11 months with one-month delay. Portfolios are weighted by capitalization and are rebalanced every 6 months.

Table 3. Summary statistics for the Carhart (1997) model — asset-weighted portfolios

	α^{Carh}	β^{M}	β^{S}	β^{H}	β^{W}	R^2	**#funds**
Local equity	**0.31%*** **	**0.95*** **	**0.13*** **	**-0.08** **	**-0.03* **	**0.98**	**78**
universal	0.23%***	0.94***	0.09***	-0.06**	-0.03**	0.98	51
SME	0.90%***	1.02***	0.47***	-0.19**	-0.07	0.86	21
sector	0.84%***	0.83***	0.45***	-0.19**	-0.04	0.81	2
others	-0.53%**	1.28***	-0.43***	0.20*	0.02	0.93	4
Local hybrid	**0.31%*** **	**0.45*** **	**0.00**	**-0.06**	**-0.02**	**0.88**	**61**
balanced	0.27***	0.58***	0.01	-0.08**	-0.03*	0.94	14
stable growth	0.19%**	0.36***	-0.02	-0.06*	-0.02	0.87	29
asset allocation	0.09%	0.58***	0.07**	-0.05	-0.03	0.94	16
others	3.11%*	0.25	-0.16	0.03	-0.00	0.01	2

Notes: The table contains an estimate for the parameters of the 4-factor model for regression performed according to the equation (5) for asset-weighted portfolios on a given style/group. In addition, the value of the coefficient of determination and the number of funds in a given portfolio can be found below.
*significant at the 10% level, **significant at the 5% level, ***significant at the 1% level

Table 4. Summary statistics for Carhart (1997) model — arithmetic mean

	α^{Carh}	β^{M}	β^{S}	β^{H}	β^{W}	R^2	**#funds**
Local equity	**0.47%**	**0.93**	**0.24**	**-0.11**	**-0.04**	**0.86**	**78**
universal	0.31%	0.97	0.15	-0.09	-0.04	0.89	51
SME	0.89%	1.03	0.47	-0.17	-0.05	0.80	21
Sector	0.92%	0.93	0.53	-0.21	-0.05	0.72	2
Others	0.14%	-0.13	0.02	-0.06	-0.02	0.93	4
Local hybrid	**0.25%**	**0.46**	**0.02**	**-0.05**	**-0.02**	**0.75**	**61**
balanced	0.28%	0.60	0.03	-0.08	-0.03	0.87	14
stable growth	0.24%	0.36	0.01	-0.06	-0.03	0.78	29
asset allocation	0.00%	0.57	0.07	-0.03	-0.02	0.67	16
Others	2.03%	0.16	-0.08	0.01	0.00	0.07	2

Notes: The table contains the arithmetic mean of the parameters estimated for the four-factor model used for regression performed according to the equation (5)—for investment funds from a given style/group (with restriction of at least 36 observation). In addition, the arithmetic mean of the value of the coefficient of determination, as well as the number of funds in a given portfolio, can be found below.

Table 5. Summary for regression: performance to fund characteristics — model selection and elimination of non-significant variables

	p-values of tests			optimal model	eliminated characteristics
	Wald	**Breusch-Pagan**	**Hausman**		
domestic equity	0.0000	0.0343	0.0000	FE	CF
foreign equity	0.4432	0.0159	0.0000	OLS	all
domestic hybrid	0.0000	0.0000	0.0000	FE	CF
foreign hybrid	0.2589	0.0820	0.0000	OLS	all
domestic fixed income	0.0002	0.6140	0.0000	FE	---
foreign fixed income	0.0284	0.1384	0.0000	FE	CF, $\ln AGEM$
domestic money market	0.0000	0.0000	0.0000	FE	---
absolute return	0.0027	0.3793	0.0000	FE	CF, $\ln AGEM$

Notes: The table contains the p-values of Wald, Breusch-Pagan and Hausman statistical tests for the model described by equation (9) broken down into by styles of domestic investment fund industry (due to asset class). Based on the tests, we indicate the optimal model: OLS or with individual FE. The last column contains non-statistically significant variables that have been eliminated through the step regression procedure. In the absence of statistically significant variables ("all"), regression is not considered.

Table 6. Summary for regression: performance to fund characteristics — values of estimated parameters

	$const$ [1]	β^C	β^N	β^A	R^2
domestic equity	+20.3%***	---	-0.0093***	-0.0066***	0.05
domestic hybrid	+7.95%***	---	-0.0027***	-0.0056***	0.05
domestic fixed income	+3.07%***	0.0017***	-0.0012***	-0.0009	0.05
foreign fixed income	+7.07%***	---	-0.0037***	---	0.04
domestic money market	+1.92***	-0.0001**	-0.0006*	-0.0009***	0.16
absolute return	+8.71***	---	-0.0046***	---	0.06

Notes: The table contains an estimate of the parameters for regression performed—according to the equation (9). The analysis results for styles with at least one statistically significant variable are reported. In the case of a model with an individual FE, the value of coefficient of determination for the corresponding LSDV estimator is given.

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

[1] According to Gould (2013), also in Table 7 and 9.

Table 7. Summary for regression: rate of management fee to performance

$FEE = ARMF$ $PER = \alpha^{Carh}$	share of outliers	p-values of Hausman tests	$const$	δ^P	δ^R
domestic equity	3.0%	0.5648	3.65%	0.0234***	-0.0091
domestic hybrid	0.6%	0.8292	2.97%	0.0049**	-0.1580***
$FEE = ARMF$ $PER = r^*$	share of outliers	p-values of Hausman tests	$const$	δ^P	δ^R
domestic equity	1.4%	0.8934	3.52%	0.0058***	0.0231
foreign equity	1.8%	0.9906	3.33%	0.0010	0.0448***
domestic hybrid	0.6%	0.9949	2.81%	0.0043***	0.0050
foreign hybrid	4.2%	0.5036	2.16%	0.0065**	0.0222***
domestic fixed income	0.9%	0.4163	1.28%	0.0117***	0.0217
foreign fixed income	1.7%	0.0000	1.55%	0.0054	0.1156***
domestic money market	2.6%	0.2481	0.87%	0.0149**	0.0486***
absolute return	2.8%	0.6810	2.63%	0.0104	0.3236***
$FEE = TOC$ $PER = \alpha^{Carh}$	share of outliers	p-values of Hausman tests	$const$	δ^P	δ^R
domestic equity	3.0%	0.1722	4.00%	0.0314***	---
domestic hybrid	0.6%	0.5939	3.22%	0.0052**	---
$FEE = TOC$ $PER = r^*$	share of outliers	p-values of Hausman tests	$const$	δ^P	δ^R
domestic equity	1.4%	0.9095	3.93%	0.0065***	---
foreign equity	1.8%	0.8330	3.82%	0.0038**	---
domestic hybrid	0.6%	0.6700	3.32%	0.0008	---
foreign hybrid	4.2%	0.7200	3.25%	-0.0162	---
domestic fixed income	0.9%	0.7715	1.47%	-0.0078	---
foreign fixed income	1.7%	0.9730	1.86%	0.0044	---
domestic money market	2.6%	0.0574	1.03%	0.0313*	---
absolute return	2.8%	0.8646	3.19%	0.0221*	---

Notes: The table contains an estimate of the parameters for regression performed according to the equation (10). The first part contains the results on the assumption that the measure of performance is Carhart's (1997) alpha. In the next lines, the data is given on the assumption that the measure of performance is before-fee return. In all cases, the model with an individual effect turned out to be optimal against OLS—only the p-value of the Hausman test is given. The middle columns contain the values of parameters δ and δ^P , which was estimated using the FE model. The last column contains coefficient of determination for the LSDV estimator.

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

Table 8. Summary for regression: rate of management fee to fund characteristics — model selection and elimination of non-significant variables

	$FEE = ARMF$		$FEE = TOC$	
$PER = \alpha^{Carh}$	p-values of Hausman tests	eliminated characteristics	p-values of Hausman tests	eliminated characteristics
domestic equity	0.4653	CF, $\ln NAV$, $\ln AGEM$, $ARAC$	0.2466	CF
domestic hybrid	0.8489	CF, $\ln NAV$,	0.0275	r^*, CF
$PER = r^*$	p-values of Hausman tests	eliminated characteristics	p-values of Hausman tests	eliminated characteristics
domestic equity	0.8442	CF, $\ln NAV$, $\ln AGEM$, $ARAC$	0.1732	CF
foreign equity	0.5564	r^*	0.0003	r^*, CF
domestic hybrid	0.2014	CF	0.0000	r^*, CF
foreign hybrid	0.0000	---	0.0018	r^*, CF
domestic fixed income	0.2286	CF, $OAUM$	0.1275	CF
foreign fixed income	0.0000	r^*, CF, $\ln NAV$	0.7085	r^*, CF, $OAUM$
domestic money market	0.6113	r^*, CF	0.1519	r^*, $OAUM$
absolute return	0.0007	r^*, CF, $\ln NAV$, $\ln AGEM$	0.0285	r^*, CF, $\ln AGEM$

Notes: The table contains the result for regression performed—according to the equation (11). The first part contains the results on the assumption that the measure of performance is Carhart's (1997) alpha. In the next lines, the data is given on the assumption that the measure of performance is a before-fee return. In all cases, the models with an individual fixed effect turned out to be optimal, so only the p-value of the Hausman test is given. The last column contains coefficient of determination for the corresponding LSDV estimator.

Table 9. Summary for regression: ARMF to fund characteristics — values of estimated parameters

$FEE = ARMF$ $PER = \alpha^{Carh}$	$const$	δ^E	δ^C	δ^N	δ^A	δ^R	δ^T
domestic equity	3.74%***	0.0026***	---	---	---	---	-0.0002***
domestic hybrid	2.64%***	0.0051***	---	0.0002***	---	-0.1379***	-0.0001***

$FEE = ARMF$ $PER = r^*$	$const$	δ^E	δ^C	δ^N	δ^A	δ^R	δ^T
domestic equity	3.62%***	0.0053***	---	---	---	---	-0.0002**
foreign equity	2.63%***	---	0.0000***	0.0003***	0.0011***	0.0431***	-0.0004***
domestic hybrid	2.46%***	0.0037***	---	0.0003***	-0.0004***	0.0159***	-0.0001*
foreign hybrid	0.10%***	0.0082***	0.0001***	0.0022	-0.0018	0.0160	-0.0013***
domestic fixed income	0.54%***	0.0145***	---	0.0004***	-0.0002***	0.0468***	---
foreign fixed income	1.29%***	---	---	---	0.0013***	0.1329***	-0.0002***
domestic money market	1.01%***	---	---	-0.0001***	0.0002***	0.0385***	-0.0001***
absolute return	3.92%***	---	---	---	---	0.3642***	-0.0040***

$FEE = TOC$ $PER = \alpha^{Carh}$	$const$	δ^E	δ^C	δ^N	δ^A	δ^R	δ^T
domestic equity	4.90%***	0.0283***	---	-0.0006***	0.0008***	n/d	-0.0002***
domestic hybrid	5.07%***	---	---	-0.0013***	0.0015***	n/d	-0.0001***

$FEE = TOC$ $PER = r^*$	$const$	δ^E	δ^C	δ^N	δ^A	δ^R	δ^T
domestic equity	5.27%***	0.0055***	---	-0.0009***	0.0011***	n/d	-0.0002***
foreign equity	5.08%***	---	---	-0.0010***	0.0024***	n/d	-0.0006***
domestic hybrid	6.20%***	---	---	-0.0023***	0.0036***	n/d	-0.0003***
foreign hybrid	-0.32%***	---	---	0.0039	-0.0052	n/d	-0.0015
domestic fixed income	2.44%***	---	-0.0006***	-0.0006***	0.0006***	n/d	-0.0001***
foreign fixed income	2.74%***	---	---	-0.0008***	0.0014***	n/d	---
domestic money market	2.79%***	---	-0.0001***	-0.0012***	0.0012***	n/d	---
absolute return	6.00%***	---	---	-0.0011***	---	n/d	-0.0025***

Notes: The table contains an estimate of the parameters for regression performed according to the equation (11). The first part contains the results on the assumption that the measure of performance is Carhart's (1997) alpha. In the next lines, the data is given on the assumption that the measure of performance is before-fee return.

* significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level

Table 10. Individual effects by style

style		Individual FE (IFE)				Normalized IFE	
		min	**max**	**average**	**Standard deviation**	**min**	**max**
domestic equity	AKP	-3.12%	+1.41%	+0.00%	+0.88%	-3.52	+1.59
foreign equity	AKZ	-1.58%	+1.15%	+0.00%	+0.61%	-2.59	+1.89
domestic hybrid	MIP	-2.28%	+1.62%	0.00%	+1.00%	-2.29	+1.63
foreign hybrid	MIZ	-2.14%	+1.48%	-0.00%	+0.97%	-2.20	+1.53
domestic fixed income	PDP	-1.27%	+1.09%	+0.00%	+0.52%	-2.46	+2.11
foreign fixed income	PDZ	-1.55%	+0.88%	-0.00%	+0.53%	-2.94	+1.66
domestic money market	RPP	-0.71%	+0.59%	+0.00%	+0.27%	-2.63	+2.18
absolute return	ARN	-2.48%	+2.98%	-0.00%	+1.46%	-1.70	+2.04

Notes: Maximum and minimum values of individual effect and normalized individual effect. Normalization occurs by subtracting the mean value and dividing by the standard deviation. The average values are close to zero, due to the inclusion of a constant in the panel model according to Gould (2013) and the lack of exact equality results from the unbalancing of the sample.

Figure 1. Box plot showing the impact of dependent variable PER on an independent variable (a) ARMF and (b) TOC; i.e. $\delta^{P} PER$

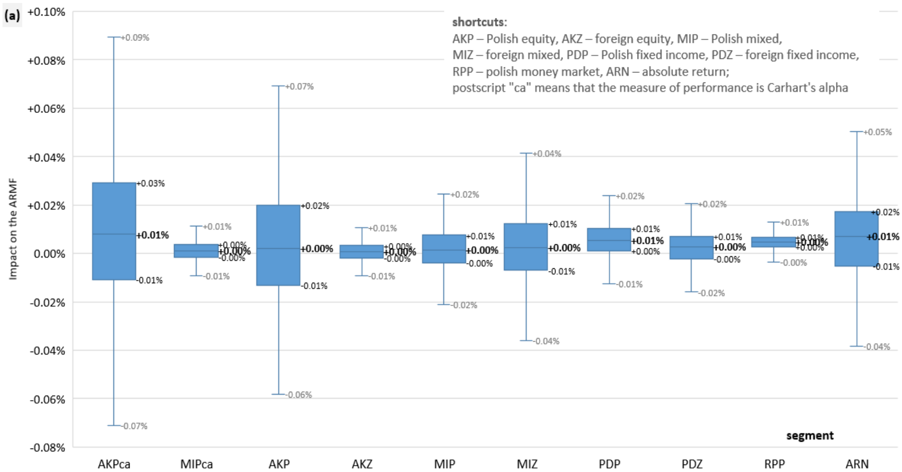
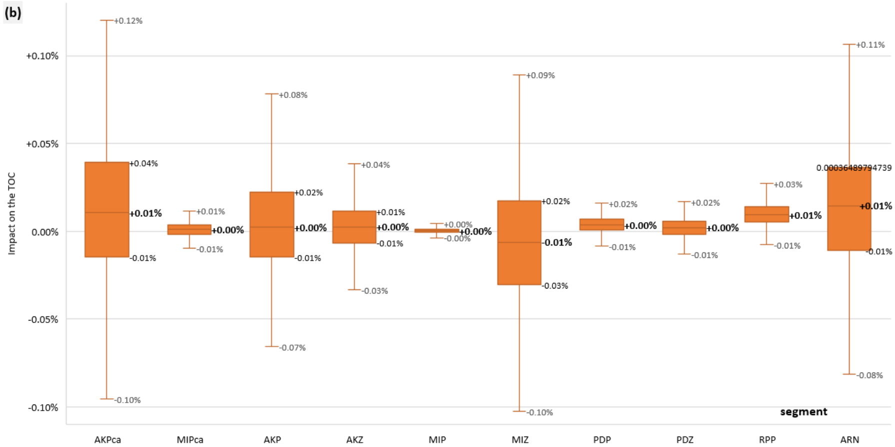


Figure 1. Continued



Notes: Box size is the so-called interquartile range (IQR). i.e. the difference between upper and lower quartiles. Whiskers have a length 1.5· IQR. A median is marked inside the box. For better visibility. the values outside the whiskers are not visible.

Figure 2. Box plot showing the impact of dependent variable ARAC on an independent variable ARMF. i.e. $\delta^{R}ARAC$

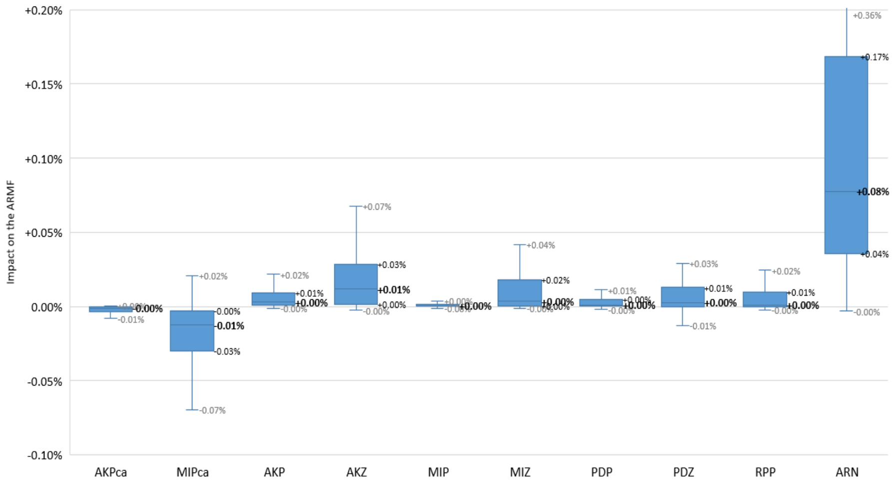


Figure 3. Domestic equity funds_ca — box plot showing the impact of dependent variables on: (a) ARMF ($const = 3.74\%$) and (b) TOC ($const = 4.90\%$)

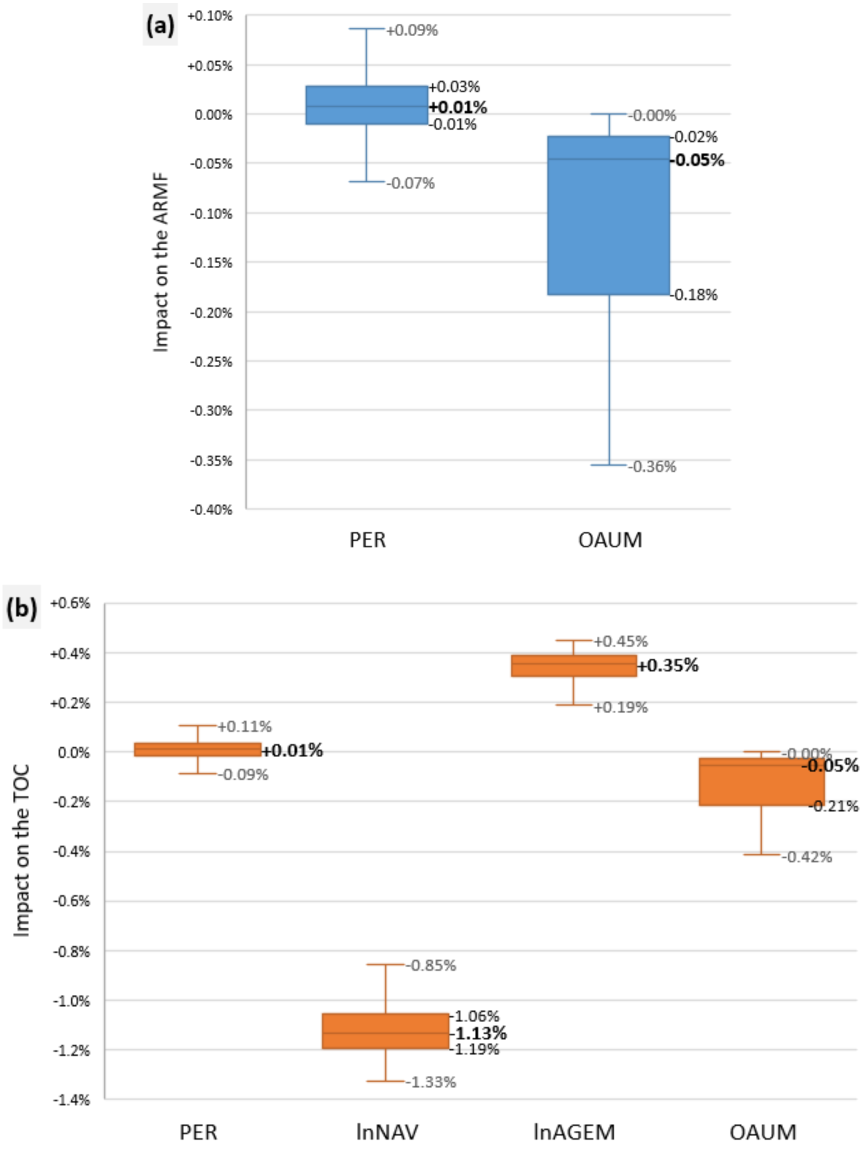


Figure 4. Domestic hybrid funds_ca — box plot showing the impact of dependent variables on (a) ARMF ($const = 2.64\%$) and (b) TOC ($const = 5.07\%$).

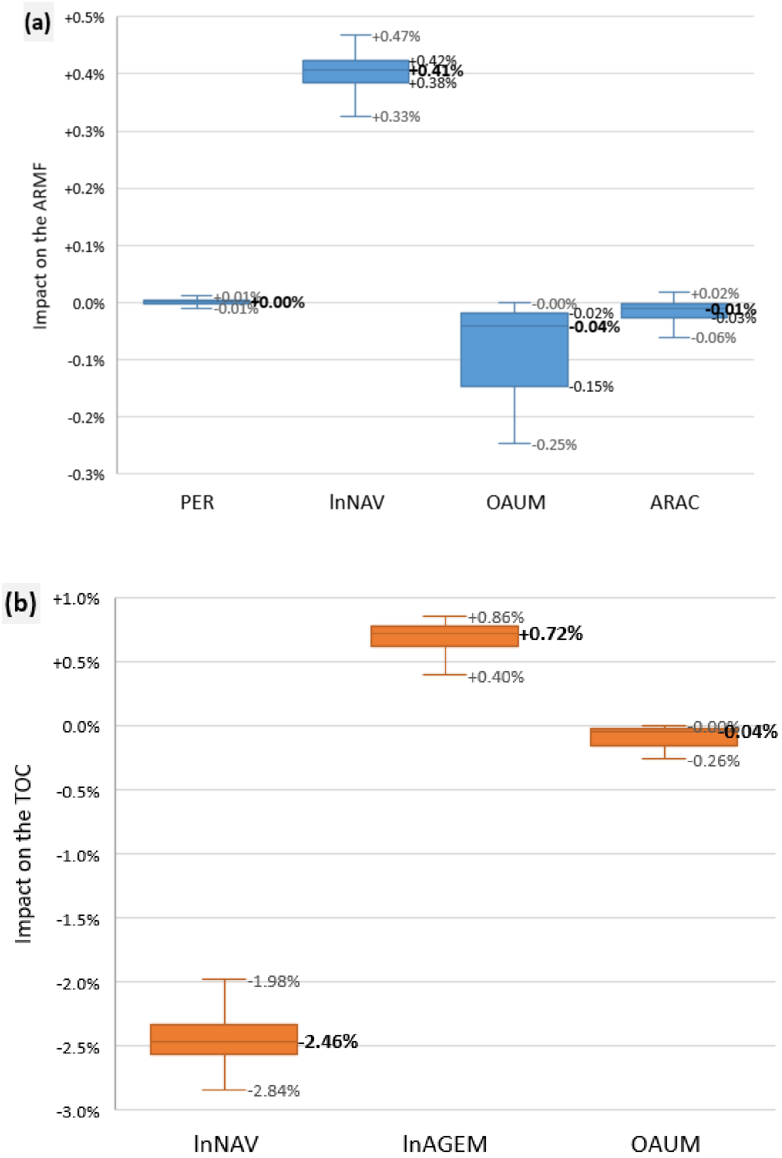


Figure 5. Domestic equity funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 3.62\%$) and (b) TOC ($const = 5.27\%$)

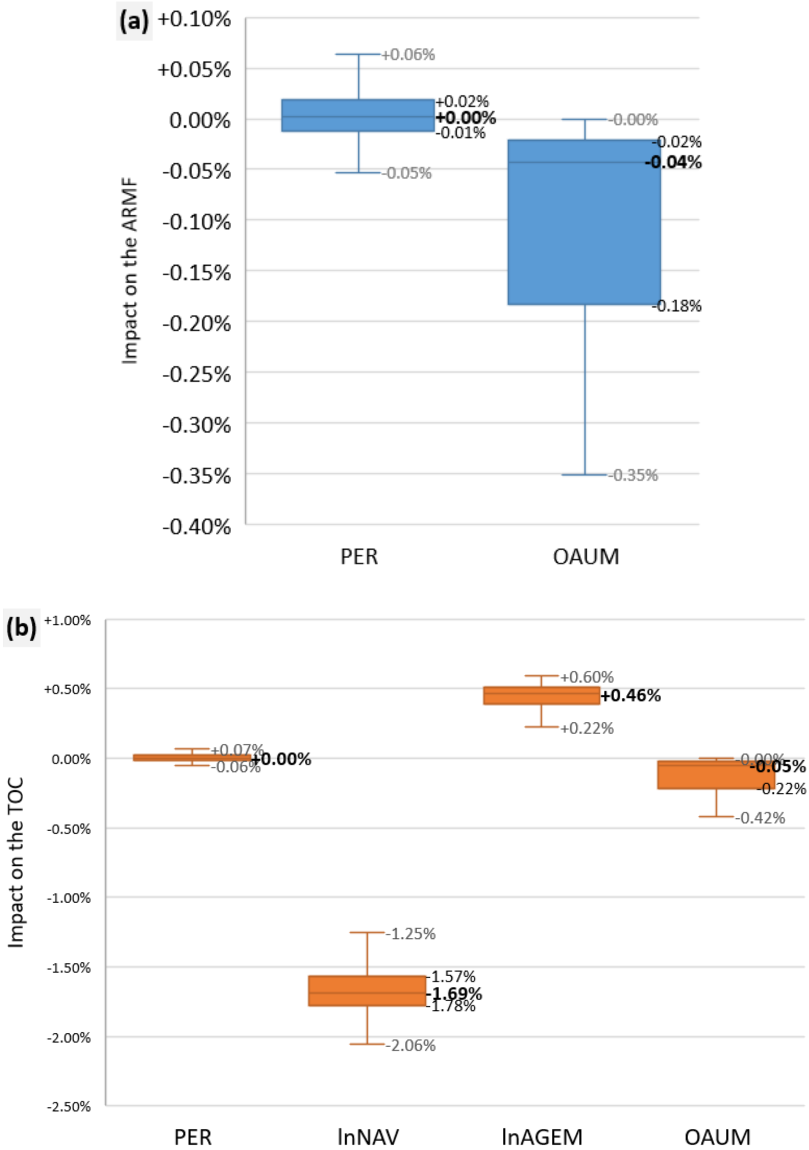


Figure 6. Foreign equity funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 2.63\%$) and (b) TOC ($const = 5.08\%$)

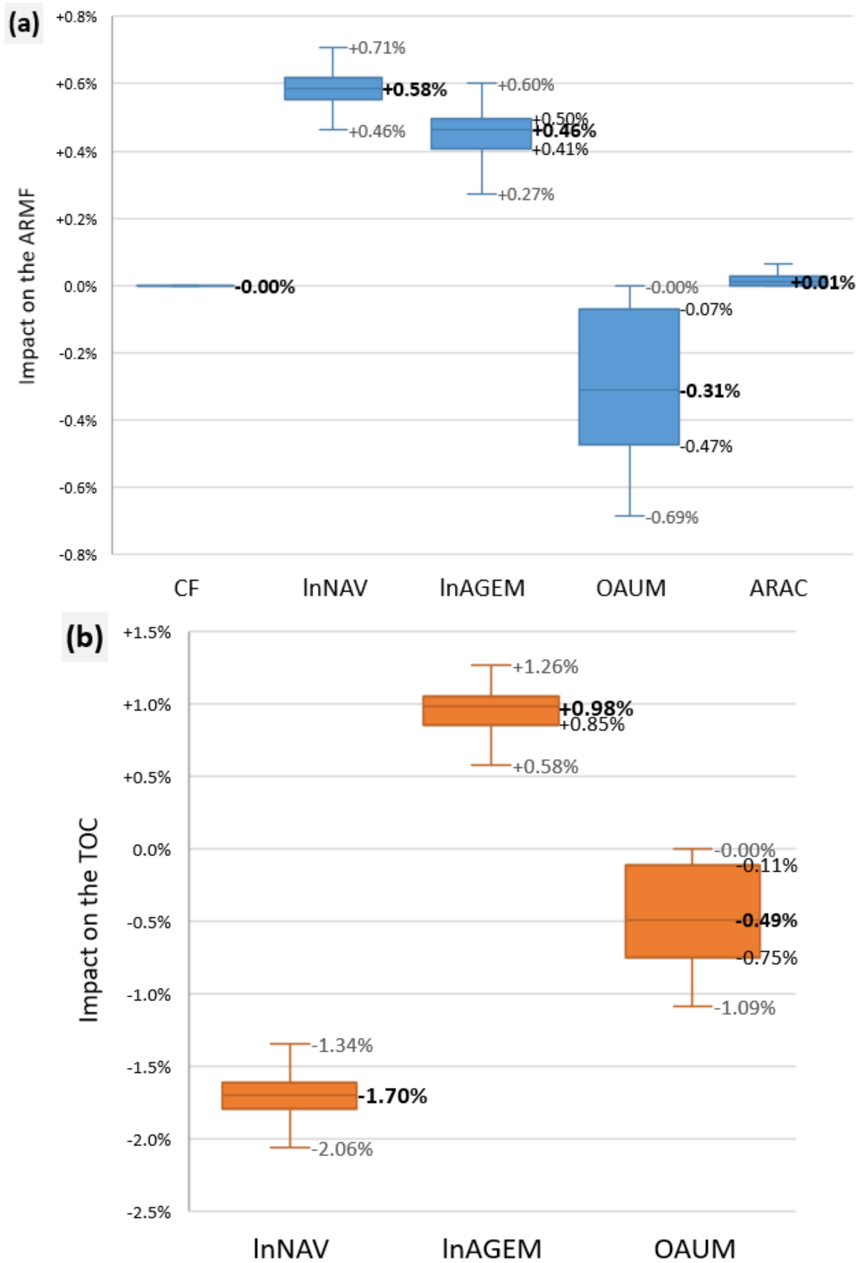


Figure 7. Domestic hybrid funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 2.46\%$) and (b) TOC ($const = 6.20\%$)

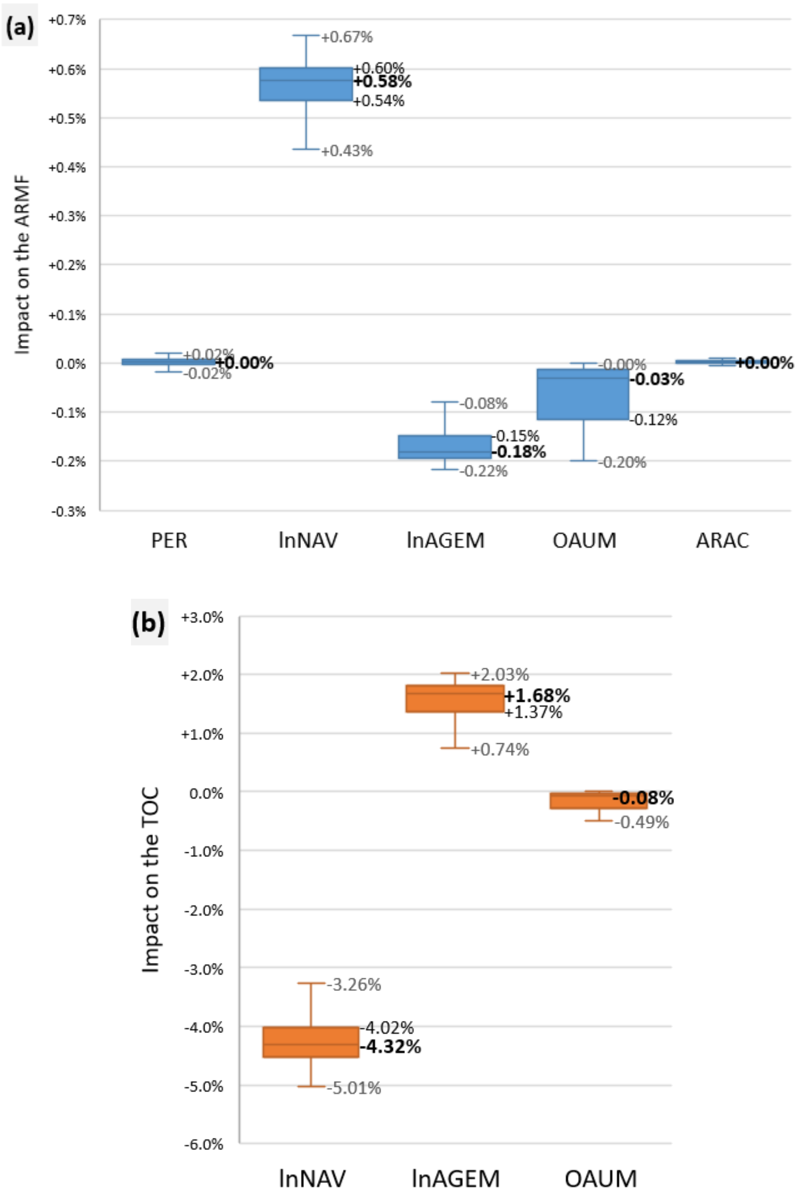


Figure 8. Foreign hybrid funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 0.10\%$) and (b) TOC ($const = -0.32\%$)

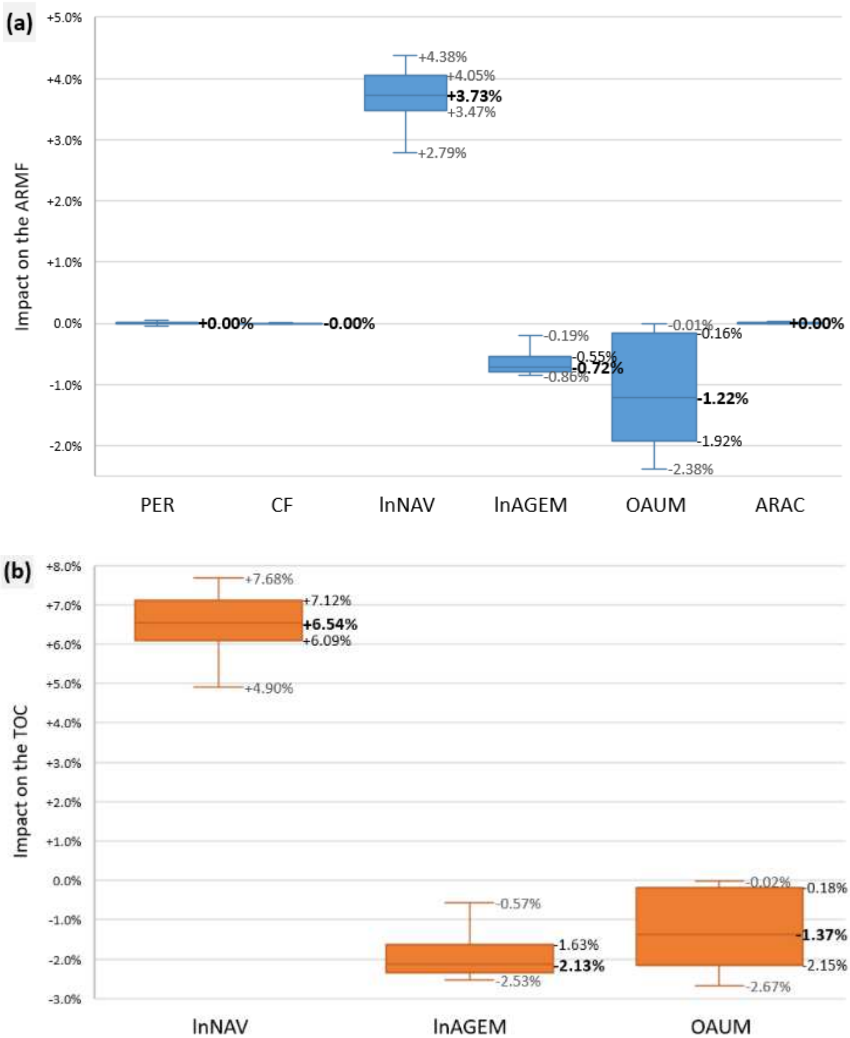


Figure 9. Domestic fixed income funds — box plot showing the impact of dependent variables on (a) ARMF $(const = 0.54\%)$ and (b) TOC $(const = 2.44\%)$

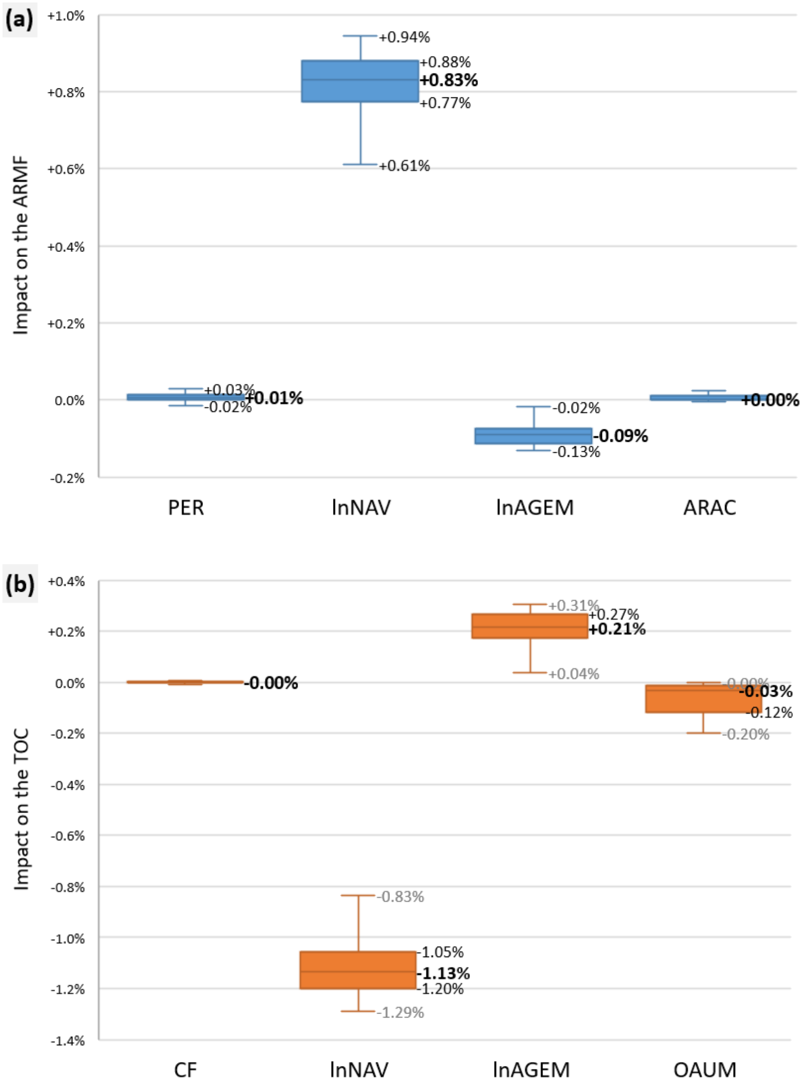


Figure 10. Foreign fixed income funds — box plot showing the impact of dependent variables on (a) ARMF $(const = 1.29\%)$ and (b) TOC $(const = 2.74\%)$

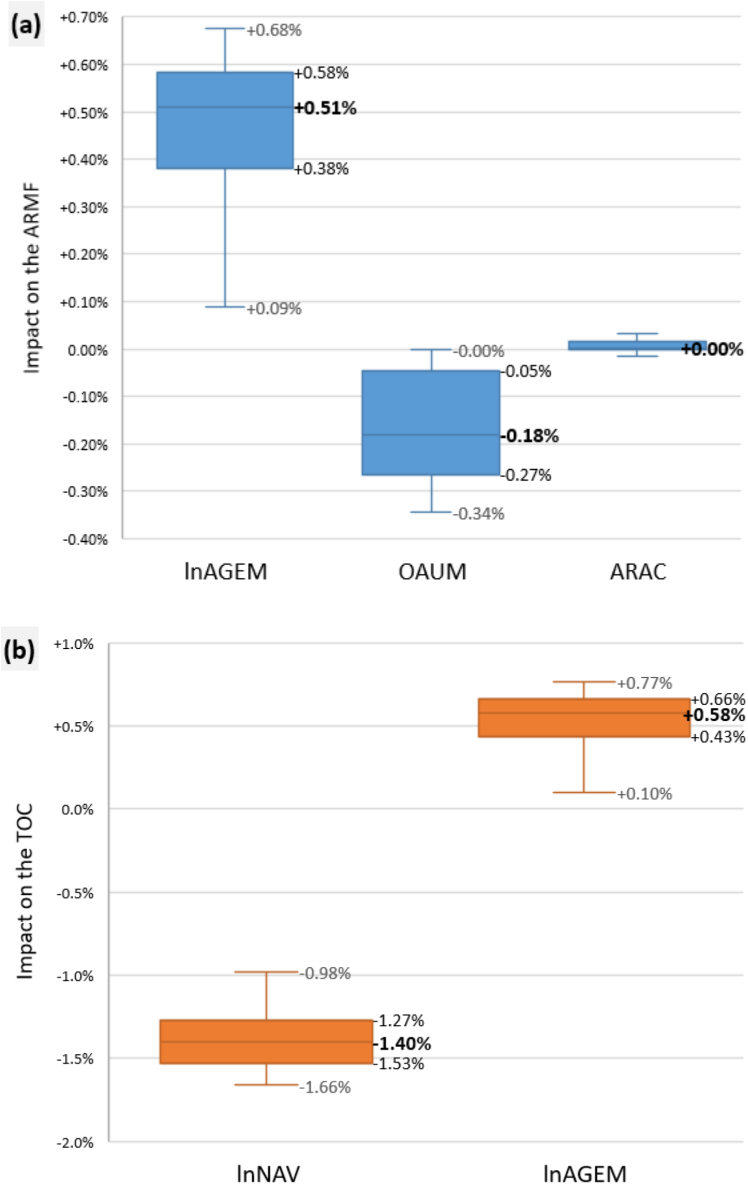


Figure 11. Domestic money market funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 1.01\%$) and (b) TOC ($const = 2.79\%$)

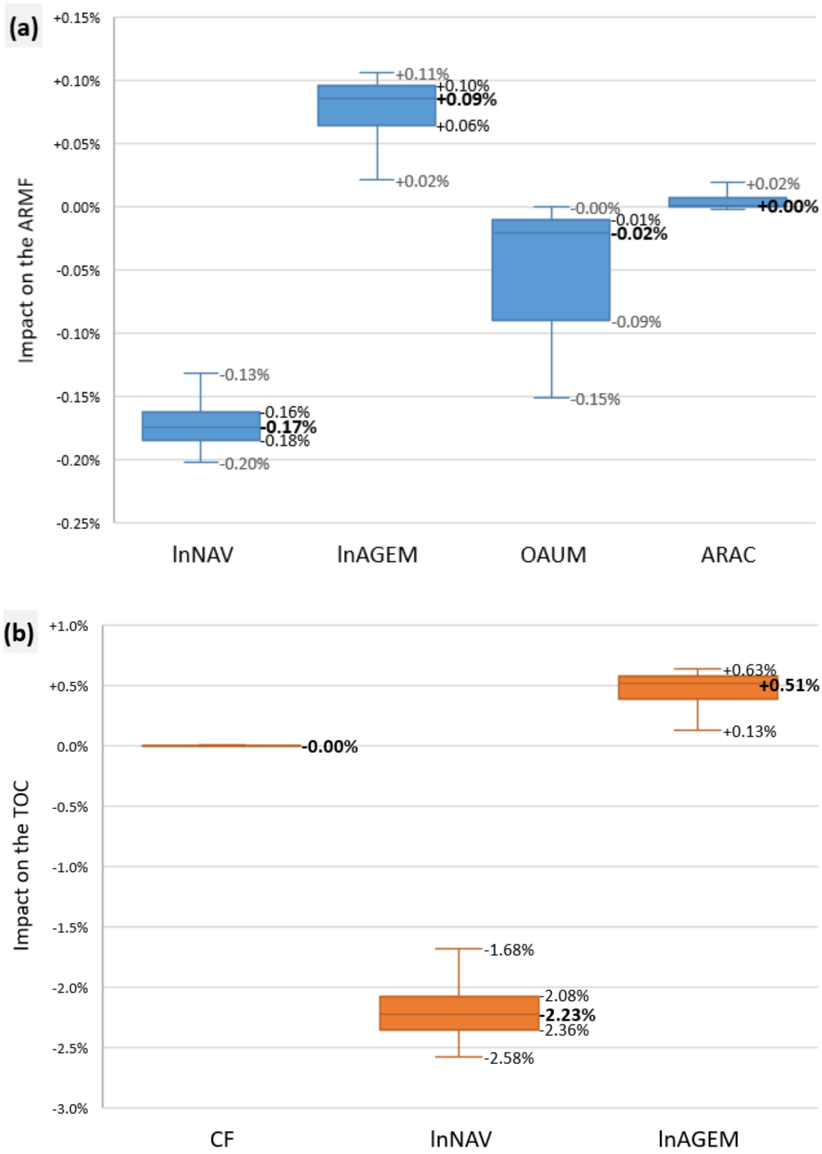


Figure 12. Absolute return funds — box plot showing the impact of dependent variables on (a) ARMF ($const = 1.92\%$) and (b) TOC ($const = 6.00\%$)

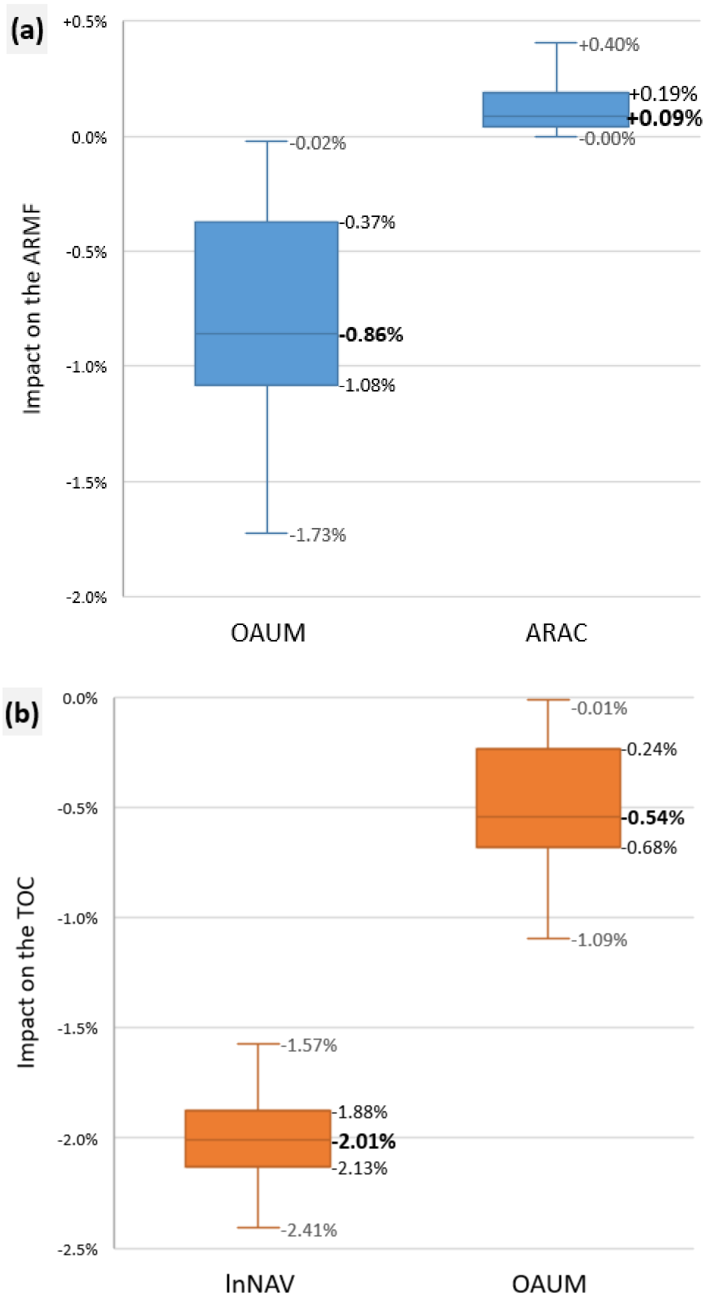
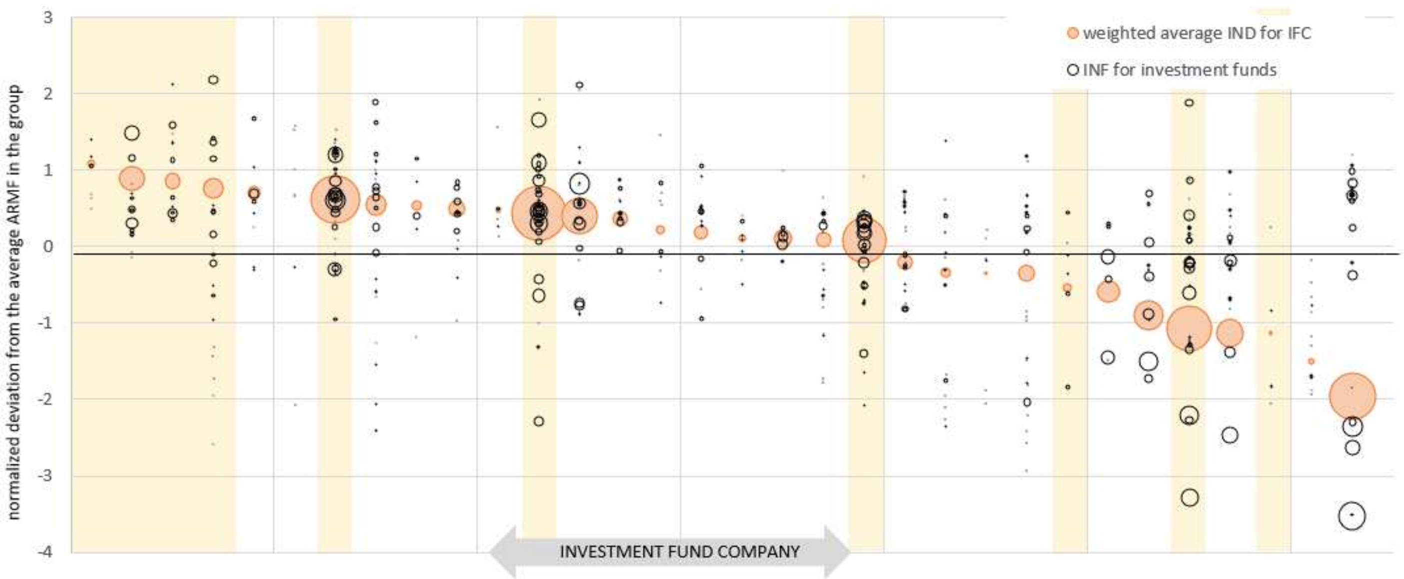


Figure 13. Normalized deviation from the average ARMF in the group for the given investment fund company (IFC)



Notes: The normalized deviation is set in successive vertical lines according to the average normalized ARMF deviation weighted by investment funds assets. Bubble size represents the average IFC. or investment fund assets. in the sample. Values for IFC that belong to a banks' capital groups are highlighted in yellow.